

GENESIS AND SPATIAL DISTRIBUTION OF UPLAND SOILS IN EAST CENTRAL
KANSAS

by

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B.S., Iowa State University, 1999
M.S., Kansas State University, 2002

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

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Department of Agronomy
College of Agriculture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

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Abstract

Upland soils in east central Kansas have a complex genesis, often contain one or more paleosols, and form in multiple parent materials including loess, colluvium, residuum, and alluvium. Quaternary loess/paleosol investigations have largely ignored this region of Kansas, as the total loess thickness on uplands is <2 m thick. In this study, the objectives are to examine the morphology and genesis of the soils of interest and how these characteristics vary within soil profiles, across landscapes, and throughout the current series mapping extent. The series of interest include the Irwin, Konza, Dwight, and Ladysmith soil series. Methods used in this study include field descriptions and sampling, terrain analysis, micromorphological investigations, and laboratory characterization, including silt and clay mineralogy. Accelerator mass spectrometry (AMS) was used for numerical dating and determination of stable carbon isotope values ($\delta^{13}\text{C}$) for selected paleosols. Radiocarbon ages ranged from 24,000 to 19,000 yr BP and $\delta^{13}\text{C}$ values were between -19 and -17 ‰ (PDB), indicating that the paleosols were formed in Gilman Canyon loess or the Severance formation, under a mix of C_3 and C_4 vegetation. Terrain analysis results illustrated that, in given drainage areas, the soil series were mapped on a wide range of slope positions. Field observations and terrain analysis confirmed no relationships between mollic epipedon thickness, solum thickness, paleosol thickness, or depth to the paleosol with respect to landform. Micromorphological investigations revealed increasing soil development with depth, i.e., the presence of two paleosols beneath the modern soil. Mean particle size and mineralogy vary geographically within individual series. Pedogenic carbonate accumulations and redoximorphic concentrations are common features of the soils of interest, and less common features include sodium and gypsum accumulations, slickensides, and redoximorphic depletions. Results from this study will be provided to the USDA-NRCS for use in future soil survey updates, and will contribute to Quaternary loess/paleosol knowledge in Kansas and the Great Plains.

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Major Professor
Michel D. Ransom

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Dedication

This is dedicated to my husband, Wess Presley.

CHAPTER 1 - Introduction and Objectives

“Why study how soils are mapped? Isn't that all done already anyway?”

Soil survey information is downloaded by thousands of people each day from the United States Department of Agriculture Natural Resources Conservation Service's (USDA-NRCS) Soil Data Mart website. Soil survey information for the entire state of Kansas has been available on the USDA-NRCS' Soil Data Mart website for the past few years, and there are many people from around the world downloading and using these data. This soil survey information can be updated at any time by the state soil scientists, an improvement that is in contrast to the bound copies of soil surveys that are no longer available to the general public, many of which are more than 30 years old.

There are many uses and users for soil information, such as environmental consultants, engineers, and state and local government entities. The USDA-NRCS uses soil survey information as the base for all conservation plans and programs. The Kansas Department of Revenue's Property Valuation Division uses soil survey information to assess property taxes in Kansas. Ecologists, climate scientists, and likely many other scientific disciplines use soil survey information as a model input, often on a regional or continental basis. Therefore, it is important to have accurate, updated soil survey information for scientific, political, financial, even global purposes. Because of these important uses, it is crucial that soils are mapped as accurately as possible.

This research project was conducted in cooperation with the Kansas USDA-NRCS due to an observed need for a thorough investigation of the distribution as well as genesis and morphology of particular upland soil series that are mapped in the Bluestem Hills Major Land Resource Area (MLRA 76). These soils also extend into MLRA 74, the Central Kansas Sandstone Hills (Figure 1.1). The selected soil series include the following, along with their taxonomic classification:

- Konza: Fine, smectitic, mesic Udertic Paleustolls
- Irwin: Fine, mixed, superactive, mesic Pachic Argiustolls
- Dwight: Fine, smectitic, mesic Typic Natrustolls

- Ladysmith: Fine, smectitic, mesic Udertic Argiustolls

The official series descriptions for all soil series are available at the following USDA-NRCS website: <http://www.soils.usda.gov/technical/classification/osd/index.html>.

The Konza soil series is the most recently established of these four series of interest, as the series was created in 1991. Therefore, it is not found in most of the existing published soil surveys of Kansas counties, and thus its acreage is the smallest of these four series, with 98,638 acres mapped in Kansas (Table 1.1).

The Irwin soil series was established in 1958, and the Dwight soil series was established in 1957, both in Geary County (Tables 1.1 and 1.2). Dwight is no longer mapped in Geary County (all of the area that was previously mapped as Dwight in Geary County was recorelated to Konza in the 1990's). The Ladysmith series is an old series that was established in 1926 in Clay County, and it is also no longer mapped in that county. The three older series, Irwin, Ladysmith, and Dwight, are still mapped in many of the soil surveys of Kansas. All are quite extensive, ranging from 398,330 acres mapped for Dwight to 1,453,296 acres mapped for Irwin.

The genesis of the Dwight, Irwin, and Ladysmith soils has never been intensively studied. Clayey sediments, such as loess, colluvium, and residuum are often listed as parent materials in previous soil descriptions. Old alluvium is frequently mentioned as a possible parent material for Ladysmith soils, but no attempt has been made to verify this. Frye and Leonard (1952) estimated that one-third of Kansas has Peoria loess at the surface (Fig. 1.2). Later, Welch and Hale (1987) used a combination of sources including geologic maps and county soil surveys to estimate that approximately 65% of the state was covered with Pleistocene loess. Welch and Hale (1987) used a minimum thickness of 0.6 m for the loess whereas geologic maps often use 0.9 meters as the thickness required to recognize loess. According to Welch and Hale (1987), widespread loess deposits are not recognized in east-central and southeastern Kansas, which includes the southern two-thirds of the Bluestem Hills MLRA. Many extensively-mapped soils are thought to have a loess component, and Welch and Hale (1987) list Dwight, Irwin, and Ladysmith as having a surficial loess component, as well as forming from old Pleistocene alluvium predominantly from Lower Permian rocks. Polygenesis is

a feature common to the Irwin and Konza soils, but the numerical age of the paleosols has never been determined. Although loess-paleosol sequences from the Quaternary period (the past 2 million year) are present throughout much of Kansas, they have rarely been explored in east-central Kansas, likely due to thinness (or possible lack) of loess deposits in this region (Fig. 1.2).

There is a lack of basic characterization information for the selected series, especially for Ladysmith. Sodium accumulations are common to the Irwin, Konza, and especially Dwight series. Irwin and Ladysmith soils are mapped adjacently, with the main difference being drainage class: Well or moderately well drained for Irwin, and somewhat poorly drained for Ladysmith. Both the Irwin and Konza soils are in pachic subgroups, meaning that they contain an organic-rich horizon that is greater than 50 cm in thickness, while the adjacently mapped Ladysmith soil does not contain this feature. The mineralogy class for the Ladysmith, Konza, and Dwight series is smectitic whereas the mineralogy class for Irwin is mixed. All are in the fine family particle size class, meaning that they contain greater than 35% clay in the control section.

The landscape position of these four selected series has been associated with flat, upland positions. In many counties, Irwin and Ladysmith soils are mapped on high, flat, upland interfluves; on sideslopes; and on paleoterraces high above the present-day floodplains of rivers.

Geographically, the Irwin, Konza, Ladysmith, and Dwight soil series are mapped in both the Bluestem Hills MLRA, as well as the Central Kansas Sandstone Hills MLRA. The Bluestem Hills MLRA (76) is approximately 19,585 km² (7555 mi²) in size, and is also commonly referred to as the Flint Hills region. The bedrock is Permian-age shale and limestone. About 70% of the area is in rangeland used for grazing cattle. Twenty percent of the area is cropland, which is located on the uplands and in river valleys. Tallgrass prairie is the native vegetation and includes big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*). The annual precipitation is 785 to 965 mm (United States Department of Agriculture Natural Resources Conservation Service, 2006). In contrast, the Central Kansas Sandstone Hills MLRA (74) is predominantly used for crop production (52%), namely hard red winter wheat. The bedrock is Cretaceous sandstone. Grassland used for grazing

comprises 40% of the area, and annual precipitation is 660 to 840 mm (United States Department of Agriculture Natural Resources Conservation Service, 2006). Despite these vast differences in landscape and land use, from steep, sloping rangeland in 76, to broad, flat cropland to the west in 74, the soils of interest are mapped in both MLRA 76 and 74. The structure of the landscape is quite different, suggesting differences in geology, which is confirmed by looking at the Geologic Map of Kansas. Loess is mapped at the surface in MLRA 74, while MLRA 76 is predominantly Permian shales and limestones, according to the Geologic Map of Kansas (Kansas Geological Survey, 1991).

In short, the genesis, morphology, geomorphology, and geography of the soils of interest are in question, and a review of existing information as well as the collection of new information and use of new analysis techniques is needed. Below are the objectives for this research project, as well as an outline of this dissertation.

Objectives and Overview of Chapters

Chapter 2 will provide a review of literature studied for this project. Chapters 3, 4, and 5 were prepared to serve as stand-alone, manuscript- or report-ready chapters. The focus and objective for each chapter is given below.

Chapter 3 analyzes the morphology and genesis of polygenetic upland soils in the Bluestem Hills Major Land Resource Area (MLRA 76). Stable, polygenetic soils will be examined with respect to the macromorphology, micromorphology, and laboratory characterization data. The emphasis is on understanding the parent material stratigraphy of loess, colluvium, and residuum, including the paleosols formed in these materials. The objective for this chapter is to determine the genesis of the soils of interest, specifically studying the parent materials and soil forming processes of polygenetic soils.

Chapter 4 will discuss the mapping, morphology, and properties of soil series mapped across a wide range of geomorphic positions in the Saffordville quadrangle, located in the Lower Cottonwood River watershed in Chase County, Kansas. Nineteen soil profiles were sampled and described and four were characterized. Radiocarbon dating was done in this study area for four soil horizons, and yielded ages indicative of

the Gilman Canyon loess/Severance formation. The objective for this chapter is to use terrain analysis techniques to examine relationships between soil properties/processes, parent materials, ages and occurrence of paleosols, and landscape features/positions.

Chapter 5 will examine the variability in the soil properties and pedon properties within soil series and with respect to geography. The objective for this chapter is to examine and evaluate the morphology, parent material, and geographic properties, including a thorough analysis of laboratory data and profile descriptions, throughout the current spatial extent of the series of interest.

Chapter 6 contains a summary of the overall project conclusions.

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Figure 1.1. Major Land Resource Areas that occur in Kansas (United States Department of Agriculture Natural Resources Conservation Service, 2006).

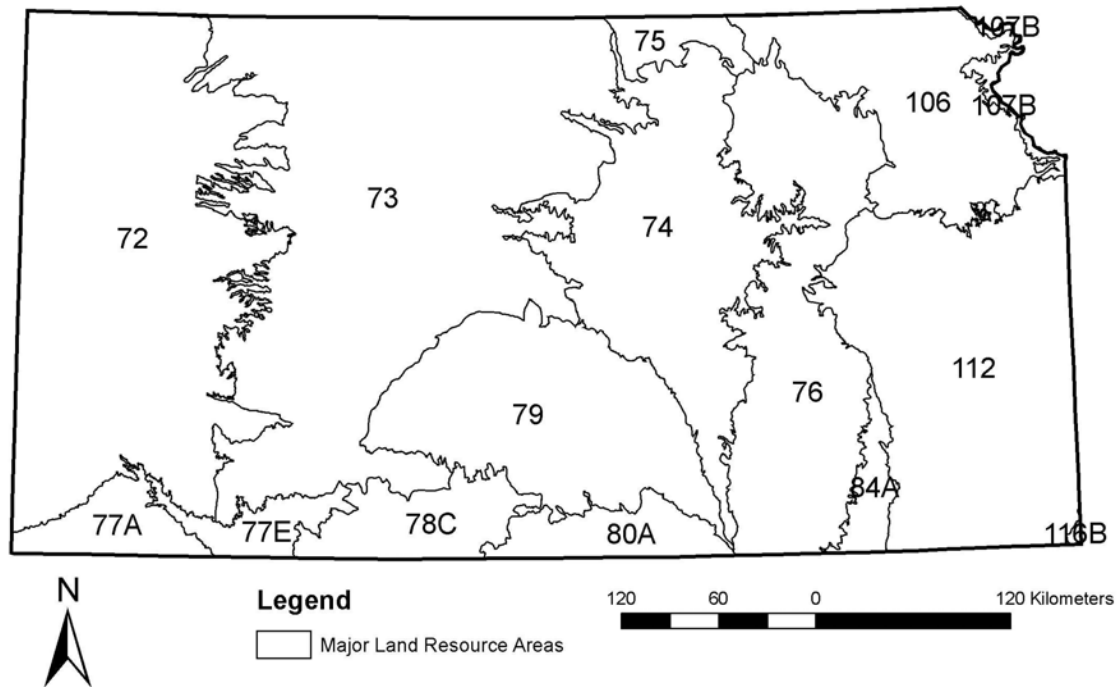


Figure 1.2. Distribution of loess in Kansas (Kansas Geological Survey, 1991).

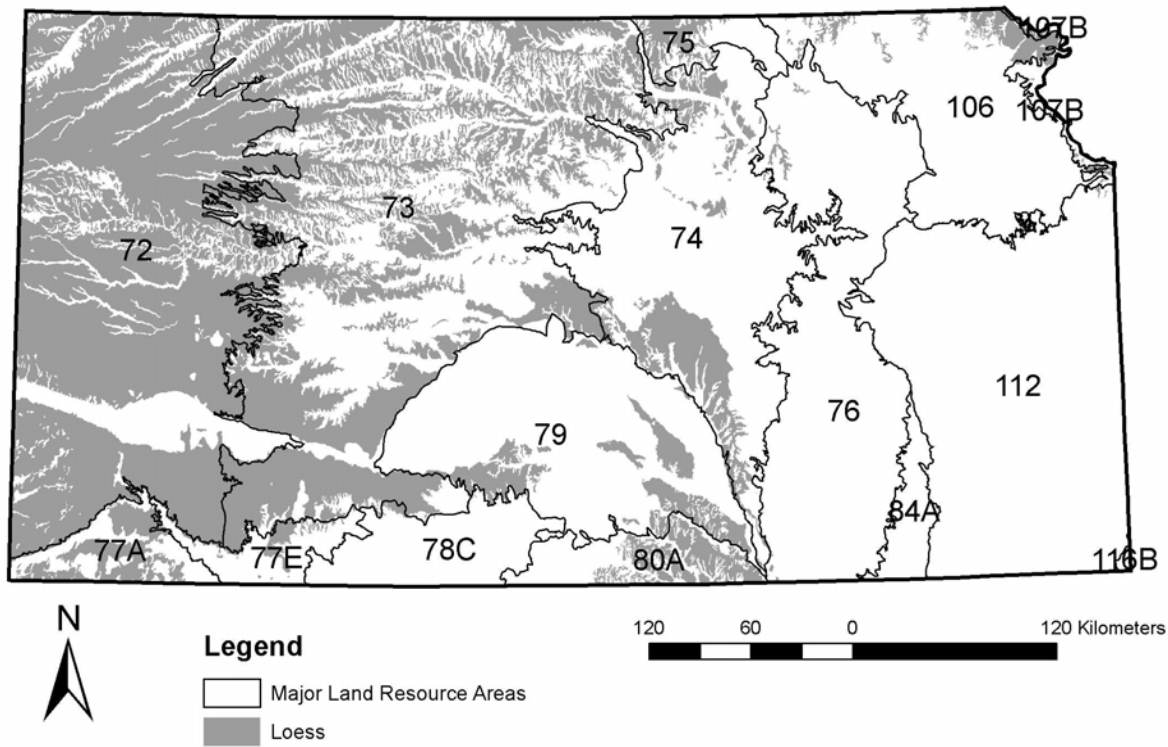


Table 1.1. Acres of Irwin, Ladysmith, and Konza mapping units by Kansas county (Soil Survey Staff, 2007).

County	4670 Irwin 0-1%	4671 Irwin 1-3%	4672 Irwin 1- 3% eroded	4673 Irwin 3-7%	4674 Irwin 3- 7% eroded	3890 Ladysmith 0- 1%	3891 Ladysmith 1- 3%	3892 Ladysmith 1- 3% eroded	4735 Konza 1-3%
Butler	8444	182400		13852	20005	42307			
Chase		24753	8733	3344	3875	1766	3592	1063	
Comanche		45219							
Dickinson		132412		112087		735			226
Geary				17080		4968			27183
Greenwood		662	6						
Harvey		22964		2163	373	46805			
Lyon		770	174	94	29	45934	34480		
McPherson		17014		10		79774			
Marion		173547		11882		29749	85		
Marshall						67276			
Morris	6956	50233	50440	6701	2204	29851		4716	4545
Reno						836			
Riley		943		18928	28112				
Saline		11837		8829		12			
Sedgwick		39687		1225	1687	2753	195		
Sumner		2339				22			
Wabaunsee		48037		16968		13331	5		2219

Table 1.2. Acres of Dwight mapping units by Kansas county (Soil Survey Staff, 2007).

County	4600 Dwight 0-1%	4605 Dwight 1-3%	4620 Dwight 1-3% eroded	4625 Dwight- Irwin complex	4630 Dwight- Irwin complex eroded	4744 Labette- Dwight complex	8993 Zaar- Dwight complex	8699 Dennis- Dwight complex	7310 Martin- Dwight complex	8751 Eram- Dwight complex
Butler	97766		3870			102964				
Chase	630	20120				29108	5069			
Chautauqua						337		2348	13985	
Comanche	9405					32061				
Dickinson										
Elk	1111					11110				1814
Geary										
Greenwood	4301					31073				
Harvey										
Lyon						13785				
McPherson										
Marion	3490					13517				
Marshall										
Morris		17615				64143				
Riley				16845	13417					

CHAPTER 2 - Literature Review

Introduction

If a soil profile forms as a result of the five soil forming factors (climate, organisms, parent material, relief, and time) of Jenny (1941), a polygenetic soil profile has formed as a result of two or more different sets of soil forming factors acting upon a soil profile (Birkeland, 1999). Paleosols are referred to as buried, exhumed, or relict (Ruhe, 1965). Buried paleosols formed and then were buried by sediments; exhumed paleosols formed, were buried, and then resurfaced by erosion; and relict paleosols formed under some previous set of soil forming factors, and are still exposed at the landscape surface today, with properties that may or may not reflect modern soil forming factors.

The Bluestem Hills Major Land Resource Area (MLRA 76) is approximately 19,400 km² (7,490mi²) in size, and is also commonly referred to as the Flint Hills region. About 60% of the area is in rangeland used for grazing cattle. Twenty percent of the area is cropland, which is located on the uplands and in river valleys. Tallgrass prairie is the native vegetation and includes bluestem, indiagrass, and switchgrass. The annual precipitation is 750 to 900 mm (United States Department of Agriculture Natural Resources Conservation Service, 2006).

According to Welch and Hale (1987), widespread loess deposits are not recognized in east-central and southeastern Kansas, which includes the southern two-thirds of the Bluestem Hills MLRA. Many extensively mapped soils are thought to have a loess component, and Welch and Hale (1987) list Dwight, Irwin, Ladysmith, Parsons, Kenoma, and Woodson as having a surficial loess component, as well as forming from old Pleistocene alluvium predominantly from Lower Permian rocks.

In east central Kansas, including the region known as the Flint Hills or Bluestem Hills Major Land Resource Area (MLRA 76) buried paleosols with a preserved A horizon are rare. It is much more common to find the modern soil superimposed (e.g., welded)

almost seamlessly onto the Bt horizon of one (or more than one) paleosol. Three of the upland soil series mapped in east central Kansas in which polygenesis is recognized include the Irwin, Konza, and Dwight soil series, which are collectively mapped in more than 20 counties. More specifically, approximately 500,000 hectares (1.5 million acres) of Irwin soils are mapped in more than 20 counties, 160,000 hectares (400,000 acres) of Dwight soils are mapped in more than 20 counties, and 38,000 hectares (nearly 100,000 acres) of Konza soils are mapped in five counties. Previously, studies have been completed concerning polygenetic upland soils in the Bluestem Hills. William Wehmueller (1996) investigated the genesis and distribution of soils of the N4D watershed on the Konza Prairie Research Natural Area (currently referred to as the Konza Prairie Biological Station). He studied soils throughout the landscape, and found polygenetic soils that contained loess-paleosol sequences on the uplands. As a result, he determined that a significant amount of area that was previously mapped as Irwin or Dwight did not actually meet the classification criterion or fell outside the accepted range in properties for either series. As a result a new series called Konza was established. Susan Glaze (1998) further examined three upland polygenetic Konza soils, and focused on the genetic processes that led to sodium and gypsum accumulations within the profile. In both studies, the pedons sampled were in either Riley or Geary County. That is, all were located within an approximate distance of 10 kilometers (or less) of Manhattan, Kansas. As was previously discussed, the Irwin and Dwight series in particular are mapped across an approximately 20 county range, or across a range of approximately 280 kilometers in the north-south direction, and 120 kilometers in the east-west direction throughout MLRA 76.

Original Loess/Paleosol Sequences Recognized in Kansas and the Great Plains

Loess-paleosol sequences of the Quaternary Period (the past 2 million years) are present throughout much of Kansas. Geological information of the Pleistocene Epoch (2 million years to 10,000 years before present) was summarized by Frye and Leonard in 1952. At that time, the loess units and paleosols recognized in Kansas included the following, listed from oldest to most recent: Loveland loess (late Illinoian), Sangamon paleosol, Peoria loess (late Wisconsinan), Brady paleosol, and Bignell loess (early

Holocene). Bignell loess is not recognized east of 97°W longitude, and is only distinguished when the Brady paleosol is present (Welch and Hale, 1987). Reed and Dreeszen (1965) described a loess unit in south central Nebraska that was older than Peoria, and younger than Loveland, and called it Gilman Canyon. The following is a review of literature, with a focus on the numerical ages and morphology of loess/paleosol sequence in Kansas, followed by a discussion on the sources of loess in Kansas.

Loveland Loess and Sangamon Paleosol Numerical Ages and Morphology

Loveland Loess is late Illinoian in age and correlates to marine oxygen isotope stage (MIS) 6. It was deposited during the penultimate glacial period between approximately 160,000 and 130,000 years ago in Nebraska and Iowa, according to thermoluminescence ages summarized in Busacca et al. (2004). Thermoluminescence (TL) dating determines the period of time that has elapsed since quartz grains were exposed to sunlight, i.e., when the grains were transported and subsequently buried. Note that even MIS numbers denote glacial periods, i.e., periods of loess deposition, and odd numbers denote interglacials, i.e., periods of soil formation (Bloom, 1998; Bradley, 1999; Dawson, 1992). At the Loveland type location in western Iowa, Forman and Pierson (2002) reported a mean infrared stimulated luminescence (IRSL) age of about 159,000. In southcentral Nebraska, Loveland loess was dated by thermoluminescence to about 163,000 (Maat and Johnson, 1996). During pre-Illinoian time, the Laurentide Ice Sheet (LIS) extended as far south as the present-day Kansas River, and as far west as the Big Blue River in Kansas. The Sangamon interglacial period lasted from approximately 130,000 to 55,000 years before present (yr BP) during MIS 5, when midlatitudes were slightly warmer than today, sea levels were slightly higher, and paleosols formed. Therefore, the Sangamon paleosol formed in Loveland loess. Loveland loess is found throughout the Great Plains and Midwest United States, and is thus one of the most widespread loess deposits. However, it is relatively thinner and less continuous than Peoria loess in Kansas (Frye and Leonard, 1951).

Frye and Leonard (1952, p.118) stated that Loveland loess has not been recognized in the “chert gravel province east of the Flint Hills, although Sangamon soil, as a residual profile on shale, has been observed below thin Peoria loess” The

Sangamon soil is described as well drained, formed under prairie, and having a tough (clayey) B horizon that is a strong red-brown in color.

Gilman Canyon Loess and Severance Formation Numerical Ages and Morphology

In 1965 Reed and Dreeszen described a loess unit in south-central Nebraska that was older than Peoria, and younger than Loveland, and called it the Gilman Canyon Formation. Reed and Dreeszen (1965) hypothesized that the "...dark colored humus-enriched horizon, 1 ½ to 4 feet thick, overlying the reddish-brown Loveland Formation..." (p.40-41) was not the buried A of the Sangamon soil, but rather, represented "Very thin blankets of Early Wisconsinan Loess draped over the Illinoian landscape..."(p. 41). Reed and Dreeszen (1965) stated the need for radiocarbon dating, which has since been performed using both radiocarbon and thermoluminescence (TL). Published ranges for Gilman Canyon are 40,000 to 24,000 yr BP (Bettis et al., 2003), 50,000 to 30,000 yr BP (Busacca et al., 2004), 36,000 to 22,000 yr BP (Muhs et al., 1999), and 36,000 to 30,000 yr BP (Maat and Johnson, 1996). Gilman Canyon loess is stratigraphically equivalent in age to Roxana loess that is found east of the Great Plains (Busacca et al., 2004) and dates to about 60,000 to 30,000 yr BP (Forman and Pierson, 2002). In summary, Gilman Canyon loess is now regarded as middle Wisconsin in age and correlates to MIS 3.

Feng (1991) and Feng et al. (1994) studied nearly complete Pleistocene loess/paleosol sequences (i.e., contained a surface soil, Bignell Loess, Brady Soil, Peoria Loess, Gilman Canyon pedocomplex, reddish pedocomplex, Barton Sand, and Loveland Loess) in central Kansas between 98° and 100°W longitude. At the site location in Barton County (Feng, 1991) the Gilman Canyon loess is one meter thick. Feng et al. (1994) described the Gilman Canyon material as organic rich and lacking B horizon development and therefore concluded that the climate would have been cool and moist. The Gilman Canyon material has also been described as being low in clay, strongly leached, and lacking clay coatings and sesquioxide coatings (Feng et al., 1994, p. 65). The Gilman Canyon ages clustered into three potential periods of accumulation from 31,000-30,000 yr BP, 25,000-24,000 yr BP, and 21,000-20,000 yr BP. A reddish pedocomplex that is locally called the Sangamon paleosol was also present, and described as "Reddish silt, non-calcareous, with well-developed soil peds with

identifiable pedocomplex clay coatings and oxide stains” (Feng et al., 1994). The lowest part of this material dated to 69,000 ± 640 yr BP with the TL method.

Mandel and Bettis (1995) described Gilman Canyon loess in southeast Nebraska as non-calcareous, with common macropores, platy to subangular blocky structure, iron and manganese oxide stains and discontinuous clay films. At one site near Lincoln, Nebraska, the Gilman Canyon loess was 0.5 m thick, the horizons were called buried A horizons, and the uppermost part of the Gilman Canyon loess was radiocarbon dated to 23,460 ± 380 ¹⁴C yr BP. The uppermost part of the underlying Sangamon soil dated to 28,280 ± 590 ¹⁴C yr BP. Above the Gilman Canyon loess was a rather clear contact with Peoria loess, which was 4 meters thick. Another loess/paleosol sequence was described nearer the Platte River, with a similar thickness of Peoria loess, and thicker (1 m) Gilman Canyon loess, with more gradual contacts between the loess units. Maat and Johnson (1996) sampled Gilman Canyon loess in Nebraska, and described two meters of organic rich A horizons, and one meter of unaltered loess at the site location of the Eustis Ash Pit.

Mandel and Bettis (2001, 2003) observed a deposit that was similar in age and properties to the Gilman Canyon loess in valleys and older terraces in northeast Kansas (Mandel and Bettis, 2001; Mandel and Bettis, 2003). These authors referred to the colluvial and alluvial facies as the Severance Formation. Radiocarbon ages of the Severance Formation range from 25,000 to 15,000 ¹⁴C yr BP (Mandel and Bettis, 2003). In northeast Kansas, Mandel and Bettis (2003, p. 130) describe the Gilman Canyon loess as thin (less than 1.5 m thick), dark and non-calcareous that has been modified by pedogenesis and welded to the Sangamon paleosol. At the Severance Formation type location in northeastern Kansas (Doniphan County), Mandel and Bettis (2003) described 95 cm of Peoria Loess over a paleosol developed in the Severance Formation. At this particular location, the materials are separated by a clear smooth boundary. The textures of the Peoria Loess are silt loam, silty clay loam, and silt loam in the A, Bt, and BC horizons, respectively. The textures of the Severance Formation are heavy silt loam and light silty clay loam of the buried AB and Bt horizons, respectively. A second paleosol is described with silt loam and loam textures in the buried AB, Bw, and C horizons. The Peoria loess was described with 10YR hues, as

was the upper Severance Formation paleosol, while the lower paleosol was described with 7.5YR hues and 3/3 and 4/3 value/chroma. The upper part of the upper, younger paleosol dated to $17,390 \pm 110$ ^{14}C yr BP, and the upper part of the lower, older paleosol dated to $25,600 \pm 410$ ^{14}C yr BP (Mandel and Bettis, 2003). Also, the Severance Formation was described from 95 to 513 cm, followed by 2 m of stratified alluvium, and finally, Pennsylvanian limestone at seven m below the surface.

Mandel (2006) has also observed thin deposits (0.20 to 1.56 m) of Severance Formation in the Flint Hills region of Kansas on colluvial/alluvial fans. The Severance Formation contained a buried A horizon at a depth of about 1.25 to 1.5 meters below the soil surface, and dated to about 24,500 to 22,500 ^{14}C yr BP. The buried Bt horizons were brown to reddish brown, contained prominent clay films and prismatic structure, and were thus similar in appearance and numerical age to the Severance Formation observed in the previously described studies.

Peoria Loess and Brady Paleosol Numerical Ages and Morphology

Peoria loess was deposited during the last glacial maximum during MIS 2, or late Wisconsin time. The Wisconsin age (75,000-10,000 yr BP) was the final stage of Pleistocene glaciation, however, continental glaciers were not present in Kansas during this time. The sequence has been divided into early Wisconsin (approximately 75,000-53,000 yr BP), Middle Wisconsin (approximately 53,000-23,000 yr BP), and Late Wisconsin (approximately 23,000-10,000 yr BP). The substages have been defined as: Altonian (approximately 75,000-25,000 yr BP), Farmdalian (approximately 25,000-22,500 yr BP), Woodfordian (approximately 22,500-12,500 yr BP). The Woodfordian-Holocene transition occurred about 12,000-9,000 yr BP. The Holocene epoch dates from about 10,000 years ago (about 8,000 BC) until the present, and is characterized as an interglacial period with warmer temperatures and retreating continental ice sheets (Fredlund and Jaumann, 1987).

The numerical age for Peoria loess in the Great Plains ranges from approximately 25,000 to 11,000 radiocarbon years before present (^{14}C yr BP) as summarized in Busacca et al. (2004), and in the Missouri and Mississippi River basins the range is about 25,000 to 10,000 yr BP (Forman and Pierson, 2002). A recent summary of last glacial loess information by Bettis et al. (2003) gives a range of about

21,000 to 12,000 for Peoria loess in the Great Plains. Maat and Johnson (1996) reported a range of 24,000 to 17,000 yr BP in south-central Nebraska. In central Nebraska, Peoria loess was deposited approximately 10,500 to 25,000 years before present based on ¹⁴C dating, and 15,000 to 24,000 years before present by the thermoluminescence (TL) dating technique (Mason, 2001).

Peoria loess is calcareous and often described as buff colored. Frye and Leonard (1952) state that Peoria loess accumulated slowly, so Peoria loess was likely incorporated into the Sangamon soil/Loveland loess. Frye and Leonard (1952) estimated that 1/3 of the state of Kansas has Peoria loess at the surface. Later, from a combination of sources including geologic maps and county soil surveys, Welch and Hale (1987) estimated approximately 65% of the state was covered with a minimum thickness of two feet (0.6 m) of Pleistocene loess, whereas geologic maps often use a three feet (0.9 m) thickness to discriminate loess.

The lower part of the Peoria loess (i.e., the base of the Peoria loess) has been observed to contain fossils of ground squirrels (genus *Citellus*), and this has been called the *Citellus* zone (Frye and Leonard, 1952). The Brady paleosol formed during an interglacial stage in Peoria loess-aged sediments. The Brady soil is described as moderately to poorly drained (Frye and Leonard, 1952).

A note on the Cottonwood River of east central Kansas, from p. 207 of Frye and Leonard (1952): “The headwaters of the Cottonwood River by headward erosion have extended themselves through the Flint Hills, but the complete absence from all the terrace deposits of western type sediments that are now available to these headwaters indicates that the transgression of the upland by the Cottonwood River system was accomplished in late Pleistocene time. The Kansas River is the only one that crosses the Flint Hills upland—this is a result of glaciation.”

Bignell Loess Numerical Ages and Morphology

Bignell loess is not recognized east of 97°W longitude (i.e. is not recognized in the Flint Hills and eastward), and is only distinguished when the Brady paleosol is present (Welch and Hale, 1987). Ruhe (1984) called the 96-97°W division the “demarcation zone” between Udolls and Ustolls in a study of climate and properties of Mollisols. Bignell loess is Holocene in age, or MIS 1. It has been described as

moderately to poorly drained. Maat and Johnson (1996) report TL and ^{14}C ages from 9,000 to 6,000 yr BP in Nebraska, and Johnson and Willey (2000) report a range of ^{14}C ages from about 12,000 to 8,000 yr BP for sites in Nebraska and Kansas. Mason et al. (2003b) believe that Bignell loess was deposited throughout the Holocene, as recently as 1000 years ago. Due to its downwind location from dune fields, Mason et al. (2003b) concluded that the source of Bignell loess in Nebraska is the Nebraska Sand Hills region.

Sources and Features of Loess

Swineford and Frye (1951, p. 316) wrote, "The origin of massive silt deposits (loess) has been a subject of controversy for more than fifty years." They completed seven transects across western and northern Kansas and measured particle size of Peoria loess, determining a range in median diameter from 0.051 mm to 0.021 mm. Samples were coarser in texture near the Arkansas, Platte, Republican, and Missouri River valleys, and where the deposits were thickest. Generally, the median particle size decreased to the south and east of these river valleys. Minerals observed in silt fractions included quartz, feldspars (orthoclase, sodic plagioclase, and microcline), volcanic ash, carbonates, and mica (muscovite and biotite). Feldspars, as well as the ratio of biotite to muscovite decreased from west to east. Montmorillonite and illite were observed in all samples of the $< 1\mu\text{m}$ clay fraction with electron microscopy and x-ray diffraction (XRD). Note that only four samples were examined with XRD. Based on seven transects, Swineford and Frye (1951) concluded that the major Peoria loess source for Kansas was the Platte River, and that the Republican (located in NC Kansas and SC Nebraska) and Arikaree (located in NE Colorado) were locally important in western and north central Kansas, and the Missouri River contributed to loess of northeastern Kansas. Many of the other rivers of Kansas, including the Smoky Hill, Saline, Solomon, Big Blue, and Little Blue were not sources of loess, as they were not carrying Wisconsin outwash.

Thirty-six years later, Welch and Hale wrote, "The source of the loess in Kansas has been debated for the last 50 yrs." (1987, p.77). Much work has since been conducted on the origin of Great Plains loess.

Two broad classes of eolian deposits can be found in central and western North America. East of the Missouri River, most loess is thought to be of glaciogenic origin from outwash from the continental Laurentide Ice Sheet (LIS) during the last glaciation (Grimley, 2000). To the west of the Mississippi River, specifically in study areas in Nebraska, Nevada, and California, loess deposits are thought to be of a predominantly nonglaciogenic origin. First, loess deposits of a primarily glaciogenic origin will be reviewed, followed by those of a primarily nonglaciogenic origin. (Note that Kansas loess is probably a mixture of both, hence use of the term “primarily”).

Central North America east of the Missouri River: Primarily glaciogenic sources

The Mississippi, Missouri, and Illinois Rivers ultimately drained much of the land area affected by the LIS, and thus much sediment was transported in their channels and deposited in their floodplains. Very thick loess deposits exist immediately to the east of these rivers, and gradually become thinner to the east. The particle size is also affected by distance from the source area, having slightly coarser textures near the source and finer textures as distance from the source increases. East of the Missouri River in western Iowa, Peoria loess is very thick, measuring 40 m in thickness at the Loveland, Iowa, type location (Muhs and Bettis, 2000). There are three distinctly different zones in the Peoria loess, which are called upper, middle, and lower. Peoria loess has been estimated to have been deposited beginning from about 27,000 to 24,000 years before present up until about 14,000 to 11,000 ¹⁴C years ago in western Iowa. The coarse silt fraction is dominant in all zones, but the zones have different coarse silt contents. The upper zone has a high content of fine silt, the middle has low fine silt, and the lower has high but variable content of fine silt. The upper zone is relatively higher in clay content, and the lower zone is lower in carbonate content. The middle and upper zones both have similar, high carbonate contents. Muhs and Bettis (2000) concluded that the lower carbonate content in the lower zone could be a result of slower deposition rates along with simultaneous leaching of carbonates, calling this “syndepositional leaching,” or it could be attributed to low carbonate content in the source material. It is thought the changes in particle size properties between the upper and middle zones are related to a change in climate or a change in source area. Muhs and Bettis (2000) proposed three possibilities for changes in source location, but preferred the possibility that there was

an increase in sediments from more distant sources in the upper zone, which would explain the higher and more variable fine silt contents in this zone, and lower content of coarse silt relative to the middle zone. Geochemical measurements of the upper Peoria loess were made at 2 to 3 meters below the soil surface, which is below the modern soil. The clay content was found to increase in the eastward direction, and was dominated by layer silicates, rather than primary minerals. As such, the Al and Fe content increased as well, since both are major constituents of layer silicates. Muhs and Bettis (2000) concluded that these data supported their hypothesis that the paleowinds responsible for loess deposition in Iowa were indeed from the western direction, and that the source area was predominantly alluvium of glacial origin from the Missouri River valley.

Grimley (2000) also studied loess that was long thought to be of primarily glaciogenic origin in southwestern Illinois. However, many different glacial lobes extended into Illinois at different times during the Pleistocene, with interglacial periods of soil formation in between. Therefore, there are many possible glacial drift sources, as well as non-glacial sources of sediment for the loess deposits found in southwest Illinois. The objective was to determine the proportion of glacial and non-glacial sources for the Peoria and Roxana loess in southwest Illinois. The provenance or source of glacially derived loess can be determined by comparing loess mineralogy to possible source till mineralogies. Till is a function of the bedrock that the glacier came into contact with, and so each has a suite of minerals present in it that make it unique. In this study, Grimley (2000) measured magnetic susceptibility, plagioclase:quartz (silt fraction), dolomite (silt fraction), and illite (clay fraction) in unweathered till and loess sources and also from non-glacial sources. He used these four parameters as diagnostic parameters in statistical analyses, and performed analysis of variance to determine which of the sources were different from each other, and which were too similar to differentiate. Grimley (2000) attempted to use the source area data to determine the provenance of loess found in three different sections, which contained Roxana loess, and lower, middle, and upper Peoria loess. Using many assumptions, they calculated the percent composition of each source that comprised each of the loess units. For example, they calculated that the Roxana loess along the Illinois River

Valley is 36% Superior Lobe, 36% northwestern source sediment (which is Des Moines and Wadena lobes of the late Wisconsinan age) and 28% non-glacially eroded sediment from pre-Wisconsinan episode tills and paleosols. This blend accounts for the mineralogy and magnetic susceptibility of the Roxana loess. The lower and middle Peoria silt have different composition, and the upper Peoria silt is similar to the middle Peoria silt. The lower and middle Peoria silt have compositions different from Roxana loess, meaning that they had different sources. The upper Peoria silt is similar to the middle Peoria silt, so their sources were fairly similar. Grimley (2000) concluded that the composition of loess is proportionally related to the composition of the tills that contributed sediment to the river valleys. Till was the most important sediment source, but each unit had a significant proportion that was contributed from non-glacially eroded sediments, i.e., existing tills and soils. Generally, Grimley (2000) concluded that there were changes in composition over time for the Roxana, lower, middle, and upper Peoria silt that were related to the composition of till in the different lobes of the Laurentide ice sheet. Each lobe had its own unique properties that were related to the bedrock that it passed over and incorporated into the till. Each loess unit was different in the proportional amount of till sources and non-glacial sources, resulting in different properties, such as magnetic susceptibility and mineralogy. The composition of the loess will therefore be different in time as well as space, as proximity to the different till lobes will also cause a change in composition and provenance.

Western North America west of the Missouri River: Primarily non-glaciogenic sources

Much of the area in the Great Plains west of the Missouri River was never directly passed over by continental glaciers, but the regional climate was affected. The climate was cooler and drier, as inferred from shifts in vegetation documented in pollen and microfossil records (Wells and Stewart, 1987) and grass phytoliths (Twiss, 1983). A shift from a warmer and wetter climate to a cooler and drier climate would result in less biomass and more soil erosion, which could contribute to the theoretical source of non-glaciogenic sediments in western North America.

As previously discussed, Muhs and Bettis (2000) studied Loveland loess at the type location in western Iowa. Loess from the Loveland type location was compared

with Loveland-aged loess from other sites in Nebraska and Illinois. The Loveland-aged Nebraska loess is representative of non-glaciogenic loess, and the Loveland-aged loess from Illinois is representative of glaciogenic loess. They found that the Loveland type location loess had chemical properties intermediate between the Nebraska and Illinois loess samples, i.e., meaning that the Loveland type location loess was derived from both glaciogenic and non-glaciogenic sources. The chemistry of the upper Peoria loess at the Loveland type location was closer to that of the Nebraska Peoria loess (which is non-glaciogenic) than the Illinois Peoria loess (which is glaciogenic). This would imply that upper Peoria loess at Loveland has more of a non-glaciogenic source, coming from a western and distant source, than from a glaciogenic source, such as Missouri River deposits from the Laurentide Ice Sheet. The middle Peoria loess at the Loveland type location is more glaciogenic in nature. Also, the fine silt content of the upper Peoria loess at this location is similar to the fine silt content of Peoria loess sampled at Plattsmouth and Elba, NE, and both of these locations have been determined to have had non-glaciogenic loess sources. From these results, the researchers concluded that upper Peoria loess at Loveland contains some Nebraska-derived loess.

Mason and colleagues have extensively researched the sources and distribution of loess in Nebraska as well as other Midwestern states (Mason, 2001; Mason et al., 1999; Mason and Jacobs, 1998; Mason et al., 2003a; Mason et al., 2003b; Jacobs and Mason, 2005; Feggestad et al., 2004). They concluded that Peoria loess in the western Great Plains is not derived from glacial sources, but from the erosion of western land surfaces as glacial activity took place in other places. That is, there was a climate change in the western Great Plains associated with glacial advance in other places, and the source of Peoria loess in Nebraska, for example, is from non-glaciated areas to the west. In order for loess to accumulate in a particular area, it has to have a source that contains silt and sand, and a reason for accumulating where it does. It will often get deposited and re-entrained by wind near the source. This is because near the source there is also a lot of sand that was deposited. Sand starts saltating or bouncing along the surface, and dislodges smaller particles. Without sand, smaller particles are less likely to get re-entrained. So, dust will not accumulate in the presence of sand. Silt will accumulate in areas without sand, or in areas where it is difficult for sand to saltate and

where it is hard for silt to become re-entrained. One barrier is vegetation. Mason et al. (1999) propose that topography can also be a barrier for erosion, and thus, cause loess to accumulate. Also, Mason et al. (1999) hypothesize that loess will only accumulate downwind of these barriers. Steep slopes and narrow valleys are thought to stop the movement of sand. Steep slopes prevent the movement of saltating sand, and narrow valleys catch sand. Valley floors have more moisture and more vegetation.

Aleinikoff et al. (1998) found that material from the White River Group was present in Peoria Loess in Nebraska. The White River Group is Oligocene in age and outcrops in eastern Colorado, western South Dakota, and northwestern Nebraska in a non-glaciated area. Aleinikoff et al. (1998) concluded that the provenance of the Peoria loess in Nebraska is from non-glaciated areas. Mason (2001) states that provenance alone is not enough, but that the transport of this material must also be understood. He examined historical test hole records to determine Peoria loess thicknesses and created an interpolated loess thickness layer in a geographic information system. He found that much of eastern and southern Nebraska is covered with a nearly continuous layer of Peoria loess, which is thickest to the northwest part of the region and thinnest in the southeast part of the region. A model was constructed relating the thickness of Peoria loess to the distance from the northwest loess border. He plotted the distance from the border against the Peoria loess thickness and performed regression analysis. He concluded that the Peoria loess source in Nebraska is northwest of the area in question. Because of the provenance study performed by Aleinikoff et al. (1998), Mason felt that the loess source was the White River Group that is exposed in South Dakota, western Nebraska, and northeast Colorado. However, the source and the study area are far apart (100 kilometers) and there is no Peoria loess in between. Also, the Peoria loess at the northwest border is dominated by coarse silt and very fine sand, which normally would not be transported that far by wind. Mason (2001) proposed two hypotheses for potential transport mechanisms. The first possibility is that the in-between area, the Sand Hills of Nebraska, was not a good accumulation area. That is, any and all material that got deposited on the Sand Hills was re-entrained, later to be deposited downwind. Mason thought that there was little or no vegetation in this area, and that this in-between area was not suitable for deposition because eolian sand was active at

that time. Once the wind-entrained sediment reached the northwest border area, however, the land surface changed and became suitable for loess deposition and not suitable for eolian sand activity. This could have been due to the presence of river valleys and escarpments. His other hypothesis was that the White River silts were transported into Nebraska by water (river) systems, and then re-deposited as loess. These silts are from streams flowing through the White River Group source areas, and would have been deposited during the Pliocene and Pleistocene, and thus, would have been source areas for Peoria loess before being covered by eolian sands during the Holocene. A provenance study could be performed to compare the silts beneath the Sand Hills to Peoria loess in the study area to test this idea. Both hypotheses are based on the idea that the source areas were being eroded and were not glaciated, but were affected changes in climate, and thus, a reduction in vegetation on the landscape allowed the source area to be eroded and to supply source of loess for south and central Nebraska. Loess from this source was deposited by westerly and northwesterly winds. Mason (2001) also concluded that the Platte and Missouri river valleys were loess sources of local importance, but they were not the source of large regional loess deposits in Nebraska.

Mason and Jacobs (1998) were interested in determining whether loess at three sites in Illinois and Minnesota was locally derived, or if there had also been additions of finer dust from more remote sources. They found that C horizon material of the Peoria loess was quite uniform in both particle size and chemical composition. The soil horizons that formed in the Peoria loess were much more variable. The soil horizons contained more clay and more fine silt than the C horizons. Elemental chemistry was analyzed with X-ray fluorescence on whole soil samples. Relative to the parent material, the soil horizons were depleted in Ca, Mg, and Na on a whole profile basis, and were enriched in Al, Fe, and Ti. The loss of bases is related to the dissolution and subsequent leaching of calcite and dolomite that was originally present in Peoria loess. However, Mason and Jacobs (1998) conclude that positive mass fluxes mean that either the Peoria loess was very heterogeneous to begin with, or that the profile has received a net gain of these elements relative to the original Peoria loess. This implies that there have been inputs of dust since the Peoria loess was deposited. The authors

felt that the added dust was from sources far away (as it is high in fine silt and clay) rather than from more local sources. If it was from the same local source as the original Peoria loess, it should have a particle size similar to the local loess, and it did not. Also, the underlying Peoria loess was very homogenous. Since these soils were sampled on ridgetops, the authors concluded that there was no input of hillslope sediment that would explain these differences. The inputs had to be from a different dust than Peoria loess. This dust was finer in texture than Peoria loess, and must have contained more Al, Fe, and Ti than the local dust. The new dust was finer in texture, and thus probably contained more secondary minerals than primary minerals. They estimated that "...13.3 to 18% of the soil's actual parent material would have been fine dust, the remainder being the locally-derived loess deposit" (Mason and Jacobs, 1998, p.1138). This was estimated by determining how much Al had been added via fine dust deposition, relative to the Al content of the Peoria loess. They conclude that fine dust could have been added in the Holocene, or even earlier as the last of the Peoria loess was being deposited slowly. This could also have resulted from translocation or bioturbation, which would be difficult to determine without evidence of krotovinas.

Reheis et al. (1995) indicate that non-glacial dust can accumulate and become part of the soil profile. Their work was conducted in southern Nevada and California on alluvial fan soils. In their study, the present-day rates of dust accumulation were measured and properties of the dust were characterized, and soils nearby the dust traps were sampled and characterized. The original parent material for these soils was alluvium, but they received dust additions beneath the desert pavement during the study period. McFadden et al. (1987) had previously concluded that desert pavements formed as dust accumulated beneath a one to two particle thick layer of surface gravel. Thus, dust continually lifts the gravel with increasing dust additions. Reheis et al. (1995) found that the surface horizon was more like modern dust than the alluvial fan parent material. The dust was fine textured and the alluvial material was coarse textured. Modern dust was calcareous (plus contained other soluble salts) and so was the modern soil, while most of the alluvial material was not. Generally, they found that the upper horizons of the modern, Holocene-aged soils had a mineralogy similar to that of dust. Deeper in the profile, the soil mineralogy was different from dust. In older

Pleistocene soils, the soil mineralogy was different from dust mineralogy. Measured modern dust accumulation rates were higher than the “best” calculated rates of dust accumulation for most soils, which means that it is reasonable to conclude that the soils are currently receiving enough dust to account for the differences in surface and lower horizons in soils on alluvial fans.

Clayey loess

Particle size analysis data are used to indirectly determine the transport direction or wind strength for loess because coarser particles will dominate loess deposits closest to the source, while finer particles are dominant at greater distances. Bettis et al. (2003) reviewed the information on variable particle size for Peoria loess in the Great Plains. The mean particle size was reported as medium silt (31-15 μm) by Swineford and Frye (1951). In contrast, Muhs et al. (1999) reported a mean particle size of fine silt (6-7 μm) in eastern Colorado. Mason et al. (2003a) found problems with using mean particle size for wind strength when they observed sedimentary aggregates in C horizons of Peoria loess in Nebraska. In thin section, clay coatings were present on silt and sand grains, and were not of pedogenic origin. Aggregates were also visible in thin sections, and could be of either sedimentary or pedogenic origin (from faunal activity). Aggregates < 250 μm in size persisted during a particle size analysis in water that used minimal dispersion, and the dominant particle size was > 20 μm . With full dispersion treatment, the aggregates dispersed, and the particle size distribution curve developed a shoulder in the < 10 μm region, indicating that the aggregates contained fine silt and clay. Mason et al. (2003a) observed normal particle size distribution trends in transect work. As the loess thinned (and thus distance from the source increased), the particle size decreased, and aggregate abundance increased.

As previously discussed, loess can have multiple sources and can be strongly influenced by local geology and sediments. Muhs et al. (1999) studied clayey loess in eastern Colorado. Loess deposition occurred in two periods in eastern Colorado: 20,000 to 12,000 ^{14}C yr BP and 11,000 to 9,000 ^{14}C yr BP. Muhs et al. (1999) found that there were multiple sources that contributed loess, and that winds were from the west, and the climate was cool and moist. The particle size distribution was bimodal, with peaks in the 20-30 μm range and in the <4 μm clay-size fraction. They attribute

this to either a clayey source, or from silt-sized clay aggregates. Possible sources for eastern Colorado loess include: the alpine glacier meltwater carried by rivers, the White River Group, or the Pierre Shale (for the clayey loess). No differences between Colorado and Nebraska loess were observed, so a similar source is proposed for the loess in both states.

Soil mapping, soil organic matter, and texture-contrast soils

Jacobs and Mason (2005) studied Bignell loess (Holocene) in Nebraska, and observed that A horizon thickness as well as the thickness of mollic colors significantly increased with a decrease in the precipitation gradient. They also observed that the thickness of mollic colors and A horizon features were significantly related to the distance from the source of Bignell loess, the Sand Hills of Nebraska. They propose a theory of aggradational pedogenesis, where loess is slowly deposited on a microbially active zone, thus burying the A horizon and simultaneously creating a thicker A (organic-matter rich) horizon. “Overall, there is evidence that the Brady Soil SOC inherited by modern surface soils could have formed under a wide range of climatic conditions and plant communities, some quite different than those of the present or even the past 10,000 years. This observation, along with the clear impact of dust aggradation on C storage, suggests SOC stocks in modern soils of the central Great Plains are probably not in equilibrium with modern climate conditions” (Jacobs and Mason, 2005, p.104).

Ruhe (1984) called the 96-97°W longitude division the “demarcation zone” between Udolls and Ustolls in a study of climate and properties of Mollisols. Soils to the east of this zone are older, wetter, and have lower base saturations than the younger, drier soils west of the demarcation zone. Argillic horizons had a weighted-average clay content of 33% in the east, and abruptly increased to 40% at the boundary, and decreased again to the west (around 100°W). Illite was the dominant mineral in surface horizons and decreased with depth, while 2:1 expandable minerals increased with depth. “Consequently, there is little evidence that weathering in these soils has produced the clay that is concentrated in the Bt horizons.”(Ruhe, 1984, p. 216). “...near-surface change in composition may reflect the additions of clay from atmospheric dust to the soils.” (Ruhe, 1984, p. 216).

Kuzila and Lewis (1993) studied the Crete soil series in southeastern Nebraska. The Crete series had been previously mapped in basins and adjoining uplands in Clay County, Nebraska. This seemed counterintuitive, so Kuzila and Lewis (1993) sampled transects of the Crete series across landscape positions. They found that the soil properties were quite consistent across the sampling transect, and concluded that the sample area topography reflected the paleotopography that was subsequently mantled with 2.5 to 8.0 meters of multiple loess units, including Peoria loess and Gilman Canyon Formation. Radiocarbon ages for the top of the Gilman Canyon Formation ranged from about 26,000 to 20,000 ^{14}C yr BP. Due to an abrupt increase in the clay content between two soil horizons, Kuzila and Lewis (1993) classified one of the study pedons into the Paleustoll great group in Clay County, Nebraska, a great group which had not previously been recognized in south-central Nebraska. The clay mineralogy of all horizons was dominated by smectite, and the smectite peak became more intense below 70 cm in the study pedons, which could indicate a change in parent material. This subtle change in lithology was not detected in the field description.

Bronger (1978) also concluded that the clay maxima that he observed in Great Plains Argiustolls were not from illuviation. An increase of 20% clay from the topsoil to the subsoil, and a change in structure from granular to subangular blocky were common in these soils. Bronger (1978) studied thin sections, and observed very little clay illuviation in either the A or B horizons. The author concluded that the B horizon was not formed from illuviation, but was relict, and the soils were polygenetic.

Sources of eolian dust in the Flint Hills of Kansas

In theory, it seems that uplands in the Flint Hills should be a good place to find evidence of the complete loess history of Kansas. There are many nearly level upland areas, and the landscape is already well-dissected. For example, if loess was deposited on the landscape, it would probably erode from the steep backslopes and would be buried by colluvium on the footslopes. The loess could potentially still be recognized on upland summit and shoulder landscape positions. According to Welch and Hale (1987, p. 73), "...widespread loess deposits have not been recognized in these two areas" referring to the east-central and southeast areas of the state.

There are three possible reasons that loess is not found to any appreciable extent on the upland summits: (1) the region is source-limited for eolian deposits, that is, no eolian material was ever deposited there, (2) material was deposited there briefly, and was eroded and removed by either wind or water, or (3) the material has become “welded” or mixed with the existing soils, and is no longer recognizable. If loess is eroded by wind, it would likely be re-entrained and could move some distance. If loess was eroded by water and gravity it would likely be redistributed in the valley below as either alluvium or colluvium.

It does not seem likely that the Flint Hills are source limited, because loess found throughout Kansas probably has the same sources as those proposed by Mason (2001), Mason and Jacobs (1998), Reheis et al. (1995), possibly Aleinikoff et al. (1998) and others. That is, the source is probably nonglaciogenic (but glacially influenced) sediments eroded from nonglaciaded landscapes to the west of Kansas, perhaps at a great distance. Local loess sources within the Flint Hills could include rivers such as the Cottonwood, Neosho, or Walnut, among others.

It seems that if loess is present in extreme southeast Nebraska (although thin) as reported by Mason (2001), then loess should exist in Kansas too. Twiss (1983) measured modern dust deposition in the Great Plains and Kansas in the 1960's, finding that Manhattan had lower rates of accumulation than St. John or Tribune. However, Manhattan had similar rates of accumulation as Hays, which is in an area with significant loess deposits. The fact that the modern climate is different from the past climate adds complexity to this analysis. However, Roberts et al. (2003) used optically stimulated luminescence (OSL) dating in Nebraska and found that mass accumulation rates were extremely high at certain times in the late Pleistocene in Nebraska. It seems likely that much of the same material was probably available as a source to the Flint Hills of Kansas.

So, if the Flint Hills were not source limited, it is likely that loess was deposited on the uplands. As previously mentioned, it is reasonable to assume that it could be removed from backslopes or footslopes, but some loess should occur on the summits. The second possible explanation offered was that it was deposited here and then removed by either water or wind. The removal could have been immediate, or perhaps

loess was deposited, stabilized, and subsequently removed by erosion possibly as a result of another climate change in the late Pleistocene. This hypothesis was proposed by Muhs et al. (2003) to explain low loess accumulation rates in Alaska during the Pleistocene, despite the fact that there is a tremendous amount of glacially-derived source material in central Alaska. They did find evidence of many alternating periods of loess deposition and pedogenesis in the loess record there, including many paleosols. However, the supply and availability of the source material was so great that the loess sections should have been thicker than they are, according to Muhs et al. (2003). The authors conclude that the environment did not favor deposition, and believe that vegetation was largely responsible for this. Pollen records show that the vegetation was mostly tundra, which is not very rough, and therefore is not expected to trap much loess. When the climate shifted and the dominant vegetation became forest, then more loess accumulated as silt was trapped by the rougher forest vegetation. Vegetation may also have affected loess deposition in the Flint Hills. For example, more material was probably deposited on the Flint Hill ridges, but did not persist here, either because of wind erosion or water erosion. Wells and Stewart (1987) found that Kansas had a wetter, forest-like climate and vegetation association between 18,000 and 14,000 years ago, which coincides with the time of Peoria loess deposition in Nebraska and Kansas. At this time, the rougher forest vegetation might have effectively trapped more loess across the landscape, and then when the climate became warmer and drier, the vegetation type shifted to warm-season grasses, and loess was eroded from the landscape. The Altithermal period, from 8,000 to 4,000 years before present, is characterized as a time when the climate became warmer and drier, and vegetation became more sparse (Mandel, 1995, 2006). Widespread erosion could have removed Peoria loess from the uplands, and prevented the accumulation of Bignell loess, which has not been described east of 96-97°W longitude. Mandel (1995) hypothesized that this period of erosion might explain the paucity of archaeological remains dating to this period in the central U.S.

The third explanation for the lack of an extensive loess/paleosol sequence in the Flint Hills is that it is still present, but has become welded or mixed in with the underlying soil and sediments to such an extent that the loess is hard to recognize. Soil

welding in polygenetic soils means that the different parent materials begin to blend into one another in the vertical direction, and the lower soil horizons take on the properties of the upper horizons. Also, on stable landscapes such as the Flint Hills summit position, pedogenesis is at a maximum, and loess might become altered so that it no longer resembles the original loess deposit. Another explanation is that the loess becomes physically mixed with other sediments on the landscape (colluviated loess).

Loess & Pleistocene climate connection

Although this project does not focus on determining paleoclimate, a brief review of information reported in the literature is given here. The production of atmospheric dust and changes in global climate conditions have been linked and correlated with ice core data, and loess/paleosol sequences provide terrestrial records of climate change. Consequently, loess accumulation indicates a time period when widespread (possibly continental scale) soil erosion was taking place, likely as a result of dry conditions and sparse vegetation. Paleosols indicate periods of stability when soil formation processes, such as melanization, mineral weathering, illuviation, etc., occur. Foster and Vance (2006) report that the chemical weathering rates during interglacial periods are two to three times higher than during glacial periods. In sediments and paleosols, proxy records have been used to determine features of paleoclimate. These include, but are not limited to, pollen, plant macrofossils, opal phytoliths, and interpretation of stable carbon isotope ($\delta^{13}\text{C}$) values from soil organic matter or pedogenic carbonates.

Stable carbon isotope values are reported relative to a standard reference material, the Peedee belemnite limestone (often abbreviated PDB), which is a marine carbonate (Faure, 1998). During photosynthesis, green plants discriminate in favor of the ^{12}C isotope, and thus are depleted in ^{13}C relative to the atmosphere (Bender, 1970). Plants that follow the C_3 pathway (cool-season grasses and trees) of photosynthesis are more depleted in ^{13}C , and have values of $\delta^{13}\text{C}$ that range from -23 to -34‰, with a mean of -27‰ (PDB). The symbol ‰ means per mille, or per thousand. Plants that follow the C_4 photosynthetic pathway (warm season grasses) are less depleted, and have values of $\delta^{13}\text{C}$ ranging from -6 to -23‰, with a mean of -13‰ (PDB). Generally, C_3 vegetation is associated with cooler and/or wetter climates, and C_4 vegetation is adapted to warmer and/or drier climates.

Calcium carbonate precipitates in equilibrium with the surrounding environment. It has $\delta^{13}\text{C}$ values near zero, relative to the PDB standard (Faure, 1998). Pedogenic calcium carbonate precipitates in equilibrium with the soil CO_2 , and has been reported to be 14 to 16 ‰ more positive than the soil organic carbon (Cerling et al., 1989). Values around -1‰ (PDB) were determined for pedogenic carbonates in the modern soil profile at Konza Prairie (C_4 tallgrass prairie vegetation) near Manhattan, Kansas, and soil organic carbon values were approximately -15‰ (PDB) (Cerling et al., 1989).

Great Plains climate/vegetation-timeline as reported in literature

In the Great Plains, the following relative climate inferences have been reported. The late Wisconsin (21,000 to 10,000 yr BP) has been determined to have been cooler and moister with less seasonality, and the Holocene has been characterized as warmer and drier by Arbogast and Johnson (1998).

Muhs et al. (1999) reported that C_3 vegetation (cool season grasses and trees) was dominant from 23,000 to 12,000 ^{14}C yr BP, and C_4 (warm season grasses) dominated after 12,000 ^{14}C yr BP in loess units of eastern Colorado, which correlates to the time when alpine glaciers were receding in the Rocky Mountains.

Wells and Stewart (1987) found that Kansas had a wetter, forest-like climate and vegetation association between 18,000 and 14,000 years ago, which coincides with the time of Peoria loess deposition in Nebraska and Kansas. Feggestad et al. (2004) reported C_3 -type values for stable carbon isotopes from organic matter of the Peoria loess in Nebraska, shifting towards C_4 values in the Brady soil, which formed at the Pleistocene/Holocene boundary. This indicates that either a shift towards decreased precipitation or increased temperature (or both) occurred approximately 10,000 years ago. The authors concluded that the vegetation shift was caused by a shift in temperature, and not moisture, due to the thick A horizon and argillic horizon of the Brady soil, i.e., conditions were favorable for plant growth and pedogenesis, meaning that there was sufficient moisture. If moisture had also decreased, the landscape would likely have destabilized and eroded (Feggestad et al., 2004). Vegetation varied within Bignell loess, and the authors attributed these shifts to changing moisture conditions, rather than temperature changes, during the Holocene. C_4 vegetation has dominated during the past 6600 years, including the present (Feggestad et al, 2004).

Baker et al. (2000) studied links between climate, vegetation, and fluvial activity (sediment production and transport) of southeastern Nebraska during the Holocene. Overall, the Holocene is usually considered to be a dry period, but Baker et al. (2000) observed five distinct periods of time during the Holocene when climate and fluvial activity alternated between drier and more moist conditions, resulting in periods of sediment erosion and transport, and landscape stability, respectively.

Arbogast and Johnson (1998) reported C₃ type stable isotope values for late-Wisconsin aged alluvium, and C₄ type values for Holocene sand dunes dating to 5000 ¹⁴C yr BP in the Great Bend Sand Prairie Region of south-central Kansas. Charcoal from white spruce dated to 17,000 ¹⁴C yr BP in the alluvium, indicating a cool and moist climate.

Mandel (2006) reported $\delta^{13}\text{C}$ values of -15.5 and -15.9 ‰ for Severance Formation samples dating to 22,620 ± 340 and 24,560 ± 350 ¹⁴C yr BP at a location in Chase County, Kansas (Mandel, 2006).

Residual soils and reddish paleosols

In the Bluestem Hills region of Kansas, it is common to see dark red soil that is located above bedrock, and beneath the younger paleosol and surficial loess. This red paleosol sharply contacts interbedded Permian limestones and shales, and is commonly regarded by NRCS soil scientists as being derived mostly from residuum from these bedrock members (William Wehmueller, personal communication; Patrick Abel, personal communication). This material or soil in the Flint or Bluestem Hills of Kansas is often dark red in color with hues of 5YR or 7.5YR (or redder) and values and chromas of 3 or less. Many soil scientists agree that the dark red soil observed above bedrock in Kansas is a paleosol, but differ in opinions as to the parent material and age of the paleosol and/or sediments. A term that is not often used in Kansas, but used throughout the world for red soils over limestones (i.e., red clay sharply contacting limestone) is “terra rossa,” meaning “red earth.” (Spelling varies in the literature; common spellings are terra rossa or terra rosa, and terrae rossae for the plural term). In the Mediterranean region, terra rossa soils commonly have a hue of 5YR or redder and chroma of 5 or higher (Yaalon, 1997) or a chroma of 3.5 or greater according to

Bech et al. (1997). Therefore, the “red” soil observed in Kansas is a dark and red color, and the terra rossa soils are generally a bit more of a vibrant, red color. Terra rossa soils are recognized in Wisconsin and Indiana, USA, but are more commonly associated with xeric or Mediterranean climates (including Italy, Turkey, and Croatia) and in Australia. Wine production on terra rossa soils is common in the Mediterranean and Australia. Formation theories for terra rossa soils include the following: Dissolution of the underlying bedrock (Bronger et al., 1983; Bronger and Bruhn-Lobin, 1997; Moresi and Mongelli, 1988), polygenesis from other sediments (loess, pediment) deposited on top of the bedrock (Olson 1979; Olson et al., 1980; Yaalon, 1997), or that terra rossa red clay is derived by a replacement reaction with the underlying limestone that produces kaolinite (Merino and Banerjee, 2005; Merino et al., 2006; Stiles and Stensvold, 2006).

Bronger and Bruhn-Lobin (1997, p. 279) stated that “The development of *Terrae rossae* from material with high carbonate content can result only by carbonate dissolution and accumulation of limestone residue (LR)” Bronger et al. (1983) studied terra rossa soils in Slovakia, observing limited primary mineral weathering and clay formation. However, all *terrae rossae* contained more hematite than the limestone residuum. Despite the increase in hematite, the authors concluded that the lack of mineral weathering to produce clay minerals indicated that the *terrae rossae* are the insoluble residue of dissolved limestone.

Moresi and Mongelli (1988) studied the geochemistry of terra rossa and limestones of Italy. They concluded that terra rossa was derived from carbonate rocks. The terra rossa had a lower K_2O/Al_2O_3 ratio (or illite/kaolinite ratio) than the carbonate rocks. That is, the terra rossa is higher in kaolinite, and the limestone is higher in illite content. The authors hypothesized that the increase in kaolinite was either from the addition of low illite material (most likely from an eolian source), or from the weathering of illite to form kaolinite. They concluded that the most probable explanation was mineral weathering, as most eolian deposits in the region are quite high in illite content, and also because of the similarities in the geochemistry of the limestone residue and terra rossa. That is, with the addition of eolian materials, the composition of other oxides would have also been affected, and they were not dissimilar.

Olson (1979) and Olson et al. (1980) studied the terra rossa soils of Indiana, which are red, clayey materials that were buried by Wisconsin loess, separated by a stoneline, and equated to Sangamon age. The red clay (hues of 5YR or 2.5YR) makes a sharp contact with the Mississippian limestone. Olson hypothesized that the parent material was not limestone for three reasons: volume, composition, and the sharpness of the contact. The limestone contained between about 5 and 15% insoluble residue, which means that between 27 to 41 meters of limestone would have to dissolve to create the observed thicknesses of terra rossa soils observed in Indiana. Compositionally, the modern soil, paleosol, and residuum differed in mineralogy. Illite and vermiculite are found in the surface soil, and kaolinite content is greater in the paleosol. Illite was dominant in the residuum. Olson concluded that limestone dissolution alone did not explain these differences in mineralogy, rather, that the terra rossa soil formed in pedisement. Olson found that field observations and laboratory measurements did not always match in terms of separating the modern soil from the paleosol, likely due to soil welding. This caused her to revise soil horizonation and placement of the parent material change from loess to the paleosol after laboratory characterization.

Durn et al. (1999) studied terra rossa in Croatia, and also concluded that dissolution alone did not account for differences in mineralogy. Illite was dominant in limestone, while kaolinite and illite were dominant in the clay fraction of terra rossa. The primary mineral plagioclase was observed in all terra rossa soils, and was only observed in one limestone sample. Vermiculite was also observed in all terra rossa soils, and not in limestone. Durn et al. (1999) concluded that eolian additions contributed to the properties of the terra rossa.

Fedoroff (1997) observed laminated clay coatings and concluded that clay illuviation is the dominant soil forming process in red Mediterranean soils, and likely took place during the last interglacial and earlier interglacials around the Mediterranean Sea. Bronger and Brunhn-Lobin (1997) studied terra rossa soils in Morocco in order to determine whether they were modern or relict. They observed high to very high rates of clay mineral formation, namely kaolinite, and thus determined that these were relict polygenetic soils.

Merino and Banerjee (2005) observed a thin bleaching zone between limestone and terra rossa clay in Indiana, resulting in the *in situ* replacement of limestone by red clay. This method of dissolution and precipitation in place, and the “force of crystallization-controlled replacement” were first described by Maliva and Siever (1988). Merino and Banerjee (2005) hypothesized that the reaction is best described by the following “growth driven pressure solution” reaction:



Using strontium isotope analysis, Merino et al. (2006) concluded that the aluminum and silicon needed for this reaction are contributed by dust, i.e., eolian sediments. Stiles and Stensvold (2006) also concluded that the terra rossa soils of Wisconsin, the Rountree Formation, form via silicate replacement and augmentation with eolian materials. They hypothesized a step-wise process, involving replacement, lamination (interpreted as illuviation), hydrolysis, and dissolution, resulting in the reverse direction of “normal” argillic horizon formation, i.e., from the bottom (bedrock) towards the soil surface.

Use of geospatial technologies in predictive soil mapping

Soil survey has traditionally been performed using expert knowledge and aerial photographic interpretation, taking many years and great human input to create map products. Soils are recognized as being part of a thermodynamically open system; where energy and matter are both free to move throughout the system and in all directions. Because of this, soils form as continuous surfaces on a landscape, often with gradual changes in properties both vertically and laterally. However, soil survey maps show soils as being discontinuous, in that they are shown as polygons drawn with solid boundaries on top of the landscape. This has been the convention since soil survey began in the early 1900's, and there are reasons for this. One is related to the scale at which the map is drawn. Soil surveys can be first, second, third, fourth, or fifth order. First-order maps are the most detailed, and second-order maps are what are normally found in county-level soil surveys or more recently, as Soil Survey Geographic

data base (SSURGO). Second-order surveys were created with a map scale ranging from 1:12,000 up to 1:24,000 for counties in Kansas. For a soil map created with a 1:12,000 scale, the minimum polygon size can be 1.5 acres, and the minimum size for a 1:24,000 scale map is 5.7 acres (Soil Survey Division Staff, 1993). Therefore, soil scientists doing the original soil mapping would have had limitations on their ability to draw complex and small areas on their base maps, resulting in the inclusion of small areas within larger polygons on the final map, even though the field soil scientist could have recognized the existence of these map inclusions. Another reason for this discontinuous mapping style is that it is easier for a person to draw polygons on a map than it would be to try to create a more continuous kind of map. A continuous map could be drawn by blurring the solid line, or making a shading scheme to represent transitional areas. Both would be more difficult to do by hand than drawing lines, and so the use of lines and polygons was permitted, even though soil scientists recognize that soils are continuous on a given landscape.

In the past, lines were drawn by experts on aerial photographs to create these soil boundaries. These experts had the ability to recognize many different soils in a mapping area. They would traverse the landscape sampling the soil by hand as far as they could go vertically, and each would map several hundred acres per day. Along the way, they would decide when to group soils and when to differentiate them with a solid line. They couldn't sample every acre of every county, and did not have unlimited time. Different soil scientists with different opinions mapped different counties at different points in time. If there were some way to create maps for large areas automatically, and with no minimum delineation size. That would allow for soil information to be represented as a continuous surface. Geospatial technologies, such as remote sensing, geographic information systems (GIS), and global positioning systems (GPS) are being increasingly used for predictive soil mapping.

Scull et al. (2003) list four components of predictive soil mapping: 1) geographic data models of soil variability and soil mapping, 2) digital terrain modeling, 3) remote sensing, and 4) fuzzy logic. Scull et al. (2003) also list four methods used in predictive soil mapping. The four methods are: 1) geostatistical methods, 2) statistical methods, 3) decision tree analysis, and 4) expert systems. In all of the methods, the goal is to

identify areas in space that have similar soil properties and in some cases, to attempt to identify different soil series. These approaches have some similarities and much overlap, because they all usually incorporate the use of one or more of the components.

The following review of literature will discuss selected predictive soil mapping research projects and the components and methods that were used will be discussed. Also note that none of the papers reviewed use decision tree methods because no papers were found that dealt with the use this method in predictive soil mapping. Scull et al. (2003, p. 186) state that this method "...is just beginning to be explored in predictive soil mapping research, although it has been used successfully in the related field of predictive vegetation mapping since the early 1990's."

Statistical methods

Vegetation is one of the five soil forming factors, and vegetation differences are often clues that are used to differentiate soils in field mapping. Therefore, Su et al. (1990) attempted to use remotely sensed vegetation information from the French Systeme de Probatoire d'Observation de le Terre (SPOT) and DEM data to delineate soils on the landscape. Their goal was to be able to differentiate five soil types at Konza Prairie. The SPOT data were registered to the DEM data, and then a statistical method (canonical analysis) was performed. The first four canonical variables were determined to contain 100% of the variability, although the first two contained 99.56%. DEM slope and elevation and SPOT's Band 1 accounted for most of the variability, indicating that these are the most important parameters to use when trying to separate these particular soils. However, they noted that soils which occur on similar landscape positions may be hard to distinguish from each other, and/or classify correctly. They concluded that their methods were appropriate and accurate for separating and mapping soils at a scale of 1:24,000.

Moore et al. (1993) intensively sampled a 5.4 hectare area in Colorado to develop a geographic data model. Soil properties were measured on a grid, and the terrain of the site was measured and analyzed. Multiple linear regression analysis was performed to relate soil attributes such as A-horizon thickness, phosphorous, organic matter, pH, and texture to primary and secondary terrain attributes such as slope, aspect, profile curvature, etc. The outcome was that soil properties were related to

terrain properties, and then this relationship was used to create continuous prediction maps, otherwise known as geographic data models. By knowing the relationships between soil attributes and terrain, the model can be applied throughout the soil survey area to create additional prediction maps of soil attributes, which can serve as a starting point for the rest of the area to be surveyed. However, this method predicts only attributes. No attempt was made to group the attributes into soil series mapping units.

Geostatistical methods

A.B. McBratney and J.J. de Gruijter have pioneered the use of fuzzy logic in soil science, and have written numerous theoretical papers on the subject. The main principle of fuzzy logic is that things that are continuous in nature do not belong to only one set of something, but that a thing can be a member of a several sets and to different degrees. The idea of fuzzy sets is that any given place (or pixel of a grid) can have properties of both sets and thus be a partial member of both sets. When classified, each pixel will be grouped according to the set that it most represents. In this method, there are no longer discrete polygons, but rather, the map will have a raster format and will have more gradual changes between major soil groups.

McBratney and de Gruijter (1992) present data from a project conducted in the Netherlands. Soil samples were collected from a 4800 hectare area in a grid fashion. Soil horizon data were recorded for each sample. More specifically, thickness and texture of each horizon was recorded to a total depth of 140 cm per sample. The minimum, mean, and maximum thickness of each type of horizon and its frequency was calculated. A fuzzy clustering method called fuzzy k-means was used in classification. The authors found that certain horizon features were common, while other horizon sets had very low membership. They found that there were five major classes that the soils were members of, and that these tended to cluster topographically. The main point of this project was to show that the soil attributes themselves can be used to create these general soil classes. Also, the result is a map of similar soils with similar horizons, rather than a map of soil attributes.

This method is similar to what field soil scientists have been doing all along: They determine what the most common soil properties are in a given study area, and match them to topographic position, and then attempt to apply that strategy consistently

throughout the survey area. The benefit to this method is that once this general geostatistical model has been created for a survey area, it can then potentially be applied systematically to the entire study area, which would potentially reduce the amount of errors in soil survey. Also, this method will produce a continuous surface of soil mapping units, which is more like what is normally observed on the landscape surface (as compared to the current, discontinuous maps).

Ahn et al. (1999) used remotely sensed data from an airborne visible/infrared imaging spectrometer (AVIRIS), whereas Su et al. (1990) used SPOT data, which collects data in three wide bands. It is important to note that Ahn et al. (1999) used AVIRIS data, which is hyperspectral, meaning that it measures data in 224 narrow bands and across a much wider portion of the electromagnetic region. In other words, Ahn et al. (1999) used this technology because they hypothesized that hyperspectral data might do a better job at differentiating soils than the previous technology. They processed the data with a linear mixture model, created a layer from the data by block kriging interpolation, and created fuzzy membership sets by using a fuzzy c-mean algorithm. The final step was to create a likelihood map that was a composite of the membership layers, which was done with a fuzzy set logic max operation. That is, any given pixel would be grouped with other pixels for which it had the highest membership value. The final composite fuzzy membership was shown next to the soil survey map of the study area, and they appeared to be very similar to each other. It is important to note that this method is entirely remote-sensing based, and that no soil properties were actually measured. Their goal was only to test methods for manipulating spectral data to show variability on the soil's surface. The authors acknowledge that soil sampling would be needed to validate their findings, and that these methods could also be paired with some of the other components discussed in this literature review (such as terrain) but emphasize that their methods show promise for delineating soil surface variations systematically. Soil surface variations are also used by field soil scientists to detect changes in soils. Therefore, this method could be useful with further testing.

Expert Systems

Zhu et al. (2001) use predictive soil mapping components that include the creation of geographic data models, GIS (including vegetation layers from remote sensing and

terrain data), and fuzzy logic. The geographic data models were constructed for sites in Montana and Wisconsin, and extensive model validation has been performed using grid soil sampling and subsequent laboratory analyses. Zhu et al. (2001) used a soil land inference model (SoLIM) to estimate soil property surfaces at the study areas, and then fuzzy logic was used to classify the soil properties into membership sets. Soil series are suites of soil properties that are specified by experts (soil scientists). In general, expert knowledge is a set of rules that are created by an expert. In predictive soil mapping, those rules are created by experienced soil scientists, and the rules dictate how soils will classify into taxonomic units, such as soil series. Consequently, the various layers of soil properties that were generated by SoLIM can now be combined using expert knowledge to assemble them into suites of properties, or series. This is again done with fuzzy logic membership values created by the expert knowledge rules. As previously mentioned, the rules are provided by experts, and these are the same rules used in field mapping. Expert knowledge would take all of these rules into consideration when assigning the fuzzy membership values, and it would do it systematically for the entire survey area. It would also result in the creation of a continuous surface, with groups of pixels representing soil series, rather than discrete polygons.

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CHAPTER 3 - Morphological Characteristics of Upland Polygenetic Soils in the Bluestem Hills Major Land Resource Area of Kansas

Abstract

The Bluestem Hills are underlain by alternating, level beds of Permian and Pennsylvanian shale and limestone. Upland soils in the Bluestem Hills Major Land Resource Area (MLRA 76) have a long and complex genesis, multiple parent materials, and formed under tallgrass prairie. The soils of interest are the Irwin, Konza, and Dwight series which are mapped adjacently on interfluves and benches and are classified as Pachic Argiustolls, Udertic Paleustolls, and Typic Natrustolls, respectively. The Soils in the Ladysmith series classify as Udertic Argiustolls and are mapped on uplands as well as paleoterraces in MLRA 76. Parent materials were historically described as clayey sediments, although recent investigations have described a more complicated and polygenetic suite of parent materials for the modern soil and underlying paleosols. The objective of this study was to use macro- and micromorphology as well as laboratory characterization to identify parent material stratigraphy and features of soil development within polygenetic soil profiles that are mapped on stable upland landscape positions in the Bluestem Hills MLRA of Kansas. Four (predominantly) loess units were observed in polygenetic upland soils within a depth of 2.5 m, and correlate to the Bignell loess (or more recent), Peoria loess, and two periods of soil formation with materials that belong to the Severance Formation. The sharp textural contrast between the A and Bt horizons is likely due to a change in parent material, rather than illuviation as illustrated by micromorphology, as well as silt and clay fraction particle size distribution. The ubiquitous chocolate-brown paleosol that directly and abruptly overlies Permian bedrock has properties more similar to loess than bedrock, thus is loess/colluvial in origin and correlates to Severance Formation in age. Elevated sodium levels were observed in all soils, but only one profile sampled in a closed, upland depression met the criteria for classification as a Natrustoll. Likely sources for Na⁺ include primary mineral weathering

and mixing of long-distance dust with local dust derived from local bedrock. The family mineralogy class for the pedons analyzed is smectitic.

Introduction

The Bluestem Hills are underlain by alternating, level beds of Permian shale and limestone, some of which are quite cherty. Upland soils in the Bluestem Hills Major Land Resource Area (MLRA 76) are thought to have a long and complex genesis, having multiple parent materials, and forming under tallgrass prairie in an area that is transitional between udic and ustic moisture regimes. The soil series of interest include the Irwin, Konza, and Dwight series which are mapped adjacently on interfluves and benches and are classified as Pachic Argiustolls, Udertic Paleustolls, and Typic Natrustolls, respectively. In addition, the soils of the Ladysmith series classify as Udertic Argiustolls and are mapped on uplands as well as terraces in MLRA 76. Parent materials were historically described as clayey sediments, such as residuum, although recent investigations have described a more complicated and polygenetic suite of parent materials for the modern soil and underlying paleosols (Wehmueller, 1996; Glaze, 1998).

Frye and Leonard (1952) estimated that one-third of Kansas has Peoria loess at the surface. Later, Welch and Hale (1987) used a combination of sources including geologic maps and county soil surveys to estimate that approximately 65% of the state was covered with Pleistocene loess. Welch and Hale (1987) used a minimum thickness of 0.6 m for the loess whereas geologic maps often use 0.9 meters as the thickness required to recognize loess. According to Welch and Hale (1987), widespread loess deposits are not recognized in east-central and southeastern Kansas, which includes the southern two-thirds of the Bluestem Hills MLRA. Many extensively mapped soils are thought to have a loess component, and Welch and Hale (1987) list Dwight, Irwin, and Ladysmith as having a surficial loess component, as well as forming from old Pleistocene alluvium predominantly from Lower Permian rocks.

Loess-paleosol sequences of the Quaternary Period (the past 2 million years) are present throughout much of the Great Plains (Table 3.1). Geological information from the Pleistocene epoch (2 million years before present to 10,000 ago) was summarized

by Frye and Leonard (1952). At that time, the loess units and paleosols recognized in Kansas included the following, listed from oldest to most recent: Loveland loess (late Illinoian), Sangamon paleosol, Peoria loess (late Wisconsinan), Brady paleosol, and Bignell loess (early Holocene). Bignell loess is not recognized east of 97°W longitude, and is only distinguished when the Brady paleosol is present (Welch and Hale, 1987). Reed and Dreeszen (1965) described a loess unit in south-central Nebraska that was older than Peoria, and younger than Loveland, and called it Gilman Canyon. Mandel and Bettis (2001, 2003) observed a deposit that was similar in age and properties to the Gilman Canyon loess in valleys and older terraces in northeast Kansas (Mandel and Bettis, 2001; Mandel and Bettis, 2003) and called the colluvial and alluvial facies the Severance Formation. Radiocarbon ages from the Severance Formation range from 25,000 to 15,000 yr BP (Mandel and Bettis, 2003).

Swineford and Frye (1951, p. 316) wrote, "The origin of massive silt deposits (loess) has been a subject of controversy for more than fifty years." Swineford and Frye (1951) concluded that the major source of Peoria loess for Kansas was the Platte River, and that the Republican and Arikaree were locally important in western and north central Kansas, and the Missouri River contributed to loess of northeastern Kansas. Many of the other rivers of Kansas, including the Smoky Hill, Saline, Solomon, Big Blue, and Little Blue were not sources of loess, because they did not carry Wisconsin outwash. Much of the area in the Great Plains west of the Missouri River was never directly passed over by continental glaciers, but the regional climate would have been affected. A shift from a warmer and wetter climate to a cooler and drier climate would result in less biomass and more soil erosion, supplying a source of loess for the Great Plains. In Nebraska, Mason (2001) concluded that the Platte and Missouri river valleys were only locally important sources of Peoria loess, and were not large regional loess sources. Aleinikoff et al. (1998) found that material from the White River Group was present in Peoria Loess in Nebraska. The White River Group is Oligocene in age and is exposed in eastern Colorado, western South Dakota, and northwestern Nebraska in a non-glaciated area. Mason (2001) examined historical test hole records to determine the thickness of the Peoria loess and created an interpolated layer of loess thickness in a geographic information system. He found that much of eastern and southern

Nebraska is covered with a nearly continuous layer of Peoria loess, which was thickest to the northwest and thinnest in the southeast. Because of the provenance study performed by Aleinikoff et al. (1998), Mason felt that the loess source was the White River Group that is exposed in South Dakota, western Nebraska, and northeast Colorado. The source of Bignell loess is attributed to the Sand Hills of Nebraska (Jacobs and Mason, 2005).

Particle size data are often used to indirectly determine the transport direction or wind strength for loess. Usually, coarser particles will dominate loess deposits closest to the loess source, while finer particles are dominant at greater distances. The mean particle size for Great Plains Peoria loess was reported as medium silt (15 to 31 μm) by Swineford and Frye (1951), and Muhs et al. (1999) reported a mean particle size of fine silt (6-7 μm) in eastern Colorado. Mason et al. (2003) found problems with using mean particle size for wind strength when they observed sedimentary aggregates in C horizons of Peoria loess in Nebraska. In thin section, non-pedogenic clay coatings were present on silt and sand grains. Aggregates were also visible in thin section. Muhs et al. (1999) studied clayey loess in eastern Colorado. The particle size distribution was bi-modal, with peaks in the 20-30 μm range, and in the <4 μm clay-size fraction. The authors attribute this to either a local, clayey source such as the Pierre shale, or silt-sized clay aggregates (Muhs et al., 1999).

In east central Kansas, including the region known as the Flint Hills or Bluestem Hills Major Land Resource Area (MLRA 76), buried paleosols with a preserved A horizon are rare. It is much more common to find the modern soil superimposed (e.g., welded) almost seamlessly onto the Bt horizon of one (or more than one) paleosol. Three of the upland soil series mapped in east central Kansas in which polygenesis is recognized include the Irwin, Konza, and Dwight soil series, which are collectively mapped in more than 20 counties. On upland landscapes, it is common to see a dark red soil that is located above bedrock, and beneath the upper material (loess). This red paleosol sharply contacts interbedded Permian limestones and shales, and is commonly regarded by NRCS soil scientists as being derived mostly from residuum from these bedrock members (William Wehmueller, personal communication; Patrick Abel, personal communication). This paleosol (or sediment) is often dark red in color

with hues of 5YR or 7.5YR (or redder) and values and chromas of 3 or less. This material is very clayey and dense, with strongly expressed structure, thick clay films, and rock fragments that may or may not be similar to the underlying bedrock. Many soil scientists agree that this is a paleosol, but differ in opinions as to the parent material and age of the paleosol and/or sediments.

A term that is not often used in Kansas, but used throughout the world for red soils over limestones (i.e., red clay sharply contacting limestone) is “terra rossa,” meaning “red earth.” Formation hypotheses for terra rossa soils include the following: Dissolution of the underlying bedrock (Bronger et al., 1983; Bronger and Bruhn-Lobin, 1997; Moresi and Mongelli, 1988), polygenesis from other sediments (loess, pedisegment) deposited on top of the bedrock (Olson 1979; Olson et al., 1980; Yaalon, 1997), or that terra rossa red clay is derived by a replacement reaction with the underlying limestone that produces kaolinite (Merino and Banerjee, 2005; Merino et al., 2006; Stiles and Stensvold, 2006).

Objective

The objective of this study was to use macro- and micromorphology as well as laboratory characterization to identify parent material stratigraphy and features of soil development within polygenetic soil profiles that are mapped on stable upland landscape positions in the Bluestem Hills Major Land Resource Area of Kansas (MLRA 76). In addition, differences between selected pedons sampled in an \approx 175 kilometer north-south transect of MLRA 76 will be discussed, but in limited detail as this will be examined further in chapter 5 of this dissertation.

Materials and methods

Field description and sampling

Seventy-seven total pedons were sampled in 2005 and 2006 in the Bluestem Hills Major Land Resource Area (MLRA 76). Seventy-five pedons were sampled using a hydraulic, truck-mounted probe (5 cm diameter). Two representative pedons were excavated to a depth of 2 m with a backhoe. Pedons were described using the Field Book for Describing and Sampling Soils (Schoenenberger et al., 2002), and all sampling

locations were georeferenced using a global positioning systems (GPS) unit with an approximate horizontal positional accuracy of 10 meters. Pedon descriptions were entered into the United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) National Soil Information System (NASIS) database. Bulk samples were collected for laboratory characterization and oriented clods were collected from the horizons (of pit-sampled profiles only) for thin section preparation. Thick horizons (>20 cm) were split and subsampled.

In this chapter, results will be presented for the following selected pedons: 05KS161005, 05KS061001, 06KS161001, 05KS127008, 06KS127001, 06KS115007, and 06KS015010 (Fig. 3.1). Three of these pedons classify as fine, smectitic, mesic Pachic Argiustolls. Three pedons classify as fine, smectitic, mesic Pachic Paleustolls. One pedon was revised from a fine, smectitic, mesic Pachic Paleustoll to a fine, smectitic, mesic Typic Natrustoll after laboratory characterization. These profiles have been selected as they are representative of the loess/paleosol sequences encountered in field work at multiple locations throughout the Bluestem Hills MLRA. All were sampled on interfluves or gently sloping upland sideslopes, which should allow for the best possible preservation of the loess/paleosol record, as opposed to less stable sites where more mixing/averaging of the materials might have occurred.

Laboratory characterization

Air-dry bulk samples were crushed with a wooden rolling pin and passed through a No. 10 sieve with 2 mm square openings. Soil pH was determined in a 1:1 soil/water suspension using method 8C1F of the Soil Survey Laboratory Staff (1996). Total carbon (TC) and total nitrogen (TN) were determined using a high-frequency induction furnace (Leco Model CNS-2000, St. Joseph, MI) following the procedure of Tabatabai and Bremner (1970). Particle size distribution was determined using a modification of the pipet method of Kilmer and Alexander (1949) and method 3A1 from the Soil Survey Laboratory Method Manual (1996). Organic matter was removed from samples containing greater than 1.4% total C with 30% hydrogen peroxide. Cation exchange capacity (CEC) was determined by summing the NH₄OAc extractable bases and the BaCl₂-TEA extractable acidity (method 5A3a of the Soil Survey Laboratory Staff (1996)).

Exchangeable sodium percentage (ESP) was determined by dividing the exchangeable sodium by the sum of cations CEC. One to three samples per horizon were collected for bulk density measurements by cutting a sample of known volume from the probe-sampled pedon, and drying at 105°C until a constant mass was achieved. Three clods per horizon were collected from the pit-sampled pedons and trimmed for thin section preparation, marked for direction of orientation, and placed in cardboard boxes with dividers.

Micromorphology

Thin sections were prepared by a commercial laboratory (Texas Petrographics, Houston, TX) and examined with a petrographic microscope (Model Optiphot-Pol, Nikon, Melville, NY) using plane-polarized, circularly polarized, and cross polarized light. They were photographed using a camera system (Model UFX, Nikon, Melville, NY) attached to the microscope. Thin sections were qualitatively described using the terminology of Stoops (2003).

Mineralogy

Total silt and clay mineralogy was analyzed following the methods of Jackson (1975). Forty-gram samples were pretreated with 1 M NaOAc and 30% H₂O₂ to remove carbonates and organic matter, respectively. Sand was collected on a 300-mesh sieve, and silt and clay were fractioned through at least eight sedimentation periods. Stokes' law was used to calculate sedimentation times for a 10-cm depth of fall (Jackson, 1975). The clay fraction was flocculated with MgCl₂, quick-frozen in a bath of dry ice and acetone, and freeze-dried. Silt and sand fractions were oven dried at 60°C and retained in vials.

Five clay treatments were prepared: Mg 25°C, Mg-ethylene glycol, K 25°C, K 350°C, and K 550°C. For each treatment, two milliliters of solution, which yielded 30 mg of clay, were pipetted onto a glass slide.

A Phillips XRG-3100 generator and an APD X-Ray diffractometer was used to analyze all samples. The instrument was equipped with a Theta compensating slit and a monochromatic X-ray beam. The instrument operating conditions were as follows:

Target: Copper

Radiation:	CuK α
Potential:	35 kV
Current:	20 mA
Detector:	Scintillation
Range:	1000 to 2000 cps
Time Constant:	2000 cps = 1 and 1000 cps = 2
Scan Speed:	2°2 θ min ⁻¹
Chart Speed:	10 mm min ⁻¹

The clay specimens were scanned from 2°2 θ to 34°2 θ for the Mg 25°C treatment, and from 2°2 θ to 15°2 θ for the Mg-ethylene glycol, K 25°C, K 350°C, and K 550°C treatments. The silt samples were scanned from 18°2 θ to 54°2 θ using powder diffraction specimen holders. The d-spacing of each peak was determined using the table on p. 224 of Jackson (1975), and relative abundance of each clay mineral was estimated using the peak intensities.

Results & Discussion

Macromorphology/Field Descriptions

In a majority of the soil profiles, bedrock (i.e., a lithic or paralithic contact) was observed within a depth of about 2.5 m from the soil surface. In the pedons where the depth to bedrock was >2.5 m, three loess-related stratigraphic units were often observed. The parent materials were usually described as loess for the modern soil (unit 1), loess-derived colluvium for the upper paleosol (unit 2), and primarily loess-derived colluvium for the lower paleosol (unit 3). Divisions between the units were determined based on several criteria, including Munsell color and/or clay film features. Calcium carbonate nodules were usually present at the base of most modern soils and in the upper part of the upper paleosol. It is probable that the carbonates were leached from the upper paleosol prior to the deposition of the parent material for the modern soil. Then, carbonates were leached from the new material and deposited into the upper part of the upper paleosol.

Site 1

Pedon 05KS161005 was sampled from a reseeded native prairie in northern Riley County. The sample was obtained by pushing a hydraulic, tractor-mounted probe (5 cm diameter) into the soil surface a distance of 2.5 meters, in an area mapped as the Dwight-Irwin complex, 4625, 1 to 3 percent slopes. The slope at the site was measured as 2% on a shoulder of an upland interfluvium. (All pedon descriptions are located in Appendix A1). Four materials were described in this profile: Clayey loess, 0 to 116 cm; colluvium, 116 to 207 cm; colluvium, 207 to 246 cm; and weathered calcareous shale residuum, 246 to 255+ cm. The bedrock is likely a member of either the Sumner or Chase Group of the Permian system. Although they were described as colluvium, both paleosols are thought to be primarily loess-derived. Color and clay films were used to differentiate between the modern soil and two paleosols. The modern soil had hues of 10YR, the upper paleosol had 7.5YR hues, and the lower paleosol was described with 5YR and 7.5YR hues. White masses were described in the upper paleosol, appeared crystalline at 40x magnification, and are thought to be gypsum. This pedon was originally classified as a fine, smectitic, mesic Pachic Paleustoll, but after laboratory characterization was revised to a Pachic Argiustoll as it did not meet either criterion for Paleustoll classification. This will be further discussed later in the paper.

Site 2

Pedon 06KS161001 (Fig. 3.2) was described from a soil pit in western Riley County, Kansas. The pit was located on the Fort Riley Military Installation, in an area that had not been disturbed in approximately 50 years, but had likely been disturbed by either traffic or cultivation at some point earlier. The current vegetation is mixed rangeland grasses and forbs. The slope was 2% on a backslope of a sideslope on an upland, in map unit 4625, Dwight-Irwin complex, 1 to 3% slopes. An NRCS soil scientist assisted with the site description. The parent materials described were clayey loess over two units of clayey pediment, i.e. a local mix of loess and colluvium, over weathered calcareous shale bedrock. The upper unit from 0 to 66 cm was described as clayey loess and had 10YR hues; the second unit from 66 to 104 cm was described as clayey pediment and had 7.5YR 4/2 and 4/3 colors. The third unit from 104 to 178 cm was described as clayey pediment and had 7.5YR 3/3 colors, and the Cr

horizon was exposed from 178 to 185 cm and was weathered calcareous shale bedrock. The bedrock is a member of the Chase Group of the Permian system. The color of the lower paleosol, 7.5YR 3/3, is distinctly darker than the overlying material and is dark, chocolate brown in appearance. Slickensides were described from 36 to 79 cm in the profile, and had an abundance of 10 to 15%. Clay films were described as very abundant (50%) in the Bt horizon (20-36 cm) and decreased to about 10% until increasing to 20 to 25% in portions of both paleosols. Carbonate nodules (1%) were only described in the top of the first paleosol, the 2Btkss horizon from 66 to 79 cm. This pedon was classified as a fine, smectitic, mesic Pachic Argiustoll, and was not revised after laboratory characterization.

Site 3

Pedon 05KS061001 was described from a soil pit in Geary County, Kansas (Fig. 3.3). A group of NRCS soil scientists assisted with the pit description. The site was in native, well managed range that is burned annually in the spring. The slope was 3% on a backslope of a sideslope of an upland hillslope, in mapping unit 4673, Irwin silty clay loam, 3 to 7% slopes. There was much discussion between the soil scientists about the parent material stratigraphy. The upper unit (0 to 124 cm) was described as loess from a mixed source, the second unit (124 to 175 cm) was described as pedisegment derived from a mixed source, and the third unit (175 to 213+ cm) was described as residuum weathered from calcareous shale. The bedrock is a member of the Chase Group of the Permian system. Therefore, one loess unit, one paleosol, and one residuum unit were described. The paleosol was determined by the change in hue and an increase in clay films. The hue was 10YR above the paleosol, to 7.5YR in the paleosol. Clay-film percentage was described as 15% in the Btk2 horizon, and increased to 25% in the 2Bt3 (as described) horizon. Carbonate nodules were described above the paleosol, but not in the paleosol. The possible presence of another paleosol was discussed, but, for lack of evidence, was not described in the field. The possible location that was debated was a small zone directly above the paleosol, i.e., the Btk2 horizon from 107 to 124 cm. No gypsum accumulations were observed in the field. A few (5%) slickensides were observed in the Bt2 horizon, from

58 to 79 cm. In the field, this pedon was classified as a fine, mixed, superactive mesic Pachic Argiustoll.

Site 4

Site 4 is a pair of pedons, both of which were initially classified as fine, smectitic, mesic Pachic Paleustolls in the field description. Depth and landform sets these two pedons apart, while they have similar features in the upper parts of their profiles. Both pedons were sampled in southern Morris County in large, well-managed pastures. Pedon 05KS127008 or Site 4a was sampled in an area that had been tilled and row cropped and terraced in the past, but had been reseeded to big bluestem, Indian grass, and switchgrass in 1981 and hayed once per year (in July) since. Site 4a was sampled using a truck-mounted hydraulic soil probe (5 cm diameter) in an area mapped as 4605, Dwight silt loam, 1 to 3% slopes. The Dwight series is classified as fine, smectitic, mesic Typic Natrustolls, meaning that the argillic horizon contains >15% exchangeable sodium % (ESP) or > 13 Sodium Absorption Ratio (SAR). Pedon 06KS127001 or Site 4b was sampled in 2006 on a subsequent visit to the site where the goal was to find soils with a high electrical conductivity for the purpose of training soil scientists how to use geophysical equipment. Site 4b was sampled in the center of a closed upland depression. These upland depressions are often wetter, contain more redoximorphic features or contain these features higher in the profile, and have hydrophilic vegetation, such as sedges. The sodium characteristics of these profiles will be discussed later in this paper. The area in which pedon 06KS127001 was sampled has never been plowed or reseeded, but is continuously grazed by cattle. This pedon was sampled in an area mapped as 4671, Irwin silty clay loam, 1 to 3% slopes.

Pedon 05KS127008 (site 4a) was sampled to a depth of 260 cm. The slope was 1% on the summit of an interfluvium on an upland. In the field, a modern loess-derived soil was described from 0 to 99 cm, a colluvial paleosol was described from 99 to 161 cm, a second colluvial paleosol was described from 161 to 260 cm, and weathered calcareous shale bedrock was encountered from 260 to 270+ cm. The bedrock is a member of the Chase Group of the Permian system. The loess had 10YR hues, the upper paleosol had 7.5YR and 5YR hues, and the lower paleosol had a 5YR hue in the upper part and 7.5YR hue in the lower part. Clay film abundance was 1 to 5% in the

loess, 5% in the upper paleosol, and 10 to 20% in the lower paleosol. Calcium carbonate nodules were observed between 64 and 99 cm. White crystalline masses were observed from 99 to 161 cm (in the upper paleosol only). These masses were described in the field as gypsum because they did not react with 10% HCl. Under a hand lens the crystal grains appeared sugar-like, indicating that they were indeed gypsum and not calcite grains (Porta and Herrero, 1990).

Pedon 06KS127001 (site 4b) was sampled with a hydraulic, truck-mounted soil probe (5 cm diameter) to a depth of 87 cm, in an upland depression that is located on the summit of an interfluvium of an upland with 0% slope. A modern, loess-derived soil was described from 0 to 75 cm, and a colluvial paleosol was described from 75 to 87 cm. Weathered calcareous shale bedrock was observed from 87 to 88 cm, and is a member of the Chase Group of the Permian System. The paleosol was distinguished by a change in hue from 10YR in the modern soil and 7.5YR in the paleosol. No increase in clay film abundance was detected, as both the bottom of the modern soil and the paleosol were described with 5% clay films on all faces of peds. Carbonates (2%) were observed between 51 and 75 cm. Masses of oxidized iron were observed beginning at 26 cm in this profile, which is not unexpected as the site was located in a closed, upland depression.

Site 5

Pedon 06KS115007 differs from the other pedons in this study as it is currently under row crop production. This sample was obtained with a hydraulic, truck-mounted soil probe (5 cm diameter) in an area mapped as 3890, Ladysmith silty clay loam, 0 to 1% slope. The pedon was sampled on a backslope of an interfluvium with 2% slope. Pedon 06KS115007 classifies as a fine, smectitic, mesic Pachic Argiustoll. The modern loess-derived soil was described from 0 to 61 cm, a colluvial paleosol was described from 61 to 113 cm, and a second colluvial paleosol was described from 113 to 215 cm. Residuum from weathered non-calcareous shale was described from 215 to 226, and residuum from weathered calcareous shale was described from 226 to 237 cm, and a second calcareous unit was described from 237 to 242 cm. The bedrock is a member of the Chase Group of the Permian System. The modern soil and upper paleosol were separated based on the presence of 2% chert fragments ranging from 2 to 10 mm in

diameter in the 2Btk horizon. The two paleosols were separated by a change in color (10YR in upper paleosol, and 7.5YR in the lower paleosol), and an increase in clay film abundance (50%), especially in the 3Btss2 horizon. Rock fragments were not observed in the 3Btss1 horizon, but were present in the 3Btss2 horizon, and appeared similar to the underlying shale residuum, although fragments of limestone were also observed. Slickensides were present between 113 and 215 cm. Carbonates occurred between 61 and 113 cm.

Site 6

Pedon 06KS015010 was sampled in a native, continuously grazed pasture in an area mapped as 3890, Ladysmith silty clay loam, 0 to 1% slope. The sample was taken in an area with 0.5% slope, on a summit of an interfluvium and was obtained with a hydraulic, truck-mounted soil probe (5 cm diameter). This pedon classifies as a fine, smectitic, Pachic Paleustoll. Clayey loess was described from 0 to 83 cm, a colluvial paleosol was described from 83 to 113 cm, and a second colluvial paleosol was described from 113 to 251 cm. The underlying bedrock was not contacted, but is likely a member of the Chase Group of the Permian system. The paleosols were determined based on matrix color and clay film abundance. The matrix color was 7.5YR in the lower part of the modern soil as well as the upper paleosol, but clay film abundance increased from 2 to 10%, respectively. The clay film abundance increased to 50% in the lower paleosol, and the matrix color was described as 5YR. Slickensides were observed in the lower paleosol from 113 to 251 cm. Carbonates were not present in this pedon. Chert fragments were observed in the lower paleosol in all three horizons and were about 2 percent in abundance and 5 mm in diameter. One chert fragment with a diameter of 40 mm was observed at 56 cm in the profile, at the boundary between the Bt1 and Bt2 horizons.

Particle size distribution

The purpose of graphing particle size distribution for this paper is to determine parent material stratigraphy. Due to the bi-modal particle size distribution, i.e., large quantities of fine clay and coarse silt, it was evident that neither the mean or median particle size calculations provided meaningful results for these soil samples. This bi-

modal particle size distribution was attributed to aggregate transport in loess by Mason (2003) and Muhs et al. (1999). The best way to plot several horizons from one pedon on one graph seems to be done by plotting particle size (using the upper size range value in μm) versus percent by horizon. For example, very coarse sand is 1000 to 2000 μm in diameter. The very coarse sand value is graphed as the percent versus 2000 μm . The same is done for all particle size fractions. This graphical method allows for a relatively easy, visual interpretation of shifts in particle size distribution within a single pedon.

Site 1

The particle size distribution (Fig. 3.4) of pedon 05KS161005 is rather complex, but some differences are apparent. There is a considerable variability in both the coarse and medium silt fractions. The Ap and Bt1 horizons do not appear very similar to each other, which may have resulted from clay eluviation/illuviation, or may be due to a change in parent material, or period of loess deposition/change in source material. The Ap horizon has more coarse silt than the Bt1 horizon. The next three horizons, the Bt2 the Btk, and 2Bt1 differ only slightly from each other. The 2Bt2 and 3Bt3 horizons appear to have very similar particle size distributions, with the lowest medium and highest coarse silt fractions of all horizons in this pedon. The 3Bt4 horizon is probably the most unique horizon in this profile, with the highest coarse clay, fine silt, and medium silt fractions of all horizons, and the lowest fine clay and coarse silt. Interestingly, the 2Bt2 horizon and 3Bt3 horizon are more similar to each other than the 3Bt3 and 3Bt4 horizons are to each other. The particle size results indicate that the horizon nomenclature (as described in the field) may have been shifted with respect to the actual parent material stratigraphy. Revised nomenclature is as follows: Ap, 0 to 22cm; Bt1, 22 to 41 cm; Bt2, 41 to 80 cm; Btk, 80 to 116 cm; Bt1', 116 to 175 cm; 2Bt2, 175 to 207; 2Bt3, 207 to 234 cm; 3Bt4, 234 to 246 cm; and 4Cr, 246 to 255 cm.

Site 2

At site 2, the upper two horizons, the A and BA from 0 to 20 cm combined, and have a different particle size distribution (Fig. 3.5) than the underlying horizons. These two horizons contain a greater proportion of coarse silt (20 to 50 μm). While the clay

content increased gradually from the A, BA, and Bt horizons, the decrease in coarse silt between the BA and Bt horizons was quite abrupt, decreasing by about 10%. Although not recognized in the field, a change in parent material seems likely at 20 cm. The material between 20 and 132 cm had a fairly uniform particle size distribution. Another shift in particle size distribution occurred in the 3Bt3 horizon, which had relatively different values in the <5 μm fraction than the materials above it.

Site 3

The particle size distribution of pedon 05KS061001 (Fig. 3.6), the official type location for the Irwin series, is quite interesting. The upper two horizons were designated A1 and A2, from 0 to 10 and 10 to 30 cm, respectively. The clay content of these horizons was 25.9 and 25.4 %, respectively, while the clay content of the horizon below them (Bt1) was 51.4%. The boundary between these two profiles was described as abrupt in the field, meaning that the change in properties of these two horizons occurred over a 0 to 1 cm boundary. Mollic colors were described in all three of these horizons. The 't' designation means that illuvial clay films were observed, and the clay films were described as covering 15 percent of the ped faces, were continuous, faint, and very dark grayish brown in color (moist). With such an abrupt and large increase in clay, this profile meets the criteria for a Paleustoll, which requires a 15% increase in clay content over a distance of 2.5 cm (Soil Taxonomy, 1999). However, it seems unlikely that this difference in clay content should be attributed to illuviation, but rather to a change in parent material or to deposition of loess. One supporting piece of information is the coarse silt (50 to 20 μm) fraction. The coarse silt content of the A horizons is nearly double that of the underlying horizons. The fine silt fraction (20 to 2 μm) was constant at 23 to 28%.

Site 4

The particle size distribution of pedon 05KS127008 (Fig. 3.7) is rather complex, but some differences are apparent. There is a considerable variability in both the coarse and medium silt fractions as well as the fine clay fraction. The Ap horizon is higher in both coarse- and medium-sized silt particles than the Bt1 horizon, again, a change that may have resulted from eluviation/illuviation processes. The Bt2, Btk,

2Bty1 and 2Bty2 horizons loosely cluster together, with some exceptions. For example, the Btk horizon is the highest overall in coarse silt. The 3Bt1 and 3Bt2 horizons are clustered together in nearly every size fraction, and are quite different from the 3Bt3 horizon. Therefore, the nomenclature of the 3Bt3 horizon should likely be changed to 4Bt3, and the horizon below would become 5Cr.

The particle size distribution of 06KS127001 (Fig. 3.8) is somewhat similar to that of 05KS127008 in the upper 50 cm of the profile, but is truncated overall. In pedon 06KS127001, the paleosol is encountered at 75 cm in the profile, as opposed to 99 cm in the deeper pedon sampled at site 4. In the coarse silt fraction, the A horizon has a higher coarse silt content than the Btn1 horizon. Both horizons have a greater coarse silt fraction than the underlying horizons. The change in parent material in the 2Btn horizon does not appear to be supported by the particle size distribution data, although this horizon has the highest fine clay content in the profile.

Site 5

The particle size distribution of pedon 06KS115007 (Fig. 3.9) is perhaps more straightforward than some of the previously discussed pedons. The Ap1 horizon (0 to 10 cm) contains more coarse silt and less fine clay than all of the other horizons. The 4C1 and 4C2 weathered shale residuum horizons each have unique distributions that are both different from each other, and different from all of the other horizons. The Ap2 through 3Btss2 horizons have a wide range of fine clay contents (about 27 to 40%), but have fairly similar silt contents. The 3Btss2 horizons (split because of thickness) have slightly lower coarse silt contents as compared to the other Bt horizons. The classification and horizonation of this pedon remain unchanged after particle size determination.

Site 6

The particle size distribution of pedon 06KS015010 (Fig. 3.10) is also fairly straightforward. The A horizon (0 to 8 cm) appears to have the most unique particle size distribution, containing more medium silt than any other fraction, and more coarse silt than the underlying BA horizon. The A horizon also contains the least amount of fine clay. The Bt3 horizon (72 to 83 cm) contains the greatest amount of coarse silt of

any horizon, but is clustered in the middle of the other horizons in the other size fractions. The classification and horizonation of this pedon remain unchanged after particle size determination.

Micromorphology

Site 3

Thin sections (Fig. 3.11) were only prepared from soil clods sampled from one pit-sampled soil profile (site 3, pedon 05KS061001). However, virtually identical observations and conclusions were made by Wehmueller (1996), Glaze (1998), and Gunal and Ransom (2006) in studies of polygenetic soils of the Flint Hills region of Kansas.

In well-developed, welded, polygenetic soils, it is often difficult to determine the boundaries between parent materials in the field, but differences were more apparent in thin sections. In pedon 05KS061001, it was observed that the horizon located from 107 to 124 cm had properties that were different from the horizons located both above and below it. Therefore, this horizon is now designated as a paleosol, and the horizon nomenclature was changed from Btk2 to 2Btk2. Micromorphology was very useful for differentiating stress and illuvial clay coatings. The loess component of this pedon lacked illuvial clay coatings, whereas the paleosols (now referred to as upper and lower) typically had very thick, laminated, limpid illuvial clay coatings. Therefore, illuvial clay films became thicker and more abundant with increasing depth and weathering in the paleosols, a feature recognized in polygenetic soils studied in eastern Kansas by Gunal and Ransom (2006).

Lenticular gypsum crystals ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) were observed (in thin section) in the lower portion of the upper paleosol. These lenticular crystals are commonly observed in semi-arid climates and are considered to form from the weathering and reprecipitation of gypsum (often in voids), either from gypsum bedrock, or from gypsum particles inherent to the parent material, such as alluvium or eolian deposits (Porta and Herrero, 1990). Therefore, lenticular gypsum crystal formation results from a pedogenic process. In this particular pedon, pedogenic gypsum accumulated in a zone where there was

likely a difference in permeability between horizons, i.e., a change in parent material and/or texture. Gypsum could be dissolved and reprecipitated during seasonal high water tables (possibly modern, or more likely, relict). Examination of these thin sections altered the horizon nomenclature, i.e. required the addition of the 'y' subscript. In pedon 05KS061001, the 2Btk2 horizon has now become the 2Btky horizon. (And thus, the horizon above this is now the Btk horizon, rather than a Btk1 horizon).

Sodium accumulation

Site 1

Exchangeable sodium percentage (Fig. 3.12) ranged from 0.1 % in the Bt1 horizon, to a profile maximum of 2.9% in the 2Bt2 horizon. All other horizons had values intermediate to these horizons. There was abundant vegetation at the site and high sodium levels were not anticipated.

Site 2

Exchangeable sodium percentage (Fig. 3.13) ranged from a low of 1.4% in the BA horizon to a maximum of 3.2% in the Btkss horizon. (All other horizons had values between 1.4 and 3.2 %). There was abundant vegetation at the site and high sodium levels were not anticipated.

Site 3

Elevated ESP values were determined in pedon 05KS061001 (Fig. 3.14). ESP ranged from 9 to 13 in the Bt1 through 3C horizons. SAR ranged from 7 to 9 in the Bt2 through 3C horizons. Sodium levels were low in the A1 and A2 horizons. There was abundant vegetation at the site and high sodium levels were not anticipated.

Site 4

An electrical conductivity sensor, the EM-38, was used in two sub-locations at this study site, and sites 4a and 4b were sampled within these areas. Pedon 05KS127008 (Fig. 3.15) was sampled in an area that is mapped as the Dwight series (Fig. 3.16), a Natrustoll. However, this pedon does not classify as a Natrustoll as the

maximum ESP value in the profile is 8.6%. Pedon 06KS127001 (Fig. 3.17) was intentionally sampled in an area (Fig. 3.18) suspected to contain high amounts of sodium, although the site is located in an Irwin map unit, which does not contain a natric horizon. The upland depression was oval shaped, approximately 20 meters by 15 meters in diameter, and thus, too small to be mapped at the scale of mapping, which is 1:20,000 in Morris County, Kansas (Barker, 1974). The area was a closed upland depression, where vegetation was shorter and sparser than the surrounding vegetation, and populated with sedges (Fig. 3.19). These closed, upland depressions are referred to as bison wallows. Coppedge et al. (1999) studied relict and active bison wallows in Oklahoma. Bison were re-introduced into an area that contained upland depressions that were thought to be relict wallows. Bison did not revisit these wallows, but rather chose to establish new wallowing sites in areas that were predominantly sandy loam soils underlain by limestone. The relict wallows were in areas with high-sodium clay pans with silty clay textures derived from shale. Coppedge et al. (1999) concluded that bison did not create the relict wallows, but rather, these features were a natural landscape feature. Pedon 06KS127001 certainly meets the criteria for a Natrustoll, with ESP values ranging between 19.9 and 27.9% in the argillic horizon, at depths of 13 to 87 cm. This pedon's classification was therefore revised to fine, smectitic, mesic Typic Natrustoll.

The maps generated in the EM-38 study agree well with the ESP results for the two pedons sampled and analyzed for ESP. The map produced for the area where 05KS127008 (Fig. 3.16) was sampled generally did not show any areas where sodium was elevated. Rather, differences in electrical conductivity at this site were related to solum thickness, i.e., higher conductivity, and a deeper solum. Pedon 06KS127001 was sampled near the center of a 20 m by 15 m closed upland depression. The survey and map produced for this area revealed high apparent conductivity readings for the depression (Fig. 3.18), ranging from 35 mS/m at the edge, to >115 mS/m in the center of the wallow. NRCS soil scientists and the author dug a shallow hole (\approx 20 cm) to look for columnar structure. White (1999) described the process of column formation as a "doming" of the tops of prisms in natric horizons, as water and sodium cause the dispersion and swelling of the prisms. "Biscuit tops" was a term used to describe the

appearance of the tops of columns when looking at them from above, i.e., the tops of multiple columns resemble a pan of biscuits. This term seems very appropriate with respect to the size and shape of the tops of the columns.

Site 5

Pedon 06KS115007 (Fig. 3.20) contained sodium, but not enough to change the classification. The Ap horizons had ESP values $< 0.7\%$, while the ESP values increased with depth in the profile from 2.5% in the Bt1 horizon, to 11.6% in the 4C1 horizon, which may indicate that weathered residuum is a potential source of sodium.

Site 6

Pedon 06KS015010 (Fig. 3.21) contained sodium, but not enough to change the classification. The A horizon ESP was 0.1%, and the Bt horizon values ranged from 3.6% (Bt1 horizon, 8 to 21 cm) up to a maximum of 9.3% in the Bt3 horizon (72 to 83 cm). There was abundant vegetation at the site and high sodium levels were not anticipated.

Clay mineralogy

Site 1

In pedon 05KS161005, smectite dominates the clay mineral fraction (50%) from 0 to 116 cm, and kaolinite was also quite common (25%) (Fig. 3.22 and 3.23). From 116 to 207 cm the dominant clay minerals are kaolinite (25%), clay mica (20 to 30%), and smectite (10%). From 207 to 246, the dominant minerals are kaolinite (25%), clay mica (30 to 35%), smectite (30%), and lesser amounts of interstratified clay-mica and smectite, and also vermiculite and quartz. Generally, smectite content decreased and clay mica content increased with increasing profile depth. For the upper 116 cm, the mineralogy class is smectite, and for the material from 116 to 246 cm the mineralogy class is mixed. All x-ray patterns are located in Appendix C.

Site 2

Clay mineralogy was not determined

Site 3

The clay mineralogy of pedon 05KS061001 (Fig. 3.24) was mixed in the A horizons, and in the lowest paleosol, and in the C horizon weathered from calcareous shale. Note the lack of expandable 2:1 minerals in the upper 30 cm of this pedon. Smectite dominated in the Bt1, Bt2, Btk1, and Btk2 horizons (horizonation as described). This pedon was analyzed by the USDA-NRCS National Soil Survey Laboratory in Lincoln, Nebraska, and x-ray patterns are not published in this document.

Site 4

Clay mineralogy was not determined.

Site 5

Clay mineralogy was not determined.

Site 6

The clay mineralogy for pedon 06KS015010 was determined for three selected horizons (Fig. 3.25). The Bt2 horizon (57 – 72 cm) contained approximately 45% smectite, 15% illite, and 25% kaolinite. The 2Bt4 horizon (83 – 113 cm) was quite similar to the Bt2 horizon, with similar intensities for smectite, illite, and kaolinite. The 3Btss2 horizon (158 – 217 cm) contained a similar quantity of illite and kaolinite as the other horizons, but seemed to contain a relatively larger amount of smectite (60%). Figure 3.26 displays the x-ray diffraction patterns for the Mg-25 treatment. The complete set of x-ray patterns for this site are located in Appendix C.

Discussion and Conclusions

For all six pedons in this transect, the coarse silt content of the surface horizon or horizons was higher than the underlying B horizons. Possible reasons for this difference include pedogenesis (eluviation/illuviation and/or mineral weathering), or a change in parent material. In loess provenance studies, coarse silt content decreases with distance from the source, while fine silt increases. If a change in parent material is the explanation, it seems likely that the A horizon material is loess that came from a relatively close source, and that the Bt horizons are also loess that came from a much more distant source. Alternatively, if an increase in coarse silt is indicative of a horizon that once was an eluvial horizon, this could be an indicator property for locating former

A horizons and would allow for easier recognition of the boundary between two loess units, which is difficult in welded, polygenetic soils such as these.

Another important discovery is that the lowest, chocolate-brown paleosol does not appear to have properties in common with the underlying Permian-aged calcareous shales and limestones. Up to this point, the use of loess stratigraphic names (Bignell, Peoria, Gilman Canyon, and Loveland) was intentionally avoided in the results section. After field description, particle size analysis, and micromorphologic investigation (site 3 only), it is evident that four units of loess or predominantly loess-derived materials are present at these six sites. There are four loess units correlated in Kansas, so a first estimate at the possible nomenclature for the stratigraphy might be as follows: Holocene loess, Peoria loess, Gilman Canyon loess-derived paleosol, and Sangamon paleosol formed in Loveland loess (Table 1). None of the six pedons discussed herein were radiocarbon dated. However, samples from paleosols in four polygenetic pedons sampled in Chase County, Kansas, yielded radiocarbon ages of 19,000 to 20,000 ^{14}C yr BP in the upper paleosol, and 22,500 to 24,500 ^{14}C yr BP in the lower paleosol. Chase County is in the Bluestem Hills MLRA, but these pedons were not included in this paper because they were the focus of a different study. If the radiocarbon ages from the Chase County sites are extrapolated to the sites discussed in this paper it is possible to make preliminary conclusions as to the stratigraphic names of the parent materials commonly observed in this paper. Due to the fact that the Chase County radiocarbon dates were significantly younger than Sangamon (which is >75,000 yr BP), it is concluded that the two paleosol age ranges represent two periods of stability that occurred following Gilman Canyon loess deposition. Therefore, the revised potential stratigraphic units present in these six pedons include Bignell loess, Peoria loess, a colluvial facies of Gilman Canyon loess, and a second colluvial facies of Gilman Canyon loess. A name for this colluvial facies that is of approximately similar age to Gilman Canyon loess has recently been proposed by Mandel and Bettis (2001, 2003) and called the Severance Formation. Mandel (2006) has observed Severance Formation colluvium and alluvium on co-alluvial fans in Chase County, Kansas, and these paleosols have dated to 22,500 to 24,500 yr BP. Although it is concluded that a thin

modern/Holocene loess unit is present, the horizonation was not revised (i.e., A, 2Bt1, etc.) as the thickness is so minimal (8 to 30 cm).

Figure 3.27 shows the thicknesses of the four loess-like units as a function of the Universal Transverse Mercator (UTM) northing that was recorded for each site. Unit 1 appears to become thinner in a southerly direction, while the opposite is true for unit 4. No relationship was observed for units 2 and 3 with respect to UTM northing. This suggests that units 1 and 4 had locally important contributions of dust from a northern source, while units 2 and 3 were deposited on a broader, more regional scale. Figure 3.28 shows the thicknesses of the four parent materials as a function of the UTM easting. Very weak relationships appear to exist in the east-west direction. Unit 4 thickens towards the eastern side of the area studied. Figure 3.29 presents the data in an alternate format.

The sodium content of the pedons was generally greater towards the south, and were greatest in shallower pedons. Pedons 1 and 2 contained the lowest sodium, with ESP values < 3% in the profile. At sites 3 and 4a, the maximum ESP values were approximately 10%. Site 4b was the shallowest site at 87 cm to bedrock, and had ESP values in excess of 20%, easily making the criterion of 15% for a natric diagnostic horizon. Site 5 had ESP values of about 10%, and site 6 had values of about 8%. The source of sodium in this area is not well understood. Other than site 4b, all are well-drained soils that have some amount of slope. Therefore, there must be some association between sodium and the parent material. Albite was observed in the silt fraction of both site 1 and site 6, the two end-members of this transect. The chemical composition of albite is $\text{NaAlSi}_3\text{O}_8$. The hydrolysis reaction for albite yields kaolinite and sodium (Bricker et al., 1994):



Albite can also be weathered to kaolinite by carbonic acid, organic acid, and strong acid incongruent reactions (Bricker et al., 1994). Another potential Na^+ source might be the underlying Permian and Pennsylvanian bedrock (alternating marine and non-marine units) (Merriam, 1963), although this is not considered (directly) to be the parent material for any of the Bt horizons in this study. However, mixing of local dust with dust transported from greater distances at the time of deposition would be another

possible explanation for the common occurrence of sodium in polygenetic soils of the Bluestem Hills MLRA. In addition, the use of the term bison wallow is considered to be less appropriate than the term closed upland depression.

The family mineralogy class for all three pedons analyzed is smectitic, as smectite was dominant in the upper 50 cm of the argillic diagnostic subsurface horizons. Sites 1 and 3 were similar in that smectite decreased and mica increased with depth in the profile, while kaolinite content was constant. Site 6 was different as smectite increased with depth, and the illite and kaolinite content stayed constant. At this time, and with the small sample size, it is difficult to draw many mineralogical conclusions with respect to stratigraphy and geography.

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Figure 3.1. Map of site locations within the Bluestem Hills of Kansas, Major Land Resource Area 76. Loess distribution is from the 1:500,000 Geologic Map of Kansas (Kansas Geological Survey, 1991). Sites are numbered from north to south.

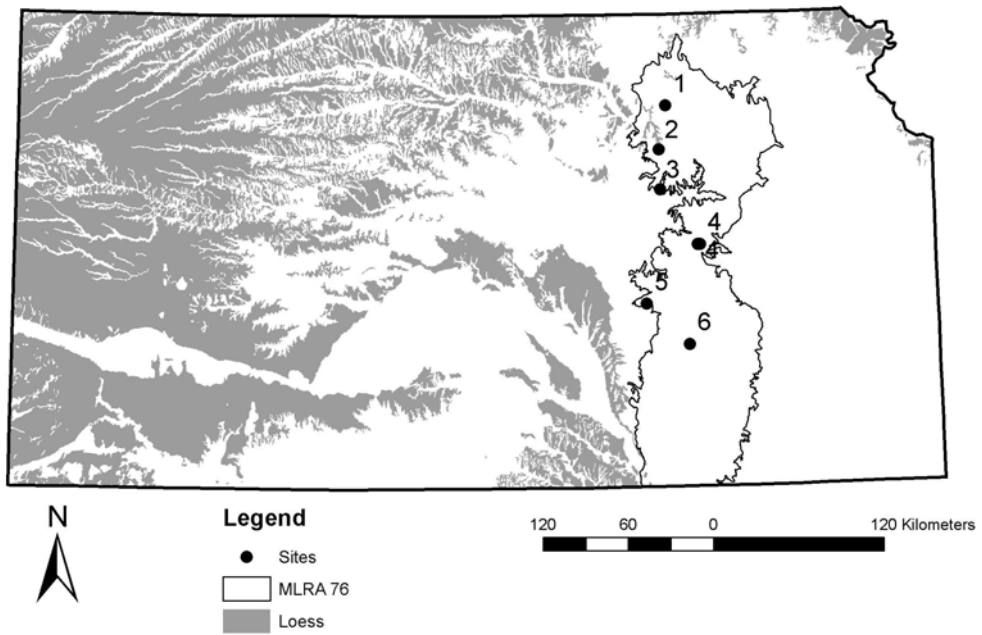


Figure 3.2. Photograph of site 2, pedon 06KS161001, sampled in Riley County, Kansas.



Figure 3.3. Photograph of site 3, Pedon 05KS061001, sampled in Geary County, Kansas.



Figure 3.4. Particle size distribution of site 1, pedon 05KS161005, sampled in Riley County, Kansas.

Site 1: 05KS161005 Particle size distribution:
Whole Soil Basis < 2mm

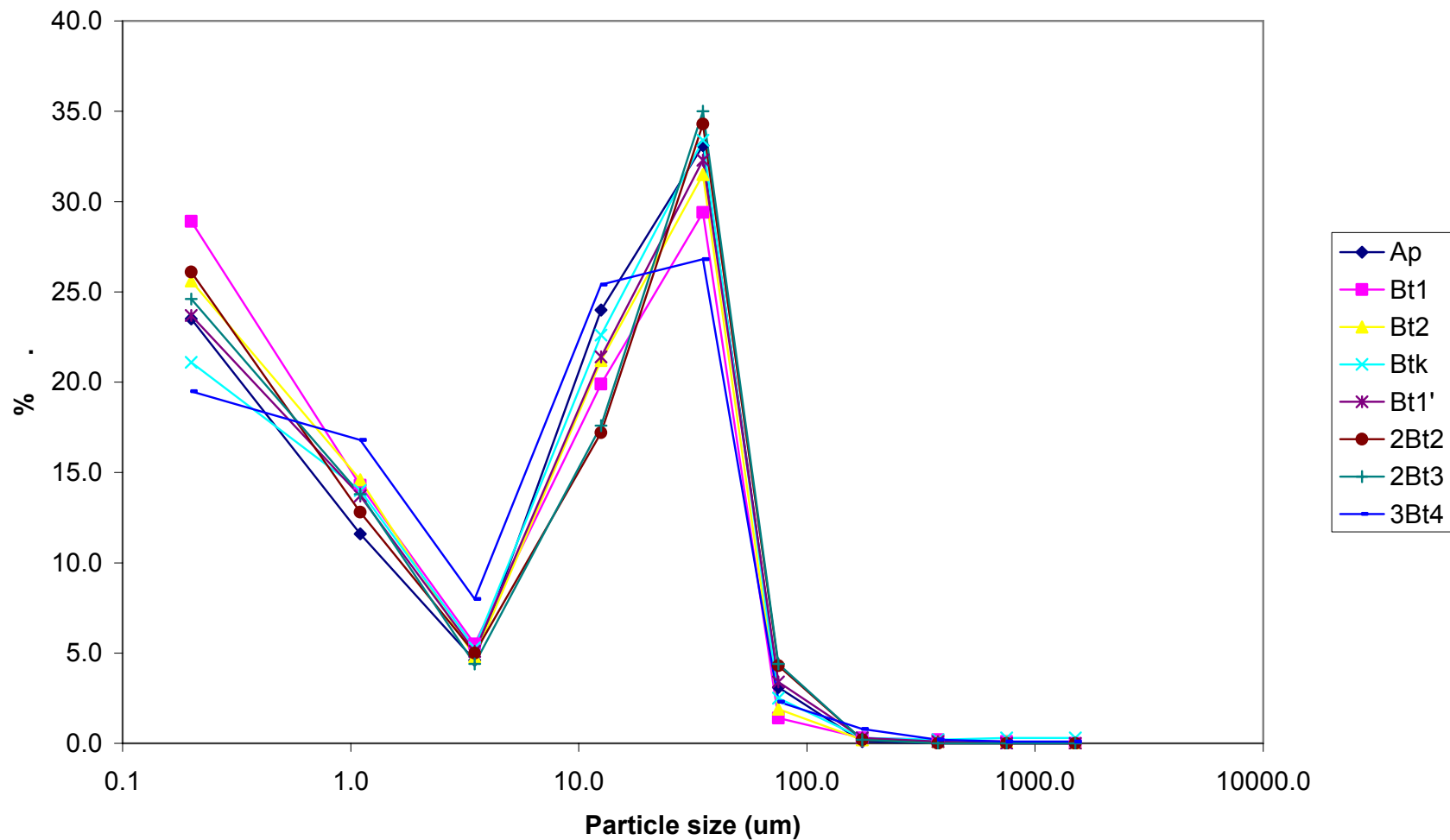


Figure 3.5. Particle size distribution of site 2, pedon 06KS161001, sampled in Riley County, Kansas.

Site 2: 06KS161001 Particle size distribution:
Whole Soil Basis < 2mm

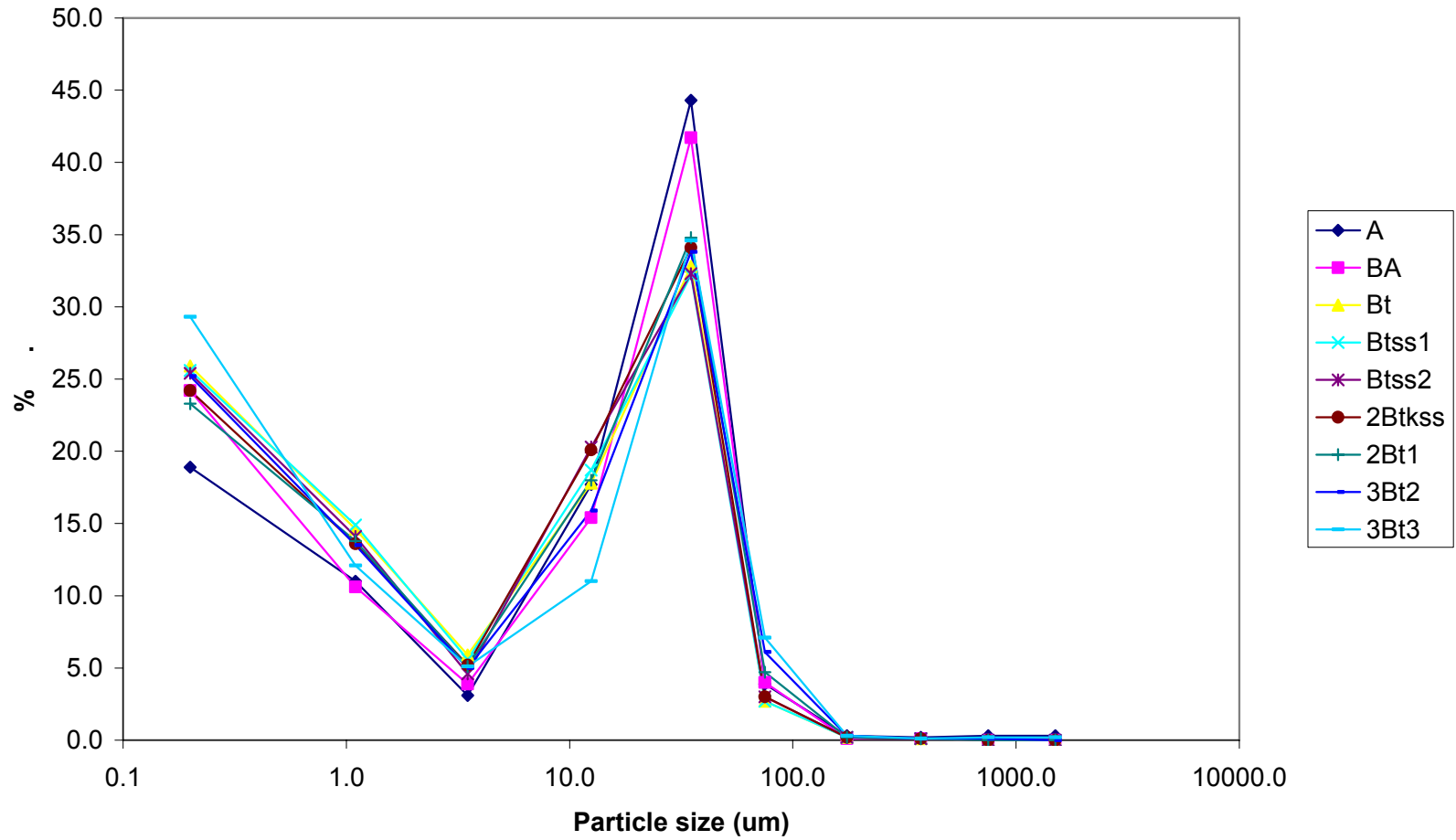


Figure 3.6. Particle size distribution of site 3, pedon 05KS061001, sampled in Geary County, Kansas.

05KS061001 Particle size distribution: Whole Soil Basis < 2mm

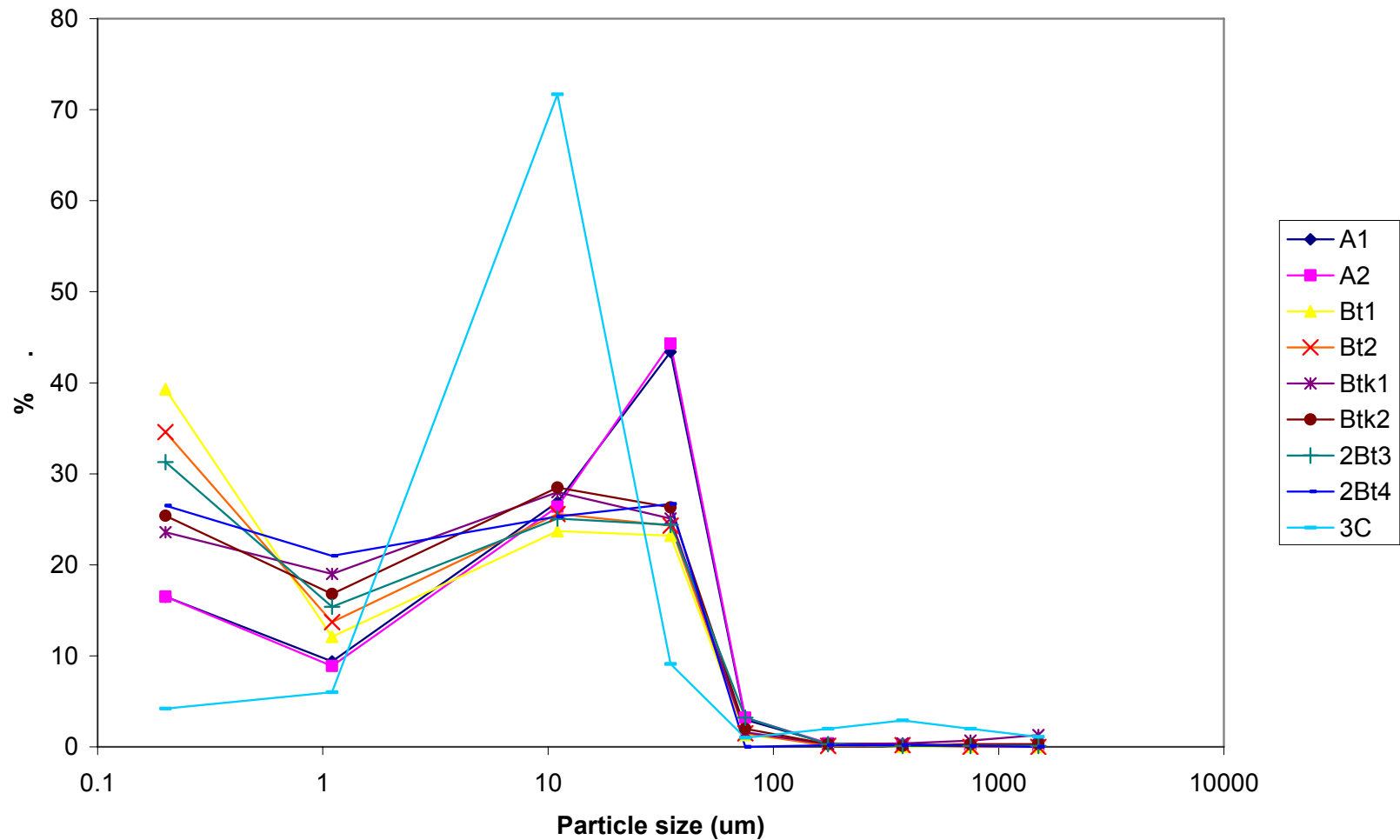


Figure 3.7. Particle size distribution of site 4a, pedon 05KS127008, sampled in Morris County, Kansas.

Site 4a: 05KS127008 Particle size distribution:
Whole Soil Basis < 2mm

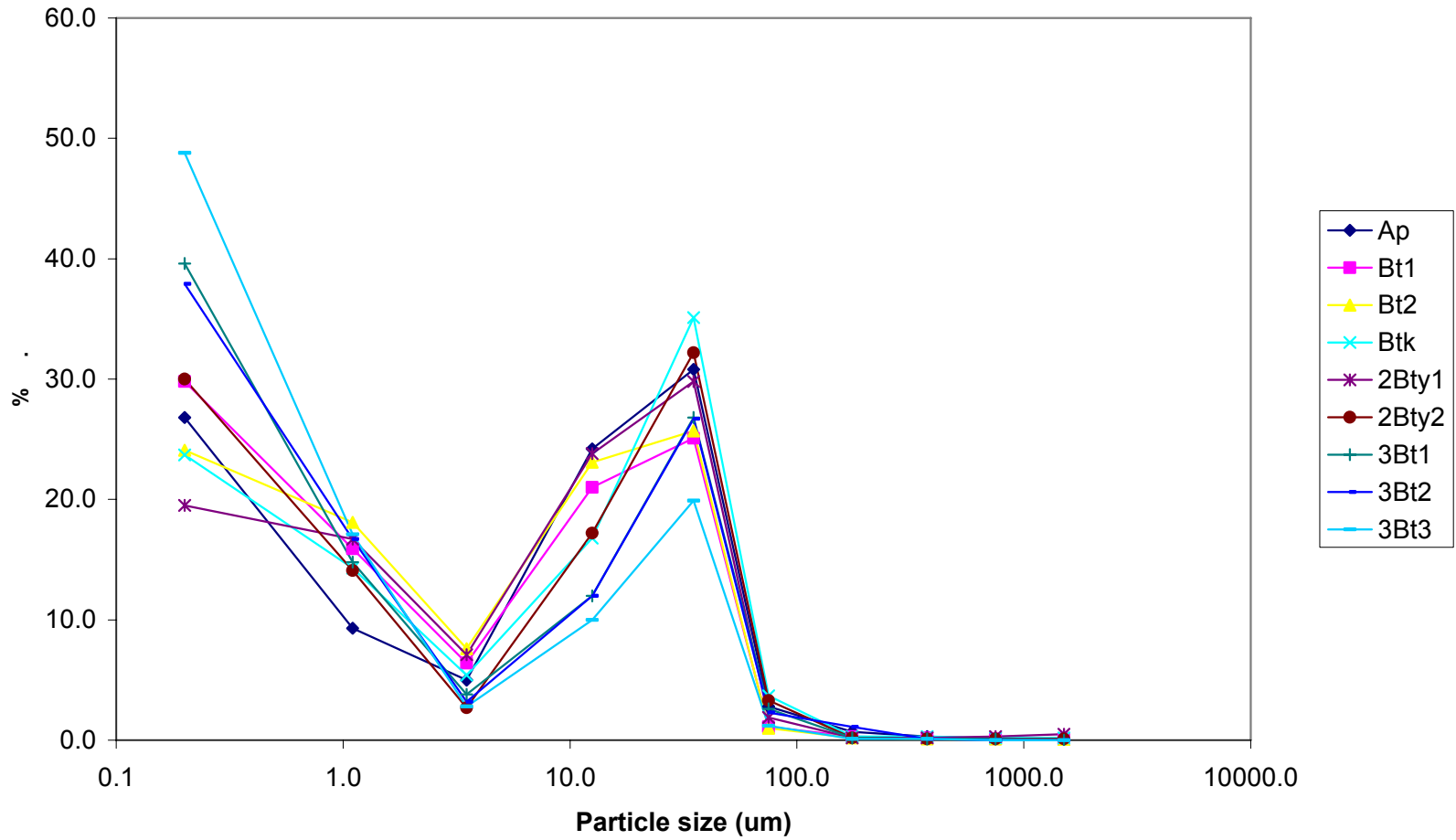


Figure 3.8. Particle size distribution of site 4b, pedon 06KS127001, sampled in Morris County, Kansas.

Site 4b: 06KS127001 Particle size distribution:
Whole Soil Basis < 2mm

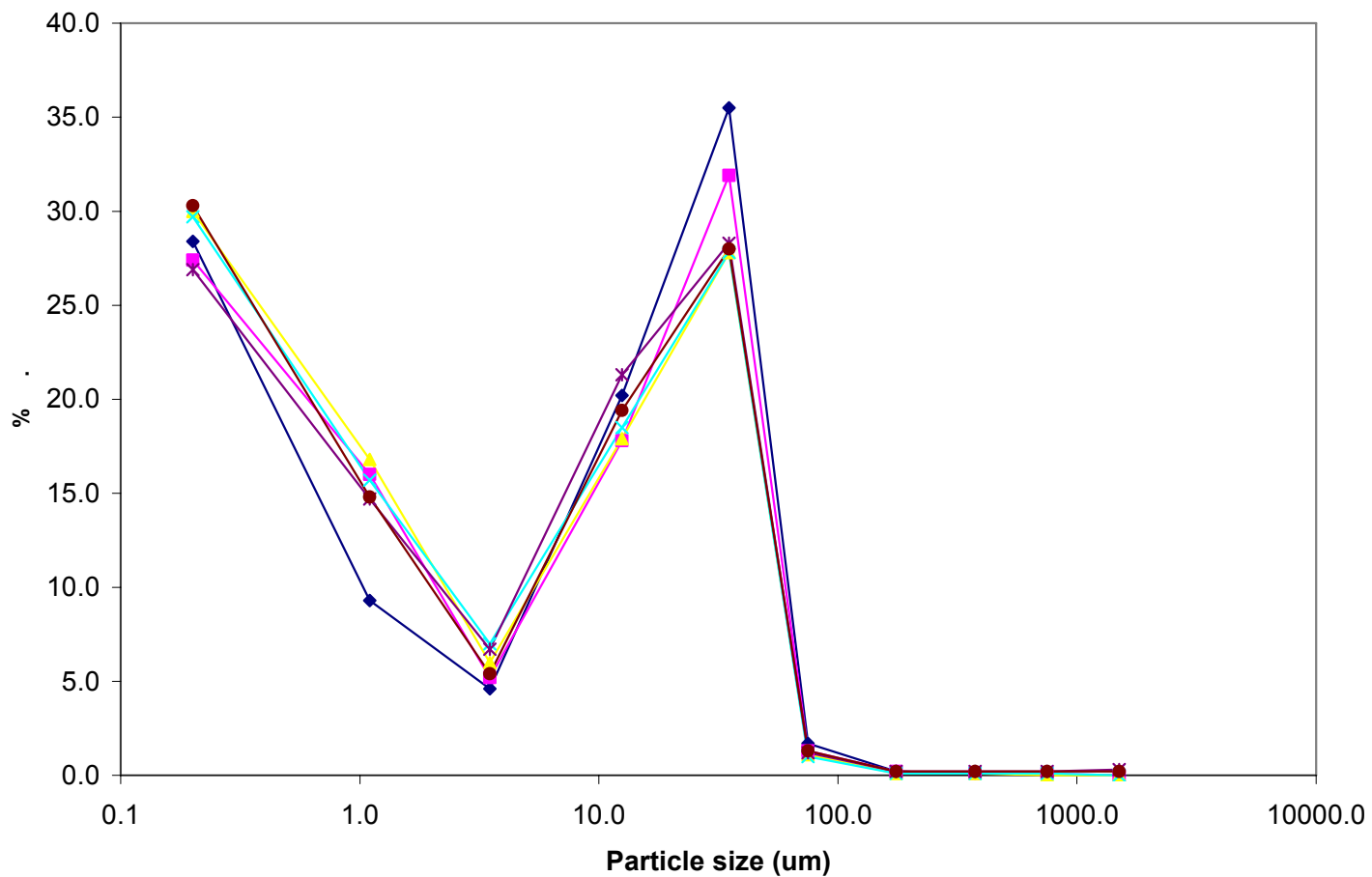


Figure 3.9. Particle size distribution of site 5, pedon 06KS115007, sampled in Marion County, Kansas.

Site 5: 06KS115007 Particle size distribution:
Whole Soil Basis < 2mm

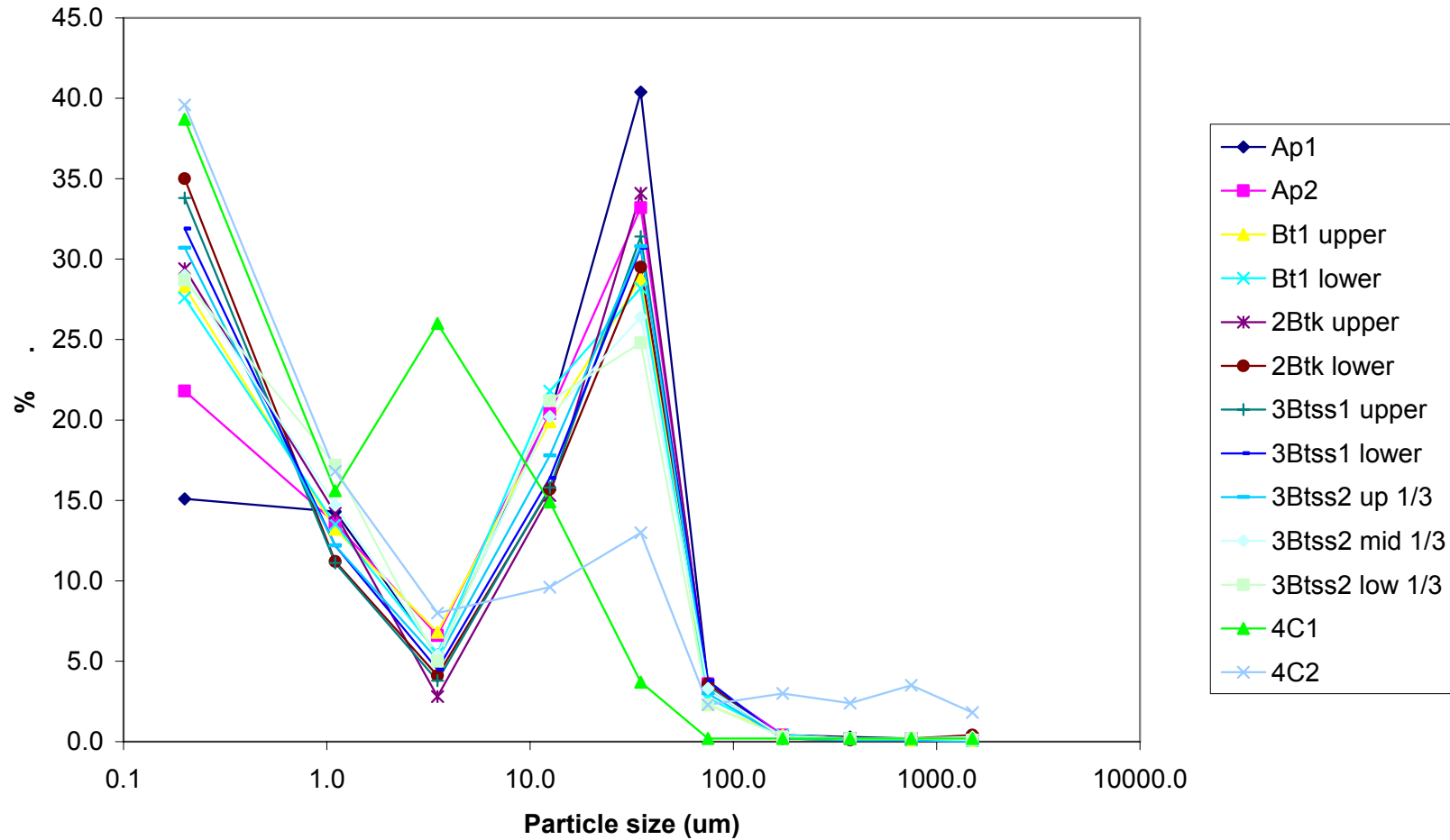


Figure 3.10. Particle size distribution of site 6, pedon 06KS015010, sampled in Butler County, Kansas.

Site 6: 06KS015010 Particle size distribution:
Whole Soil Basis < 2mm

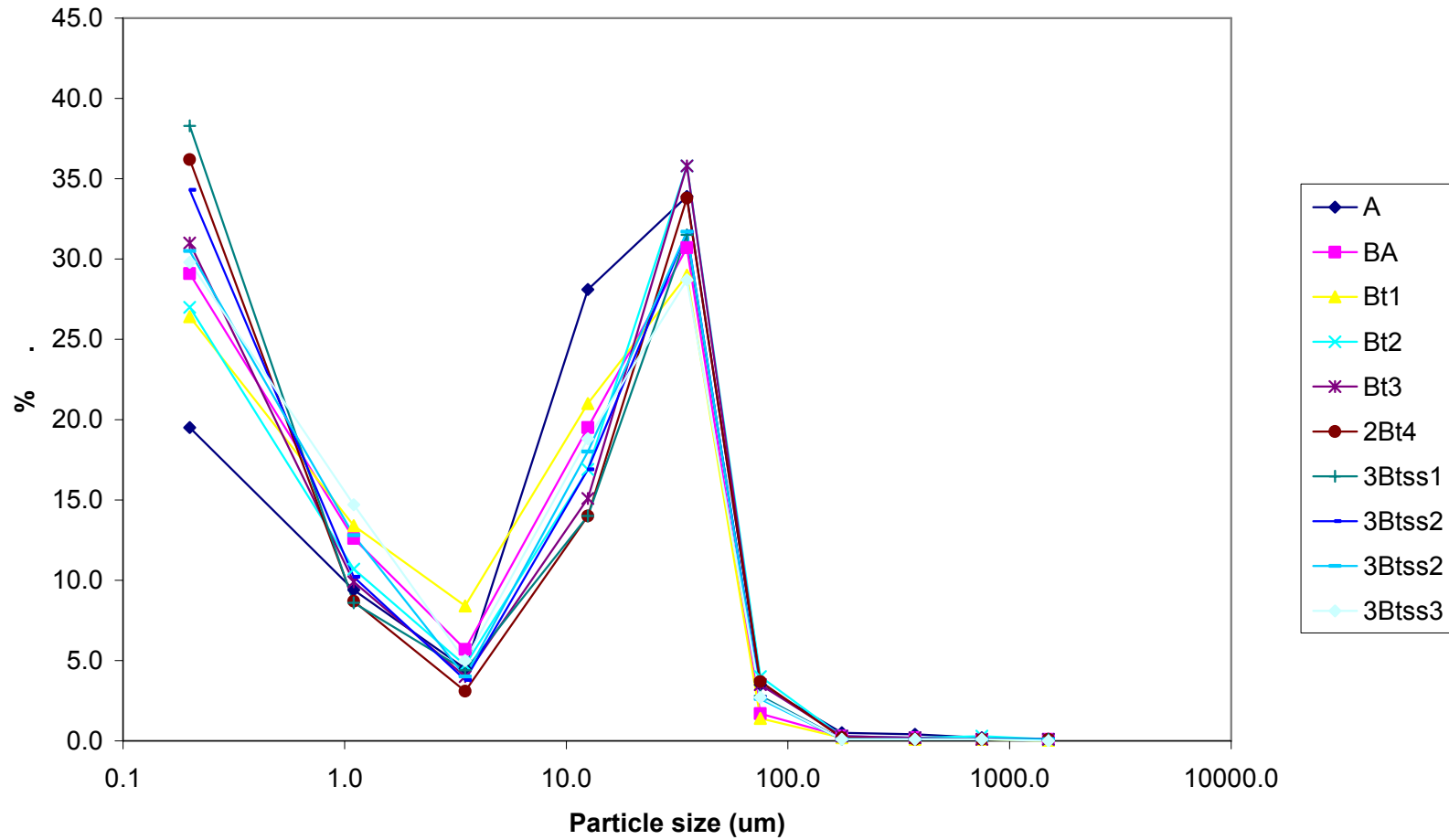
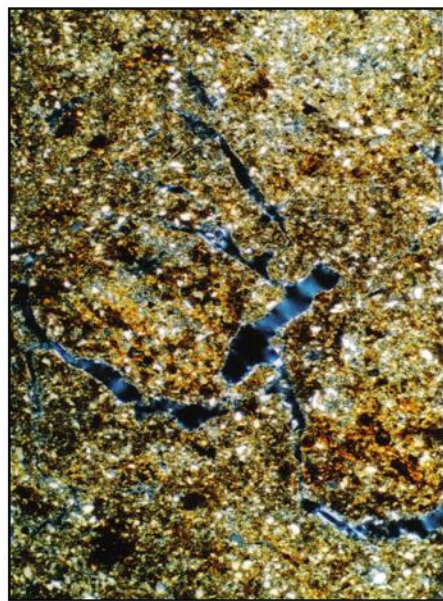
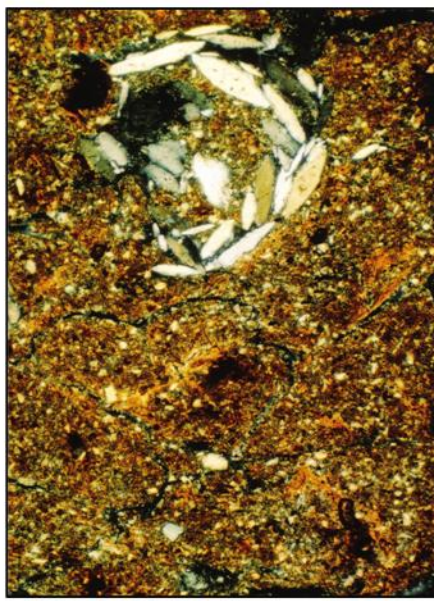


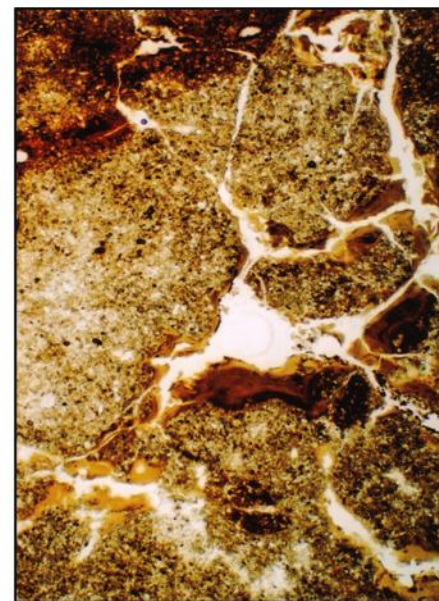
Figure 3.11. Micrographs of Irwin horizons from site 3 pedon 05KS061001. Left: Bt2 horizon (58 – 79 cm) with only stress-related clay coatings, XP. Center: 2Btky horizon (107 – 124 cm), contains lenticular gypsum and has illuvial clay coatings, XP. Right: 3Bt2 horizon (155 – 175 cm) has thick laminated limpid clay coatings, PP. Please note that horizon nomenclature is revised from the original field description. Frame length is 3325 μm for left and center, and 6650 μm for right micrograph.



200 μm



200 μm



400 μm

Figure 3.12. Exchangeable sodium percentage (ESP) for site 1, pedon 05KS161005, sampled in Riley County, Kansas. Horizons are grouped by color to indicate parent material stratigraphy.

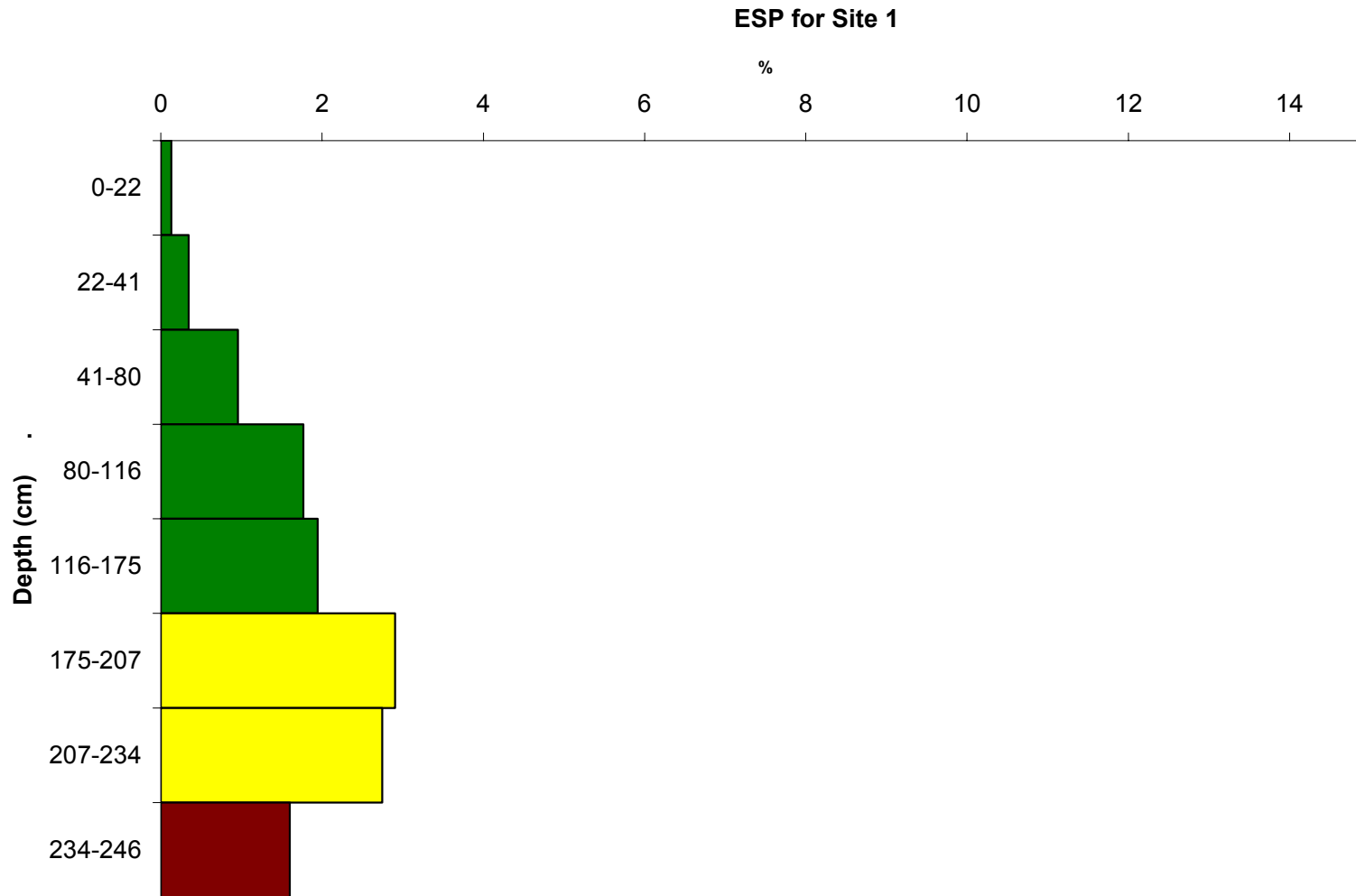


Figure 3.13. Exchangeable sodium percentage (ESP) for site 2, pedon 06KS161001, sampled in Riley County, Kansas. Horizons are grouped by color to indicate parent material stratigraphy.

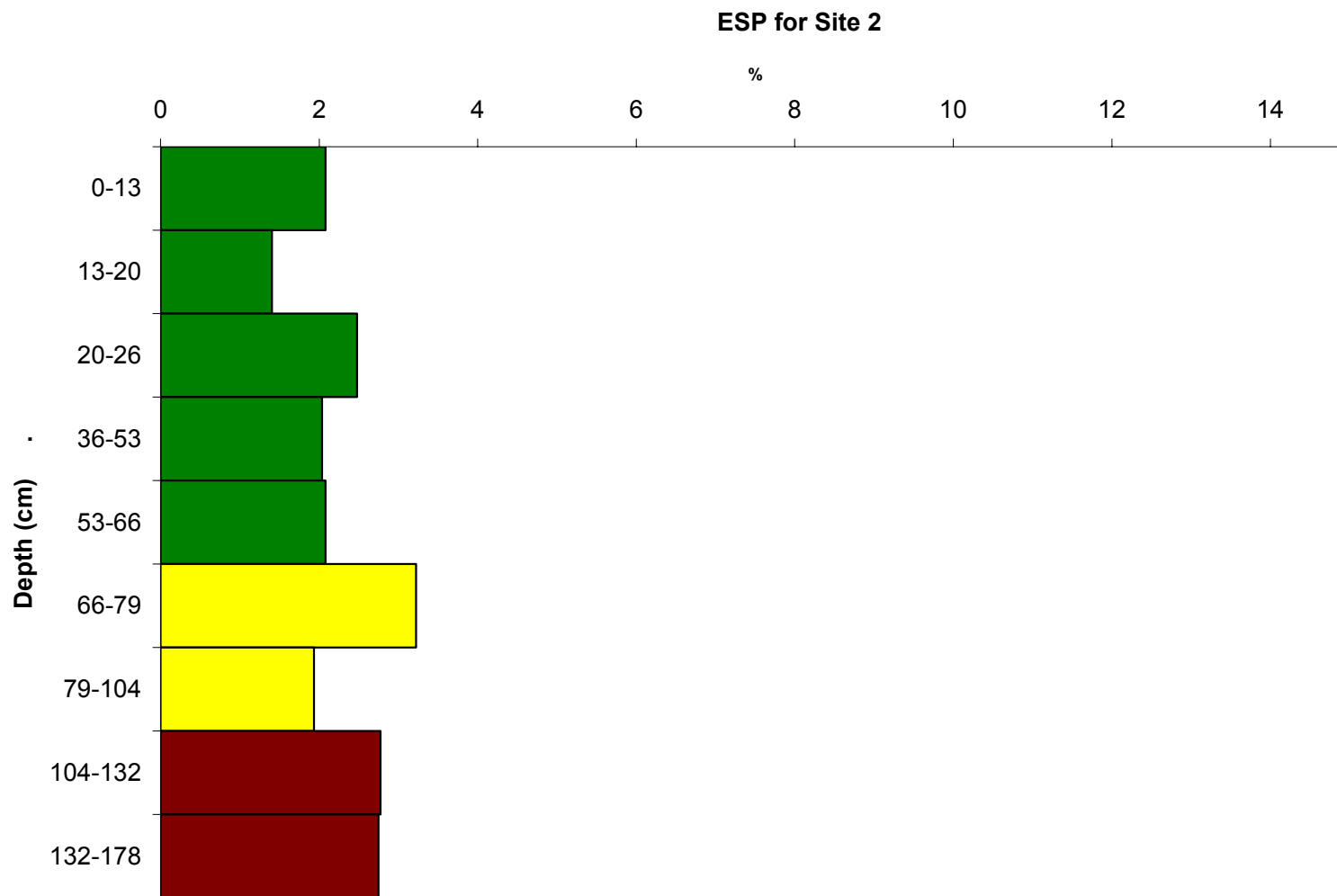


Figure 3.14. Exchangeable sodium percentage (ESP) for site 3, pedon 05KS061001, sampled in Geary County, Kansas. Horizons are grouped by color to indicate parent material stratigraphy.

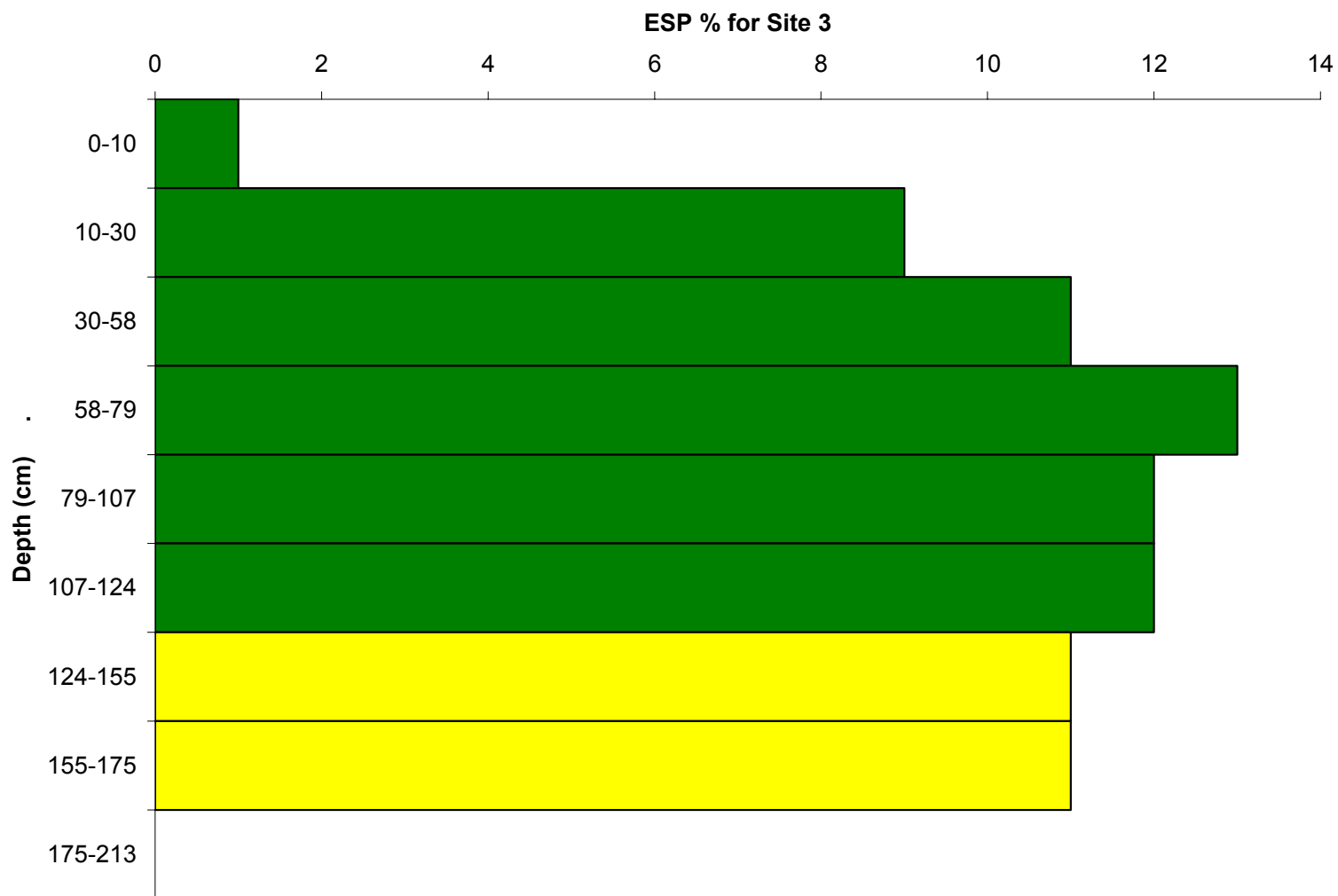


Figure 3.15. Exchangeable sodium percentage (ESP) for site 4a, pedon 05KS127008, sampled in Morris County, Kansas. Horizons are grouped by color to indicate parent material stratigraphy.

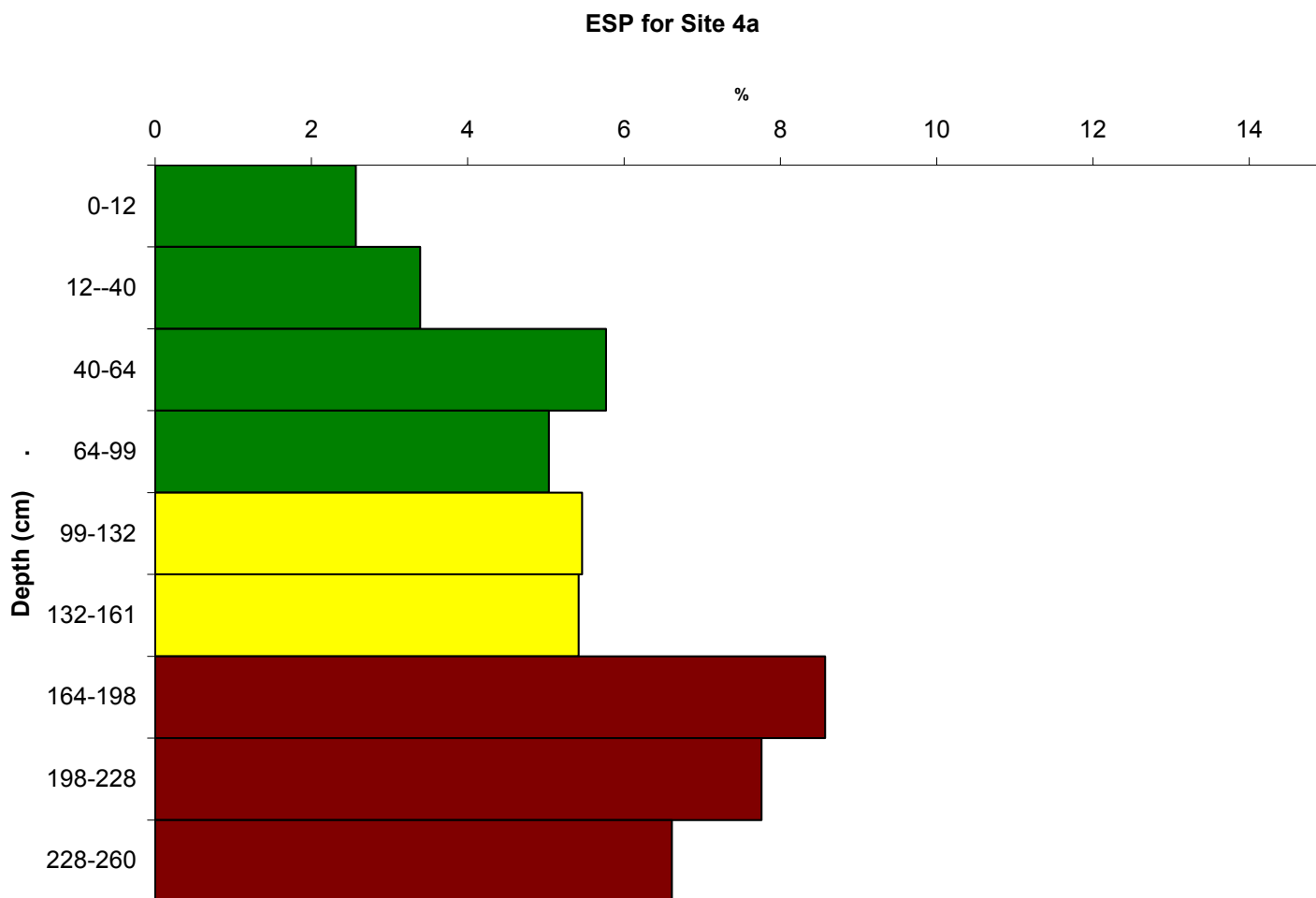


Figure 3.16. Apparent electrical conductivity map of site 4a. Zone A is mapped as Dwight silt loam, 1 to 3% slopes, and zones B1 and B2 are mapped as Labette-Dwight complex, 1 to 3% slopes. The star symbol indicates the sampling location for site 4a, pedon 05KS127008. Map created by Wes Tuttle, USDA-NRCS.

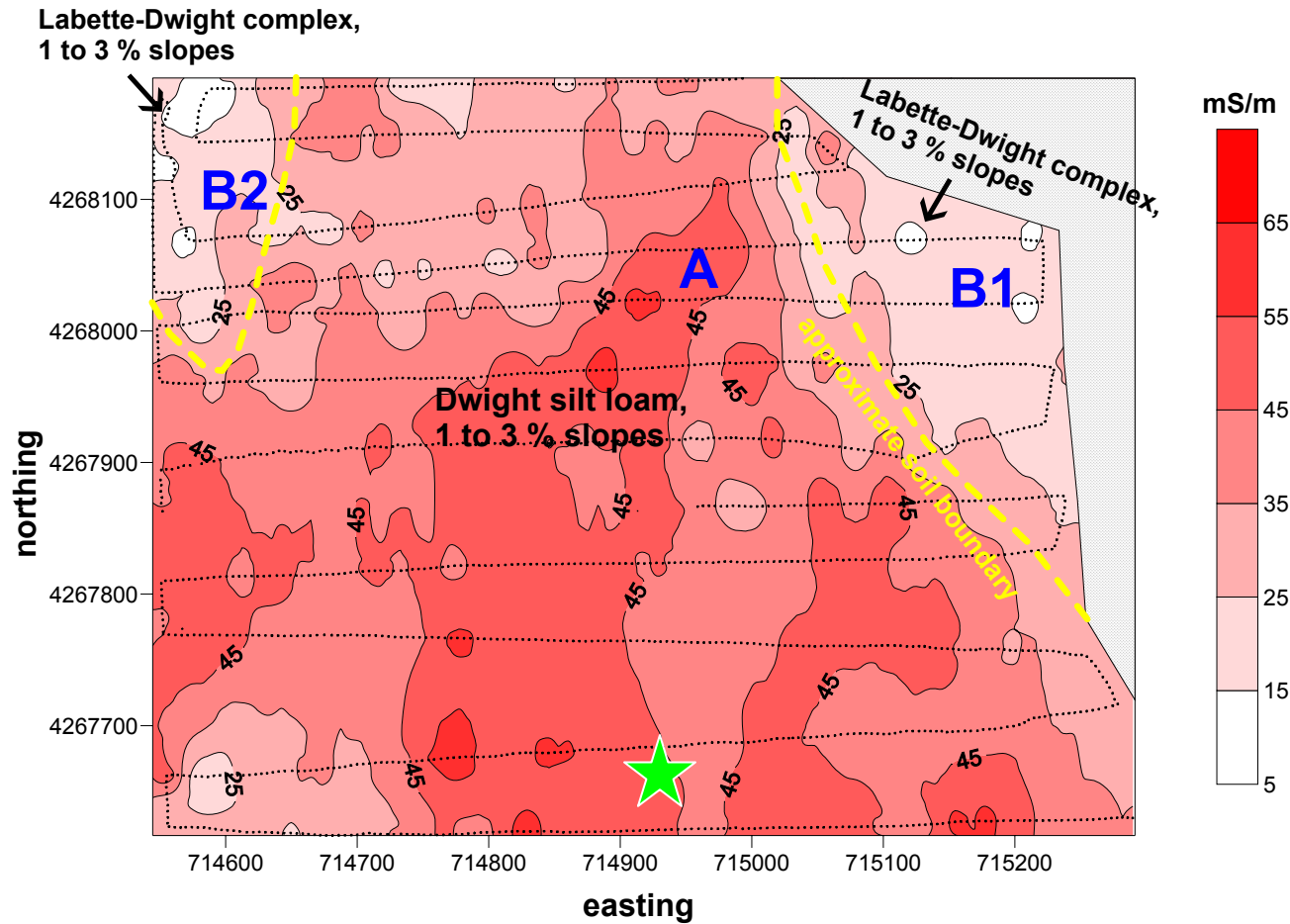


Figure 3.17. Exchangeable sodium percentage (ESP) for site 4b, pedon 06KS127001, sampled in Morris County, Kansas. Horizons are grouped by color to indicate parent material stratigraphy.

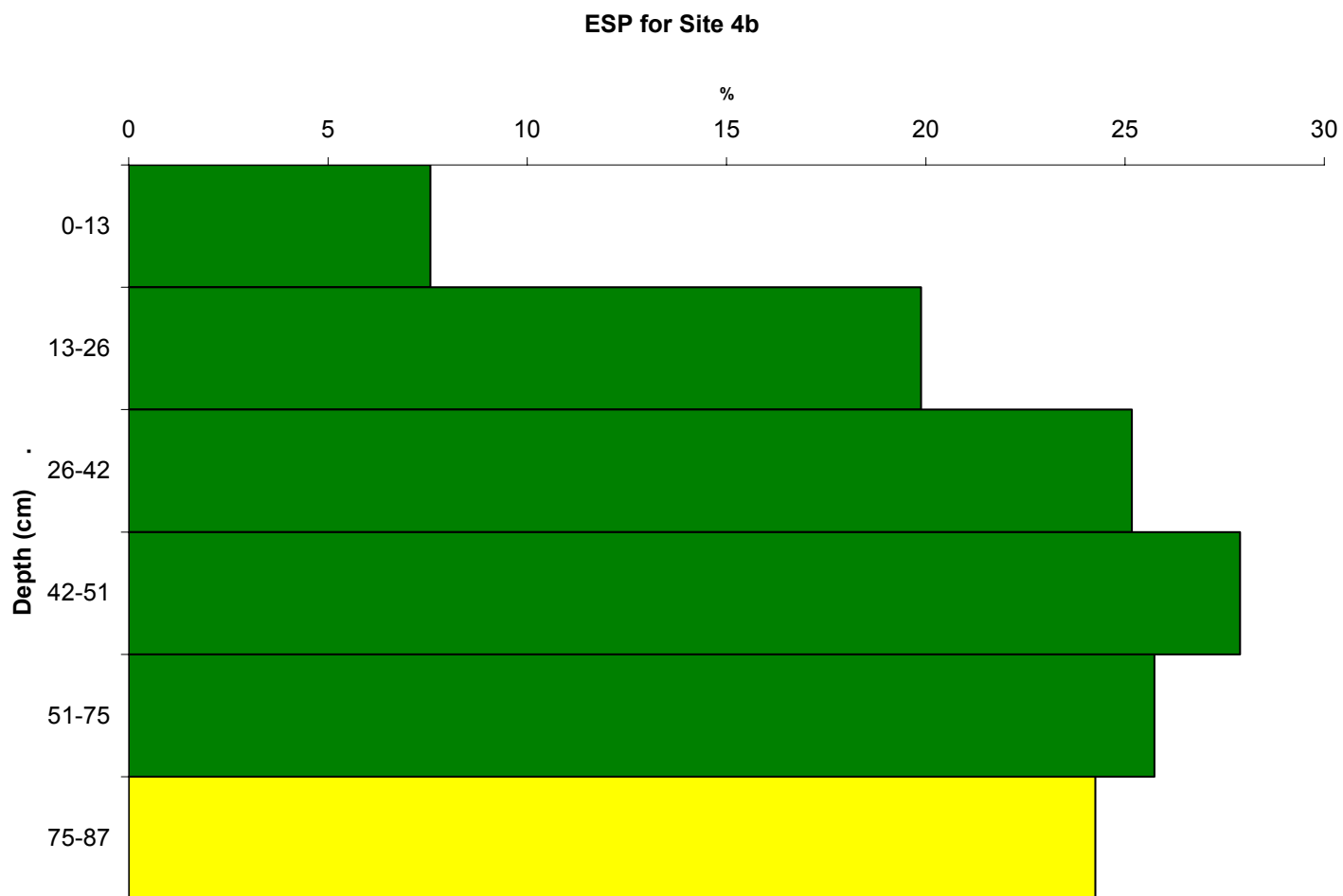


Figure 3.18. Apparent electrical conductivity map of site 4b. The star symbol indicates the sampling location for site 4a, pedon 05KS127008. Map created by Wes Tuttle.

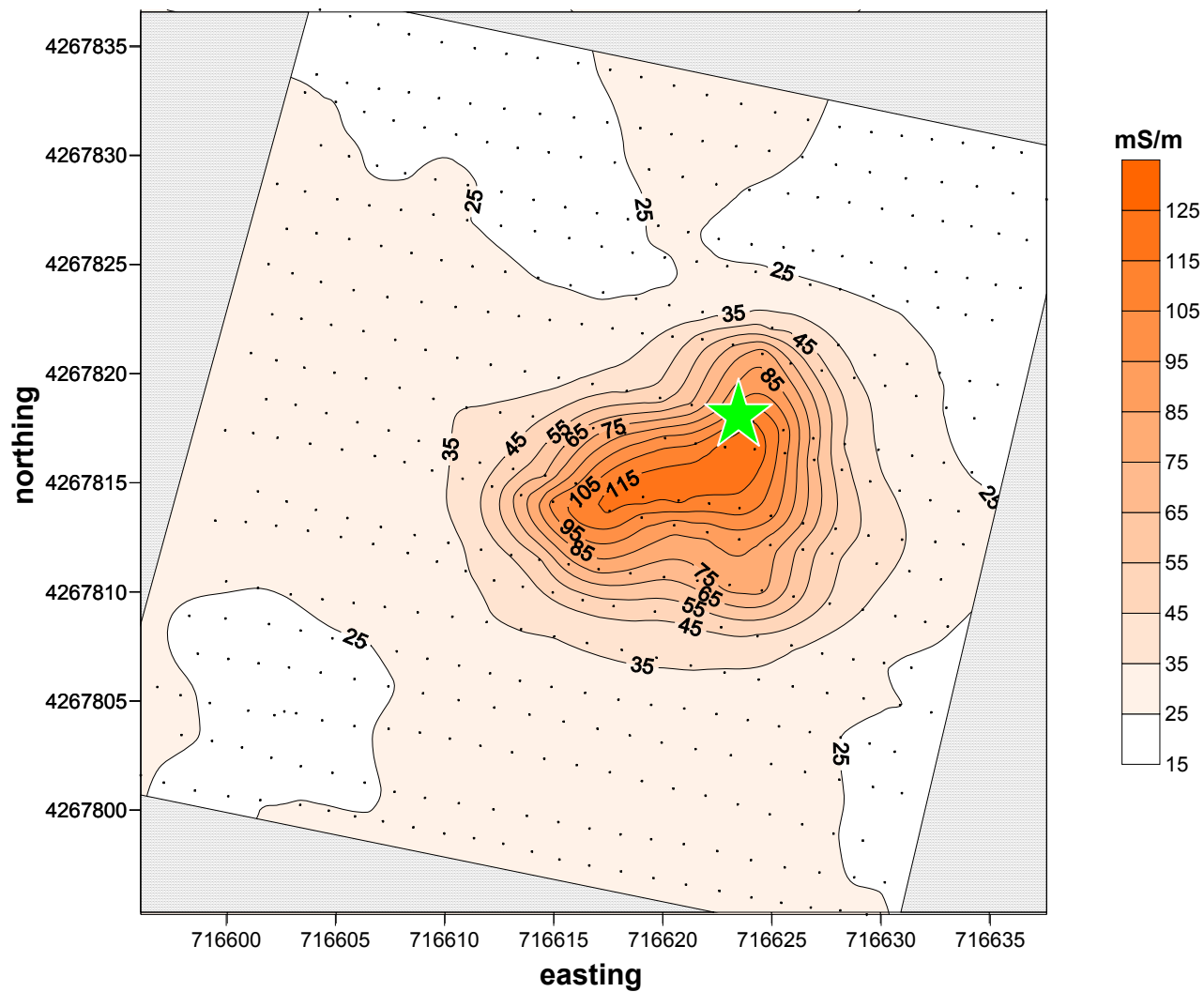


Figure 3.19. Upland depression where Site 4 pedon 06KS127001 was sampled. Depression is 20 by 15 meters in size.



Figure 3.20. Exchangeable sodium percentage (ESP) for site 5, pedon 06KS115007, sampled in Marion County, Kansas. Horizons are grouped by color to indicate parent material stratigraphy.

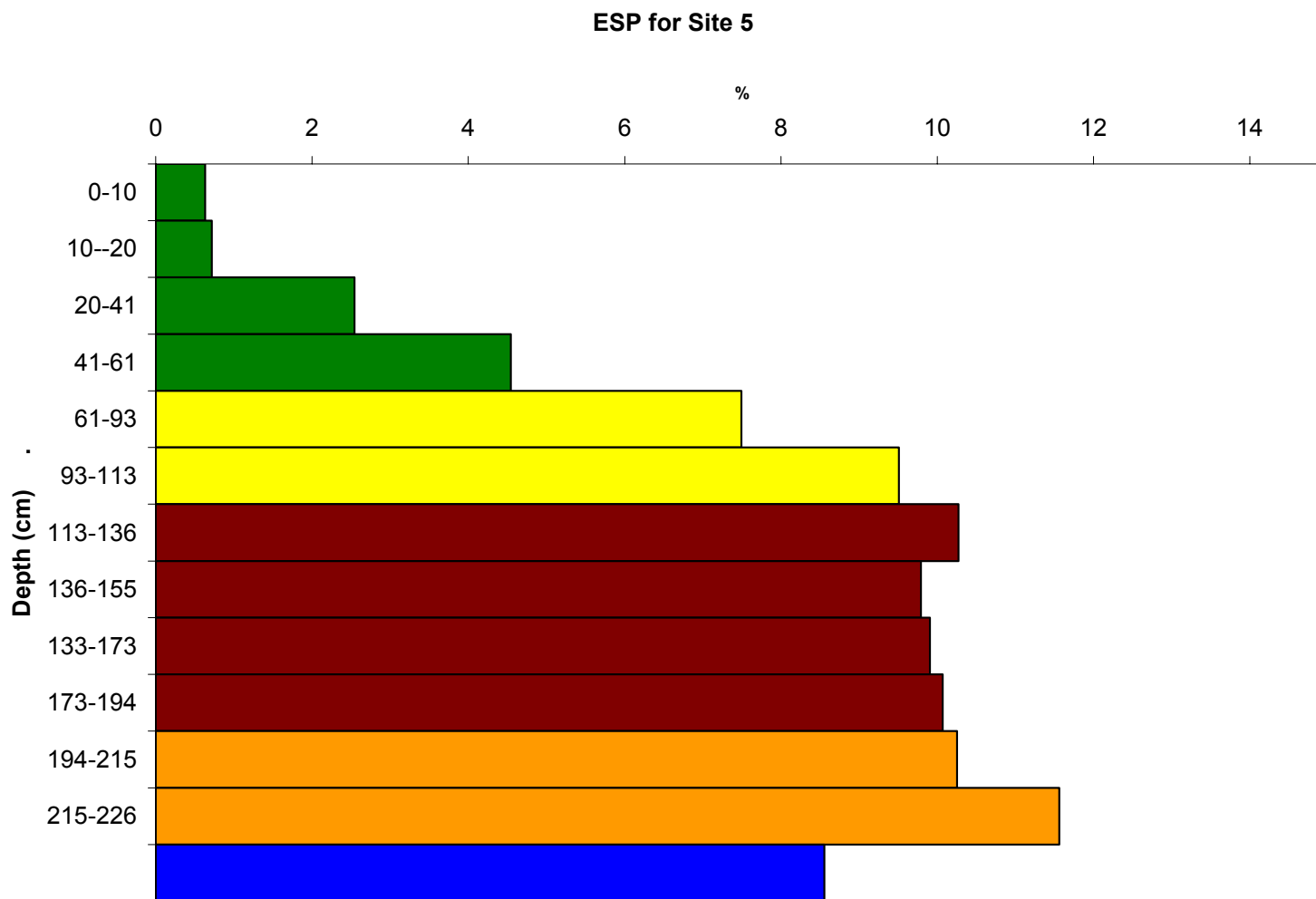


Figure 3.21. Exchangeable sodium percentage (ESP) for site 6, pedon 06KS015010, sampled in Butler County, Kansas. Horizons are grouped by color to indicate parent material stratigraphy.

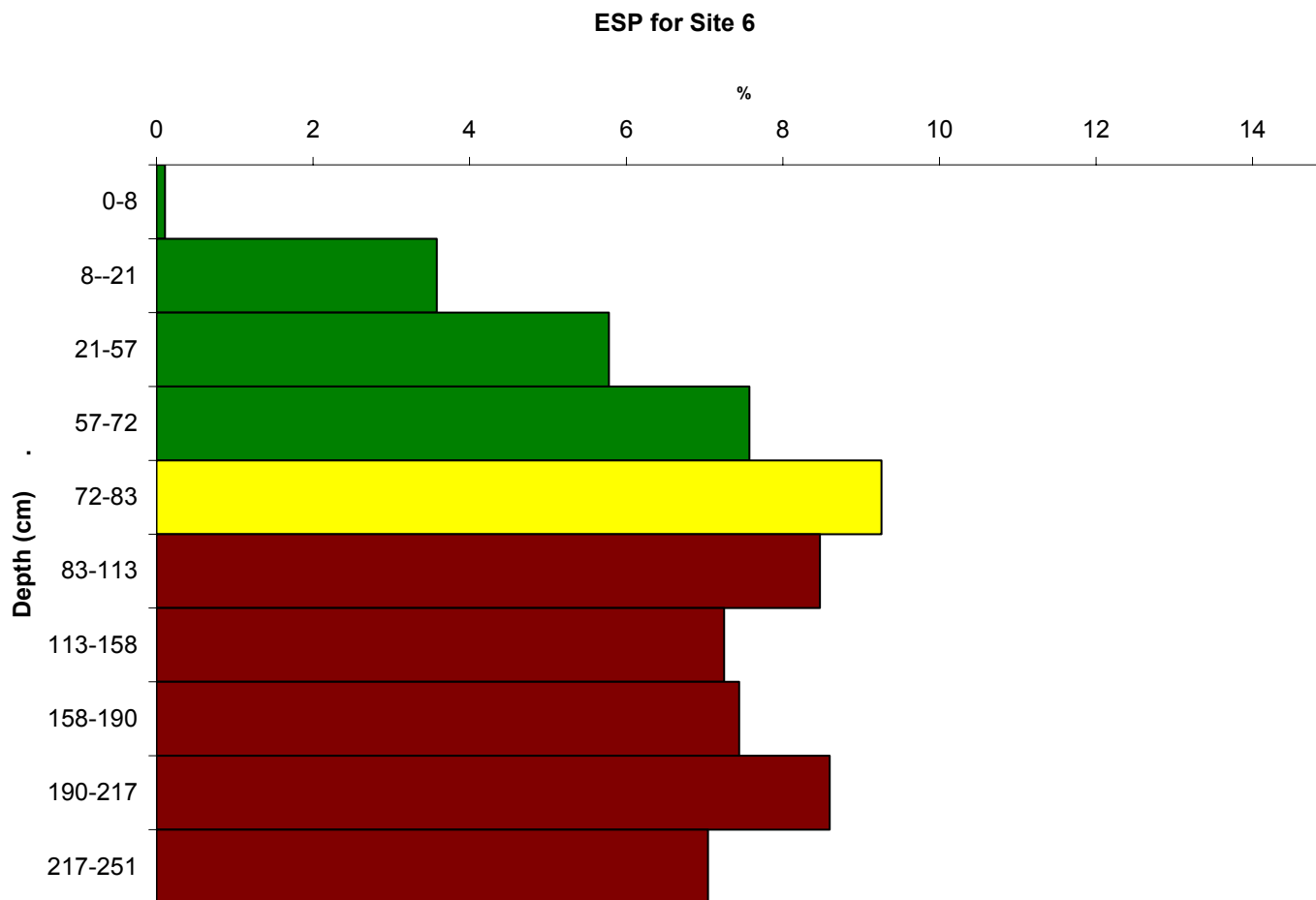


Figure 3.22. Mineralogy of total clay fraction of site 1, pedon 05KS161005, sampled in Riley County, Kansas.

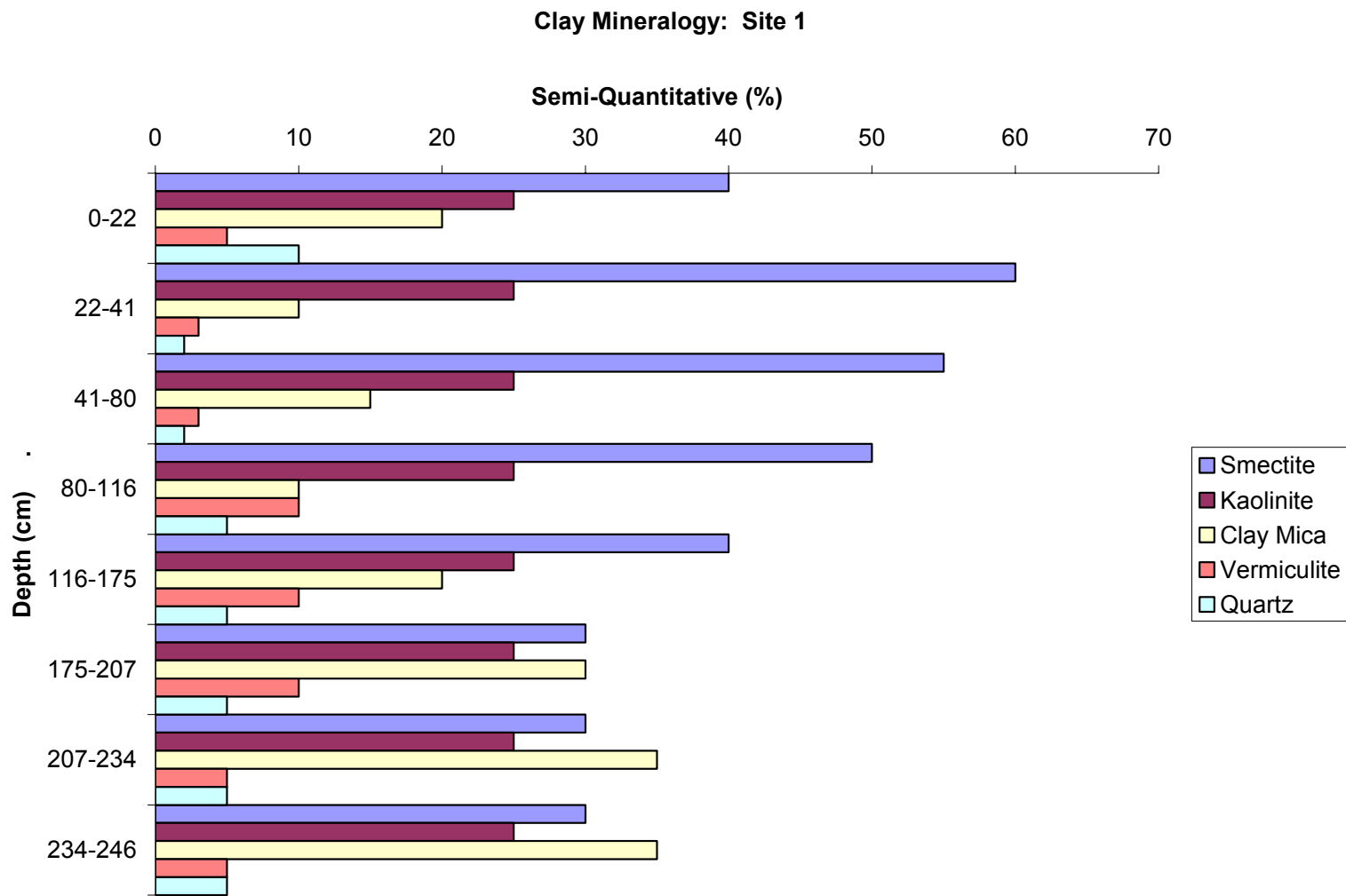


Figure 3.23. X-ray diffractogram for all horizons of site 1 pedon. Mg-25°C treatment.

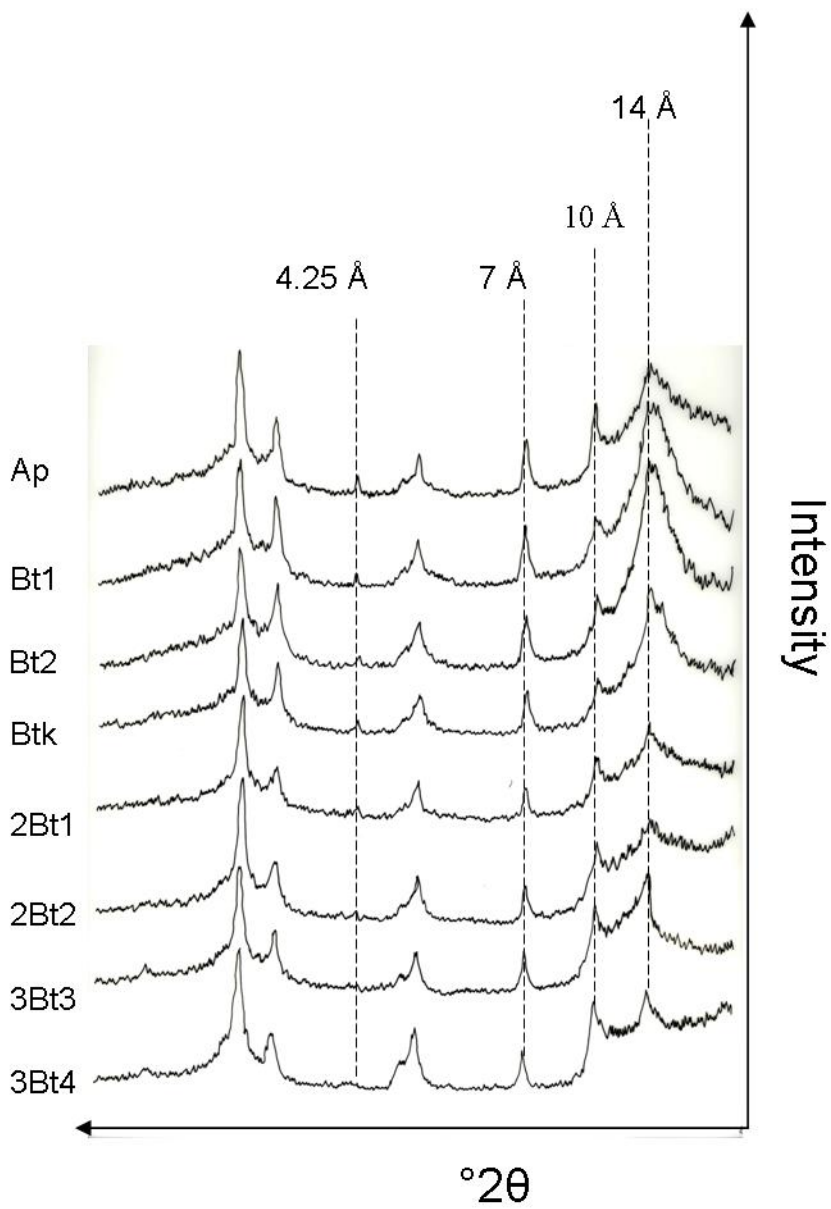


Figure 3.24. Mineralogy of total clay fraction, site 3, pedon 05KS061001, sampled in Geary County, Kansas. Samples were analyzed by the National Soil Survey Laboratory Center in Lincoln, NE. Relative peak sizes were reported, rather than percentage estimates.

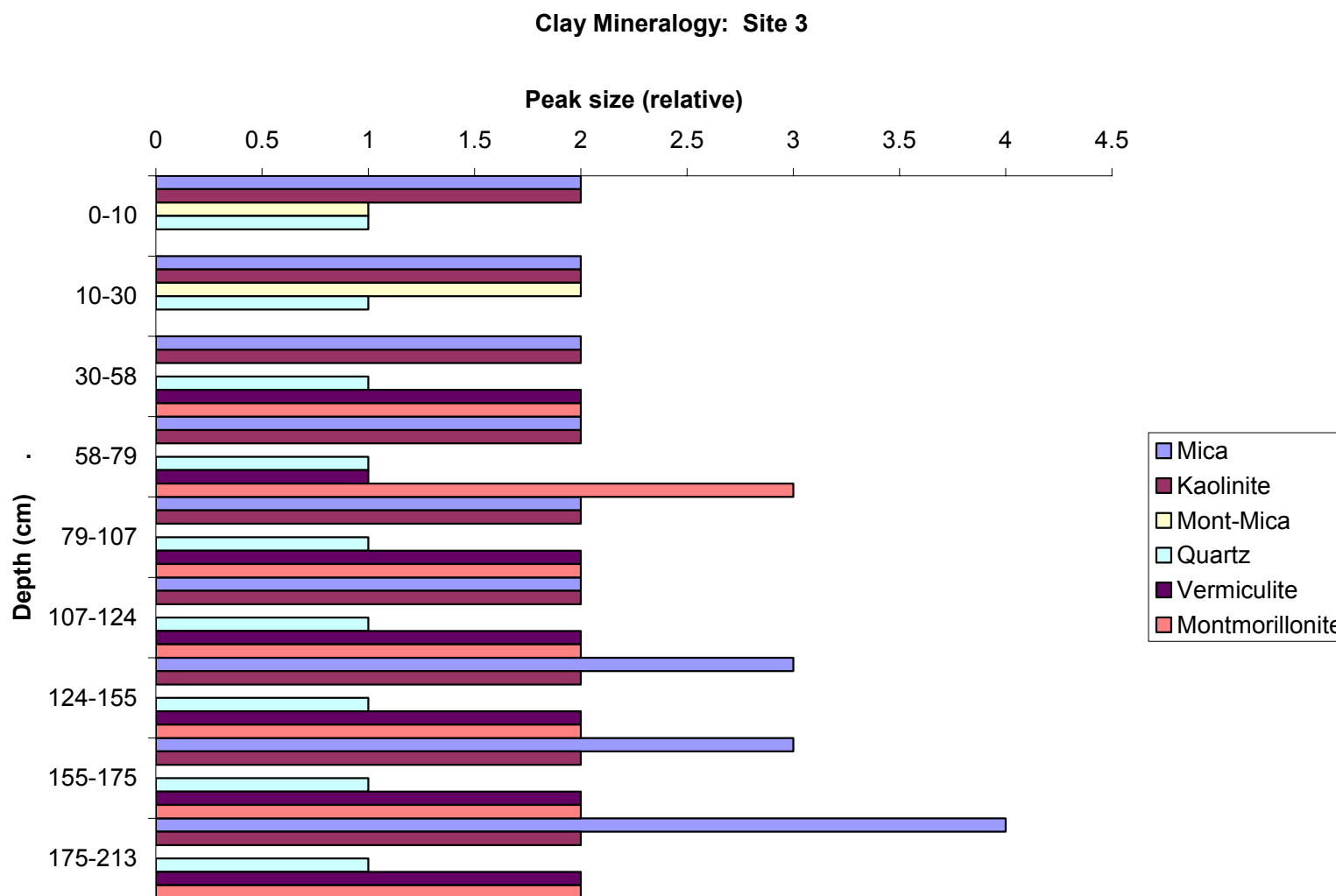


Figure 3.25. Mineralogy of total clay fraction of site 6, pedon 06KS015010, sampled in Butler County, Kansas.

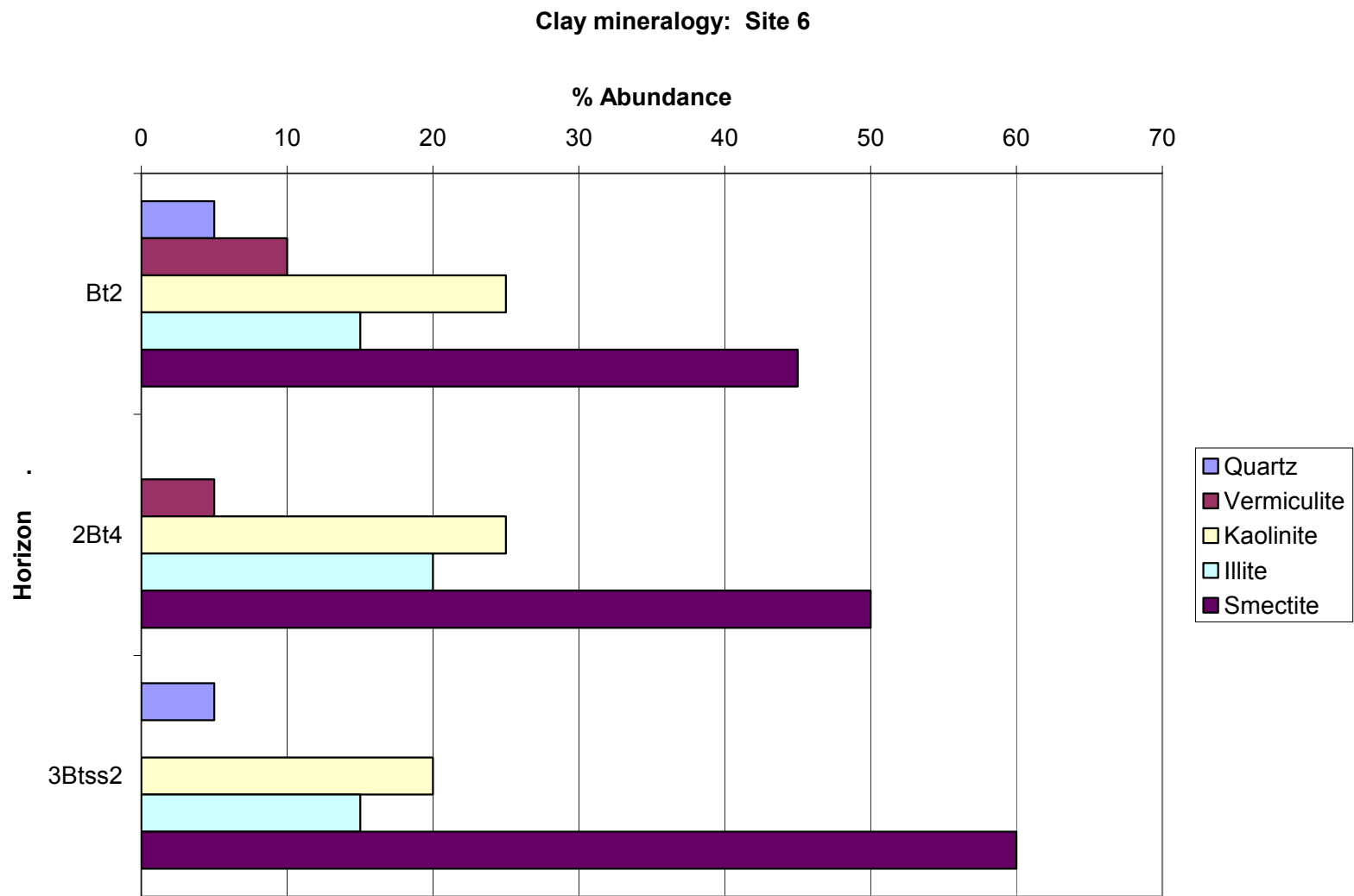


Figure 3.26. X-ray diffractogram for selected horizons of site 6 pedon. Mg-25°C treatment.

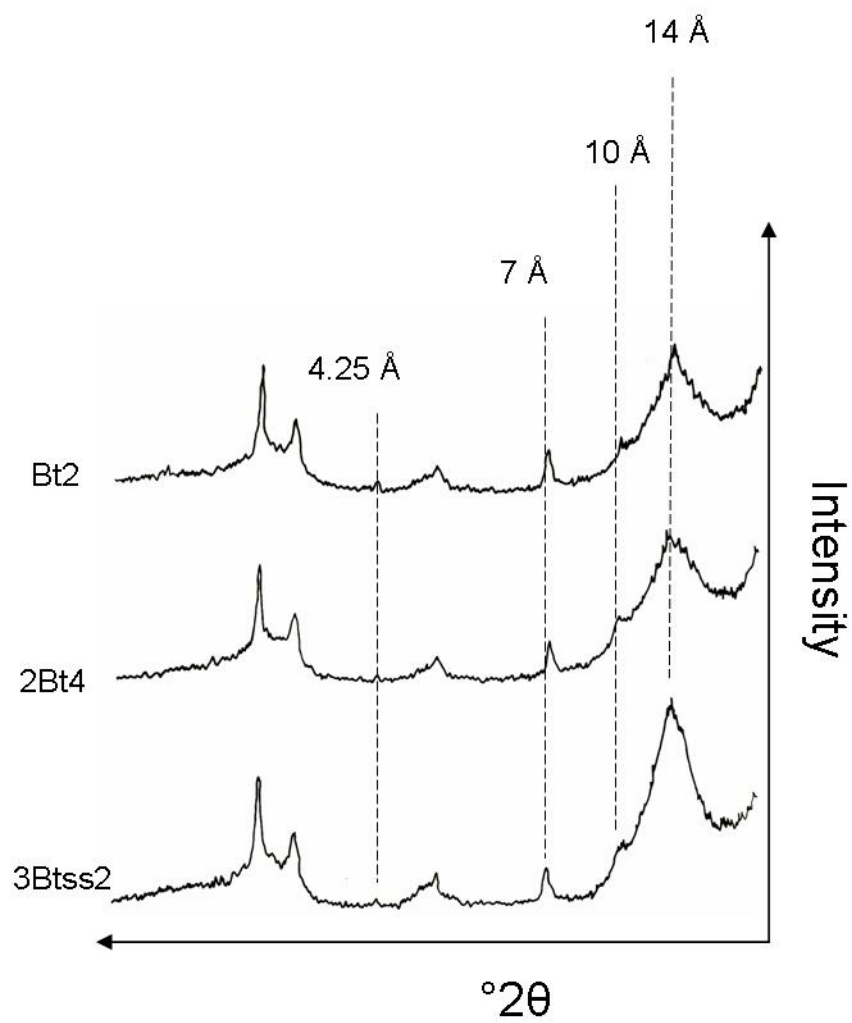


Figure 3.27. Parent material thicknesses (cm) for all six site locations, plotted against the UTM Northing (m).

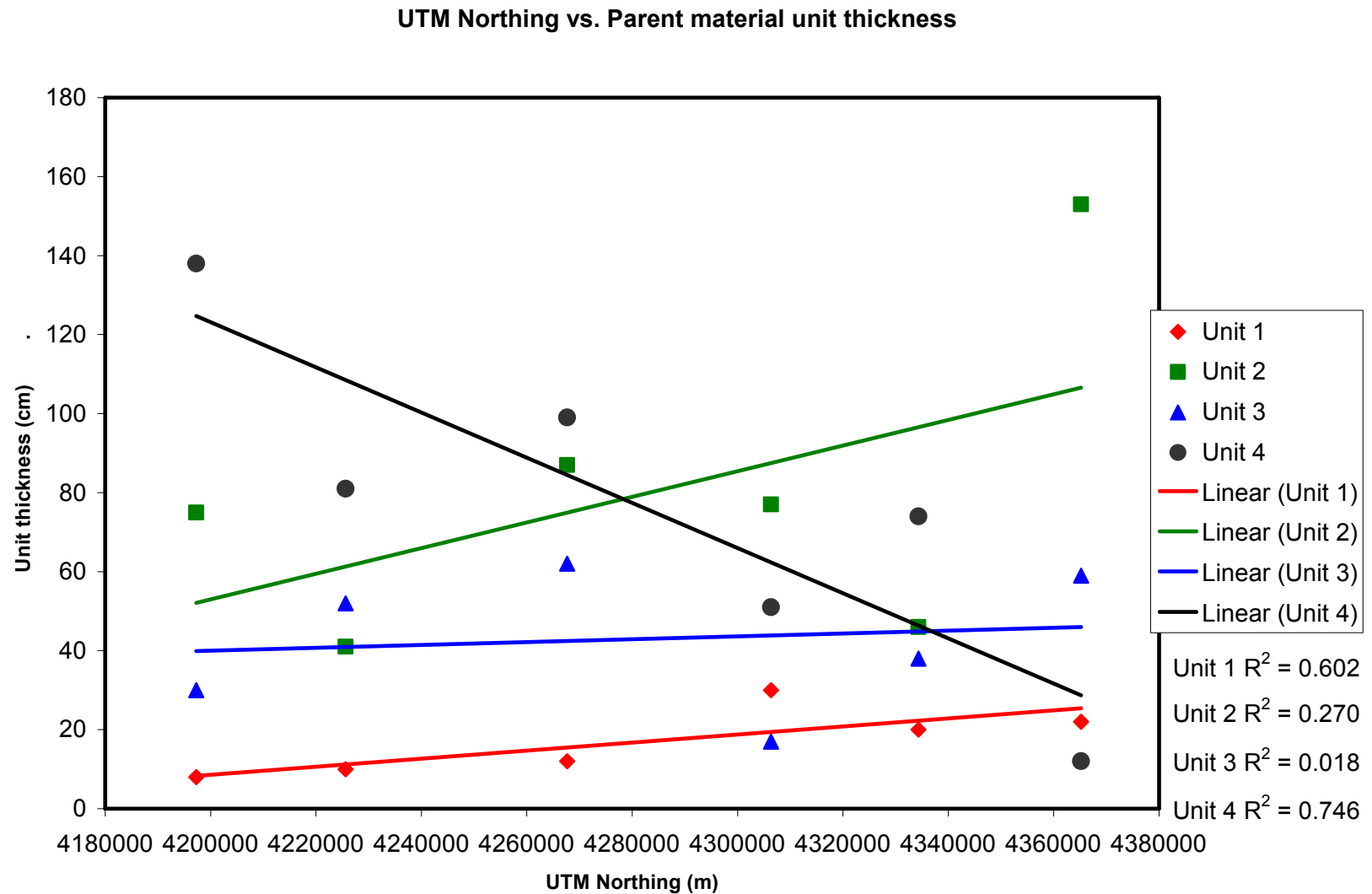


Figure 3.28. Parent material thicknesses (cm) for all six site locations, plotted against the UTM Easting (m).

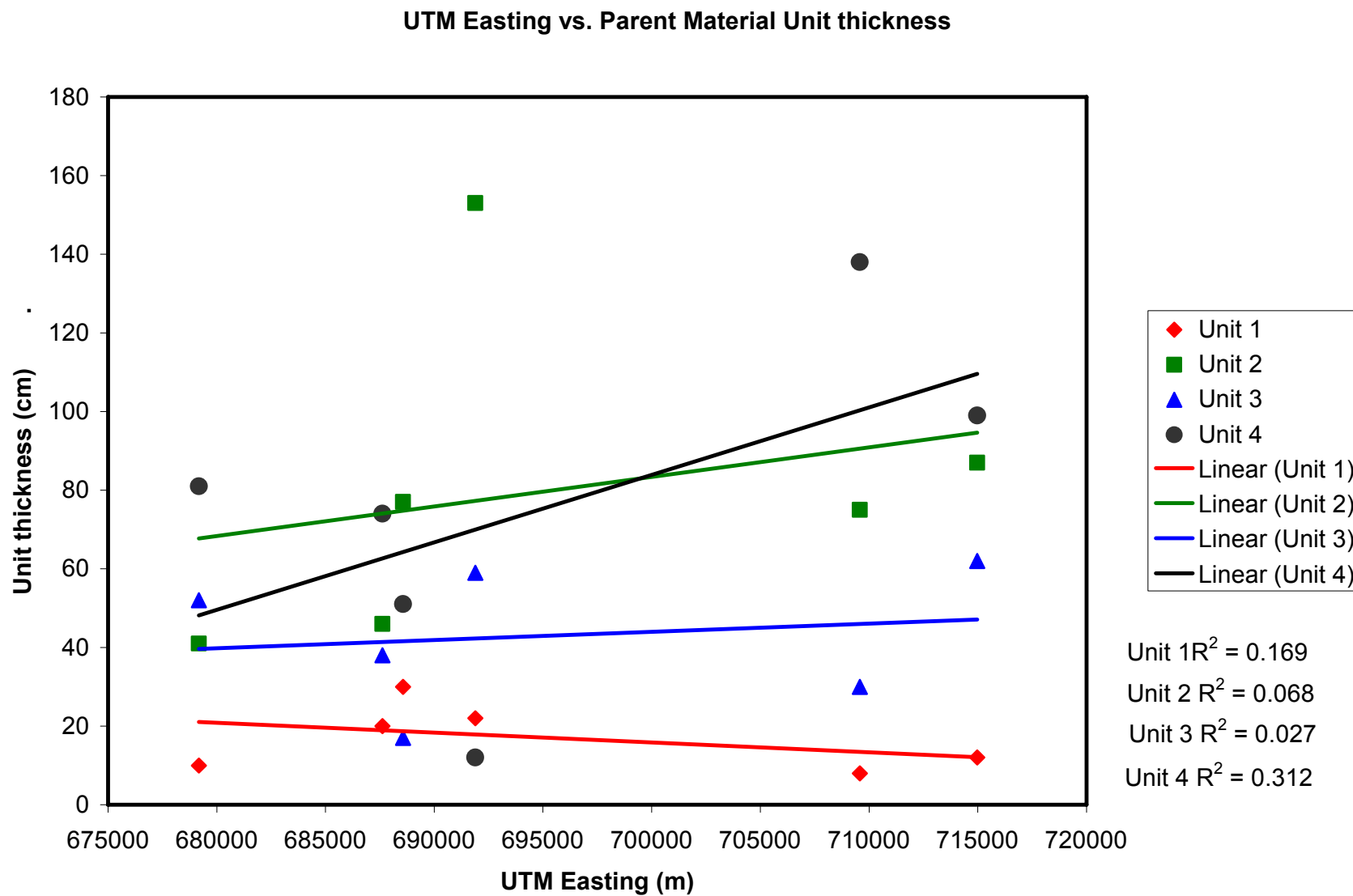


Figure 3.29. Parent material thicknesses of six selected pedons. Proposed stratigraphy is as follows: Unit 1 is recent (Holocene) loess, unit 2 is Peoria loess, and units 3 and 4 are Gilman Canyon loess or Severance formation colluvium.

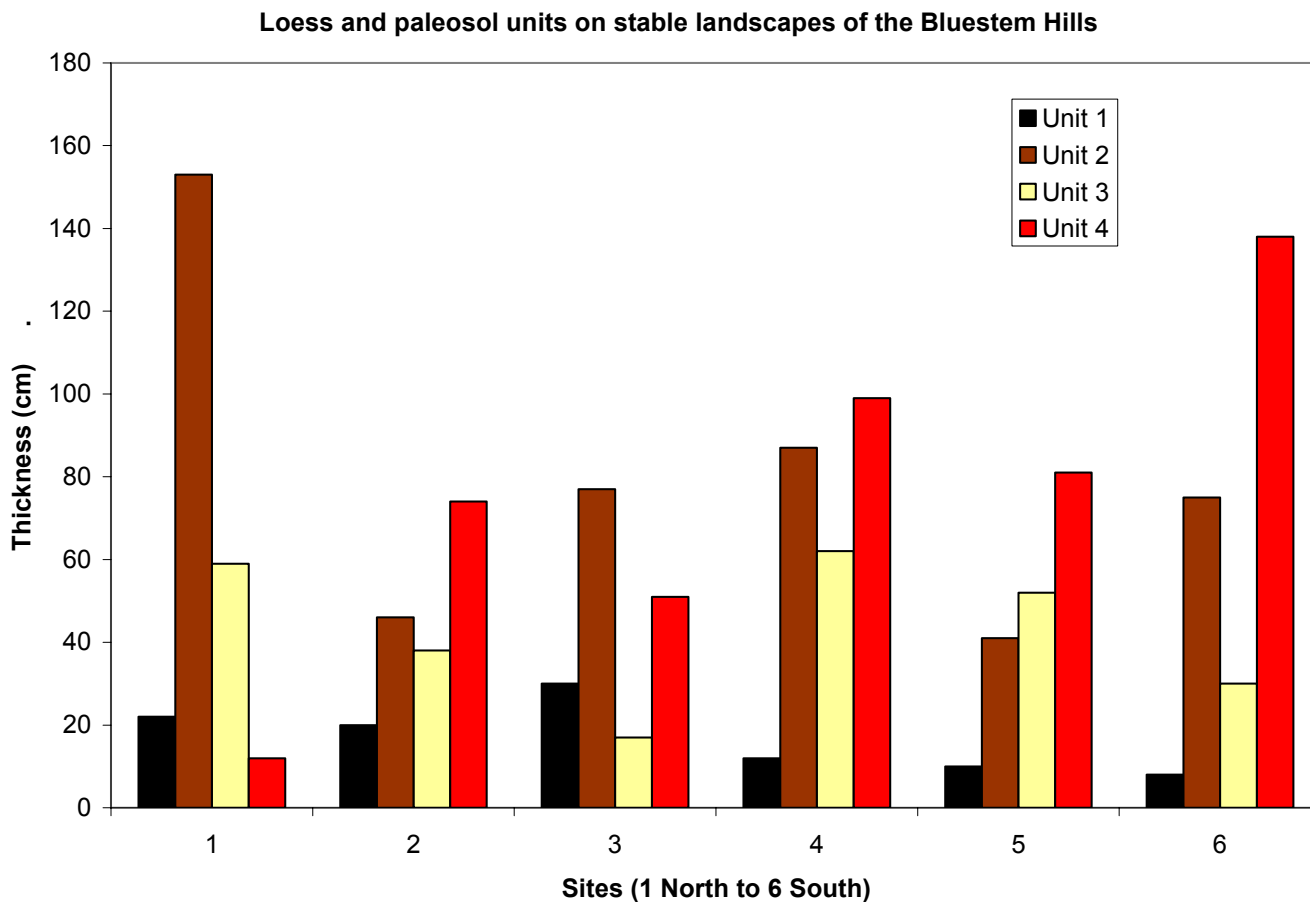


Table 3.1. Quaternary loess units and paleosols of the Great Plains.

Stratigraphic name	Numerical age†	MIS‡	Glacial/Interglacial Stage	Epoch	Period
Bignell loess	9,000 to present	1		Holocene	Quaternary
Brady soil	10,500 – 9,000	1			
Peoria loess	25,000 – 11,000	2			
Gilman Canyon Loess	40,000 – 22,000	3	Wisconsinan	Pleistocene	
Sangamon soil	125,000 – 55,000	5 to 3	Sangamon		
Loveland loess	160,000 – 127,000	6	Illinoian		

†Numerical age ranges in ¹⁴C years before present compiled from numerous sources summarized Busacca et al. (2004) and Bettis et al. (2003).

‡MIS = Marine oxygen isotope stage, from Bloom (1981, p.398).

CHAPTER 4 - Landscape Position, Geomorphology, Parent Material, Paleosols and Their Numerical Ages: Two GIS Analysis Methods

Abstract

The bedrock in east central Kansas is largely composed of alternating, very gently dipping beds of Permian shale and limestone. Upland soils in this region have a complex genesis, in many places contain one or more paleosols, and form in multiple parent materials including loess, colluvium, residuum, and possibly ancient alluvium. These soils may be mapped across a range of landscape positions, including interfluves, upland sideslopes, and paleoterraces. The objective of this study is to use existing data layers to create GIS models and perform terrain analysis in an evaluation of existing soil map units, parent materials, and landscape in order to observe where soils of interest occur in a given study area. Two GIS models were developed and used: A binary geologic model that uses parent material and slope data inputs, and another that is used to compute compound topographic index (CTI). CTI is used as a proxy for characterizing topographic landscape position in order to systematically identify the landscape features that exist where the soils of interest are currently mapped. Large CTI values indicate areas that are relatively wetter (lower) on the landscape, and small CTI values indicate drier (higher), more upland positions. The study location for this project is the United States Geological Survey (USGS) 7.5' topographic quadrangle, number 1346, Saffordville Quadrangle, in Chase County, Kansas. Soils occurred on upland bedrock areas, as well as on flatter, Tertiary terraces of the Cottonwood River, as illustrated in the binary geologic model output. Mean CTI values were 3.89 and 4.37 for the Irwin and Ladysmith series, respectively, indicating that Ladysmith is on average mapped on topographically lower landscape positions than Irwin soils, although these values are not significantly different. Both series were located on areas that spanned the scaled CTI range of values from 1 to 9, meaning that in this drainage area the soils were mapped on a wide range of slope positions.

Nineteen pedons were sampled and characterized on landscape positions that ranged in CTI values from 1 to 9. No correlation between diagnostic pedon properties and CTI values were observed, likely due to the complex topography of the site, as well as the 1.5 to 3 m layer of loess that mantles the present-day topography. Accelerator mass spectrometry (AMS) was used for numerical dating and determination of stable carbon isotope values ($\delta^{13}\text{C}$) for selected paleosols. Radiocarbon ages ranged from 24,000 to 19,000 yr BP and $\delta^{13}\text{C}$ values were between -19 and -17 ‰ (PDB), indicating that the paleosols were formed in Gilman Canyon loess or the Severance formation, under a mix of C_3 and C_4 vegetation. Terrain analysis is one tool that can be used to systematically evaluate relationships between soils, parent materials, and geomorphic positions. However, terrain analysis may not be a useful tool in soil survey updates for the loess-mantled landscapes of east central Kansas where polygenetic soils are common.

Introduction

Soil survey has traditionally been performed using expert knowledge and aerial photographic interpretation, taking many years and great human input to create map products. Soils are part of a thermodynamically open system, where energy and matter are both free to move throughout the system and in all directions. Because of this, soils form as continuous surfaces on a landscape, often with gradual changes in properties both vertically and laterally. Soil survey maps, however, show soils as being discontinuous, in that they are shown as polygons drawn with solid boundaries on top of the landscape. This has been the convention since soil survey began in the early 1900's, and there are reasons for this. One is related to the scale at which the map is drawn. Soil surveys can be first, second, third, fourth, or fifth order. First-order maps are the most detailed, and second-order maps are normally found in county-level soil surveys, or more recently as Soil Survey Geographic data (SSURGO). Second-order surveys were created with a map scale ranging from 1:12,000 up to 1:24,000 for counties in Kansas. For a soil map created with a 1:12,000 scale, the minimum polygon size is 1.5 acres, and the minimum size for a 1:24,000 scale map is 5.7 acres (Soil Survey Division Staff, 1993). Therefore, soil scientists doing the original soil mapping

would have had limitations on their ability to draw complex and small areas on their base maps, resulting in the inclusion of small areas within larger polygons on the final map, even though field soil scientists most likely recognized the existence of these map inclusions. Another reason for this discontinuous mapping style is that it is easier for a person to draw polygons on a map than it would be to try to create a more continuous kind of map. A continuous map could be drawn by blurring the solid line, or making a shading scheme to represent transitional areas. Both would be more difficult to do by hand than drawing lines, and so the use of lines and polygons was permitted, even though soil scientists do recognize that soils are continuous on a given landscape.

In the past, these lines were drawn on aerial photographs by soil survey experts to create these soil boundaries. These experts had the ability to recognize many different soils in a mapping area. They would traverse the landscape, sampling the soil by hand as far as they could go vertically, and each would map several hundred acres per day. Along the way they would decide when to group soils and when to differentiate them with a solid line. They could not sample every acre of every county, and had limited time. Different people with different expert knowledge mapped different counties at different points in time.

Scope and objectives of this study

In this project, the premise is essentially that there are many places where violations of expert knowledge have been made. That is, the expert knowledge rules have not been applied consistently throughout the current mapping extent, resulting in different soils with different properties being (wrongly) grouped into the same soil series. In this project the goal to use existing data layers to create GIS models and perform terrain analysis in an evaluation of existing soil map units, parent materials, and landscape in order to observe where soils of interest occur in a given study area. Two GIS models were used: One binary that uses parent material and slope data, and another that is used to compute compound topographic index (CTI). CTI is used as a proxy for characterizing topographic landscape position in order to systematically identify the landscape features that exist where the soils of interest are currently mapped. Large CTI values indicate areas that are relatively wetter (lower) on the

landscape, and small CTI values indicate drier (higher), more upland positions. In both models, the goal is to use GIS techniques to identify areas of concern, i.e., areas where differences within soil series would be expected, and then in theory, targeted soil sampling efforts could be focused in future soil survey update efforts.

Study area

The study location for this project is the United States Geological Survey (USGS) 7.5' topographic quadrangle, number 1346, Saffordville Quadrangle, in Chase County, Kansas (Fig. 4.1). This location was chosen because of the amount and type of data available for this area (see below). A topographic quad was selected because it would be a manageable size for computations. Also, this area lies completely within a watershed, the Lower Cottonwood River Watershed, which is a Hydrologic Unit Code (HUC) 8 level watershed (Fig. 4.2). This study site is 192 ha in size, with elevation ranging from 450 m in the northwest corner to 340 m in the southeast corner, which is approximately 1.2 km from the present-day channel of the Cottonwood River. For terrain analysis purposes, it is important that the study area does not cross watershed boundaries, i.e., has one "high" and one "low" point, and thus has a consistent flow direction (from northwest to southeast in this study area).

Methods

Two GIS models were created using existing data sets. In addition, nineteen soil profiles were sampled in the study area, and four were characterized, including numerical dating and stable carbon isotope analysis (four horizons) and mineralogy (one pedon, three horizons). Characterization data included pH, particle size, cation exchange capacity, total carbon and nitrogen, and oven-dry bulk density.

GIS Modeling Methods

Data requirements

The following model input layers were obtained for this project (clipped versions may be found in Fig. 4.3):

Geology: Represents the soil parent material to a certain point. A few counties in Kansas have the surficial geology mapped at a scale of 1:24,000. Chase is one of them, and the only one in the study area encompassed by this research project. (The rest of Kansas has geology maps at 1:500,000). The surficial geology for Chase County was downloaded from the Kansas Geospatial Community Commons (KGCC) website in geographic North American Datum (NAD) 27 coordinates. The steps used for geoprocessing are described below.

The surficial 24k data do not include loess as a parent material—only bedrock types and alluvium, both recent and terrace deposits, are mapped. The geology data may have limited value for this project, but it was used because it allowed for differentiation of gently sloping upland areas (bedrock) from gently sloping valley areas (not bedrock). Gently sloping is defined here as less than 5%. Soil surveys have historically filled in the gaps in the geologic information with respect to Quaternary deposits. Most geologic maps, such as the 24k surficial geology map of Chase County, either ignore some of the Quaternary materials (including loess and colluvium) or lump alluvial deposits into one map unit.

Elevation: Elevation data were obtained from the United States Geological Survey Seamless Data Distribution website. The data were downloaded from the National Elevation Dataset in two digital elevation model (DEM) files in geographic coordinates with (NAD) 83 projection. The version selected for download was 1/3 arc-second DEMs. Since terrain and landscape position are major factors in soil forming processes of upland soils in the study area, the finest available resolution DEM was downloaded. The cell size for this data set is 9.37 meters by 9.37 meters.

The USGS Topographic Quadrangle Boundary layer was downloaded from the KGCC website. It was in shapefile format and geographic NAD 83 coordinates. This file was not used in analysis, but was used to identify the boundaries of the selected topographic quadrangle. The geology and elevation data sets were eventually clipped to the topographic quad's extent (see geoprocessing).

Soils: The Soil Survey Geographic (SSURGO) data for Chase County was downloaded from the United States Department of Agriculture-Natural Resources Conservation Service's Soil Data Mart website. The data were in shapefile format and

in UTM Zone 14N NAD 83 projection and datum. The original soil mapping was done at a scale of 1:20,000. The attribute data files are text files that can be used with the Microsoft Access database program.

Other: Climate data were considered and rejected for use in this model. Precipitation data would likely be uniform for the study area. Topographic wetness indices, such as compound topographic index (CTI) can be calculated using DEMs. However, CTI would be highest for valley soils formed in alluvium and terrace deposits, which were identified using the geology layer. CTI was calculated in a separate GIS model and compared with soil profile properties in sampled pedons.

Geoprocessing steps

All of the steps used in geoprocessing were conducted using ArcGIS 9.1 ArcMap software program (Environmental Systems Research Institute, Redlands, California).

Elevation geoprocessing steps

Geologic model:

First, the DEM raster was projected into UTM Zone 14N NAD 83 projection. Next, the DEM was clipped to the boundaries of the USGS Saffordville topographic quadrangle. Slope was calculated using a 3D Analysis function. Map Algebra was used to group the slope map into two classes: slopes under 5% and slopes over 5%. (This was chosen because it is the range of slopes used for mapping Irwin soils in Chase County. The range for Irwin is 1 to 5%, Ladysmith ranges from 0 to 3%, and Dwight ranges from 1 to 3% slope). Slopes under 5% were assigned a value of one, and slopes greater than 5% received a value of zero.

CTI Model:

Topography or relief is one of the five soil forming factors (climate, organisms parent material, relief, and time) affecting pedogenesis and spatial distribution of soils and landscapes (Jenny, 1941). The compound topographic index (CTI) may also be referred to as the wetness index, and is a secondary topographic attribute that is

computed from two primary topographic attributes, slope and upslope contributing area. Wilson and Gallant (2000, p.6-7) summarize numerous papers in which CTI has been used in formal landscape classification to use patterns to describe processes, as a proxy for relative landscape position, and to determine relative rates of pedogenesis. Compound topographic index was calculated from the clipped DEM using the following equation:

$$\text{Compound Topographic Index} = \ln \frac{\text{catchment area}}{\text{slope}}$$

The catchment area is the number of upslope pixels. The CTI layer was then clipped by the extent of the combined Irwin map units (4671-4674) and by the Ladysmith map units (3890-3892).

Geology geoprocessing steps

First, the geographic data were reprojected to UTM Zone 14N NAD 83 projection and datum. Next, the shapefile was converted to raster format, the study topographic quadrangle was clipped out, and a weighted overlay process was performed. Class 7 and class 12 were given a restricted weighting, as these represented recent alluvium and terrace deposits where upland soils are not found. (Reclassification could have been used instead of weighted overlays, with the same outcome). All of the bedrock layers were given an equal weighting of one. In the future, or with more expert knowledge, it might be possible to associate certain soils with particular geologic groups, and thus weight them differently in the model.

Soils geoprocessing

The soils of interest were selected by attributes (using the musym field). The soils of interest were the Irwin (map units 4671-4674), Dwight (4605), Ladysmith phases (3890-3892), and the Labette-Dwight (4744) and Zaar-Dwight (8993) complexes. The shapefile for selected soils was converted to a raster data layer, and the raster layer was clipped to the extent of the topographic quadrangle. A weighted overlay was

performed with all soils receiving a weight of one in preparation for the final step, which was to compare how well the model predicted the location of selected upland soils. This layer was named the “actual” soils layer, meaning that it represented the soils as they are currently mapped.

Field Description and Sampling Methods

Nineteen pedons were sampled in 2005 and 2006 in the Saffordville quadrangle study area. All pedons were sampled using a hydraulic, truck-mounted probe (5 cm diameter). Pedons were described using the Field Book for Describing and Sampling Soils (Schoeneberger et al., 2002), and all sampling locations were georeferenced using a global positioning systems (GPS) unit with an approximate horizontal positional accuracy of ≤ 10 meters. Pedon descriptions were entered into the United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) National Soil Information System (NASIS) database. Bulk samples were collected for laboratory characterization and oriented clods were collected from the horizons (of pit-sampled profiles only) for thin section preparation. Thick horizons (>20 cm) were split and subsampled.

Laboratory Characterization Methods

Air-dry bulk samples were crushed with a wooden rolling pin and passed through a No. 10 sieve with 2 mm square openings. Soil pH was determined in a 1:1 soil/water suspension using method 8C1F of the Soil Survey Laboratory Staff (1996). Total carbon (TC) and total nitrogen (TN) were determined using a high-frequency induction furnace (Leco Model CNS-2000, St. Joseph, MI) following the procedure of Tabatabai and Bremner (1970). Particle size distribution was determined using a modification of the pipet method of Kilmer and Alexander (1949) and method 3A1 from the Soil Survey Laboratory Method Manual (1996). Organic matter was removed from samples containing greater than 1.4% total C with 30% hydrogen peroxide. Cation exchange capacity (CEC) was determined by summing the NH_4OAc extractable bases and the $\text{BaCl}_2\text{-TEA}$ extractable acidity (method 5A3a of the Soil Survey Laboratory Staff (1996). Exchangeable sodium percentage (ESP) was determined by dividing the exchangeable sodium by the sum of cations CEC. One to three samples per horizon were collected

for bulk density measurements by cutting a sample of known volume from the probe-sampled pedon, and drying at 105°C until a constant mass was achieved.

Mineralogy Methods

Total silt and clay mineralogy was analyzed following the methods of Jackson (1975). Three horizons from one pedon, 06KS017011, were analyzed. Forty gram samples were pretreated with 1 M NaOAc and 30% H₂O₂ to remove carbonates and organic matter, respectively. Sand was collected on a 300 mesh sieve, and silt and clay were fractioned through at least eight sedimentation periods. Stokes' law was used to calculate sedimentation times for a 10-cm depth of fall (Jackson, 1975). The clay fraction was flocculated with MgCl₂, quick-frozen in a bath of dry ice and acetone, and freeze-dried. Silt and sand fractions were oven dried at 60°C and retained in vials. Five clay treatments were prepared: Mg 25°C, Mg-ethylene glycol, K 25°C, K 350°C, and K 550°C. Two milliliters of solution (containing 30 mg of clay) were pipetted onto a glass slide.

A Phillips XRG-3100 generator and an APD X-Ray diffractometer was used to analyze all samples. The instrument was equipped with a Theta compensating slit and a monochromatic X-ray beam. The instrument operating conditions were as follows:

Target:	Copper
Radiation:	CuK α
Potential:	35 kV
Current:	20 mA
Detector:	Scintillation
Range:	1000 to 2000 cps
Time Constant:	2000 cps = 1 and 1000 cps = 2
Scan Speed:	2°2 θ min ⁻¹
Chart Speed:	10 mm min ⁻¹

The clay specimens were scanned from 2°2 θ to 34°2 θ for the Mg 25°C treatment, and from 2°2 θ to 15°2 θ for the other treatments. The silt samples were

scanned from $18^{\circ}2\theta$ to $54^{\circ}2\theta$ using powder diffraction specimen holders. The d-spacing of each peak was determined using the table on p. 224 of Jackson (1975), and the clay minerals were subsequently identified.

Numerical Dating Methods

Four horizons were selected for numerical dating of paleosols. Samples were analyzed by the Illinois Geological Survey Isotope Geochemistry Laboratory. About 5g of soil material that had passed a sieve with an opening of 2 mm was treated with 2M HCl for at least 15 hours at 25°C to remove carbonates and fulvic acids, and rinsed to $\text{pH} \geq 5$ with distilled water. The residue was oven-dried and 500-750 mg samples were loaded into pre-baked quartz tubes with 1g Cu, 1g CuO, and 50mg Ag foil. The tubes were evacuated for at least 2 hours and sealed with a torch. The charcoal samples were converted to CO_2 by sealed quartz tube combustion at 800°C for three hours in a programmable muffle furnace. The tubes were cooled to 25°C over 20 hours and CO_2 was purified and collected by cryogenic distillation for accelerator mass spectrometry (AMS) ^{14}C and $\delta^{13}\text{C}$ analyses (Hong Wang, personal communication). Stable carbon isotope values are reported relative to a standard reference material, the Peedee belemnite standard (often abbreviated PDB), which is a marine carbonate (Faure, 1998). The symbol ‰ means per mille, or per thousand.

Results

Geologic Model

The geology and elevation inputs were combined in a single output map algebra task to find areas that had both slopes less than 5% and bedrock for parent material. These are features that the Dwight, Irwin, and Ladysmith soils are supposed to have in common (Fig. 4.4). This layer was called “potential.” The raster composed of the clipped soil of interest was then displayed over the top of the potential map for visual inspection of the results (Fig. 4.5). Surprisingly, a great deal of Ladysmith was shown as being mapped in places that were “too far down” on the landscape. They were mapped in areas of low relief, which is acceptable, but were mapped on what was the

terrace position on the original geology map, which was unexpected. To determine how well this modeling technique predicted the occurrence of the series of interest, a single output map algebra step was used to subtract the actual layer from the potential layer. Fig. 4.6 displays the potential, actual, and performance map output layers. The potential layer has binary values of 0 and 1, and the actual layer only has possible values of 1 or no data.

When subtracted, the output values would mean the following:

- A value of 0 on the performance map means that the soils were mapped where predicted by this model.
- A value of 1 on the performance map means that the soils of interest were actually located in areas where they were not expected in the study area.

Figure 4.6 displays the final output layers that were combined to create the potential map, the actual map, and the performance map. The potential map combines the elevation and geology data. The green areas represent places where the slopes were less than 5% and the soil parent material would be dominantly bedrock derived. The areas in black would have slopes greater than 5% and/or soil parent material that was not derived from bedrock. This interpretation is only valid for the soils of interest, which are Dwight, Irwin, and Ladysmith. The “actual” soil layer was only for these soils, and didn’t include other upland soils. Therefore, the performance layer only shows two possibilities: Areas that agree with the model, and areas where the soils are mapped that were not predicted by the model. The appearance of the output map indicates that the model and the existing soils map don’t have very good agreement. It appears that the soils of interest, especially Ladysmith, are predominantly mapped “outside” of the areas where the expert (the author, as well as soil surveyors) predicted that the soils should occur. The biggest problem with the model and specifically, the expert knowledge, is that Ladysmith was not “supposed” to form in the alluvial deposits composing the terrace, but it is certainly mapped there to a rather great extent. In fact, it is almost exclusively mapped on this landscape position and geologic parent material, while it is described as being mapped on uplands and formed from clayey sediments or material weathered from shale in the Chase County Soil Survey (Neill, 1974). This gets

at one of the underlying problems with Ladysmith—it is a poorly understood and vaguely mapped soil series in the state of Kansas. As mapped, the soils appear to have formed on both residuum and non-residuum geologic materials, and these particular soils also seem to occur in close proximity to the non-residuum material. Thus, an analysis of soil properties is in order (and will be discussed below in this paper).

These criteria were selected based on expert knowledge. The properties of the soils of interest indicate that the soils are very old and formed on stable landscape positions (slope less than 5%) and at least partly from residuum (bedrock). However, the actual map of the soils shows that in this quadrangle the soils of interest are mapped to a greater extent than expected. On the bedrock-derived areas, the soils of interest agree quite well with the potential map, but the greatest difference is that these soils appear to also be mapped in the areas derived from terrace deposits and alluvium. The distinction is important because these materials are much younger, and so differences in soil properties between soils mapped on uplands and those soils mapped on terraces might be expected.

The performance map (Fig. 4.6) indicates that this model is either not valid in its current form, or that the parent material for Ladysmith is not residuum from bedrock. The model could be improved in a variety of ways. For one thing, it only takes the slope derived from elevation and the geology into consideration. Also, as constructed, the model does not distinguish any of the upland soils from each other. This indicates that the model does not have the ability to distinguish Dwight from Irwin, etc. In a more detailed model and analysis, slope curvature and aspect data could be used. Perhaps, the best result from this model is the comparison of the potential and actual maps. The potential map represents the area where experts would generally expect these soils to occur, as opposed to the actual mapping of the soils of interest. This map could be used to direct sampling efforts in future soil survey updates, and illustrates the necessity of an evaluation of the Ladysmith soil series (and others) and an inventory of pedon properties with respect to landscape position. That is, Ladysmith mapped on high upland positions should be sampled and compared with Ladysmith mapped on the relatively lower paleoterrace position.

CTI Model

Figure 4.7 shows the CTI values for the study area, and Fig. 4.8 shows the CTI values for the Irwin and Ladysmith series. CTI was not examined for the Dwight series as it only occurs to a very limited extent in this study area and is more often mapped in association with either Zaar or Labette soils. The Irwin series had a mean CTI value of 3.89 and standard deviation of 1.71. The Ladysmith series had a mean CTI value of 4.37 and standard deviation of 1.80.

Figures 4.9 and 4.10 are histograms of the pixel counts and CTI classes for the Irwin and Ladysmith soils, respectively. The histograms are quite similar in some respects. Both series have CTI values across the entire range of values. The CTI values are clearly highest in the 3 to 4 range for the Irwin series, and are nearly equal in the 3 to 4 and 4 to 5 range for the Ladysmith series.

CTI and pedon properties

Nineteen soil profiles were described and sampled in the study area (Fig. 4.11). All Chase County pedon descriptions are located in Appendix A2. Six pedons were sampled in areas mapped as Irwin, and eight pedons were sampled in areas mapped as Ladysmith. Five pedons were sampled in areas mapped as Dwight, but they were revised to Irwin because the soils did not meet the criteria for the natric horizon. Therefore, in the following statistical analysis, eleven pedons were designated Irwin, and eight pedons were designated Ladysmith. Few significant differences exist for t-test comparisons of profile features of Irwin and Ladysmith soils (Table 4.1). The average CTI for Irwin pedons was 4.3 and 5.9 for Ladysmith pedons ($P > F$ 0.10). Ladysmith soils had greater total solum thicknesses ($P > F$ 0.04), which is as expected if Ladysmith soils are usually mapped on lower landscape positions than Irwin soils. No significant differences between the series existed for the mollic epipedon, loess, and paleosol thicknesses. Irrespective of series, no relationships were observed for CTI and the thickness of the mollic epipedon, total solum, or loess (Fig. 4.12).

Moore et al. (1993) observed relationships between the wetness index and A horizon thickness in a Colorado toposequence. However, McKenzie et al. (2000) point

out that while relationships may exist between terrain properties and modern soils, “...there is always the possibility that functional relationships between soils and terrain have been complicated or obliterated by imprints from successive sets of environmental conditions.”

Laboratory Characterization and Mineralogy

Four pedons were selected for laboratory characterization: Site 3, pedon ID 05KS017003; site 9, pedon ID 06KS017002; site 13, pedon ID 06KS017006; and site 18, pedon ID 06KS017011. Site 9 was designated the summit location, site 18 the west bench location, site 13 the east bench location, and site 3, the terrace location, listed in order from highest to lowest elevation (Fig. 4.11, Table 4.2). Figure 4.13 displays selected physical properties of these pedons with respect to depth (cm). The west bench pedon is the shallowest, the east bench and summit pedons are about the same depth, and the terrace pedon is the deepest at over 2 meters to bedrock. Tables 4.3, 4.4, 4.5, and 4.6 contain information about the parent material stratigraphy, horizonation, matrix color, and clay film morphology as described in the field. In the pedons on the summit and west bench, the stratigraphy is as follows: Loess over colluviated loess, over colluviated loess, over residuum weathered from limestone and shale. The east bench pedon contains loess over colluviated loess, over two units of residuum, and the terrace pedon was described with loess over colluviated loess to a depth of over two meters. Between 83 cm (west bench) and 116 cm (summit) of loess was described on the upland positions, and 142 cm of loess was described on the terrace position. Despite having differences in thickness of the solum, and individual parent materials, all of the pedons have a similar distribution of the clay content with depth. All of the pedons had two clay maxima, one at a depth of approximately 25 cm, and one much deeper in the profile. All profiles contained less than 5 to 10% sand in the entire profile, and had median particle sizes between 10 and 15 μm (medium silt-sized) in every horizon. All four profiles contained one or two distinguishable paleosols. Paleosols with similar morphology were observed in nearly all of the sampled pedons. The common morphological characteristics of the paleosols included an increase (relative to the overlying horizons) in clay film abundance, thickness, and prominence,

as well as a change in matrix color, often becoming both redder and darker with depth in the profile. (One exception to this is the paleosol described on the terrace position. It appeared gleyed). A common color of the lower part of the loess-derived soil is 10YR 4/3 or 4/4, and in the paleosol, 7.5YR or 5YR 3/3.

Analysis of the total clay mineralogy of the west bench pedon, 06KS017011, is displayed graphically in Fig. 4.14 (Mg-25 treatment) and Fig. 4.15 (Mg-ethylene glycol treatment). The Bt2 horizon contains approximately 50% smectite whereas the 2Bt2 and 3Bt3 horizons contain approximately 25% smectite. In general, the Bt2 horizon has a different mineralogical composition than the lower two paleosols (which are nearly identical to each other). Both paleosol horizons contain up to 20% vermiculite, (although the upper paleosol contains the most vermiculite) while the Bt2 horizon (loess-derived) contains no recognizable amount of vermiculite. The kaolinite content decreased slightly with depth, while the illite content increased with depth. For this particular profile, the two paleosols have a nearly identical mineralogical composition that is mixed, and thus, cannot be distinguished based on mineralogy alone.

Radiocarbon dating and $\delta^{13}\text{C}$ values

Four samples were radiocarbon dated and analyzed for stable carbon isotopes. One sample was sent from each of the four pedons discussed in the preceding section: The summit, east and west benches, and terrace pedons (Tables 4.3, 4.4, 4.5, and 4.6). From the summit pedon, material from 143 to 152 cm was analyzed, representing the older or deeper paleosol. From the west bench pedon, the older paleosol was also dated, from a depth of 99 to 138 cm. The younger paleosol was dated from the east bench pedon from a depth of 108 to 148 cm. The terrace pedon was quite deep, and only one paleosol was identified in field observations. This would therefore also represent the younger paleosol, and material was dated from 142 to 170 cm. The age of the older paleosol was $24,490 \pm 120$ radiocarbon years before present (^{14}C yr BP) in the west bench pedon, and $22,490 \pm 90$ ^{14}C yr BP in the summit pedon. The age of the younger paleosol was $20,140 \pm 70$ ^{14}C yr BP in the east bench pedon, and $19,030 \pm 60$ ^{14}C yr BP in the terrace pedon. Therefore, it seems that both the morphology and radiocarbon ages of paleosols are quite consistent across the range of selected

landscape positions in the Saffordville quadrangle (Fig. 4.16). As these ages correlate well to reported ages for Gilman Canyon loess, it seems that the geomorphology of the study area was likely well established prior to deposition of late Wisconsinan-aged loess, which now mantles the study area. Published ranges for Gilman Canyon are 40,000 to 24,000 yr BP (Bettis et al., 2003), 50,000 to 30,000 yr BP (Busacca et al., 2004), 36,000 to 22,000 (Muhs et al., 1999), and 36,000 to 30,000 (Maat and Johnson, 1996). Mandel and Bettis (2001, 2003) observed a deposit that was similar in age and properties to the Gilman Canyon loess in valleys and older terraces in northeast Kansas. Mandel and Bettis (2001, 2003) called the colluvial and alluvial facies the Severance Formation. Radiocarbon ages of the Severance Formation range from 25,000 to 15,000 (Mandel and Bettis, 2003).

The $\delta^{13}\text{C}$ values were -17.5‰ and -19.2‰ (PDB) for the upper paleosol of the east bench and terrace pedons, respectively (Fig. 4.16). The $\delta^{13}\text{C}$ values were -16.8‰ and -16.9‰ for the lower paleosol of the summit and west bench pedons, respectively. During photosynthesis, green plants discriminate in favor of the ^{12}C isotope, and thus are depleted in ^{13}C relative to the atmosphere (Bender, 1970). Plants that follow the C_3 pathway of photosynthesis (cool season grasses and trees) are more depleted in ^{13}C , and have values of $\delta^{13}\text{C}$ that range from -23 and 34‰ , with a mean of -27‰ (PDB). Plants that follow the C_4 photosynthetic pathway (warm season grasses) are less depleted, and have values of $\delta^{13}\text{C}$ ranging from -6 to 23‰ , with a mean of -13‰ (PDB). Generally, C_3 vegetation is associated with cooler climates, and C_4 vegetation is adapted to warmer climates. Both paleosols have $\delta^{13}\text{C}$ values that are indicative of a mixed C_3 - C_4 vegetation, although the values for the older paleosol are both very similar and closer to a more dominant C_4 type vegetation. Relative to each other, these vegetation proxies suggest a slightly warmer and possibly drier climate was present between 24,000 and 22,000 yr BP (and thus similar to the present-day climate), and a relatively cooler and possibly more moist climate was present 20,000 to 19,000 yr BP. Mandel (2006) reported $\delta^{13}\text{C}$ values of -15.5 and -15.9‰ for Severance Formation samples dating to $22,620 \pm 340$ and $24,560 \pm 350$ ^{14}C yr BP at a location in Chase County, Kansas (Mandel, 2006).

Summary and Conclusions

At the Saffordville quadrangle study site, soils occurred on upland bedrock areas, as well as on flatter, Tertiary terraces of the Cottonwood River, as illustrated in the binary geologic model output. Mean CTI values were 3.89 and 4.37 for the Irwin and Ladysmith series, respectively, indicating that Ladysmith is on average mapped on landscape positions that are topographically lower than the topographic positions for Irwin soils, although these values are not significantly different. Both series were located on areas that spanned the scaled CTI range of values from 1 to 9, meaning that in this drainage area the soils were mapped on a wide range of slope positions. Polygenetic upland soils of east central Kansas have been formed through multiple and likely different sets of soil forming factors. Indeed, the lack of relationships between CTI, solum thickness, and mollic epipedon thickness, as well as the presence of two paleosols, are indicative of at least three periods of parent material deposition and soil formation. The age of the paleosols were typical for the Severance formation, clustering in two age ranges, which were $\approx 19,000$ to $20,000$ yr BP and $\approx 22,500$ to $24,500$ yr BP. The topography of the Saffordville quadrangle is likely the reflection of the paleotopography, later mantled by Wisconsin-aged loess and colluvium. Terrain analysis is one tool that can be used to systematically evaluate relationships between soils, parent materials, and geomorphic positions. However, terrain analysis may not be a useful tool in soil survey updates for the loess-mantled landscapes of east central Kansas where polygenetic soils are common.

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Figure 4.1. Location of the Saffordville Quadrangle in Chase County, east central Kansas.

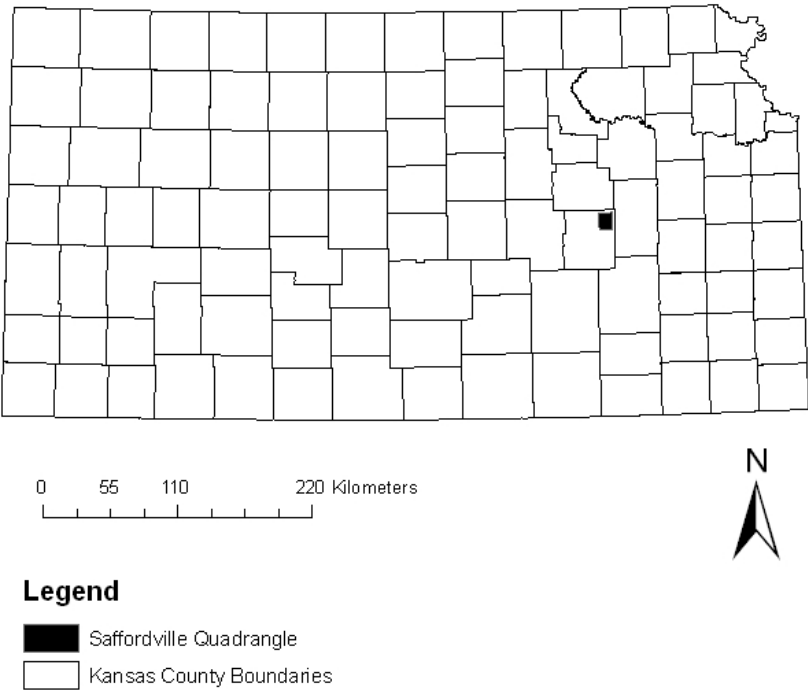
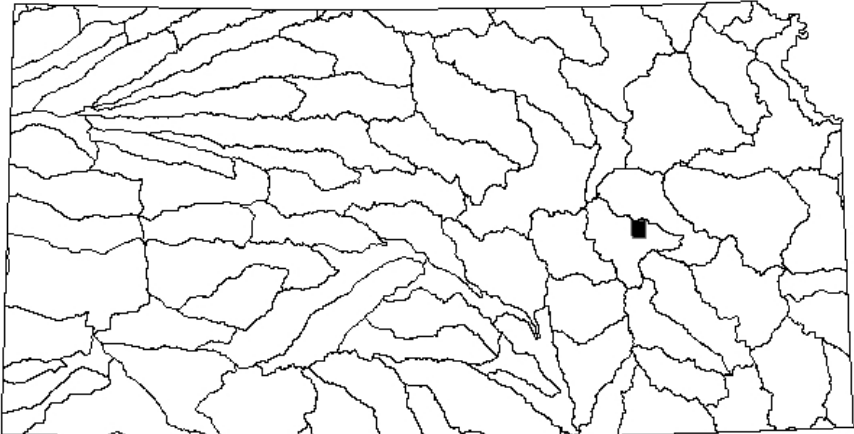


Figure 4.2. The Saffordville Quadrangle is located within the Lower Cottonwood River Watershed, Kansas.



0 55 110 220 Kilometers



Legend



-  Hydrologic Unit Code 8 Boundaries
-  Saffordville Quadrangle

Figure 4.3. Geographic Information System model input layers used for the Saffordville Quadrangle of Chase County, Kansas include elevation, geology and soils.

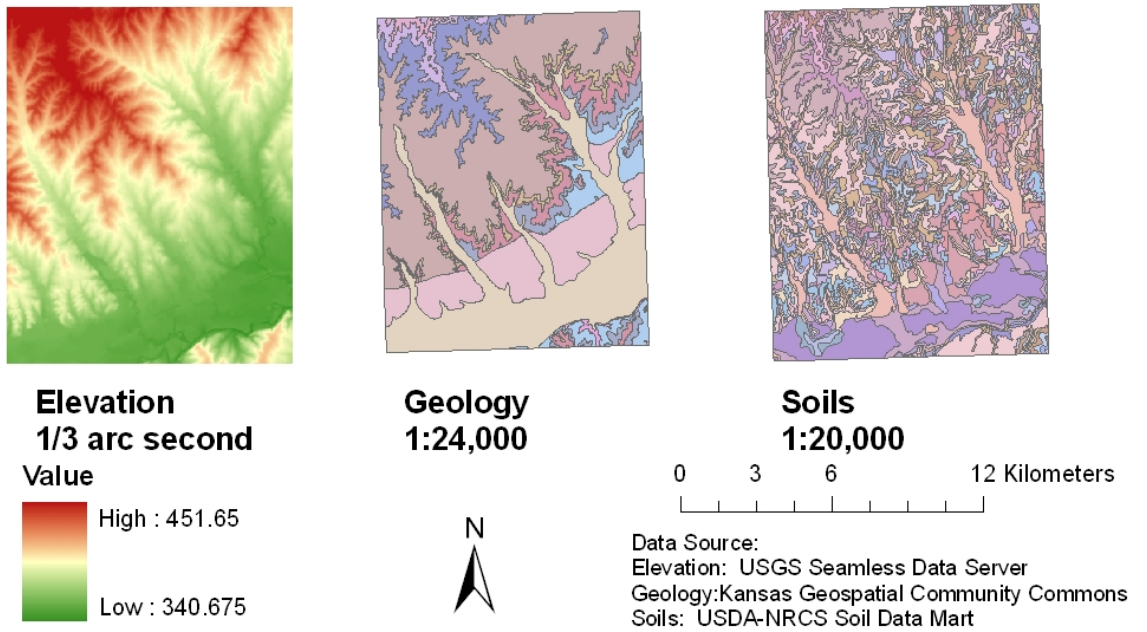
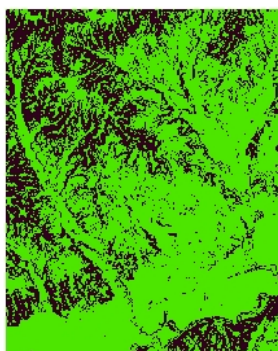


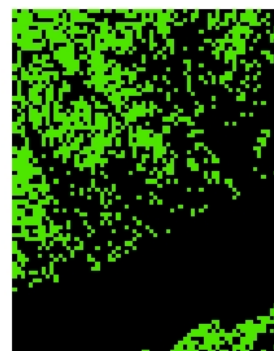
Figure 4.4. Prospective locations (shown in green) for the series of interest. The black areas represent slopes greater than 5% and non-bedrock areas.



Slopes < 5 (green)



Upland (green)



Potential (green)



Figure 4.5. First visual inspection: When the soils layer is placed upon the geology layer, it appears that the Irwin soils (in blue) and the Ladysmith soils (in red) are both mapped upon bedrock and non-bedrock areas.

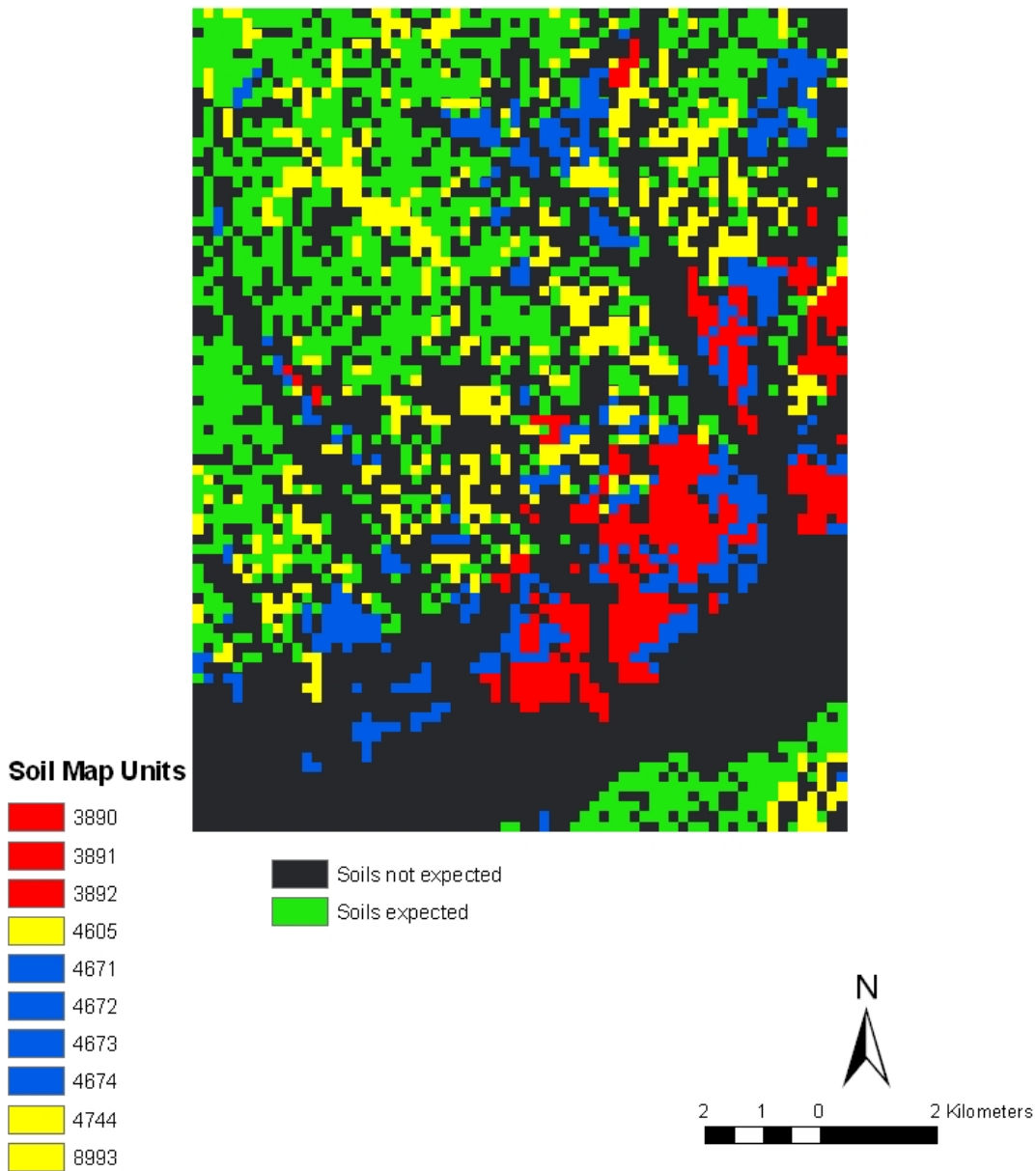
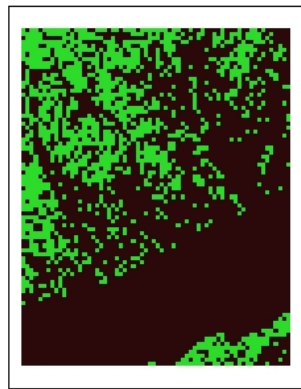
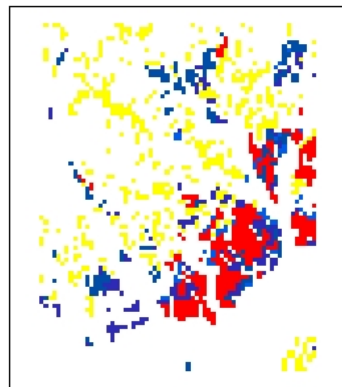


Figure 4.6. Analysis of model performance. The three graphics illustrate (from left to right) the potential areas where the soils of interest would be expected, where they are actually mapped, and an analysis of the model's performance.

Potential - Actual = Performance



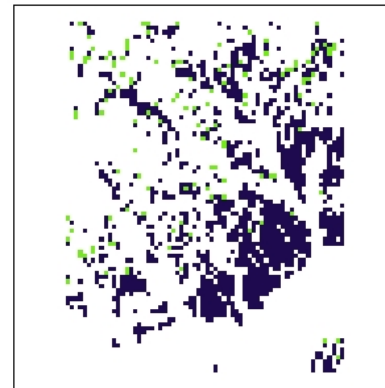
not expected
 expected



Soil map units

Musym

- 3890
- 3891
- 3892
- 4605
- 4671
- 4672
- 4673
- 4674
- 4744
- 8993



soils mapped where model didn't predict
 soils mapped where model predicted



Figure 4.7. Compound topographic index (CTI) map for site location, the Saffordville Topographic Quadrangle located in Chase County, Kansas.

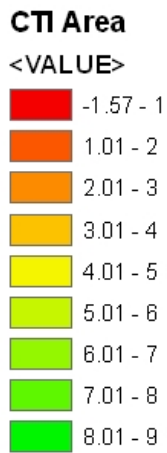
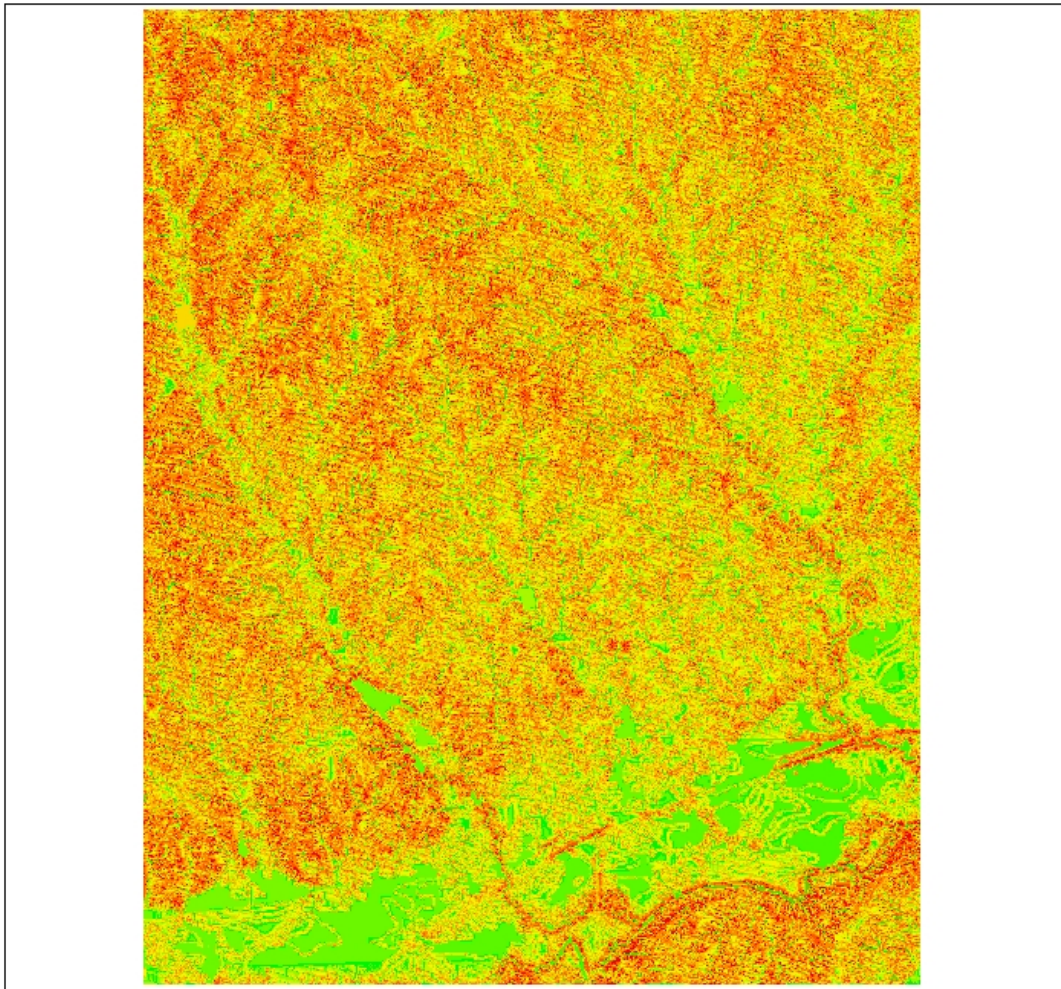


Figure 4.8. Compound topographic index (CTI) maps for soils of interest.

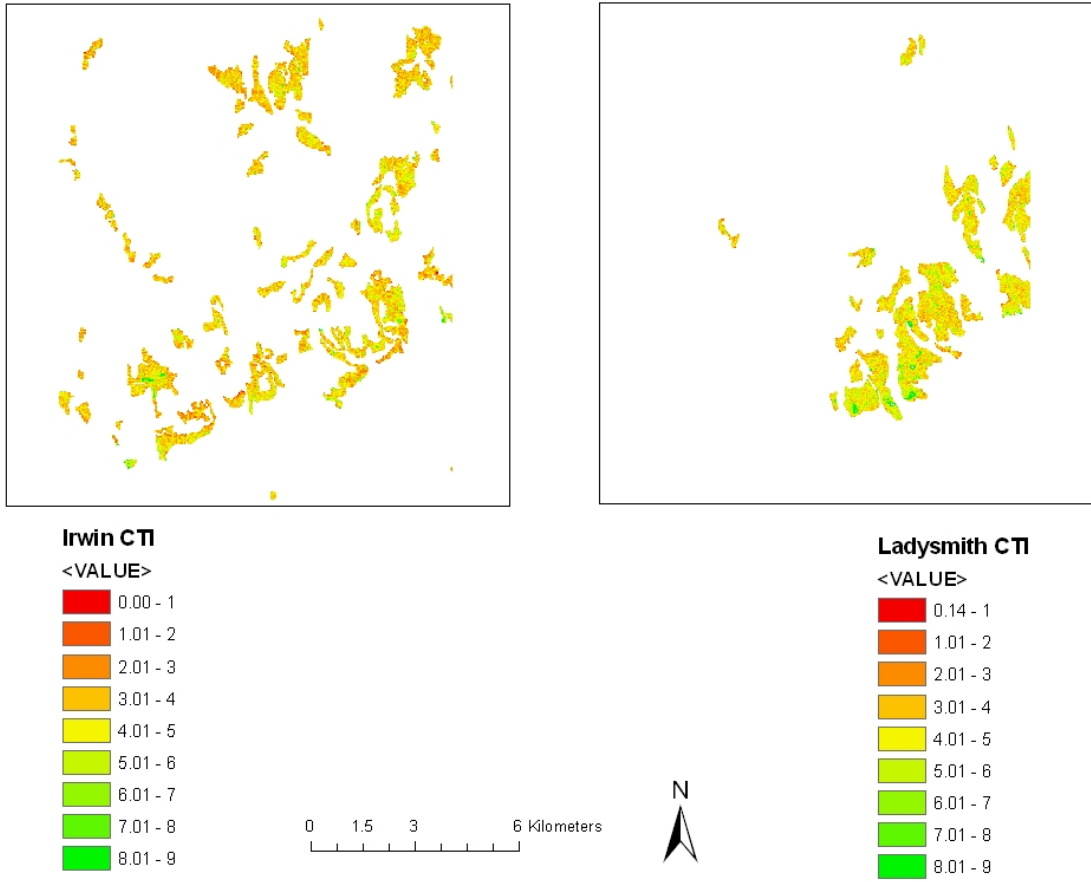


Figure 4.9. Histogram of Irwin compound topographic index (CTI) values.

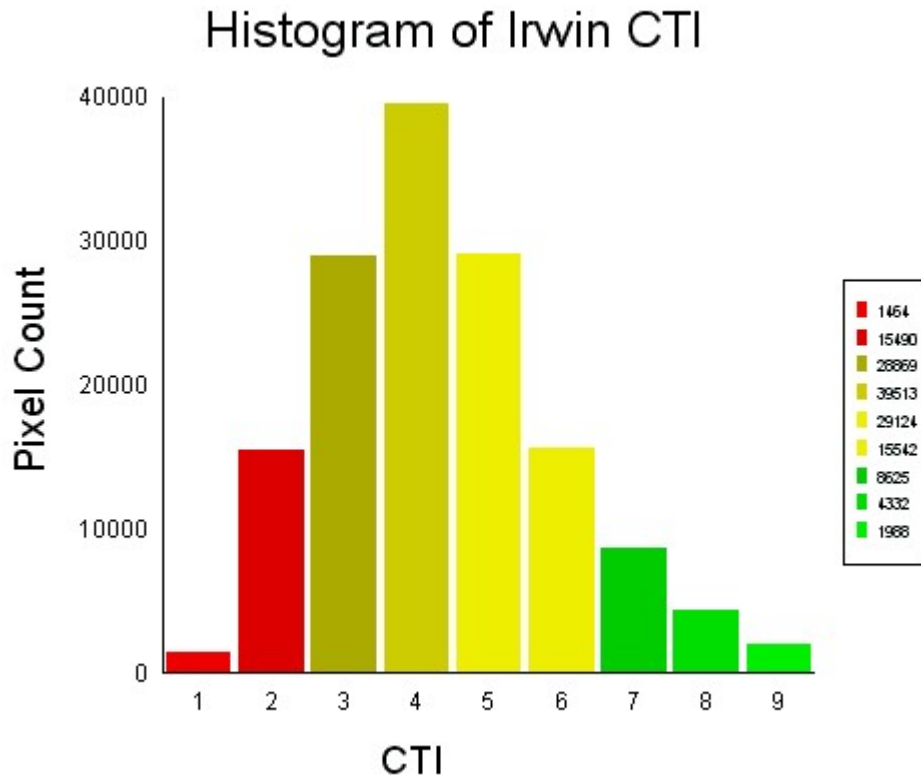


Figure 4.10. Histogram of Ladysmith compound topographic index (CTI) values.

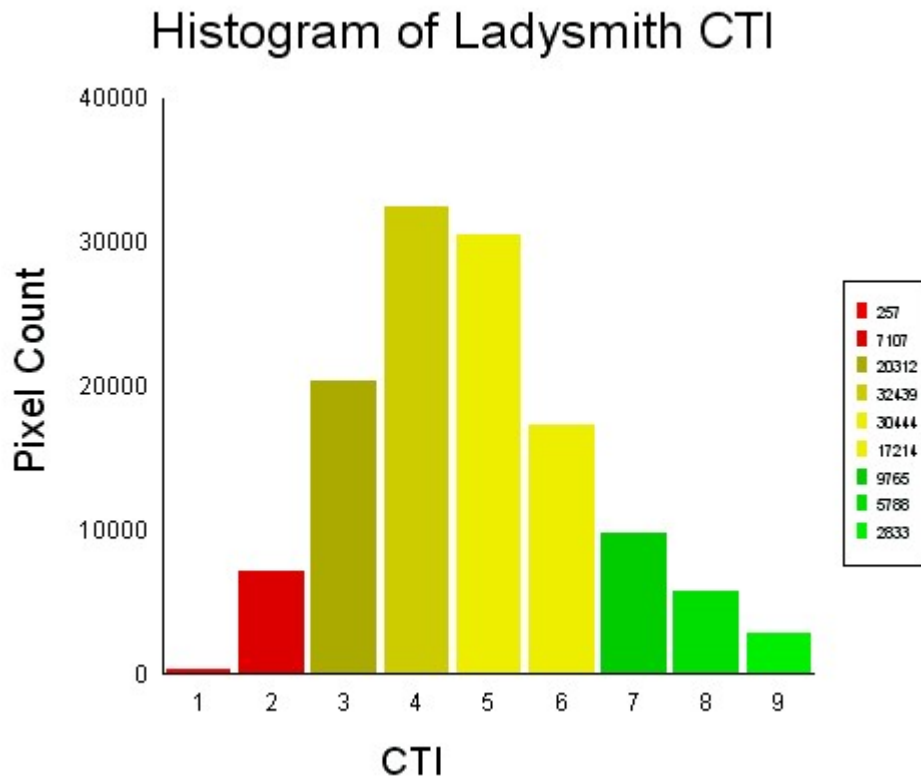


Figure 4.11. Pedon sampling locations within Saffordville Quadrangle. The inset map shows the location of the Saffordville Quadrangle in Chase County, Kansas. In the larger map, the points represent the location of sampled pedons. The locations are displayed on the elevation map to illustrate the differences in geomorphic position between sites.

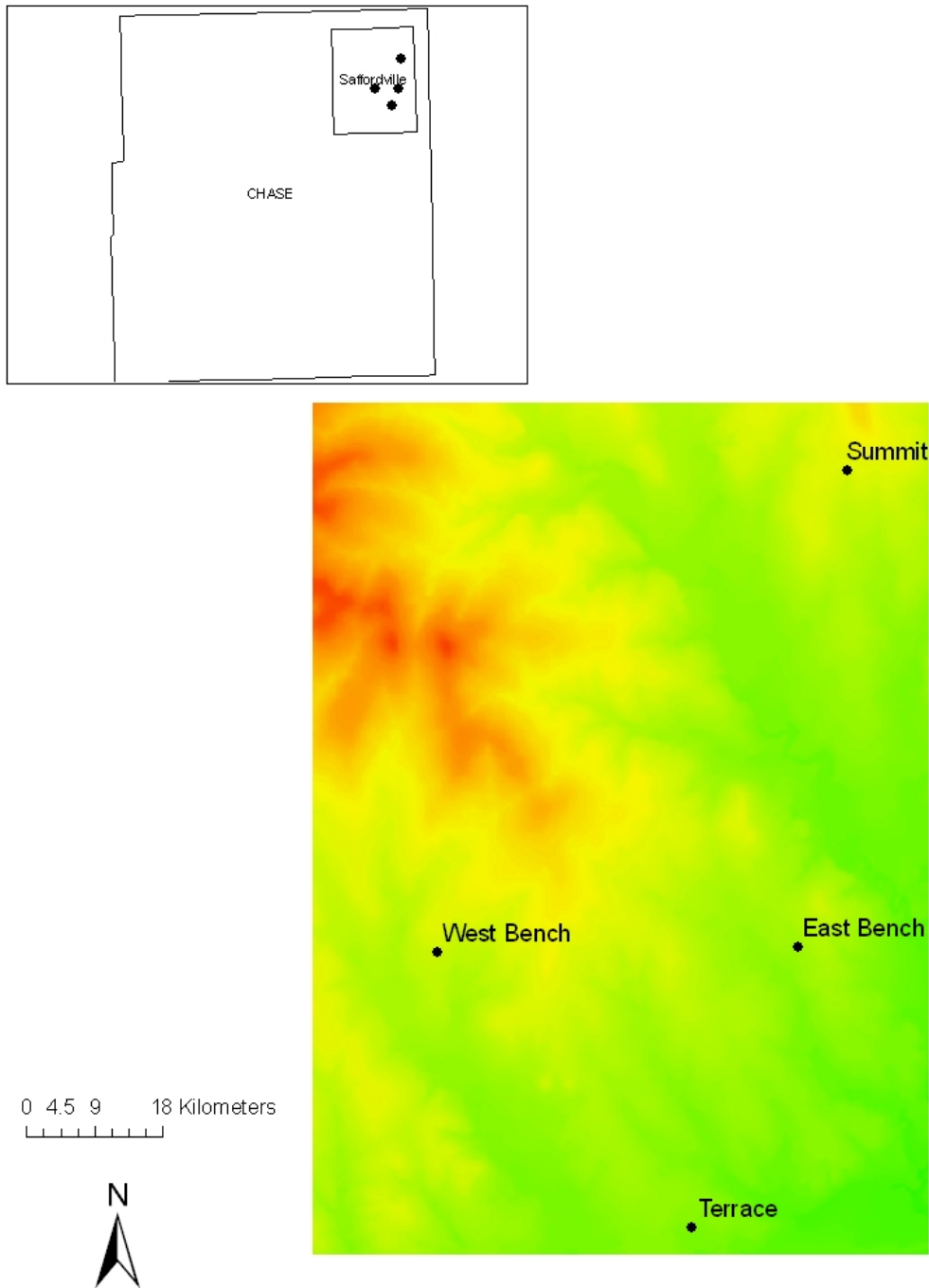


Figure 4.12. Compound Topographic Index (CTI) and thickness of pedon features, including solum thickness, mollic thickness, and loess thickness (all pedons sampled).

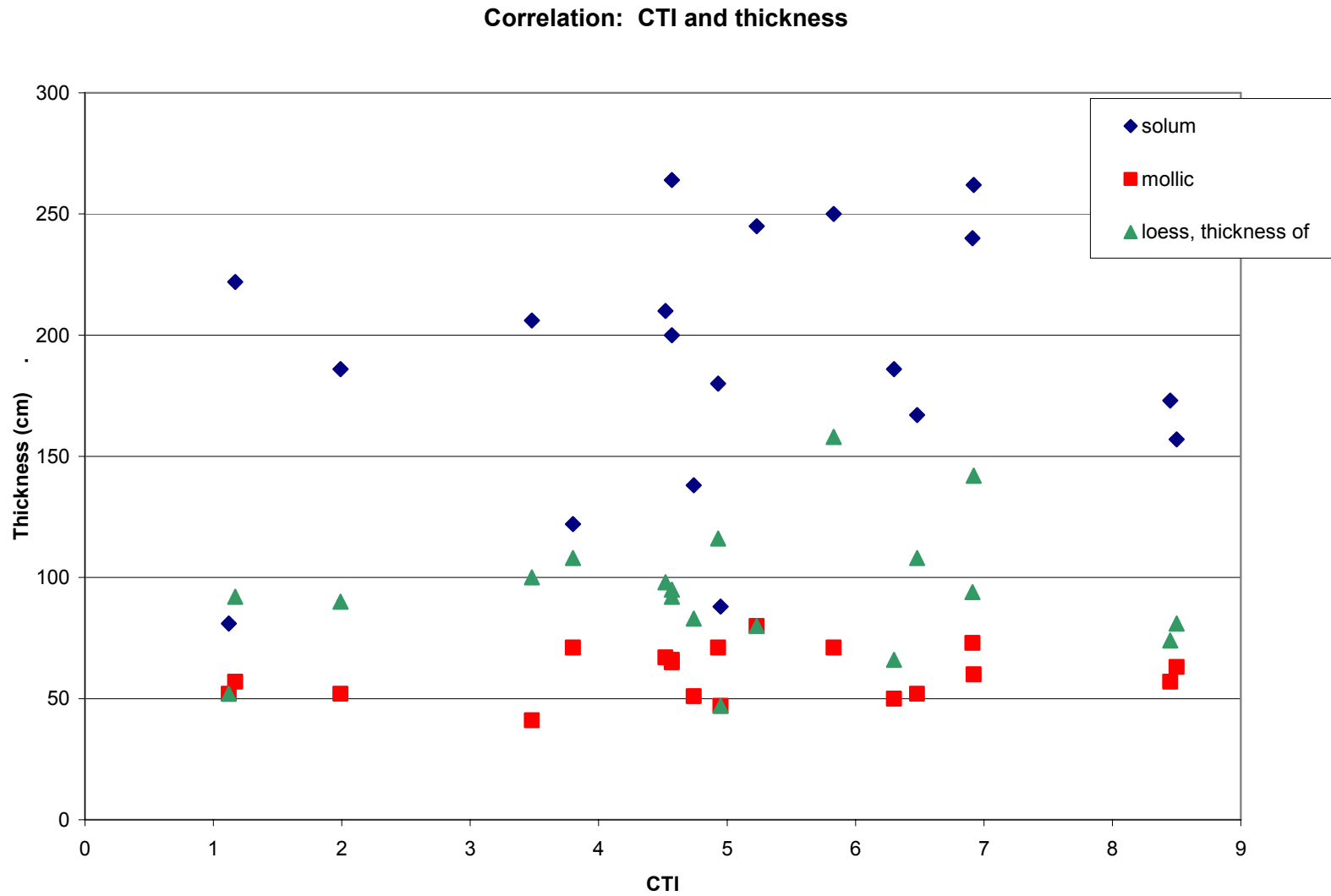


Figure 4.13. Selected physical properties of Chase County Pedons, including total clay %, median particle size (μm) and total sand %. East bench = EB, West bench = WB, Summit = S, and Terrace = T.

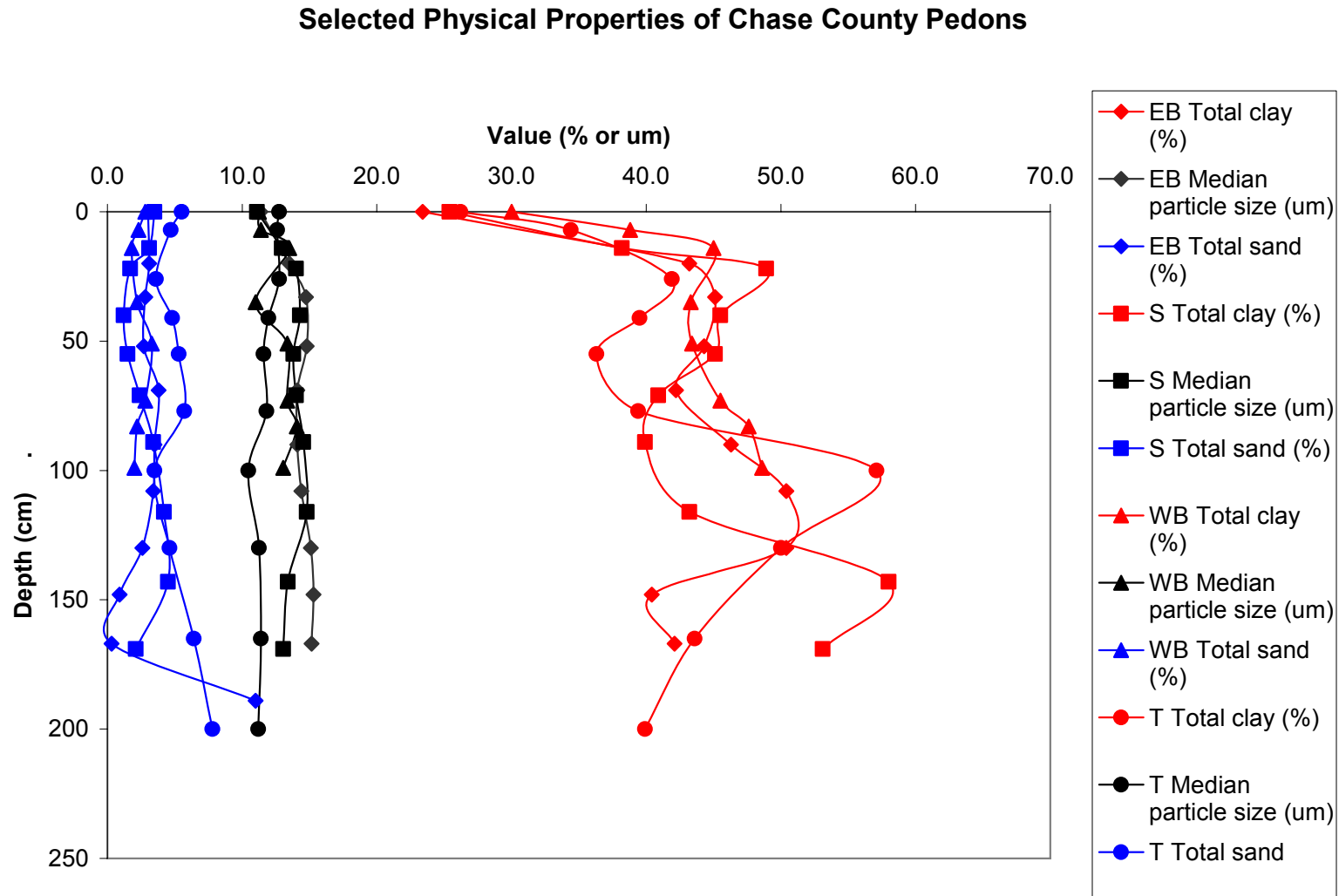


Figure 4.14. X-ray diffractogram of Mg-25°C treatment. Selected horizons from west bench pedon, 06KS017011.

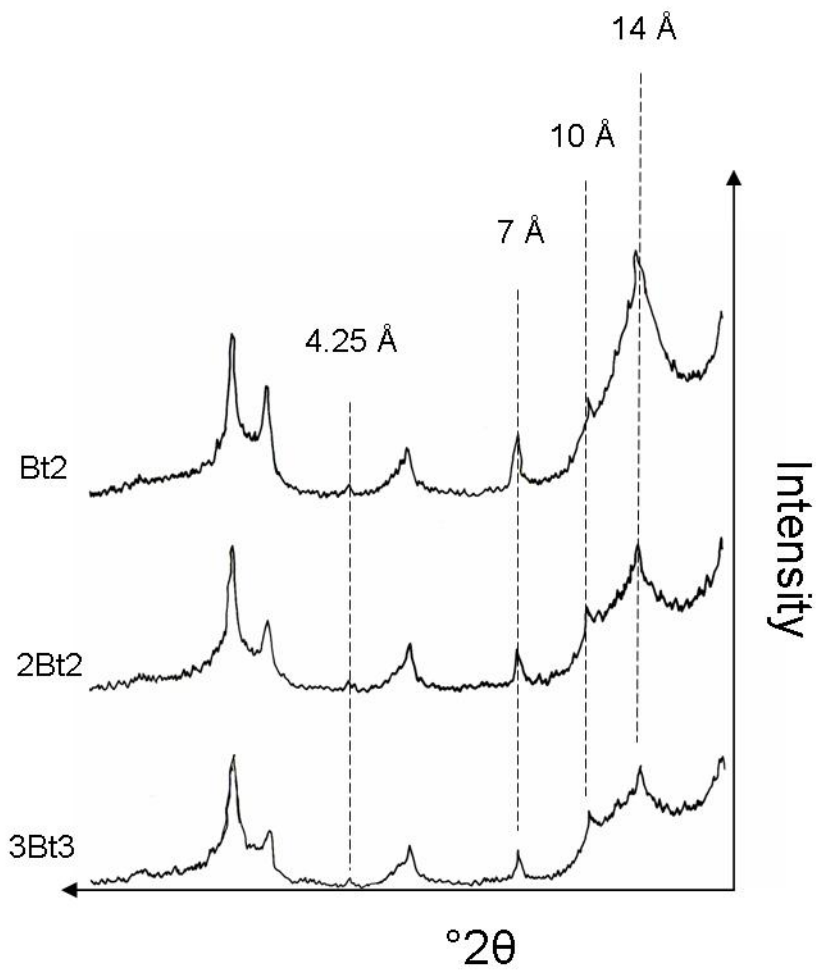


Figure 4.15. X-ray diffractogram of Mg-EG treatment. Selected horizons from west bench pedon, 06KS017011.

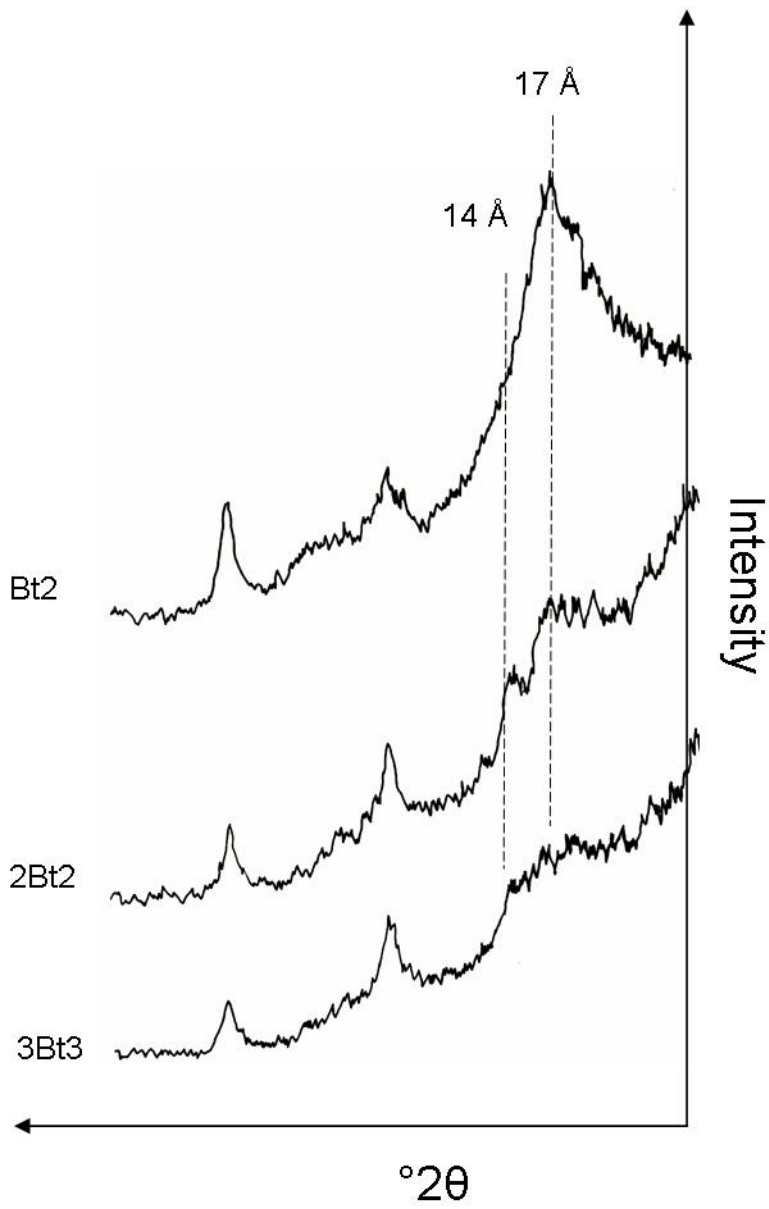


Figure 4.16. Stratigraphy of pedons sampled from Chase County across landscape positions. Pedons are arranged from highest to lowest elevation (left to right). The absolute age and $\delta^{13}\text{C}$ values were determined for selected paleosols.

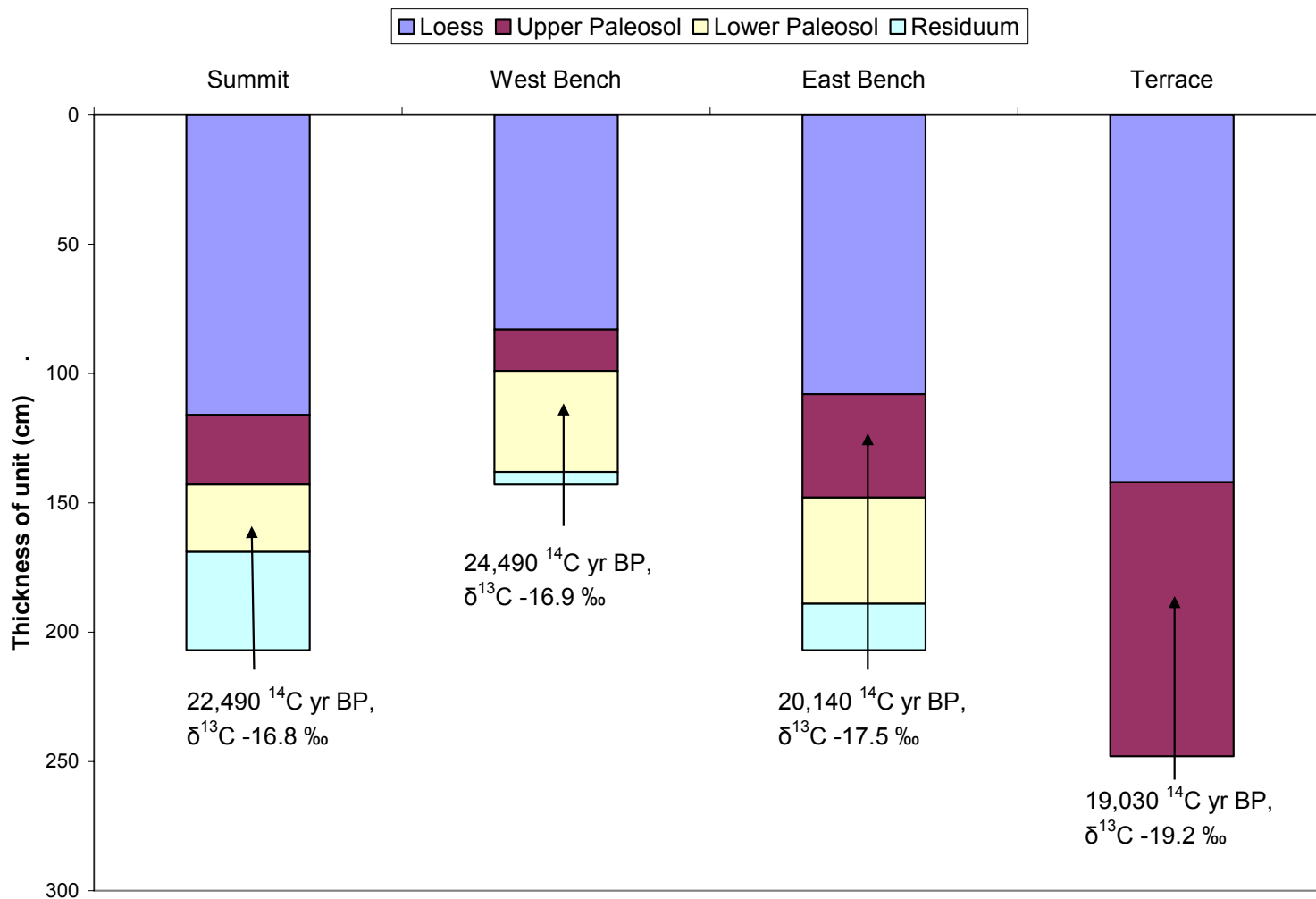


Table 4.1. Statistical comparison of Irwin and Ladysmith pedon properties.

Variable	Irwin	Ladysmith	Pr>F†
CTI	4.3	5.9	0.10
Solum (cm)	167	217	0.04
Mollic (cm)	60	60	0.98
Loess (cm)	87	103	0.18
Paleosol (cm)	49	62	0.26

† T-test comparison.

Table 4.2. Summary of landscape properties for four characterized pedons.

Landscape position	Series†	Pedon ID	CTI	Elevation (m)	Slope (%)	Taxonomic classification
Summit	Dwight†	06KS017002	4.93	382	2	Fine, smectitic, mesic Pachic Argiustolls
West bench	Irwin	06KS017011	4.74	376	2	Fine, smectitic, mesic Pachic Argiustolls
East bench	Ladysmith	06KS017006	6.48	368	4	Fine, smectitic, mesic Pachic Paleustolls
Terrace	Ladysmith	05KS017003	3.48	358	2	Fine, smectitic, mesic Typic Argiustolls

†Sampled as Dwight, but revised to Irwin.

Table 4.3. Summit pedon 06KS017002, sampled in the Saffordville Quadrangle, Chase County, Kansas.

Depth (cm)	Parent Material as Described	Horizons	Age† (¹⁴ C yr BP +/-)	Munsell color‡	Field Description of Clay Films
0 – 116	Loess	A1, A2, Bt1, Bt2, Bt3, Btk1	ND§	10YR	5%, faint, discontinuous
116 – 143	Colluvium (loess)	2Btk2	ND	7.5YR	1%, faint, continuous
143 – 169¶	Colluvium (loess)	3Bt1	22,490 +/- 90	5YR	25%, faint, continuous
175 – 213 +	Weathered limestone & shale	4BC, 4Cr	ND	10YR	None

† ¹⁴C yr BP = Uncalibrated radiocarbon years before present.

‡ Only the Munsell soil color hue of the matrix color is given, since horizons were grouped together into stratigraphic units.

§ ND = Not determined.

¶ Material dated was from 143-152 cm in the soil profile.

Table 4.4. West bench pedon 06KS017011, sampled in the Saffordville Quadrangle, Chase County, Kansas.

Depth (cm)	Parent Material as Described	Horizons	Age† (¹⁴ C yr BP +/-)	Munsell color‡	Field Description of Clay Films
0 – 83	Loess	A, BA, Bt1, Bt2, Btk, Bt1	ND§	10YR	5%, faint, discontinuous
83 – 99	Colluvium (loess)	2Bt2	ND	7.5YR	25%, faint, continuous
99 – 138¶	Colluvium (loess)	3Bt3	24,490 +/- 120	7.5YR	50%, faint, continuous
138 – 143 +	Weathered shale	4BC, 4Cr	ND	10YR	None

† ¹⁴C yr BP = Uncalibrated radiocarbon years before present.

‡ Only the Munsell soil color hue of the matrix color is given, since horizons were grouped together into stratigraphic units.

§ ND = Not determined.

¶ Material dated was from 99-138 cm in the soil profile.

Table 4.5. East bench pedon 06KS017006, sampled in the Saffordville Quadrangle, Chase County, Kansas.

Depth (cm)	Parent Material as Described	Horizons	Age† (¹⁴ C yr BP +/-)	Munsell color‡	Field Description of Clay Films
0 – 108	Loess	A, Bt1, Bt2, Bt3, Btky	ND§	10YR	5%, faint, discontinuous
108 – 148¶	Colluvium (loess)	2Bt	20,140 +/- 70	7.5YR	10%, faint, continuous
148 – 189	Residuum from shale	3CB, 3C	ND	2.5Y	None
189 – 207 +	Weathered limestone & shale	4Cr	ND	5Y	None

† ¹⁴C yr BP = Uncalibrated radiocarbon years before present.

‡ Only the Munsell soil color hue of the matrix color is given, since horizons were grouped together into stratigraphic units.

§ ND = Not determined.

¶ Material dated was from 108-142 cm directly below stone line.

Table 4.6. Terrace pedon 05KS017003, sampled in the Saffordville Quadrangle, Chase County, Kansas.

Depth (cm)	Parent Material as Described	Horizons	Age† (¹⁴ C yr BP +/-)	Munsell color‡	Field Description of Clay Films
0 – 142	Loess	A, BA, Bt1, Bt2, Bt3, Bt4	ND§	10YR	20%, faint, distinct
100 – 206¶	Colluvium (loess)	2Btg1, 2Btg2, 2Btg3	19,030 +/- 60	2.5Y	10%, faint, continuous

† ¹⁴C yr BP = Uncalibrated radiocarbon years before present.

‡ Only the Munsell soil color hue of the matrix color is given, since horizons were grouped together into stratigraphic units.

§ ND = Not determined.

¶ Material dated was from 142 to 170 cm.

CHAPTER 5 - Geographic Variability of Horizon Properties and Pedon Features of the Irwin, Ladysmith, Konza and Dwight Soil Series: Implications for Classification and Mapping

Abstract

Upland soils of east central Kansas exhibit a complex genesis, in that they have multiple parent materials and form under tallgrass prairie in an area that is transitional between the udic and ustic moisture regimes. The soil series of interest are the Irwin, Konza, Dwight, and Ladysmith series, and all are mapped across a large portion of east central Kansas, namely in both the Bluestem Hills (76) and Central Kansas Sandstone Hills (74) Major Land Resource Areas, or MLRA. These areas range in land use from 70% grazing land in the Bluestem Hills MLRA to 52% cropland in the Central Kansas Sandstone Hills MLRA. The objective of this study is to examine and evaluate the soil, parent material, and geographic properties of the soils of interest, including a thorough analysis of laboratory data and profile descriptions. One hundred and thirty-eight pedons were sampled and described, and 27 were characterized in the laboratory. The particle size, mineralogy (of the Irwin series) and use and management were different for the Irwin and Ladysmith series that are mapped in the southwestern portion of the study area west of 68000 meters E and south of 425600 meters N (Universal Transverse Mercator Zone 14N). The mineralogy of Irwin in MLRA 76 is smectitic, while the one Irwin pedon sampled in MLRA 74 had mixed mineralogy. Gypsum was observed in 20% of pedons. Sodium was present in many pedons, but only one pedon (out of 138 sampled) contained exchangeable sodium percentage (ESP) levels high enough to meet the natric horizon criteria and express the natric horizon morphology, i.e., columnar structure. Paleustolls were prevalent as 30% of all pedons sampled met the criterion for an abrupt textural increase as required for this great group. This

document will be presented as a report to the Kansas USDA-NRCS for use in decision-making in future soil survey updates.

Introduction

Upland soils of east central Kansas exhibit a long and complex genesis, having multiple parent materials, and forming under tallgrass prairie in an area that is transitional between udic and ustic moisture regimes. The soil series of interest are the Irwin, Konza, Dwight, and Ladysmith series, and all are mapped across a large portion of east central Kansas, namely in both the Bluestem Hills and Central Kansas Sandstone Hills Major Land Resource Areas (Fig. 5.1).

The Bluestem Hills Major Land Resource Area (MLRA 76) is approximately 19,585 km² (7555 mi²) in size, and is also commonly referred to as the Flint Hills region. The bedrock is Permian-aged shale and limestone. About 70% of the area is in rangeland used for grazing cattle. Twenty percent of the area is cropland, which is located on the uplands and in river valleys. Tallgrass prairie is the native vegetation and includes big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*). The annual precipitation is 785 to 965 mm (United States Department of Agriculture Natural Resources Conservation Service, 2006). In contrast, the Central Kansas Sandstone Hills MLRA (74) is predominantly used for crop production (52%), namely hard red winter wheat. The bedrock is Cretaceous sandstone. Grassland used for grazing comprises 40% of the area, and annual precipitation is 660 to 840 mm (United States Department of Agriculture Natural Resources Conservation Service, 2006).

These adjacent areas have a slightly different climate and a rather different land use and management regime, yet similar soils are mapped across both areas (Fig. 5.2). The Irwin, Konza, and Dwight series are mapped adjacently on interfluves and benches and are classified as Pachic Argiustolls, Udertic Paleustolls, and Typic Natrustolls, respectively. The Ladysmith series classify as Udertic Argiustolls and are mapped on uplands as well as terraces in east central Kansas. The complete family classification is given in Table 5.1. Parent materials for these series were historically described as clayey sediments, such as old alluvium, colluvium, loess, and/or residuum, whereas

recent investigations have described a more complicated and polygenetic suite of parent materials for the modern soil and underlying paleosols (Wehmueller, 1996; Glaze, 1998).

In the Flint Hills region, Beck (1940) mapped the Quaternary geology of Riley County and Jewett (1941) mapped the geology of Riley and Geary Counties. Smith (1991) and Ross (1995) mapped the Quaternary deposits and studied the geomorphology of the Konza Prairie Biological Station (KPBS), near Manhattan, Kansas. None of these researchers attempted to map soils. Wehmueller (1996) mapped the soils of one watershed (N4D) within the KPBS, located in Riley and Geary Counties, Kansas at a much larger scale of 1:2,000. Wehmueller found that a soil existed in this watershed that did not meet the criteria for either the Dwight series or the Irwin series, and as a result of this study, the Konza series was established in 1991.

Glaze (1998) studied two Konza pedons in Riley and one in Geary County to determine the process of sodium accumulation and genesis for the Konza series. Glaze determined that sodium as well as gypsum accumulations were highest in the part of the soil profile that developed in hillslope sediment, also referred to as pedisediment. Gypsum is usually easily leached from the soil profile under most udic and ustic soil moisture regimes; however, the gypsum in the soil profile was pedogenic. Glaze concluded that the source of the gypsum was likely the underlying shale and limestone bedrock, and that gypsum was added to the soil profile through dissolution and re-precipitation. Note that the soils-based studies of Wehmueller (1996) and Glaze (1998) were both conducted in Riley and Geary Counties.

The Irwin, Konza, Dwight, and Ladysmith series are similar in that all are primarily mapped on upland positions in MLRA 74 and 76. Also, all of these soils are Mollisols and contain an argillic horizon, and all have a “fine” family particle size class, because they contain more than 35% clay in the upper 50 cm of the argillic horizon. There are also many differences between these series. For example, Dwight and Konza are known to contain a zone of sodium accumulation. Dwight soils contain a natric horizon, but the sodium accumulation in Konza is either not great enough to classify as natric, or occurs too deep in the soil profile to classify as natric (Glaze, 1998). Ladysmith soils often contain lesser amounts of a sodium accumulation. Soils

that contain natric horizons have many land-use limitations, and this is reflected in the interpretations. Another difference is that all of the series except for Irwin have smectitic mineralogy. The family mineralogy class is listed as mixed for Irwin.

Currently, Dwight, Irwin, and Ladysmith are described as forming in clayey sediments on uplands, whereas Konza is described as polygenetic, forming in loess over pedisegment over a clayey paleosol formed in residuum on uplands. (All official series descriptions can be accessed at the website given for the Soil Survey Staff, 2007 reference). Ladysmith's parent material is sometimes called old alluvium. Irwin, Konza, and Dwight are all described as moderately well drained while Ladysmith is somewhat poorly drained and yet may be mapped on a higher landscape position than the other soils. The official series descriptions for all four series indicate that the soils are mapped on uplands. The Dwight series is typically mapped on upland divides, but can also be found on footslopes. The Konza soils are also mapped on loess-topped upland divides. The Irwin series is mapped on erosional uplands, as are the Ladysmith soils which can also be mapped on stream terraces. Irwin has also been observed on landscape positions where the shoulder slope is eroding and exhumed paleosols are exposed (Morris and Chase Counties).

Tables 5.2 and 5.3 list the counties where each of these series are currently mapped, and the total acres mapped per county by map unit. Konza soil series, officially created in 1991, is the most recently established of these four series of interest. Therefore, it will not be found in most of the existing published soil surveys of Kansas counties, and thus its acreage is the smallest of these four series, with 34,173 acres mapped in Kansas (Table 5.2). The Irwin soil series was established in 1958, and the Dwight soil series was established in 1957 in Geary County, where it is no longer mapped (all of the area that was previously mapped as Dwight in Geary County is now mapped as Konza). The Ladysmith series is a very old series that was established in 1926 in Clay County, but is no longer mapped in that county. The three older series, Irwin, Ladysmith, and Dwight, are still mapped in many of the counties of Kansas. All are quite extensive, ranging from 1,463,121 acres for Irwin to 410,239 for Ladysmith. The Dwight series is mapped on 158,308 acres, but is also often mapped in complexes (Table 5.3). The Dwight-Irwin complex is mapped in Riley County, and because Dwight

is listed first it is the most common or abundant soil in the complex. In Riley County, this totals to 30,262 acres of Dwight-Irwin complex. In other counties, Dwight is most often mapped as the lesser component of a complex, with 321,314 acres, the majority (93%) of which is mapped as the Labette-Dwight complex. Overall, the soils of interest are mapped on 4 to 5% of the land area of Kansas.

Objective

This project was conducted in cooperation with the Kansas USDA-NRCS due to a perceived need for a thorough investigation of the genesis and distribution of certain upland soil series that are mapped in both MLRA 74 and 76. One of the project goals was to increase the amount of data available for the Irwin, Dwight, Konza and Ladysmith series so that the morphology and genesis of these series of interest can be identified at multiple locations. The Kansas USDA-NRCS has asked for a close examination and evaluation of the soil, parent material, and geographic properties, including a thorough analysis of laboratory data and profile descriptions. This document will be presented as a report to the Kansas USDA-NRCS for use in decision-making in future soil survey updates.

Methods

One hundred and thirty eight pedons were sampled for this project, 77 in MLRA 76 and 61 in MLRA 74 (Fig. 5.3). Information from all 138 pedons is used in this paper. On the maps it may appear that there are less points representing pedons, however, pedons were sometimes obtained in close proximity to each other, thus the points for these pedons tend to plot so closely together that they appear as one point. Also note that some of the pedons may have been mapped slightly outside of the MLRA 76 boundary, but were sampled on landscapes consistent with MLRA 76. The study area is approximately 100 km wide (west to east) and approximately 200 km north to south. Twenty-eight pedons were characterized, 15 from MLRA 76 and 13 from MLRA 74. Most (136) pedons were sampled using a hydraulic, truck-mounted probe (5-cm diameter). Two representative pedons were excavated to a depth of 2 m with a backhoe. Pedons were described using the Field Book for Describing and Sampling

Soils (Schoeneberger et al., 2002) and all sampling locations were georeferenced using a global positioning systems (GPS) unit with an approximate horizontal positional accuracy of 10 meters. Pedon descriptions were entered into the United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) National Soil Information System (NASIS) database. Bulk samples were collected for laboratory characterization. Thick horizons (>20 cm) were split and subsampled.

Laboratory characterization

Air-dry bulk samples were crushed with a wooden rolling pin and passed through a No. 10 sieve with 2 mm square openings. Soil pH was determined in a 1:1 soil/water suspension using method 8C1F of the Soil Survey Laboratory Staff (1996). Total carbon (TC) and total nitrogen (TN) were determined using a high-frequency induction furnace (Leco Model CNS-2000, St. Joseph, MI) following the procedure of Tabatabai and Bremner (1970). Particle size distribution was determined using a modification of the pipet method of Kilmer and Alexander (1949) and method 3A1 from the Soil Survey Laboratory Method Manual (1996). Organic matter was removed from samples containing greater than 1.4% total C with 30% hydrogen peroxide. Cation exchange capacity (CEC) was determined by summing the NH_4OAc extractable bases and the $\text{BaCl}_2\text{-TEA}$ extractable acidity (method 5A3a of the Soil Survey Laboratory Staff (1996). Exchangeable sodium percentage (ESP) was determined by dividing the exchangeable sodium by the sum of cations CEC. One to three samples per horizon were collected for bulk density measurements by cutting a sample of known volume from the probe-sampled pedon, and drying at 105°C until a constant mass was achieved. Three clods per horizon were collected from the pit-sampled pedons and trimmed for thin section preparation, marked for direction of orientation, and placed in cardboard boxes with dividers.

Mineralogy

Total silt and clay mineralogy was analyzed following the methods of Jackson (1975). Forty gram samples were pretreated with 1 M NaOAc and 30% H_2O_2 to remove carbonates and organic matter, respectively. Sand was collected on a 300 mesh sieve, and silt and clay were fractioned through at least eight sedimentation periods. Stokes'

law was used to calculate sedimentation times for a 10-cm depth of fall (Jackson, 1975). The clay fraction was flocculated with $MgCl_2$, quick-frozen in a bath of dry ice and acetone, and freeze-dried. Silt and sand fractions were oven dried at 60°C and retained in vials.

Five clay treatments were prepared: Mg 25°C, Mg-ethylene glycol, K 25°C, K 350°C, and K 550°C. Two milliliters of solution, containing 30 mg of clay, was pipetted onto a glass slide.

A Phillips XRG-3100 generator and an APD X-Ray diffractometer were used to analyze all samples. The instrument was equipped with a Theta compensating slit and a monochromatic X-ray beam. The instrument operating conditions were as follows:

Target:	Copper
Radiation:	CuK α
Potential:	35 kV
Current:	20 mA
Detector:	Scintillation
Range:	1000 to 2000 cps
Time Constant:	2000 cps = 1 and 1000 cps = 2
Scan Speed:	2°2 θ min ⁻¹
Chart Speed:	10 mm min ⁻¹

The clay specimens were scanned from 2°2 θ to 34°2 θ for the Mg 25°C treatment, and from 2°2 θ to 15°2 θ for the Mg-ethylene glycol, K 25°C, K 350°C, and K 550°C treatments. The silt samples were scanned from 18°2 θ to 54°2 θ using powder diffraction specimen holders. The d-spacing of each peak was determined using the table on p. 224 of Jackson (1975), and relative abundance of each clay mineral was estimated using the peak intensities.

Results

Pedon properties

Sodium

All pedon descriptions are presented in Appendix A3 and are grouped by county. Complete soil characterization data for all samples are located in Appendix B. Sixteen pedons were sampled in areas mapped as the Dwight soil series or as a Dwight-Irwin complex. Figure 5.4 displays exchangeable sodium percentage (ESP) values for all horizons from all 28 pedons that were characterized by the Kansas State University Soil Characterization Laboratory (which includes horizons from all series of interest, including Dwight, Konza, Irwin and Ladysmith). The ESP generally increases with depth in the soil profile, and very few horizons exceed 15% ESP, the threshold value for the natric diagnostic subsurface horizon criteria (Soil Survey Staff, 2006). The only horizons that exceed 15% ESP are horizons of pedon 06KS127001. The values for ESP for this profile are displayed in Fig. 5.5.

A natric horizon is a special kind of argillic horizon that meets the following criteria for sodium saturation, according to Soil Taxonomy (Soil Survey Staff, 2006, p. 12-13):

- a. Columns or prisms in some part (generally the upper part), which may break to blocks; *or*
- b. Both blocky structure and eluvial materials, which contain uncoated silt or sand grains and extend more than 2.5 cm into the horizon; *and*

Either:

- a. An exchangeable sodium percentage (ESP) of 15 percent or more (or a sodium adsorption ratio [SAR] of 13 or more) in one or more horizons within 40 cm of its upper boundary; *or*
- b. More exchangeable magnesium plus sodium than calcium plus exchange acidity (at pH 8.2) in one or more horizons within 40 cm of its upper boundary if the ESP is 15 or more (or the SAR is 13 or more) in one or more horizons within 200 cm of the mineral soil surface.

Wehmueller (1996) and Glaze (1998) studied pedons that met the criteria for Na saturation in some horizons, however, the horizons that met the criteria occurred too

deeply in the profile to classify as Natrustolls. In the present study, only pedon 06KS127001 met the > 15% ESP criteria for classification as a Natrustoll, and it was sampled from a closed upland depression (Fig. 5.5). No other horizons from any pedon at any depth exceeded 15% ESP. One hypothesis proposed by Bill Wehmueller (personal communication) is that high ESP values are related to solum thickness, i.e., related to the proximity of bedrock. The Flint or Bluestem Hills are Permian shales and limestones, and may be high in sodium and one potential source for Na⁺ in these soils.

In order to further investigate the natric horizon question, three pedons were sampled in a Butler county cattle pasture to observe the relationship between solum thickness and ESP (Fig. 5.6). The topographically highest pedon (06KS015006) was sampled in a Dwight map unit (with very short and sparse vegetation) and had a maximum ESP value of 14.98% and solum thickness of 130 cm. Pedon 06KS015007 was sampled in an adjacent Irwin map unit (vegetation was taller here but shorter in every direction), ESP ranged from 4 to 11%, and the solum thickness was 177 cm. Pedon 06KS015010 was mapped further downslope in a Ladysmith map unit (where vegetation was tall), ESP ranged from 0 to 9%, and solum thickness was 248 cm. Two things are apparent: ESP increases with depth in all three pedons, and ESP was greater for shallower pedons. This indicates that the bedrock (Permian aged shales and limestones in MLRA 76) might be the source of Na⁺. Many pedons were sampled in areas with short, sparse vegetation, but only the pedon sampled from a shallow, closed upland depression met the natric horizon criteria. Despite this fact, high salt content is clearly affecting the abundance and type of vegetation. Therefore it seems possible that the threshold value of 15% ESP is too high, or perhaps the adoption of a term such as “paranatric” is appropriate. This could be used for sites that do not meet the natric horizon criteria but vegetation is clearly affected by elevated salt levels of > 8 and < 15% ESP.

Figures 5.7 and 5.8 display graphs of ESP values with respect to location (UTM easting and northing). In other sections of this chapter, maps generated in a geographical information system (GIS) may be used to display information that summarizes the pedon as a whole. By presenting data in a graphical manner, relationships between soil properties and geography may be explored. Trendlines and

R² values are added to the scatterplots (where appropriate) to examine potential relationships between geographic location and soil properties.

The presence of upland depressions with sparse vegetation were more prevalent in MLRA 76 than MLRA 74, that is, more were observed in the eastern part of the study area than in the western part. More Dwight acres are mapped as a stand-alone series in Butler County (located in the southern-most portion of the study area) than in all of the other counties combined (Fig. 5.2 and Table 5.3). Sixty-one percent of the stand-alone Dwight acres (i.e., not as part of a complex) are mapped in Butler County alone. Exchangeable sodium percentage and UTM easting may be weakly related, with increasing ESP values towards the eastern direction of the study area. Kansas is characterized by a regular increase in precipitation from west to east (Fig. 5.9), therefore the ESP values seem to increase with increasing eastward UTM values as well as annual precipitation. This seems counterintuitive, as more precipitation would seem to be more effective at leaching soluble salts, such as sodium chloride and gypsum, from the soil profile. However, more precipitation could also lead to greater mineral weathering and subsequent release of Na⁺ with an increase in rainfall. The difference might also be related to different parent materials/sodium content of the parent materials in the east (loess over marine shales and limestones) versus farther to the west (thicker loess).

Other chemical parameters

No relationships between location and pH, cation exchange capacity (CEC), or base saturation (BS%) were observed (Figs. 5.10, 5.11, 5.12, 5.13, 5.14, and 5.15). No relationship between surface horizon BS% and UTM easting apparently exists (Fig. 5.16). However, the BS% values of the surface horizon were positively related to UTM northing (Fig. 5.17) with a coefficient of determination of R² = 0.43. Land use differs throughout the study area (Fig. 5.18), with nearly all sites in the western area (MLRA 74) in cropland, and most sites in the Bluestem Hills MLRA in rangeland. This is the most probable reason for the relatively lower surface BS% in the surface horizons of the more intensively cropped area, the Central Kansas Sandstone Hills MLRA.

Particle size

Mean and median particle sizes were calculated from the particle size distribution. Regardless of the soil series, median particle sizes for all but one of the samples were between approximately 11 and 16 μm , which falls within the range for medium silt (Fig. 5.19). The mean particle size (Fig. 5.20) was larger and much more variable, ranging in values between about 15 and 180 μm , although many samples ranged from about 15 to 50 μm in size (medium to coarse silt). For the majority of samples, the particle size distribution is bi-modal, meaning that the samples are high in fine clay ($<2 \mu\text{m}$) and medium and coarse silt (5 to 20 and 20 to 50 μm , respectively). This type of bi-modal particle size distribution was attributed to aggregate transport in loess by Mason (2003) and Muhs et al. (1999).

Therefore, median and mean particle size may not be an accurate indicator of loess properties such as wind strength and transport direction. However, these data, especially the mean particle size, do display geographic trends (Figs. 5.21 and 5.22). Figure 5.21 shows mean particle size versus UTM easting, and a large cluster of samples have a mean particle size of $< 50 \mu\text{m}$ for all UTM easting values. However, a large spread in mean particle sizes from approximately 40 to 200 μm occurs for samples that have UTM easting values west of approximately 68000 meters E. The town of Florence, KS (Marion County) is located at approximately 68000 meters E. A similar trend is observed for UTM northing and mean particle size (Fig. 5.22), with the majority of samples clustering $< 40 \mu\text{m}$ for all UTM northing values, and a large spread in mean particle size from 40 to 200 μm south of approximately 4256000 meters N, which is about the position of the city of McPherson, Kansas (McPherson County) and Cottonwood Falls, Kansas (Chase County). Generally, the mean particle size values and distributions indicate that the area south of 425600 meters N and west of 68000 meters E is at least somewhat different in a portion, but not all, of the profile. The break between coarse silt and very fine sand occurs at 50 μm . A star indicates this location on Fig. 5.23. Note that the star falls on the boundary between MLRA 74 and 76 in Marion County, Kansas. It is important to note that, irrespective of the soil series, mean particle size is potentially related to geographic position.

Differences in mean particle size might be indicative of different parent materials, a change in the source of materials, or distance from the source of the materials.

Determining the source of the parent material is not the focus of this chapter, but rather, the goal is the observation of any geographic trends or differences with respect to soil properties that may influence the mapping and/or taxonomy of the series of interest.

Mineralogy

Total silt and clay mineralogy was analyzed for six pedons sampled in this study. One pedon, 05KS061001 (Irwin), was analyzed by the National Soil Survey Laboratory (Lincoln, NE). Therefore, the data presentation will be slightly different for this pedon as compared with the other five pedons, which are 05KS161005 (Irwin), 06KS017011 (Irwin), 06KS015010 (Ladysmith), 06KS115010 (Irwin), and 06KS113002 (Ladysmith). Figures 5.24, 5.25, 5.26, 5.27, 5.28 and 5.29 graphically display either relative peak size or semi-quantitative abundance % for minerals observed in the clay sized ($< 2 \mu\text{m}$) fraction. (All x-ray patterns except for 05KS061001 are located in appendix C). Smectite is the dominant mineral in the upper portion of the argillic horizon of the Irwin pedons sampled in Riley, Geary and Chase Counties (Figs. 5.24, 5.25, and 5.26), with a more mixed mineralogy in the lower part of the profile, with a mix of kaolinite, illite (mica), vermiculite, and quartz. In contrast, the mineralogy of the Irwin pedon sampled in Marion County (Fig. 5.28) appears to be a mix of smectite, kaolinite, and illite throughout the profile, although smectite is slightly dominant and most abundant in the the 3Btk horizon, which was the deepest horizon analyzed.

One hypothesis was that the family mineralogy class of the Irwin series should be changed from mixed to smectitic, based on texture by feel in the field, as well as stickiness and plasticity observations. The three Irwin pedons that were dominated in the upper part of the profile by smectite were sampled in MLRA 76 (Figs. 5.24, 5.25, and 5.26), whereas the Irwin pedon with a more mixed mineralogy was sampled in MLRA 74 (Fig. 5.28). As discussed in the previous section, there is a fairly large difference in the mean particle size for pedons sampled in MLRA 76 versus 74. For example, the mean particle size for pedon 06KS017011, the Irwin pedon sampled in eastern Chase County, ranged from 13 to 27 μm , which is in the medium to coarse silt sized range. However, the mean particle size for pedon 06KS115010, the Irwin pedon sampled in Marion County, ranged from 60 to 189 μm , which is in the very fine sand to upper end of fine sand sized. Therefore, it seems that the Irwin pedons sampled in

MLRA 76 have either a different parent material source or are located farther from the source area than the pedon sampled in MLRA 74.

The mineralogy of the two Ladysmith pedons analyzed (Figs. 5.27 and 5.29) was clearly dominated by smectite, which comprised 40 to 60% of the total clay fraction in all horizons analyzed. Therefore, the family mineralogy class for this series appears to be accurate, although the sample size was small (two pedons) and represented only two counties (Butler and McPherson), despite the fact that Ladysmith is mapped in fifteen Kansas counties (Table 5.2).

Taxonomic results

Mollic epipedon

The majority (72%) of sampled pedons (100 out of 138) met the criteria for either a Pachic Argustoll or Pachic Paleustoll, meaning that the pedon contained a mollic epipedon with thickness ≥ 50 cm (Soil Survey Staff, 2006). The average mollic epipedon thickness (across all series) was 71 cm \pm 43 cm, thus this property is both thick and variable. Very weak relationships were observed between the mollic epipedon thickness and UTM easting and northing (Figs. 5.30 and 5.31), with mollic epipedon thickness decreasing in the easterly direction. The decrease in epipedon thickness is counterintuitive to the precipitation gradient, as an increase in precipitation (and vegetation) should lead to greater organic carbon content in pedons in the eastern portion of the study area.

According to the official series description, the range in mollic epipedon thickness is 50 to 100 cm for Irwin, 50 to 90 cm for Konza, 50 to 100 cm for Ladysmith, and 35 to 80 cm for Dwight soils. Figures 5.32 and 5.33 display the mollic epipedon thickness with respect to geographic location by series. The 2006 Keys to Soil Taxonomy (Soil Survey Staff, 2006) has a subgroup of Pachic Udertic Argustolls that was not included in the 1999 Soil Taxonomy (Soil Survey Staff, 1999). Ladysmith soils are currently classified as Udertic Argustolls. Ninety percent of the Ladysmith pedons sampled in this project (47 out of 52) meet the criteria for Pachic. Linear extensibility measurements were not taken, however, slickensides (evidence of shrink-swell activity) were observed in 17 out of 52 Ladysmith pedons sampled (33%). Also, note that

slickensides would be more readily observed in pit-sampled pedons as opposed to core-sampled pedons that were used in this study. Eleven of 15 (73%) Dwight pedons sampled also met the Pachic criteria, although there is no Pachic Natrustoll subgroup in Keys to Soil Taxonomy (Soil Survey Staff, 2006). The Konza series is a Pachic Paleustoll, and the Irwin series is a Pachic Argiustoll. Thirty-nine of 62 (63%) Irwin samples met the Pachic criteria, and two of five (40%) of Konza pedons met the Pachic criteria.

Figure 5.34 displays information about the current land use for all pedons (note that some of these sites were cultivated in the past). Figure 5.35 displays information about mollic epipedon thicknesses by series with respect to the current land use at the locations sampled. As mentioned previously, the majority of Ladysmith pedons met the Pachic criteria, and about half were cultivated at the time of sampling, therefore, it appears that cultivation has not greatly decreased the amount of organic matter in the soil profile, i.e., not to a level where the epipedon does not meet mollic criteria. In contrast, the opposite is true for the Irwin series. The majority of non-cultivated sites meet the Pachic criteria, while the majority of cultivated sites do not, possibly indicating the degradation of the mollic epipedon through continuous cultivation. In fact, man-made erosion terraces were observed in present-day rangelands in Morris, Chase, and Butler Counties. This is commonly referred to as “broke-out” land, plowed after World War II and planted back to grass in the 1980’s and either hayed or grazed (Larry Johnson, manager of Mashed O Ranch, Morris County, personal communication, September, 2005). Eroded phases of Irwin, Ladysmith, and Dwight series are mapped in Kansas, and eroded Mollisols have been mapped in soil surveys since the 1930’s, even if they no longer have a mollic epipedon (Olson et al., 2005a). Recently, proposals for the creation of a new diagnostic characteristic, called eroded conditions, were submitted for review and adoption into soil taxonomy in order to recognize accelerated erosion (Olson et al., 2005b).

Argillic diagnostic subsurface horizon

The mean argillic horizon thickness was 139 ± 40 cm, and there were no geographic relationships between UTM easting or northing (Figs. 5.36 and 5.37). There were also no relationships with respect to series (Figs. 5.38 and 5.39). The mean

argillic horizon thicknesses were 121, 148, 147, and 159 cm for the Dwight, Irwin, Konza, and Ladysmith series, respectively. The combined thickness of the argillic horizons in the Irwin series can range from about 40 to 160 cm, and for Ladysmith is 37 to 75 cm, according to the official series descriptions. Therefore, the Irwin pedons sampled in this study have relatively thick argillic horizons, but are within the range for the series, whereas the Ladysmith pedons greatly exceed the thickness range of the official series description. Also, the Irwin, Konza, and Ladysmith pedons sampled in this study (120 pedons combined) had very similar total argillic horizon thicknesses, whereas Dwight was about 20 to 30 cm thinner on average.

Abrupt textural change

There are two major criteria for classification as a Paleustoll that could apply to Kansas soils. The following is from Keys to Soil Taxonomy (Soil Survey Staff, 2006).

a. With increasing depth, no clay decrease of 20 percent or more (relative) from the maximum clay content within 150 cm of the mineral soil surface (and there is no densic, lithic, or paralithic contact within that depth); *and either*

- (1) Hue of 7.5YR or redder and chroma of 5 or more in the matrix; *or*
- (2) Common redox concentrations with hue of 7.5YR or redder or chroma of 6 or more, *or*

b. 35 percent or more clay in its upper part and a clay increase either of 20 percent or more (numerical) within a vertical distance of 7.5 cm or of 15 percent or more (numerical) within a vertical distance of 2.5 cm, in the fine earth fraction (and there is no densic, lithic, or paralithic contact within 50 cm of the mineral soil surface).

Forty-four pedons contained an abrupt textural difference, the majority of which were located in rangeland in MLRA 76. Of these pedons, 16 were located in Morris County, 16 in Butler County, and 10 in Chase County. Figures 5.40 and 5.41 display the depth to the abrupt textural change with respect to geographic position, and Figures 5.42 and 5.43 display the same information with respect to soil series. Thirty seven of these 44 sites are currently in rangeland, and only seven are presently used for crop production.

If this is a natural pedogenic or stratigraphic feature, cultivation could easily obliterate it as the average depth of the feature is 17 ± 9 cm. One premise of soil

taxonomy is that classification should "...keep an undisturbed soil and its cultivated or otherwise human-modified equivalents in the same taxon insofar as possible. Changes produced by a single or repeated plowing that mixes the surface soil to a depth of 18 to 25 cm, for example, have the least possible effect on the placement of a soil in soil taxonomy. Truncation by erosion does not change the classification of a soil until horizons or diagnostic features important to the use or identification of the soil have been lost." (Soil Survey Staff, 1999, p. 16). Contrary to this statement, the majority of sites that were recognized as containing an abrupt textural increase (37 of 44 pedons) were in grassland. It seems quite possible that many of the cultivated pedons sampled in this study at one time could have contained an abrupt textural change, but that this feature was obliterated by cultivation (and subsequent erosion).

Another possibility should be explored: Is the abrupt textural change found in these soils strictly a property of eluviation and illuviation, or is it possible that this feature is stratigraphic in origin? That is, it is possible that the textural difference is caused by the presence of two different parent materials, as discussed in Chapter 3 of this dissertation. For example, Fig. 5.44 displays the particle size distribution for pedon 06KS161001, and the A and BA horizons had a different particle size distribution than all of the other horizons. For all six pedons in that study, the coarse silt content of the surface horizon or horizons was higher than the underlying B horizons. Possible reasons for this difference include pedogenesis (eluviation/illuviation and/or mineral weathering), or a change in parent material. One potential laboratory analysis that could help to answer this question would be to date the loess from these horizons using optically stimulated luminescence, a technique often used to determine the numerical age of the last exposure of quartz grains to solar radiation (and thus, gives the age of when the quartz grains were deposited and buried). If different luminescence ages were obtained for these horizons, it would mean that they were different stratigraphic units and that the abrupt textural change is an artifact of deposition and not pedogenic in origin.

Konza is classified as a Paleustoll, and so the abrupt textural change criterion, as it is currently written in Soil Taxonomy (Soil Survey Staff 1999, 2006), is an extremely important feature for recognizing and mapping this series. Currently, Konza is mapped

in Geary, Wabaunsee, and Morris Counties. The results from this study indicate that Paleustolls may be of greater extent than presently recognized and mapped, but that textural changes with depth may no longer be recognizable in many cultivated soils.

Pedogenic Carbonates

Accumulations of pedogenic carbonates were common in the pedons sampled (86% overall). Four out of five Konza pedons sampled contained pedogenic carbonates, as did 88, 92, 83 % of Dwight, Irwin, and Ladysmith pedons, respectively. The mean depth to carbonates was 64 ± 20 cm for all series combined. The mean depth to carbonates was very similar, at 57, 66, 50, and 66 cm for the Dwight, Irwin, Konza, and Ladysmith series respectively. No geographic relationships between the depth to pedogenic carbonates and either UTM northing and easting were observed (Figure 5.45). Generally, the depth to carbonates is related to the amount of precipitation an area receives, with a shallower depth to carbonates (and other salts) in areas that receive lower rainfall amounts, and vice versa (Jenny, 1941; Arkley, 1963). Kansas is characterized by a regular increase in precipitation from west to east, therefore an increase in the depth to carbonates from west to east might have been expected, but was not observed in the approximately 100 km wide (west to east) study area. However, the relationship between the depth to carbonates and precipitation is not so easily interpreted in polygenetic soils that contain multiple parent materials and underwent multiple periods of pedogenesis and burial. In thin sections of paleosols sampled in Kansas, carbonates have been observed superimposed illuvial clay films (Ransom and Bidwell, 1990). The relationship between carbonate depth and precipitation is extremely complex in polygenetic soils, and is probably not well characterized by geographic position.

Gypsum accumulations

Unlike calcium carbonate accumulations, gypsum accumulations do not effervesce with 1 N HCl, and this was the basis for distinguishing these features in field descriptions. The 'y' subscript was used to designate gypsum accumulations in the horizon nomenclature. Gypsum accumulations were observed in 27 pedons (of 138 total sampled, so 20% of total), and were more prevalent in MLRA 76 (Fig. 5.46).

Within MLRA 76, the geographic occurrence of gypsum was random, although the presence of gypsum within the pedon was usually limited to the paleosols and not the upper, loess-derived portion of the pedon. Forty percent of Konza and Dwight pedons contained gypsum accumulations, while 20% of Irwin and 10% of Ladysmith pedons contained gypsum accumulations. For all series, the average profile depth where gypsum was located was approximately 98 to 150 cm, and so the mean thickness was 52 cm. Kansas is characterized by a regular increase in precipitation from west to east, therefore it might be expected that gypsum would be more frequently observed in the western part of the study area, and less frequently in the eastern part. However, the occurrence of gypsum, like sodium, is probably related more to parent material than climate and geography. That is, gypsum is more common in MLRA 76 because of the Permian-aged shales/limestones that were a potential source for this material, despite the fact that loess is the parent material. Gypsum could have been contributed and mixed in locally. According to Dr. Wayne Hudnall, professor of mineralogy at Texas Tech University (personal communication), the feature shown in Fig. 5.47 illustrates this point. This micrograph was taken of the 2Btky horizon (107 – 124 cm) of pedon 05KS061001, an Irwin pedon sampled in Geary County, which also happens to be the type location and pedon for the Irwin official series description.

Lenticular gypsum crystal morphology is pedogenic, and crystals are commonly 50 to 2000 μm in size (Porta and Herrero, 1990). Infillings and coatings of lenticular gypsum crystals in voids are common to soils on relatively stable geomorphic positions (Porta and Herrero, 1990). Notice the size of the circular void, and that the lenticular gypsum crystals are inside of the void (Fig. 5.47). The void is about 1600 μm in diameter, which is very-coarse sand sized (2000 to 1000 μm). A particle this size could not be transported great distances by wind, yet is found in a horizon that is either loess or predominantly loess-derived. This loess may have been locally reworked and residual material may have become mixed in at this time. Dr. Hudnall suggested that the void, which has the size of very coarse sand, was once a large gypsum particle that has dissolved, and the lenticular gypsum crystals re-precipitated in situ. It is important to note that gypsum accumulations are associated with the paleosols rather than the loess component of these polygenetic soil profiles, which further indicates that the

gypsum source is from residuum or residuum-fragments that were incorporated into the loess. This could have happened at the time of loess deposition, i.e., gypsum-bearing fragments were incorporated during the accumulation of eolian materials. It is also possible that the loess was post-depositionally reworked by wind, or by gravity.

Slickensides

Slickensides were observed in 36 pedons (of 138 described, or 26%), most frequently in Ladysmith pedons (17 out of 52 pedons, or 33%). Slickensides were described in 19 and 24% of Dwight and Irwin pedons, respectively, and in none of the five Konza pedons sampled. This feature was observed in both MLRA 76 and 74, but was more commonly observed in MLRA 76 (east of UTM easting 68000 m), and especially in Butler County (south of UTM northing 421000 m, approximately) (Fig. 5.48). As mentioned previously, slickensides would be more easily recognizable in a pit-sampled pedon as opposed to a sample obtained with a soil probe only 3.75 cm in diameter. Slickensides were present in 20 to 30% of the pedons sampled, yet are not mentioned in the official series descriptions, although Konza and Ladysmith are both in Udertic subgroups, meaning that the soils have high shrink-swell potential. Both series also have smectitic mineralogy, the cause of the high-shrink swell potential.

Redoximorphic features

Redoximorphic concentrations were described in 135 of 138 pedons sampled. Redoximorphic depletions of iron (Fe^{2+}) were described in 45 of 138 pedons, and eight pedons contained one or more horizons with a reduced matrix (Fig. 5.49). Redoximorphic concentrations and depletions were determined by color of the feature, i.e., red colors indicate an iron (Fe^{3+}) concentration, and gley colors (chroma <2) indicate zones where Fe^{2+} has been removed or depleted from the soil horizon (Soil Survey Staff, 2006). Redoximorphic depletions were described most commonly in Ladysmith pedons (22 of 52 pedons, 42%) and were described in 19 and 28% of Dwight and Irwin pedons respectively. Of the eight pedons in which a reduced matrix was described, six were sampled in Ladysmith map units. According to the Irwin official series description, Ladysmith soils "...occur higher on the slopes and on ridge tops" (Soil Survey Staff, 2007). Like slickensides, depletions were observed in both MLRA 76

and 74, but the feature was more frequently observed in MLRA 76 and was most frequent in Butler County pedons. In the official series description, Ladysmith soils are somewhat poorly drained, and Dwight, Irwin and Konza series are moderately well drained (Soil Survey Staff, 2007). The drainage class is dependent on the rate of free water drainage and both the depth and length of time the profile is saturated during a growing season (Soil Survey Staff, 1993). At first glance, the higher proportion of pedons containing depletions and/or a reduced matrix seems to support these drainage classes. However, the mean depth to depletions is 86, 101, and 110 cm for the Dwight, Irwin, and Ladysmith pedons, respectively. However, it is very important to recall that these mean depths were calculated for only those pedons in which depletions were described. Therefore, in general, it seems that the drainage is overall poorest for Ladysmith, followed by Irwin and Dwight soils, as indicated by the presence of redoximorphic depletions and/or a reduced matrix.

Lithic and paralithic contact, and solum thickness

A lithic or paralithic contact was observed in 79 of 138 pedons (57%). In the remaining 59 pedons bedrock was not encountered in the depth of sampling for either of two reasons. Either the profile was deeper than about 2.7 meters (the limit of the sampling equipment), or soil conditions prevented deeper sampling. The soils of interest are clayey and very hard when dry. When the soils are dry, the truck-mounted probe begins to lift the back of the truck off of the ground, causing unsafe conditions and increasing the probability of either breaking equipment or getting the sampling tube permanently stuck in the ground. Another reason for not sampling below 2.7 meters occurred when soils were sampled in wetter conditions, as the sample would slide out as the tube was pulled from the ground. In addition, wet conditions also increased the chance of getting a sample stuck in the sampling tube. Despite these issues, a paralithic or lithic contact was observed for 100% of the Dwight pedons sampled (16 of 16), at an average depth of 146 ± 60 cm, and 100% of the Konza pedons sampled (5 of 5), at an average depth of 163 ± 35 cm. The average solum thickness for Irwin (reported for 37 of 63 pedons) was 178 ± 59 cm, and for Ladysmith (reported for 19 of 52 pedons) was 196 ± 35 cm. For rooting and plant growth, deep soils range from 100 to 150 cm in depth, and very deep soils are >150 cm (Soil Survey Staff, 1993).

Therefore, all four soils of interest are either on average very deep or deep, and the values obtained in this study agree with the official series descriptions.

Great Group Classification

The taxonomic classification to the great group level is shown in Fig. 5.50. Of the 138 pedons sampled, 60% classified as Argiustolls, 39% classified as Paleustolls, and 1% classified as Haplustalfs (one pedon that was likely eroded). Two-thirds of Irwin pedons classified as Argiustolls, and one-third classified as Paleustolls (Fig. 5.51). Irwin is officially classified as an Argiustoll, and Konza is a Paleustoll. Dwight (a Natrustoll) and Konza pedons were nearly equally likely (50% chance) to be classified as Argiustolls or Paleustolls. Ladysmith pedons were classified as Argiustolls for about 60% of the pedons sampled, and were classified as Paleustolls for about 40% of the pedons sampled. One Ladysmith sample was classified as a Haplustalf, but was likely very eroded as it was sampled on a hillslope in a cultivated field. Ladysmith is officially described as a Udertic Argiustoll. These results highlight the common occurrence of Paleustolls in the sampling area as currently determined by an abrupt textural increase according to Soil Taxonomy (Soil Survey Staff, 1999, 2006).

The abrupt textural change criterion is problematic for two reasons. First, this is a property that may be obliterated through cultivation, and second, this feature may be inherent to the parent material stratigraphy and not a product of eluviation and illuviation. As previously discussed, there are two criteria for Paleustolls. A pedon could meet either one of these criteria and classify as a Paleustoll. The first criteria does not allow a decrease of more than 20% in clay content within 150 cm of the soil surface, and has specific red color requirements for the matrix or redoximorphic concentrations. These features would not be changed by cultivation. The second criterion is the abrupt textural boundary, and, as previously discussed, is easily destroyed. For all of these reasons, the abrupt textural boundary criterion should not be part of the classification criteria for Paleustolls as it cannot be applied to cultivated and native soils equally, and may not result from pedogenic processes.

Conclusions

There are many conclusions from this study that the Kansas USDA-NRCS may use in future revisions of the soil mapping of MLRA 74 and 76. Some of the information will be used to revise taxonomy, and some information highlights a geographic area where the properties of the pedons deviate substantially from the series concept.

Pedon properties

The particle size, mineralogy (of the Irwin series), and use and management were different for the Irwin and Ladysmith series that are mapped in the southwestern portion of the study area. Specifically, the mean particle size for the Irwin and Ladysmith series were much coarser west of 68000 meters E (UTM easting) and south of 425600 meters N (UTM northing). In other words, all of the Ladysmith and Irwin pedons sampled in MLRA 74 had a coarser particle size than those mapped in MLRA 76. Also, the mineralogy of Irwin in MLRA 76 is smectitic, while the one Irwin pedon sampled in MLRA 74 has mixed mineralogy. The mineralogy family class needs to be reviewed, and more Irwin pedons must be sampled in MLRA 74, with one possible outcome being the creation of a new soil series.

The occurrence of pedogenic carbonate is very common, as it was observed in 80 to 90% of pedons sampled. Gypsum is less common, observed in only 20% of pedons. Sodium was present in many pedons, but only one pedon (out of 138 sampled) contained ESP levels high enough to meet the natric horizon criteria and express the natric horizon morphology, i.e., columnar structure. Slickensides were present in 20 to 30% of the pedons sampled, yet are not mentioned in any of the four official series descriptions, although Konza and Ladysmith are both in Udertic subgroups, meaning that the soils have high shrink-swell potential. The drainage class is overall poorest for Ladysmith, followed by the Irwin and Dwight soils, as indicated by the frequency of redoximorphic depletions and/or a reduced matrix color. All four of the soils of interest are either very deep or deep on average, and the values obtained in this study agree with the official series descriptions.

Taxonomic considerations

One important observation is that the Ladysmith series should be reclassified as belonging to the Pachic Udertic subgroup, as the Pachic criterion was met in 90% of

Ladysmith pedons sampled. The Dwight series very rarely meets the natric criterion, despite the commonly observed short sparse vegetation. It seems that only closed upland depressions will possibly meet the criterion. Perhaps the adoption of a paranatric diagnostic subsurface horizon would be used for landscapes with short vegetation and ESP values < 15%. The current distribution of the Dwight series is greatly over-mapped and should be addressed in future soil survey updates. Acres mapped as Dwight should be assessed for their similarity to either the Irwin or Konza series and re-mapped as such. The Konza series is a Paleustoll, and Paleustolls are probably more prevalent than previously expected, as 30% of all pedons sampled met the abrupt textural increase criteria as it is currently written in Soil Taxonomy (Soil Survey Staff, 2006) for this great group. However, the abrupt textural change criterion should be removed from the classification criteria for Paleustolls as it cannot be applied equally to cultivated and native soils, and may not result from pedogenic processes.

In conclusion, there are a number of improvements that can and should be made to the existing soil survey dataset for Kansas. As stated previously, there are an ever-increasing number of uses and users of soil survey information, and thus it is becoming increasingly important that high-quality information is generated and provided by the responsible and knowledgeable soil scientists of Kansas.

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Figure 5.1. The Major Land Resource Areas of Kansas map. MLRA 76 is the Bluestem Hills, and MLRA 74 is the Central Kansas Sandstone Hills. The study area for this project spans both of these MLRAs.

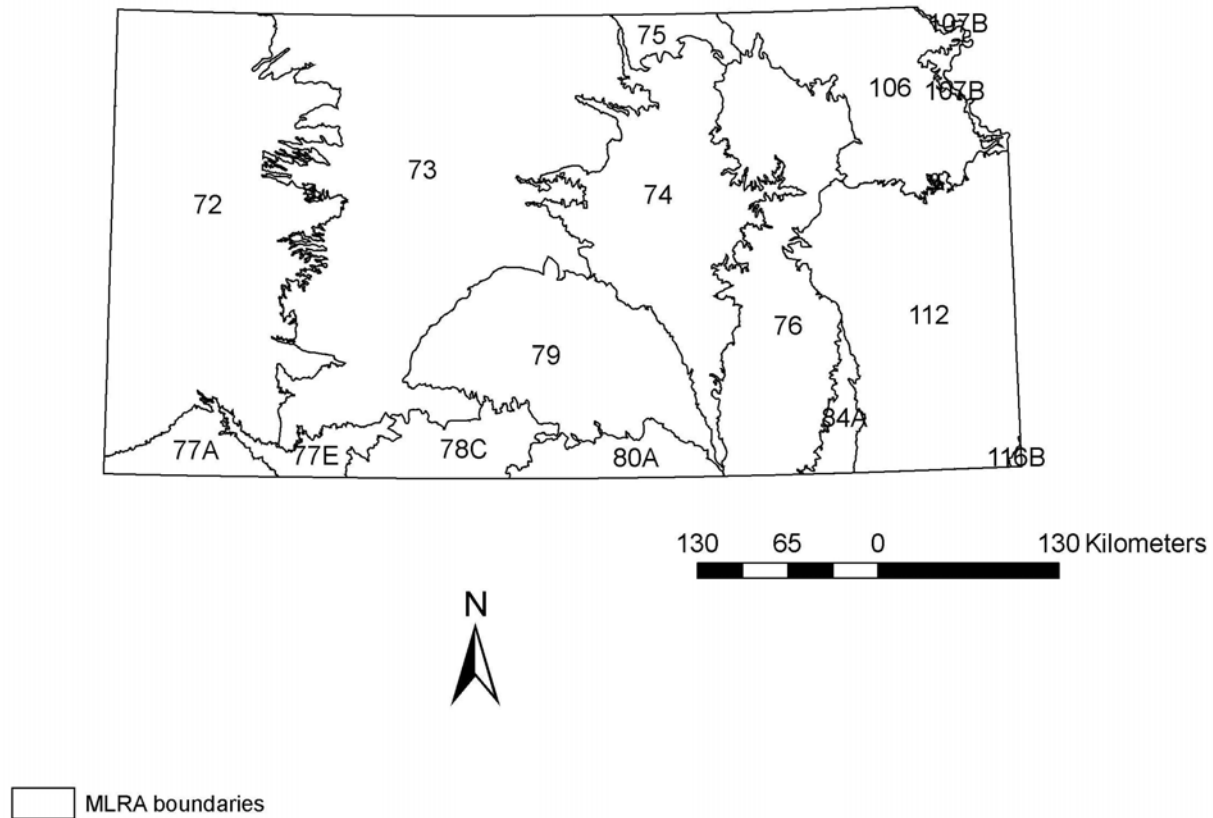


Figure 5.2. The Dwight, Irwin, Konza, and Ladysmith series are mapped in multiple Major Land Resource Areas (MLRAs). The source of this data is the Soil Data Mart website: <http://soildatamart.nrcs.usda.gov/>.

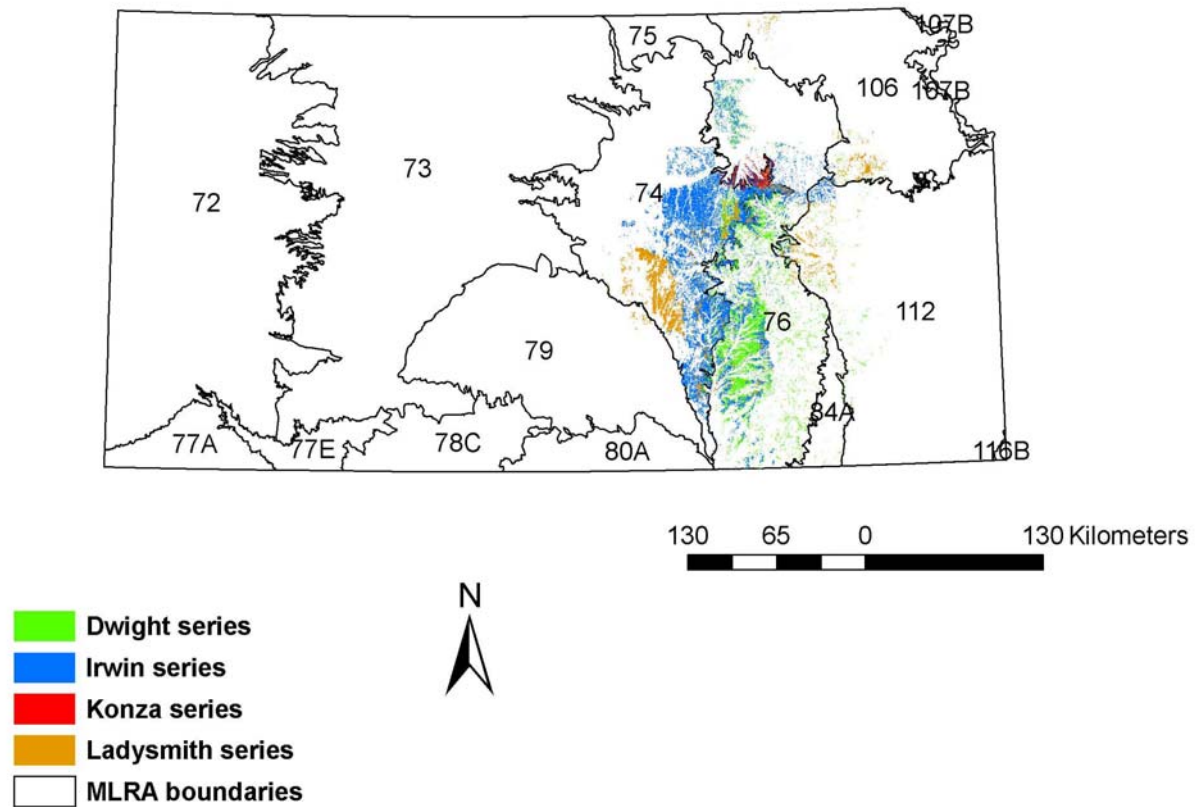


Figure 5.3. Sampling locations for all pedons in the study (n=138).

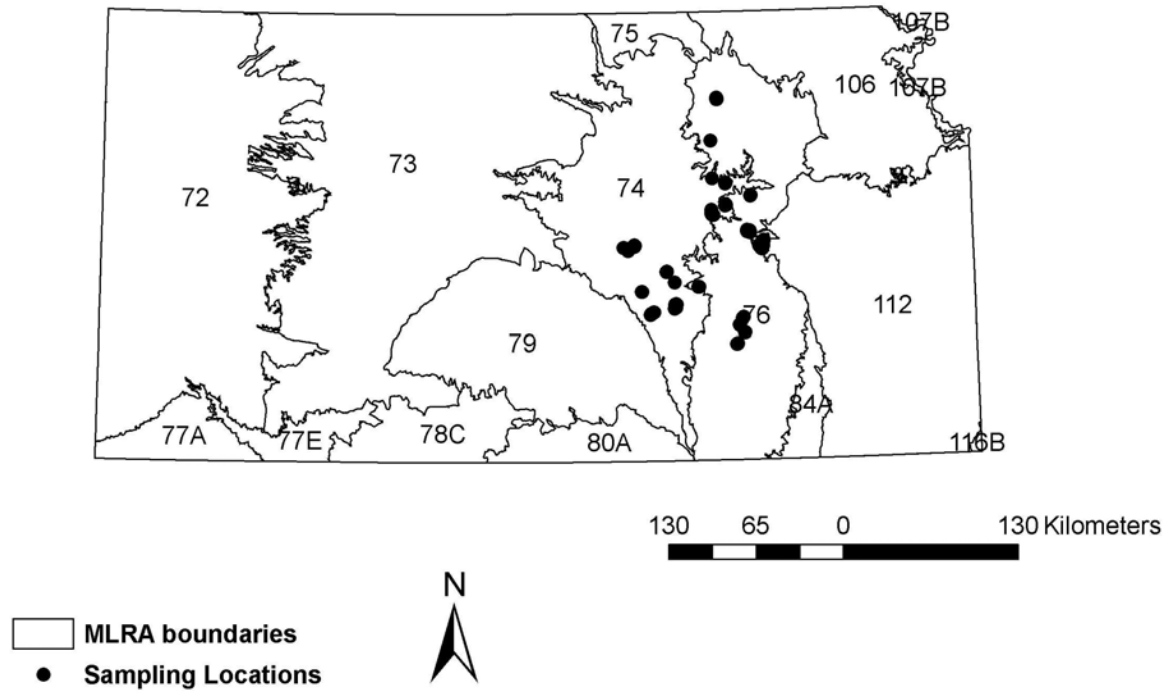


Figure 5.4. Exchangeable sodium percentage (ESP) for all horizons characterized in the study.

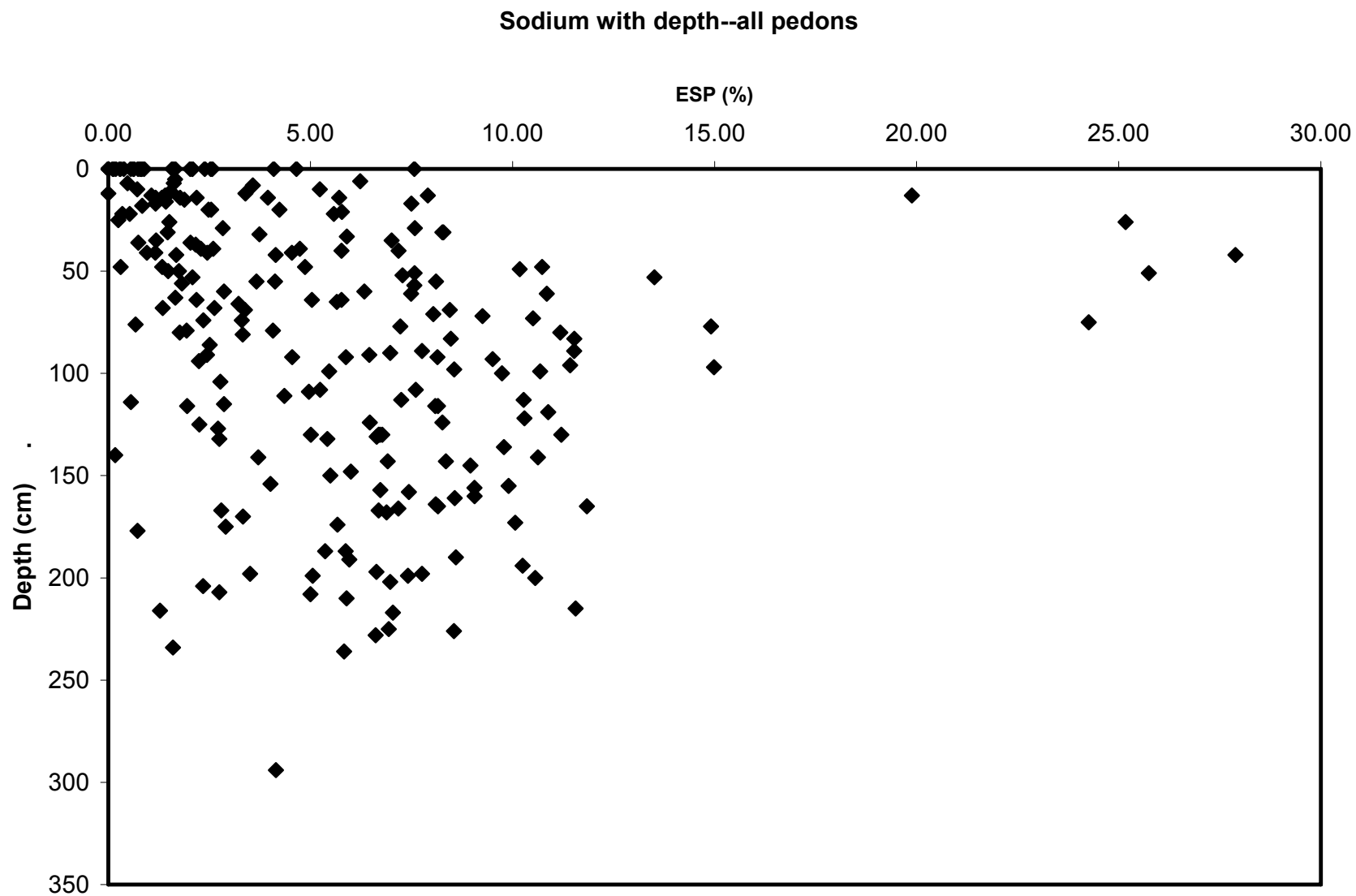


Figure 5.5. Profile depth distribution of exchangeable sodium percentage (ESP) for pedon 06KS127001.

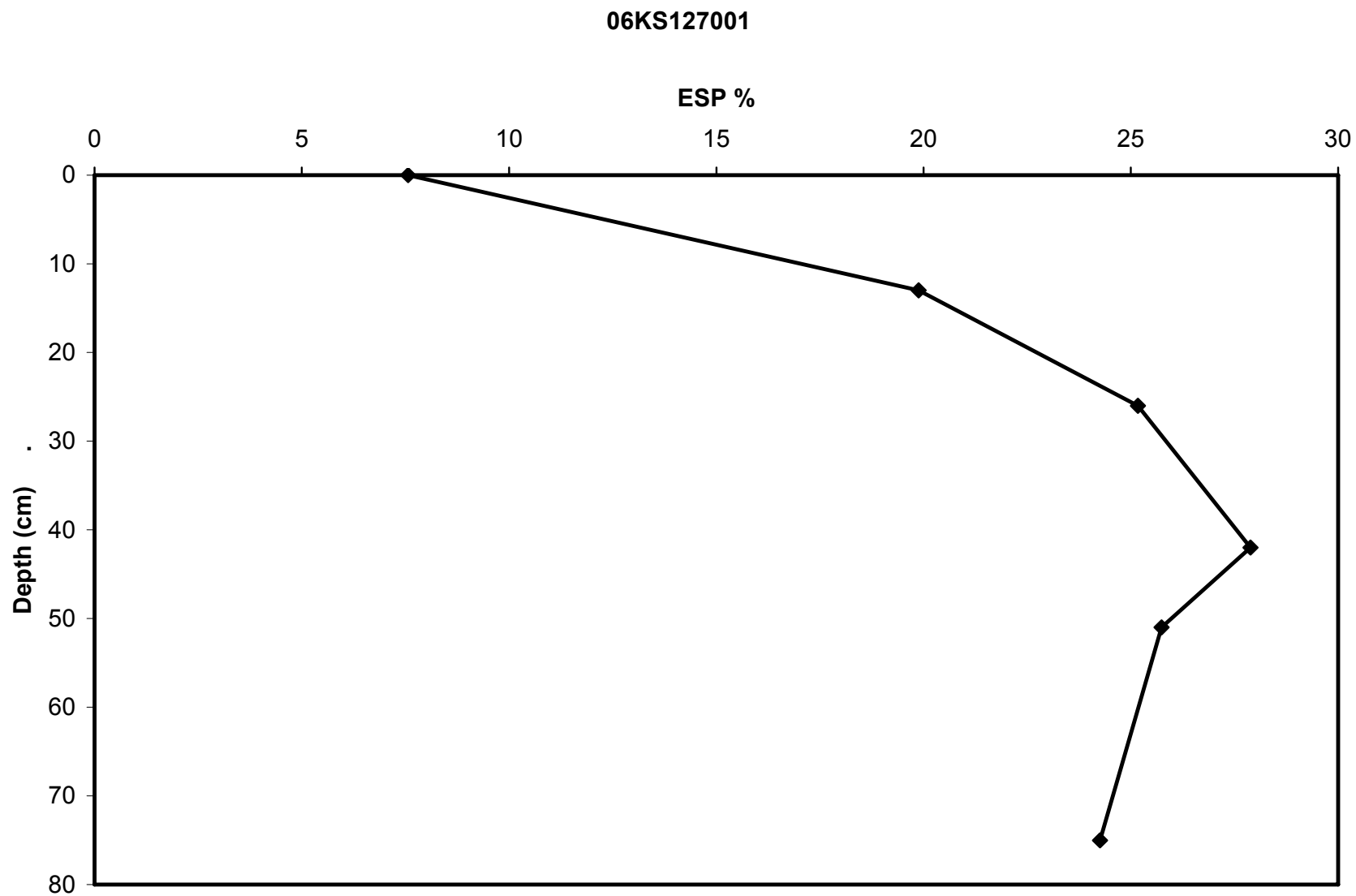


Figure 5.6. Profile depth distribution of exchangeable sodium percentage (ESP) for Butler County pedons 06KS015006, 06KS015007, and 06KS015010. These pedons were sampled as Dwight, Irwin, and Ladysmith, respectively.

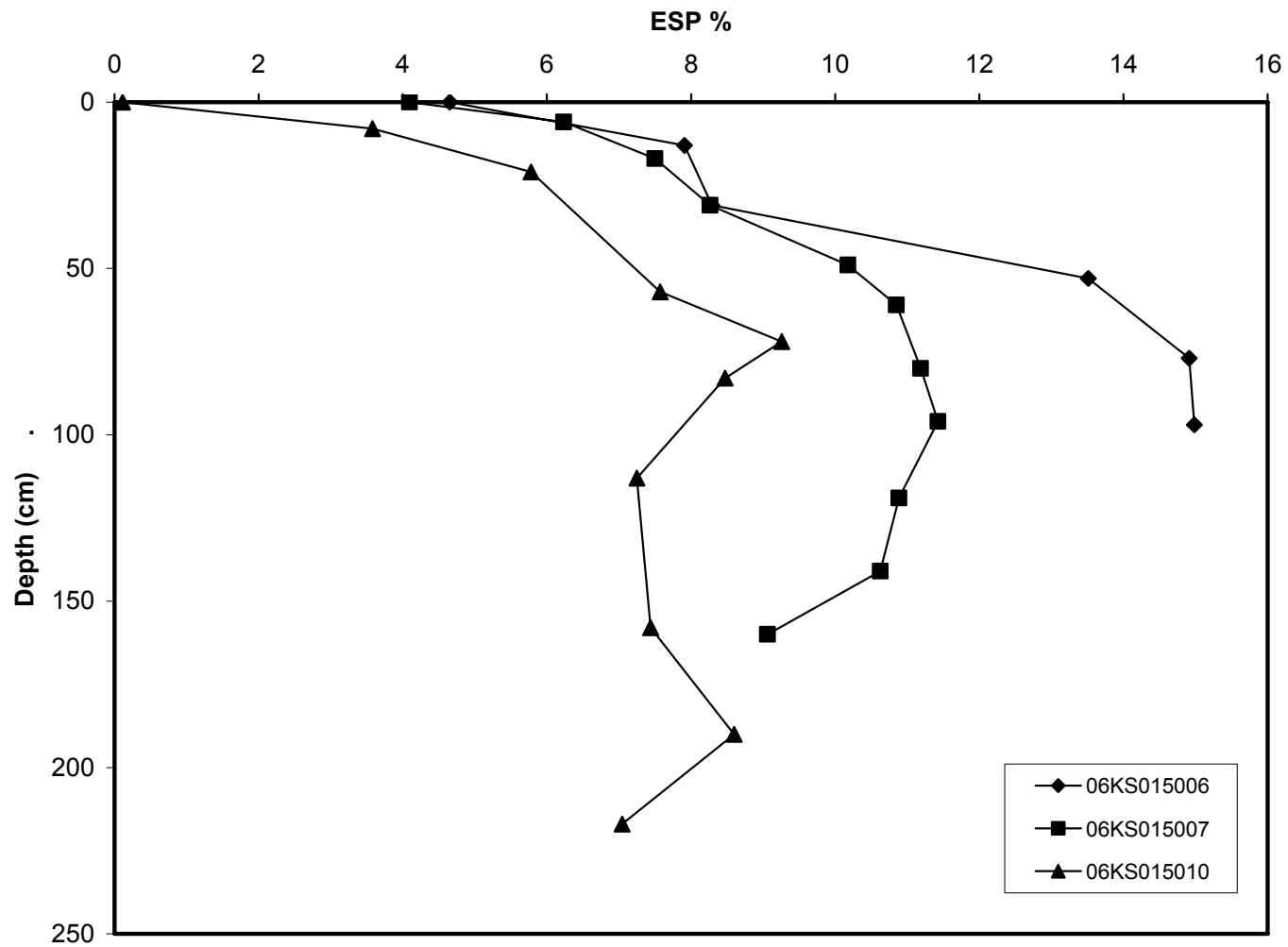


Figure 5.7. Exchangeable sodium percentage (ESP) for all horizons plotted against geographic location (Universal Transverse Mercator easting, Zone 14N).

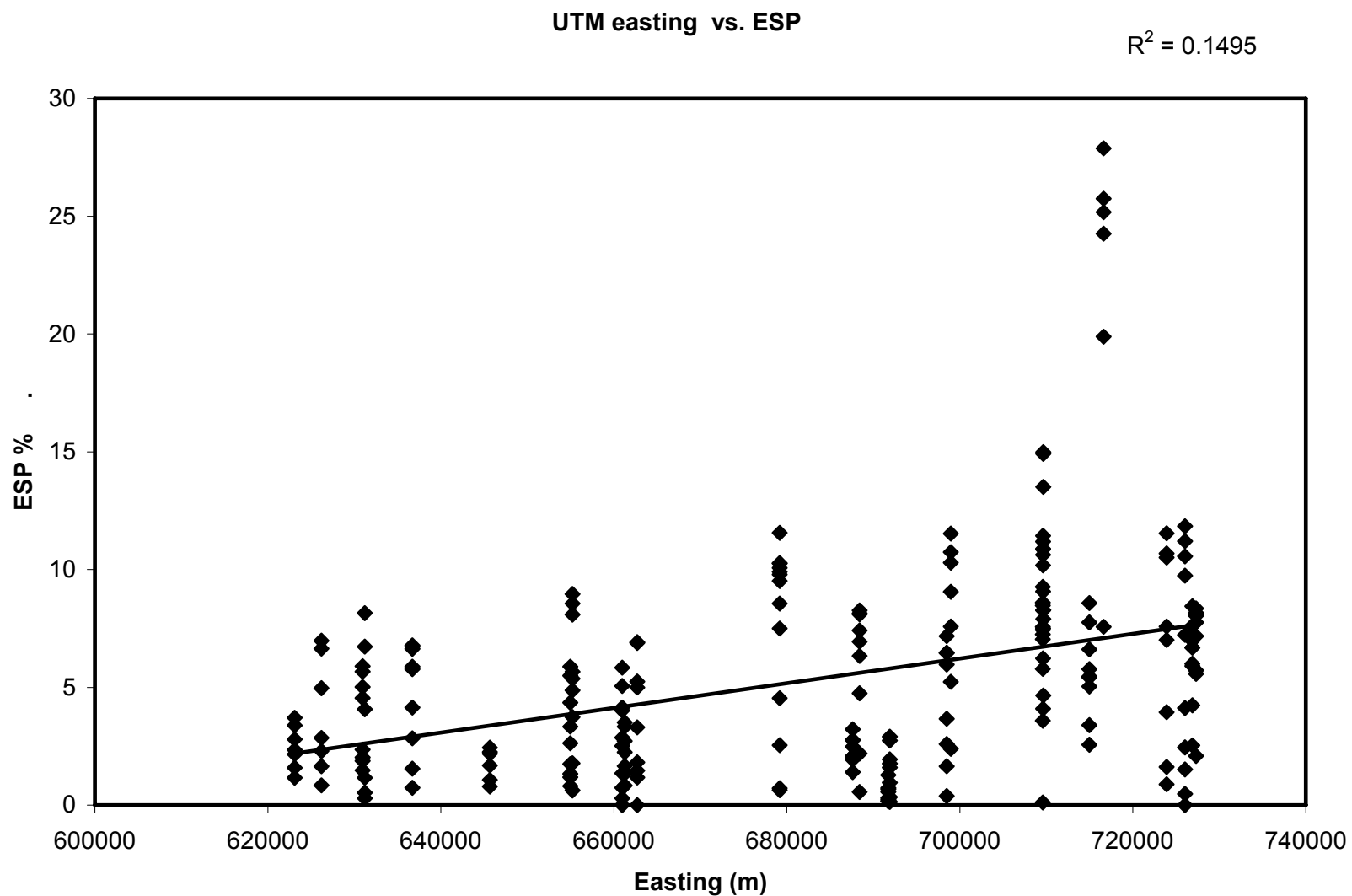


Figure 5.8. Exchangeable sodium percentage (ESP) for all horizons plotted against geographic location (Universal Transverse Mercator northing, Zone 14N).

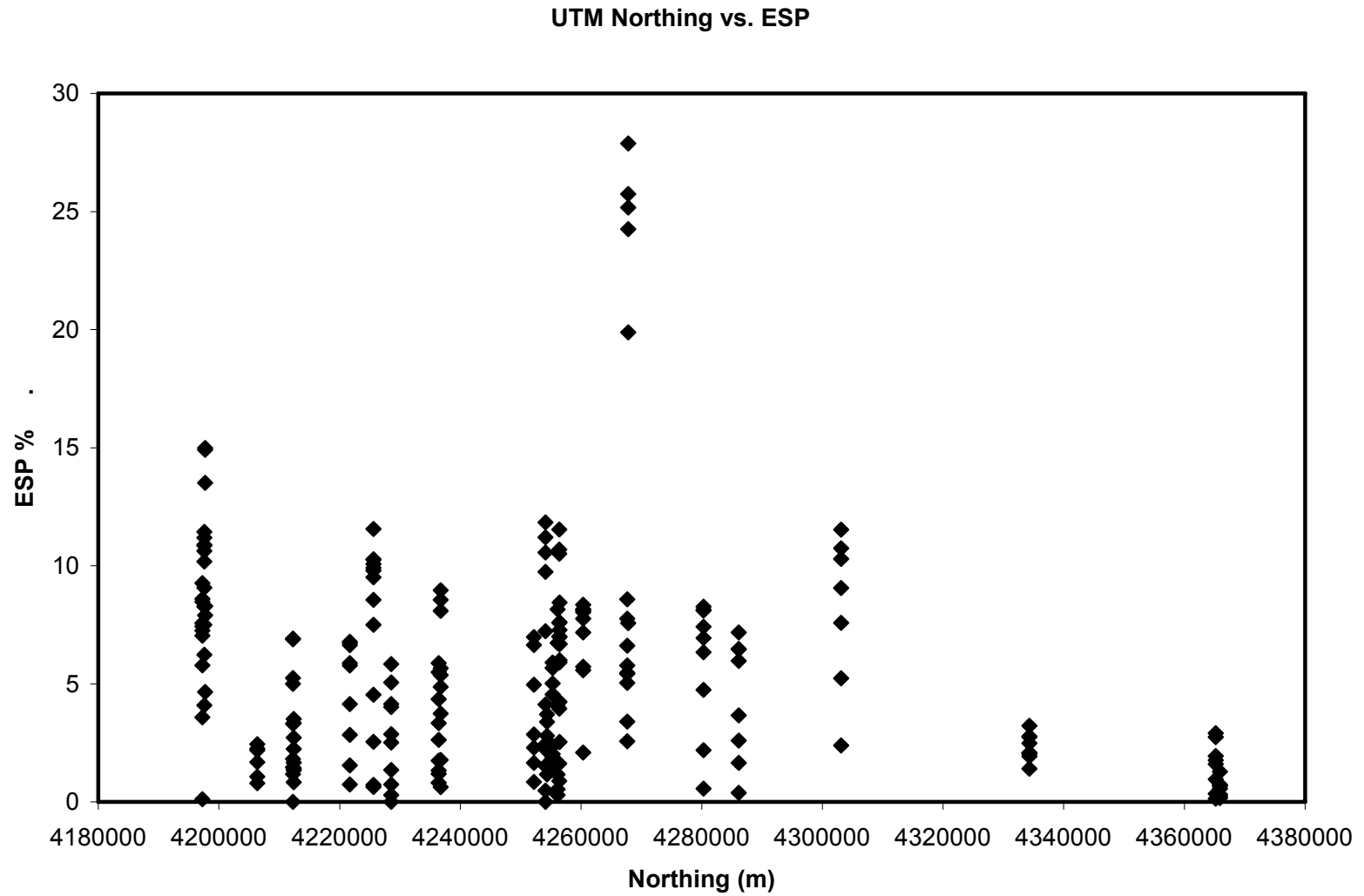


Figure 5.9. Annual precipitation of Kansas (cm). Source: National Atlas website, www.nationalatlas.gov.

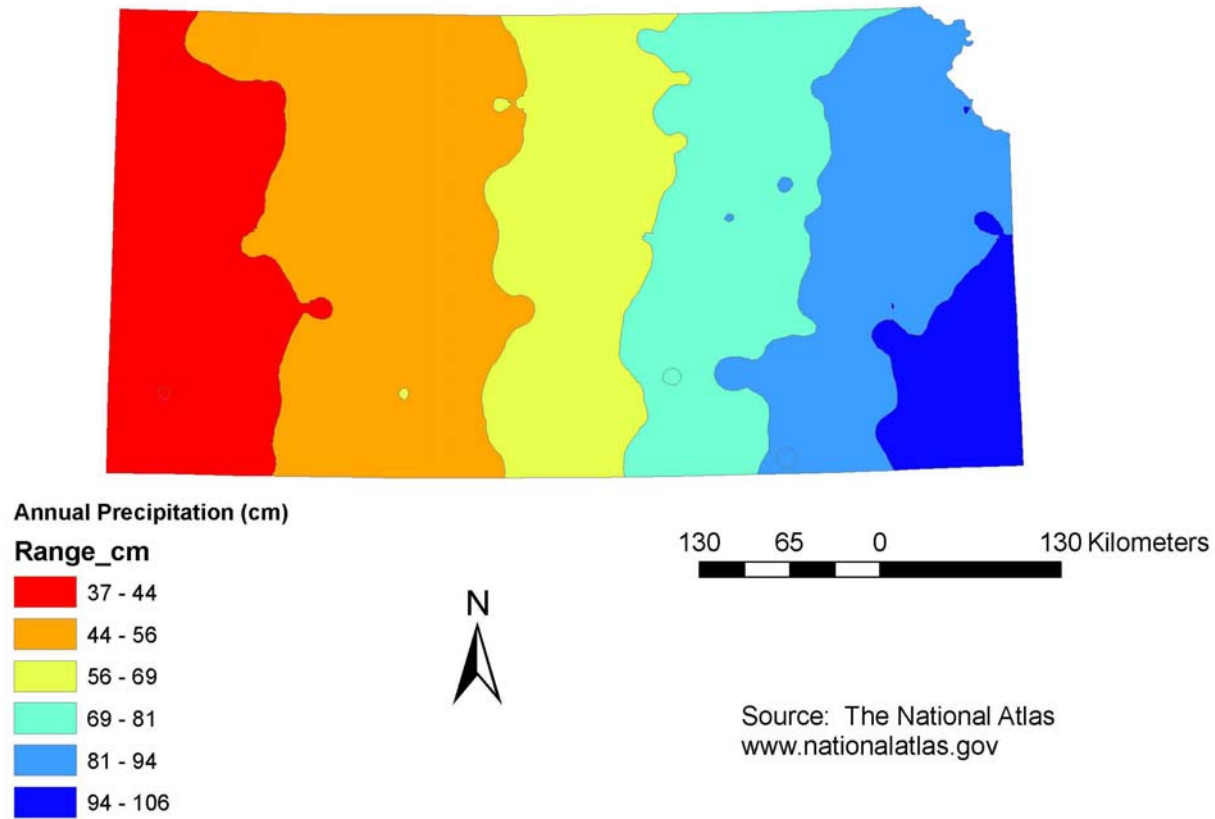


Figure 5.10. Soil pH (1:1 H₂O) for all horizons plotted against geographic location (Universal Transverse Mercator easting, Zone 14N).

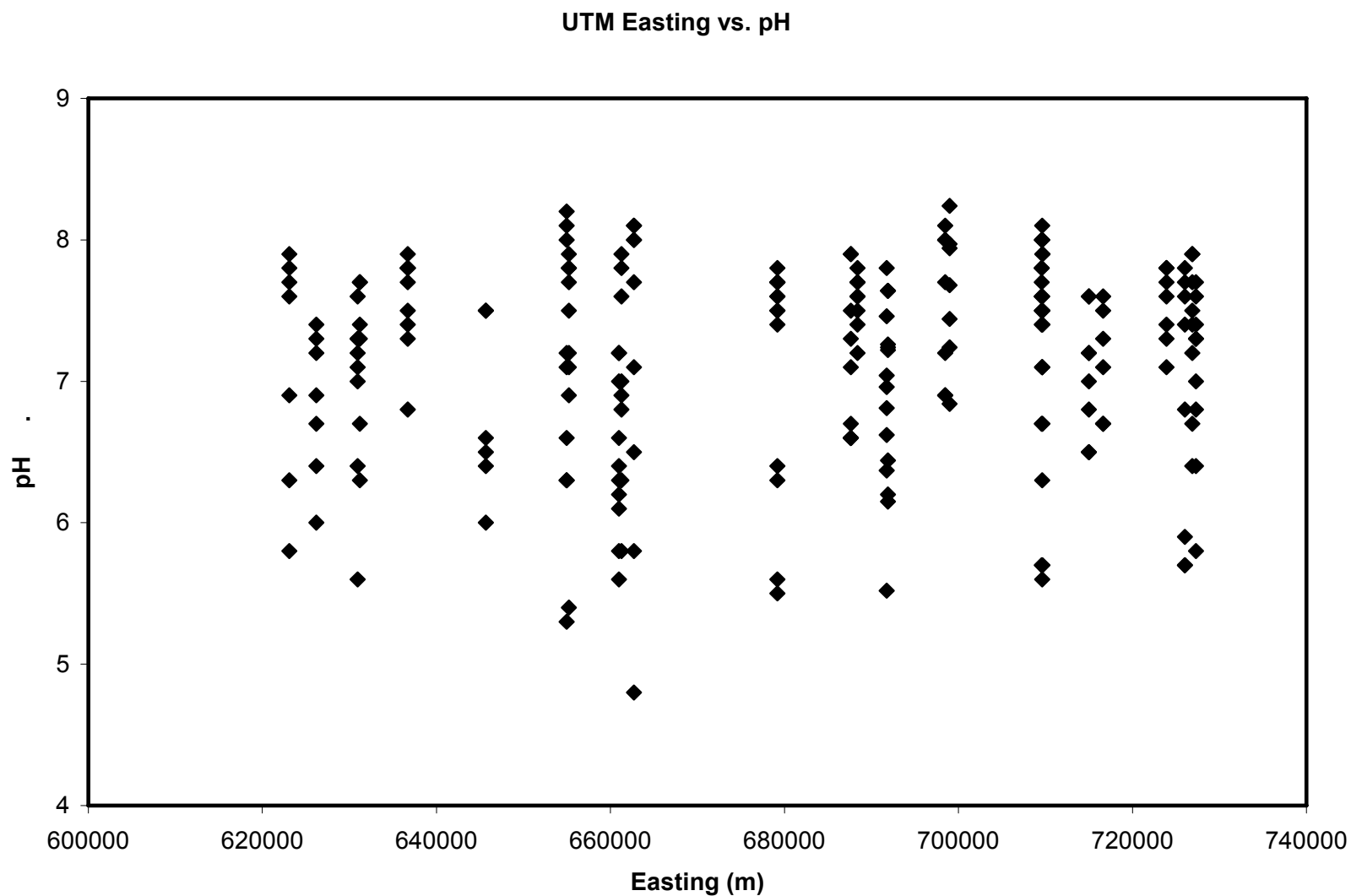


Figure 5.11. Soil pH (1:1 H₂O) for all horizons plotted against geographic location (Universal Transverse Mercator northing, Zone 14N).

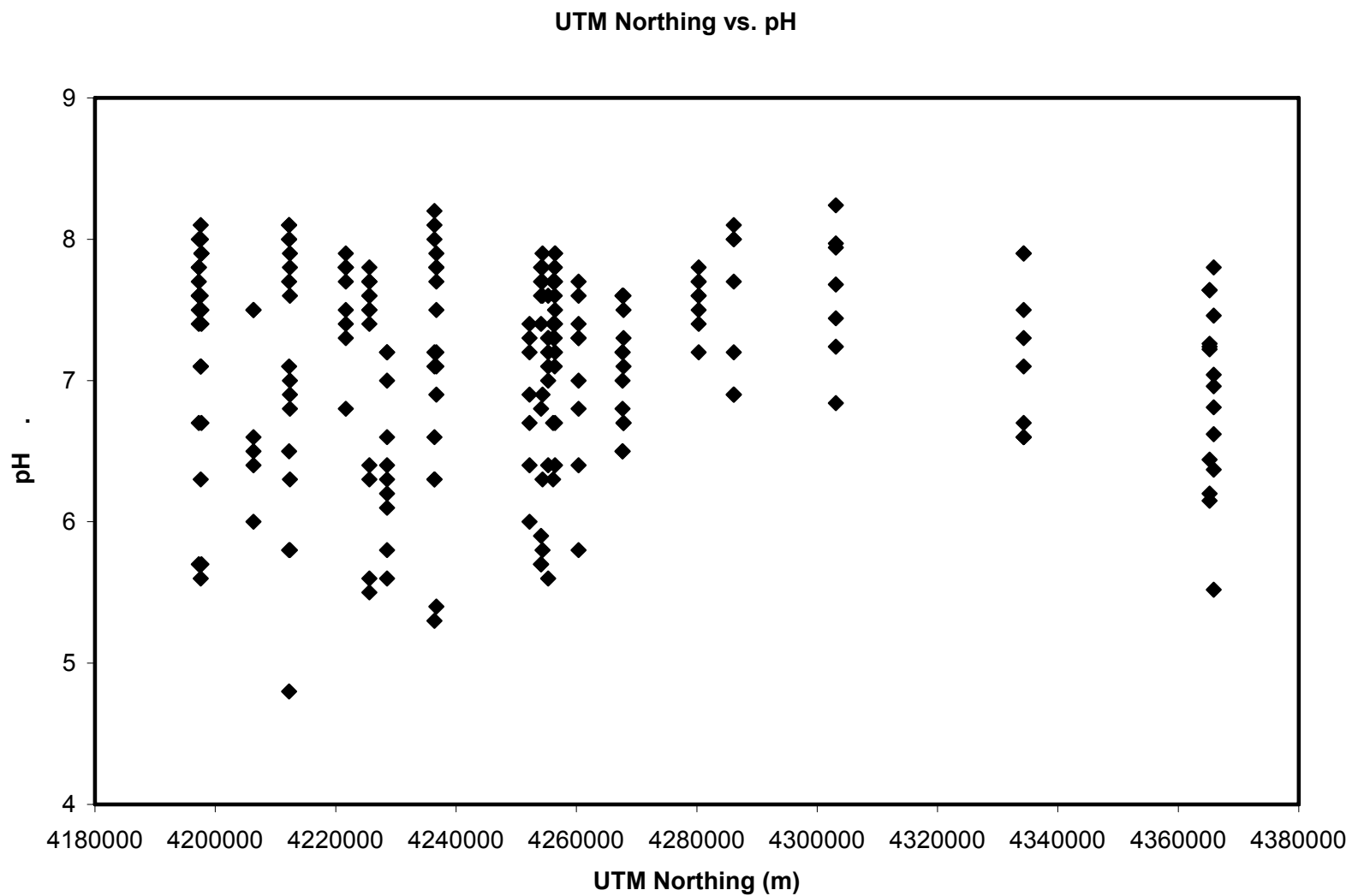


Figure 5.13. Cation exchange capacity (sum of cations method) for all horizons plotted against geographic location (Universal Transverse Mercator northing, Zone 14N).

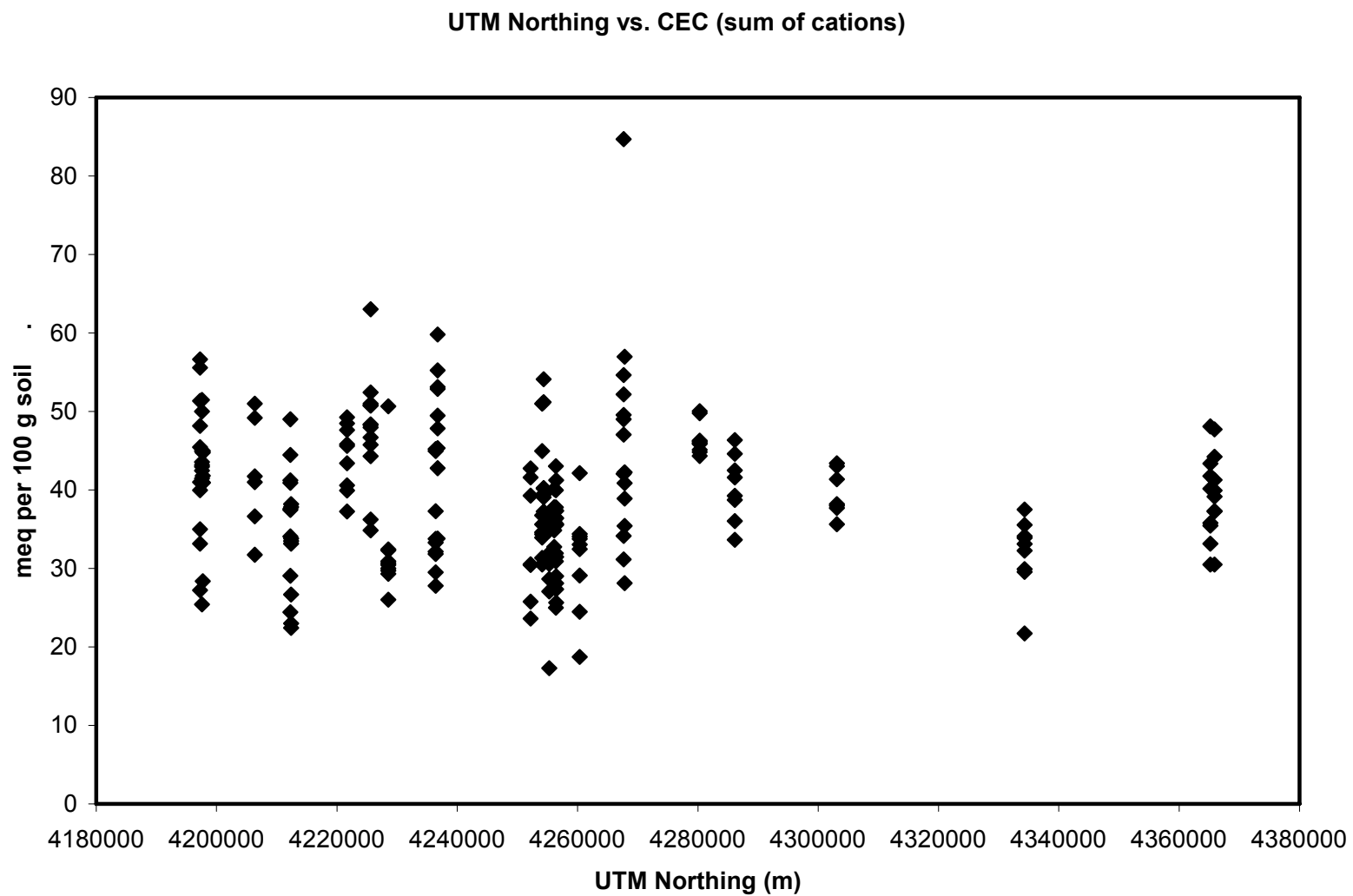


Figure 5.14. Base saturation (BS%) for all horizons plotted against geographic location (Universal Transverse Mercator easting, Zone 14N).

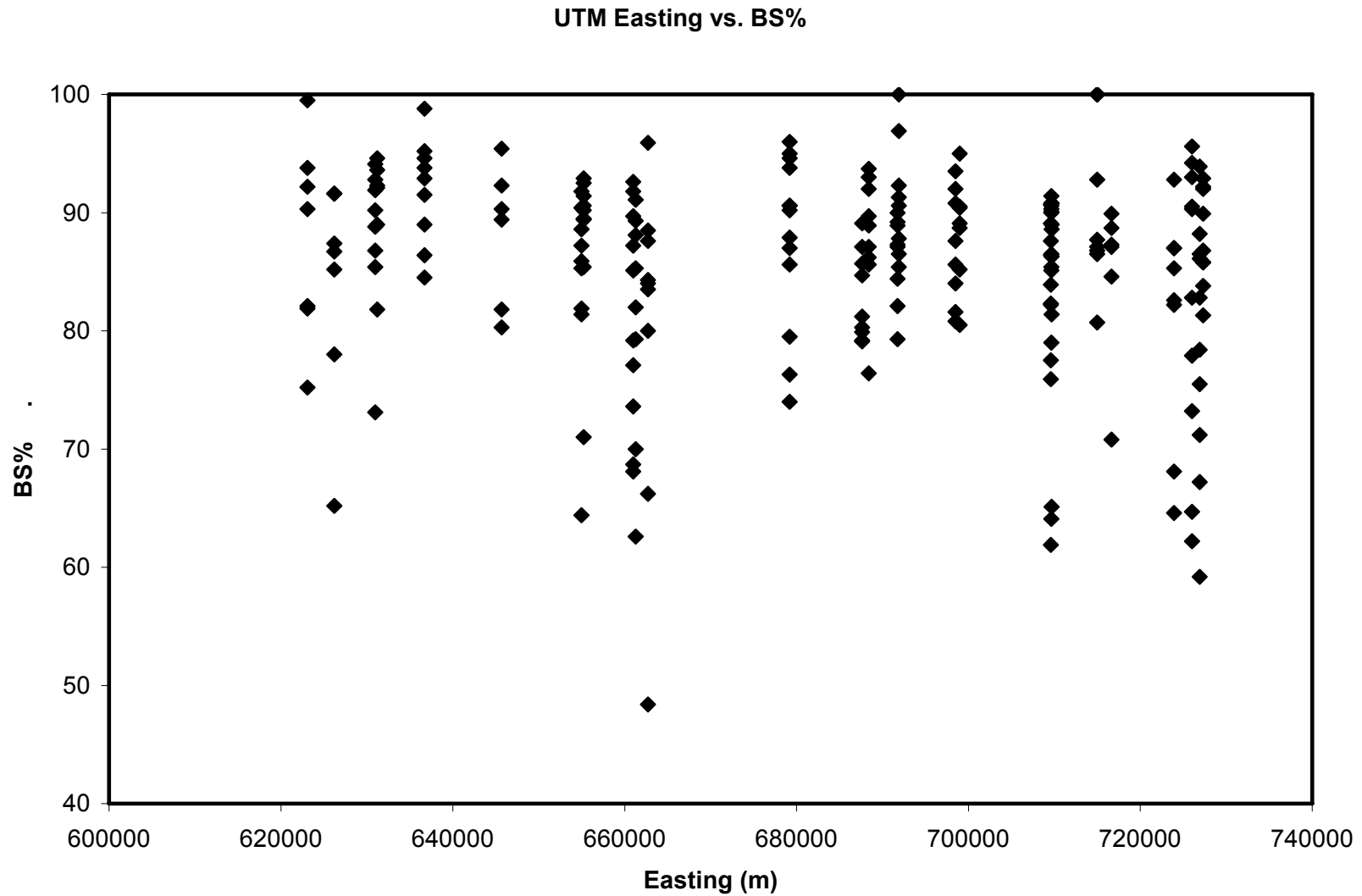


Figure 5.15. Base saturation (BS%) for all horizons plotted against geographic location (Universal Transverse Mercator northing, Zone 14N).

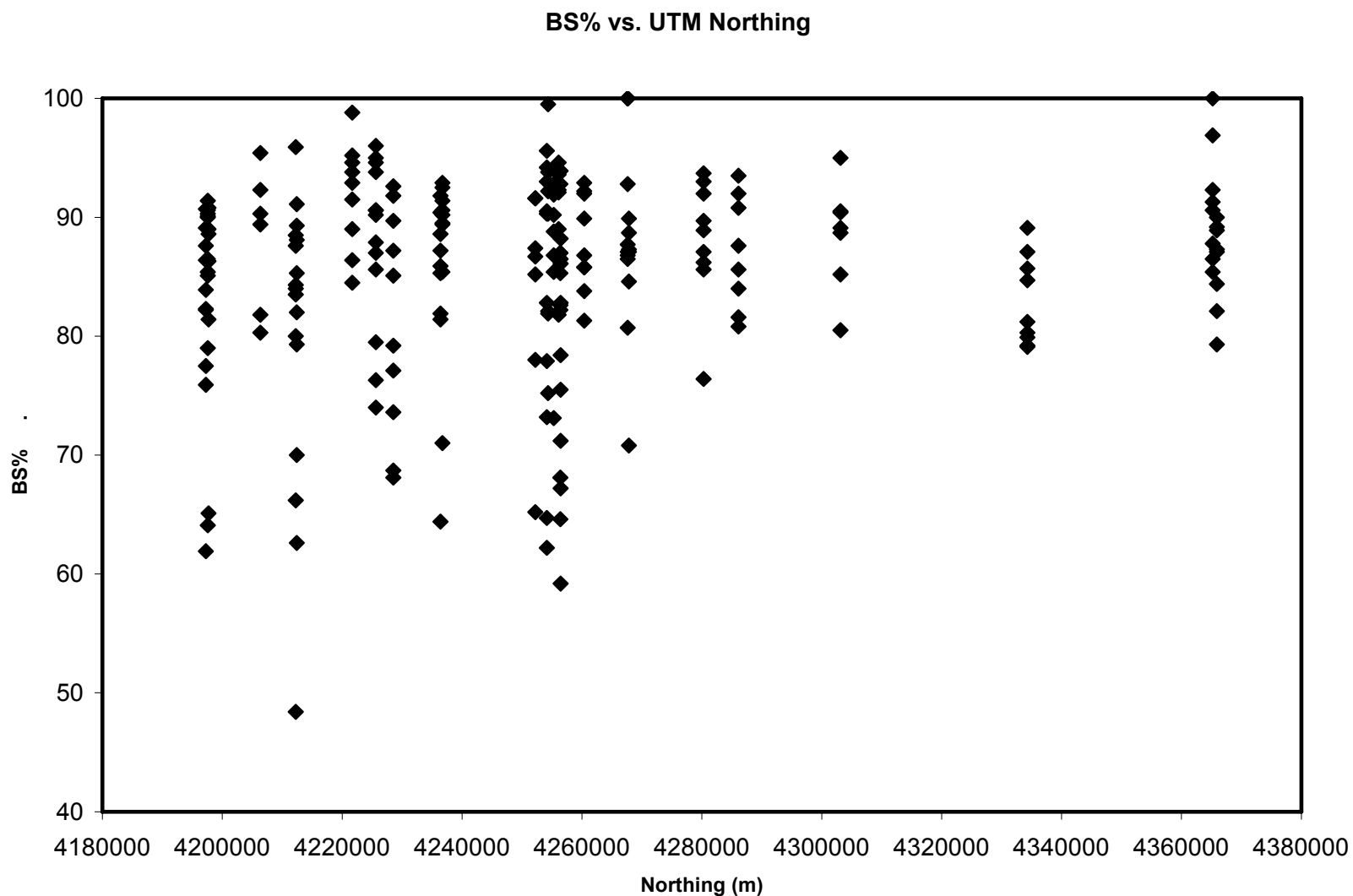


Figure 5.16. Base saturation (BS%) for surface horizons plotted against geographic location (Universal Transverse Mercator easting, Zone 14N).

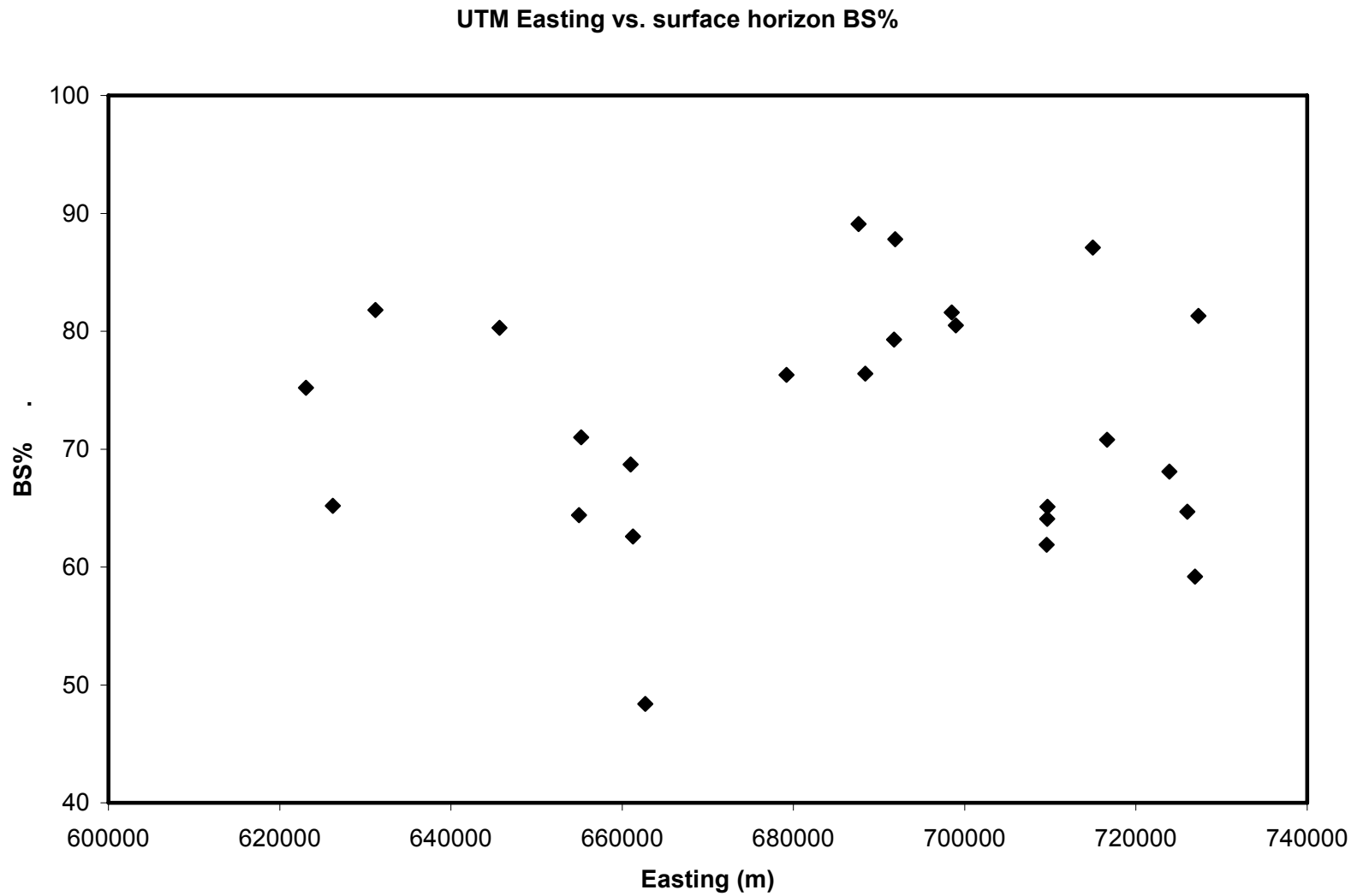


Figure 5.17. Base saturation (BS%) for surface horizons plotted against geographic location (Universal Transverse Mercator northing, Zone 14N).

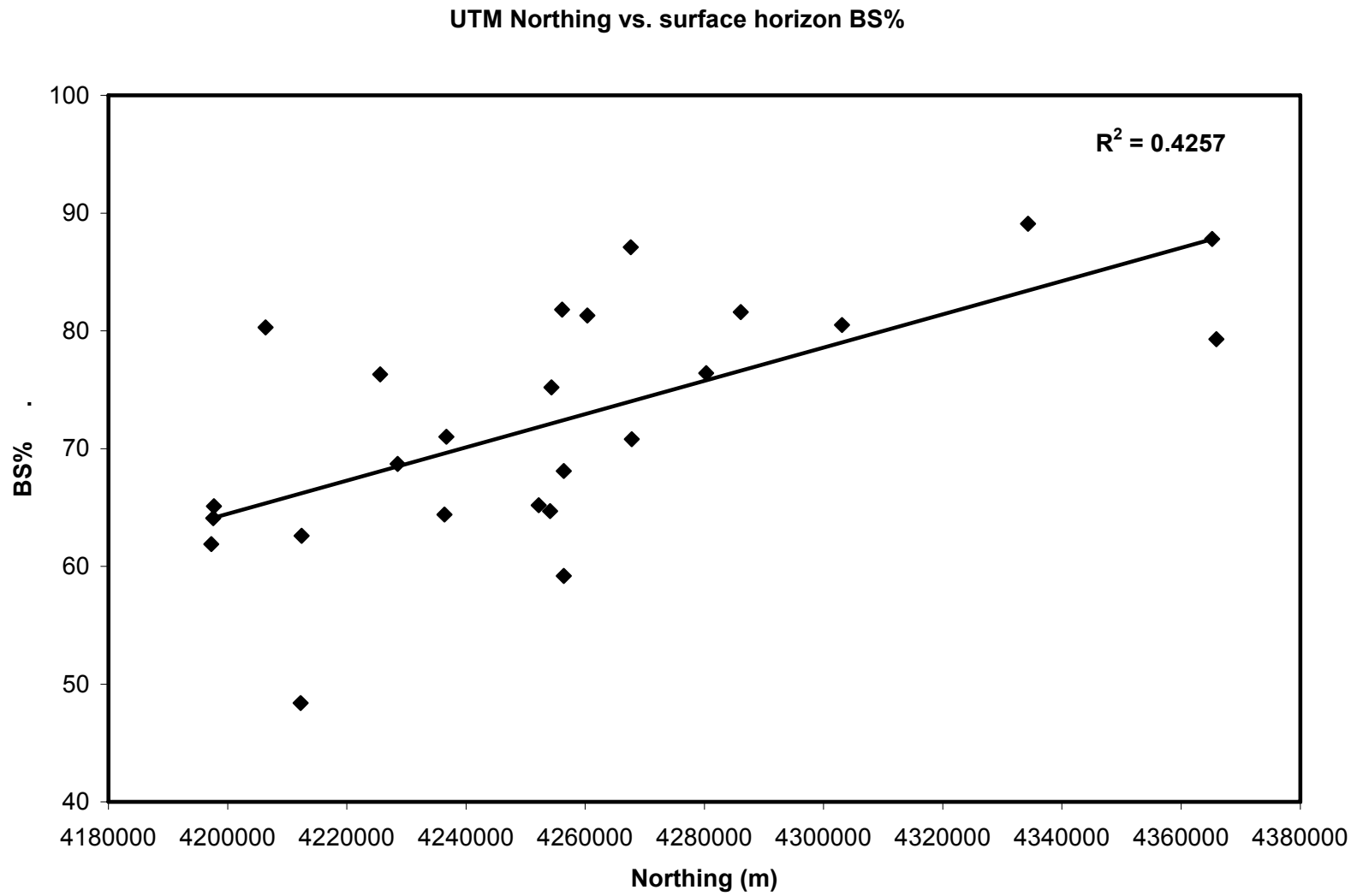


Figure 5.18. Current land uses for pedons that were characterized in the laboratory (n=28 locations).

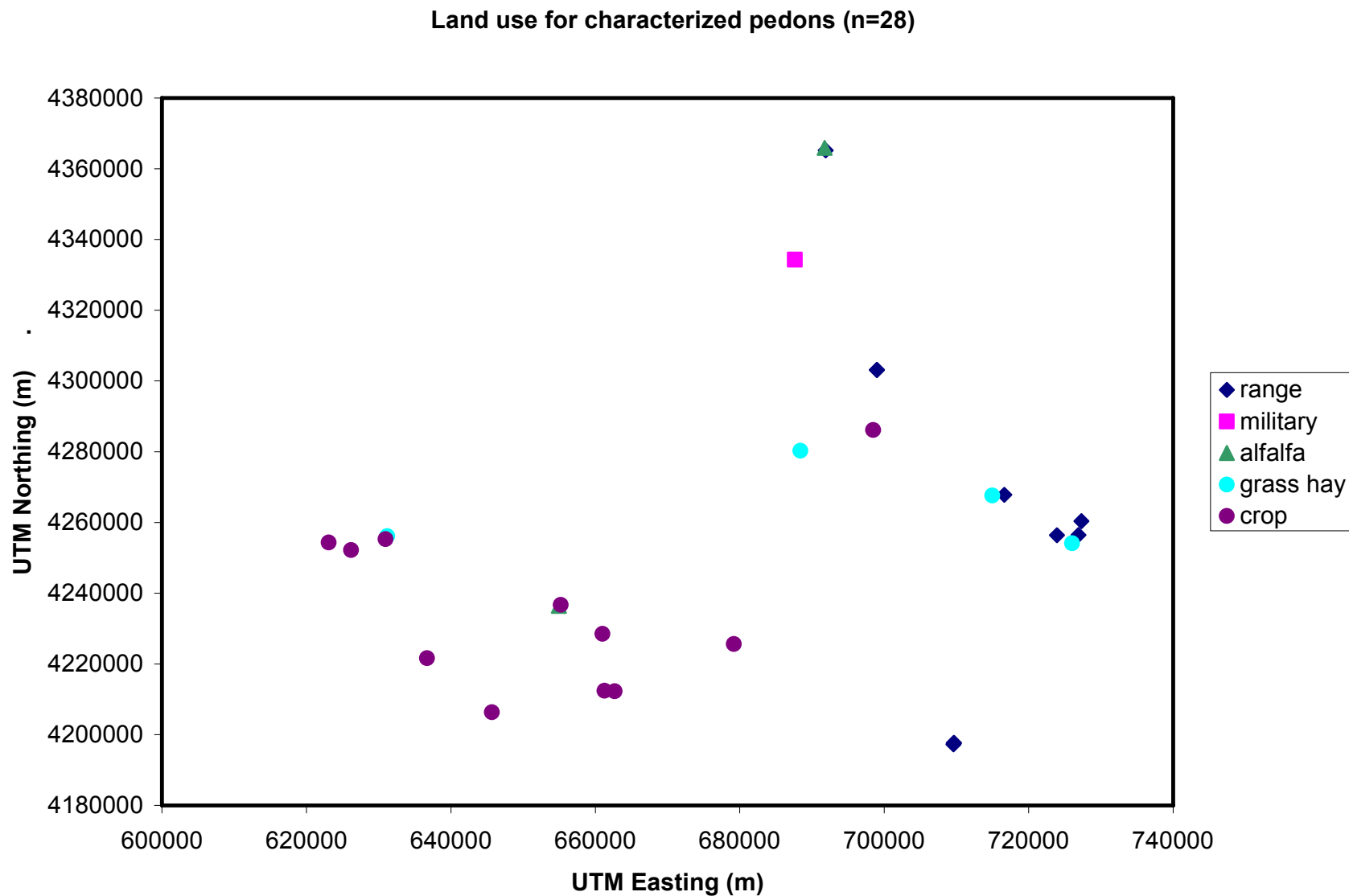


Figure 5.19. The median particle size for nearly all samples was between 11 and 16 μm (medium silt-sized).

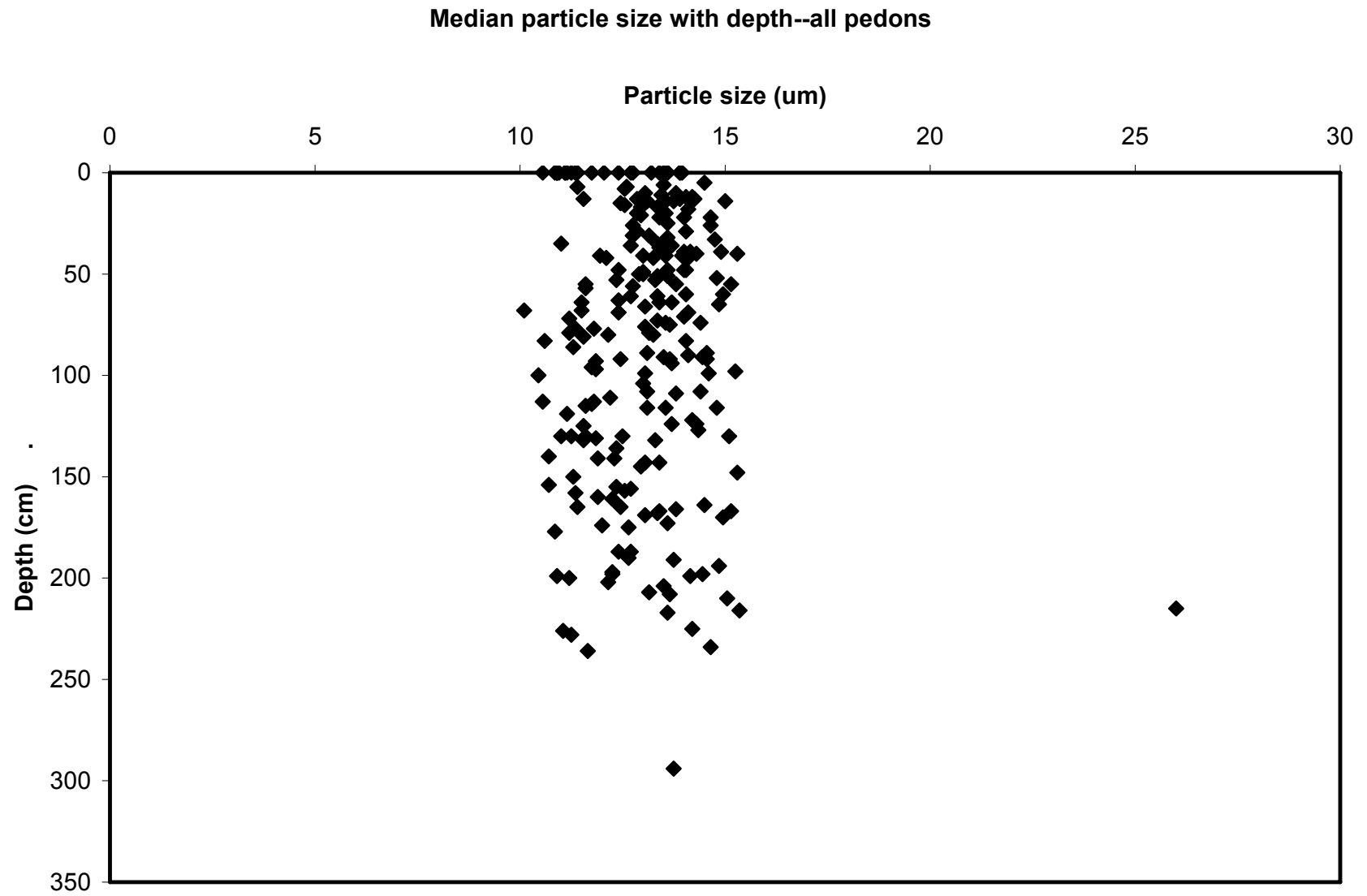


Figure 5.21. Mean particle size (μm) for all horizons plotted against geographic location (Universal Transverse Mercator easting, Zone 14N).

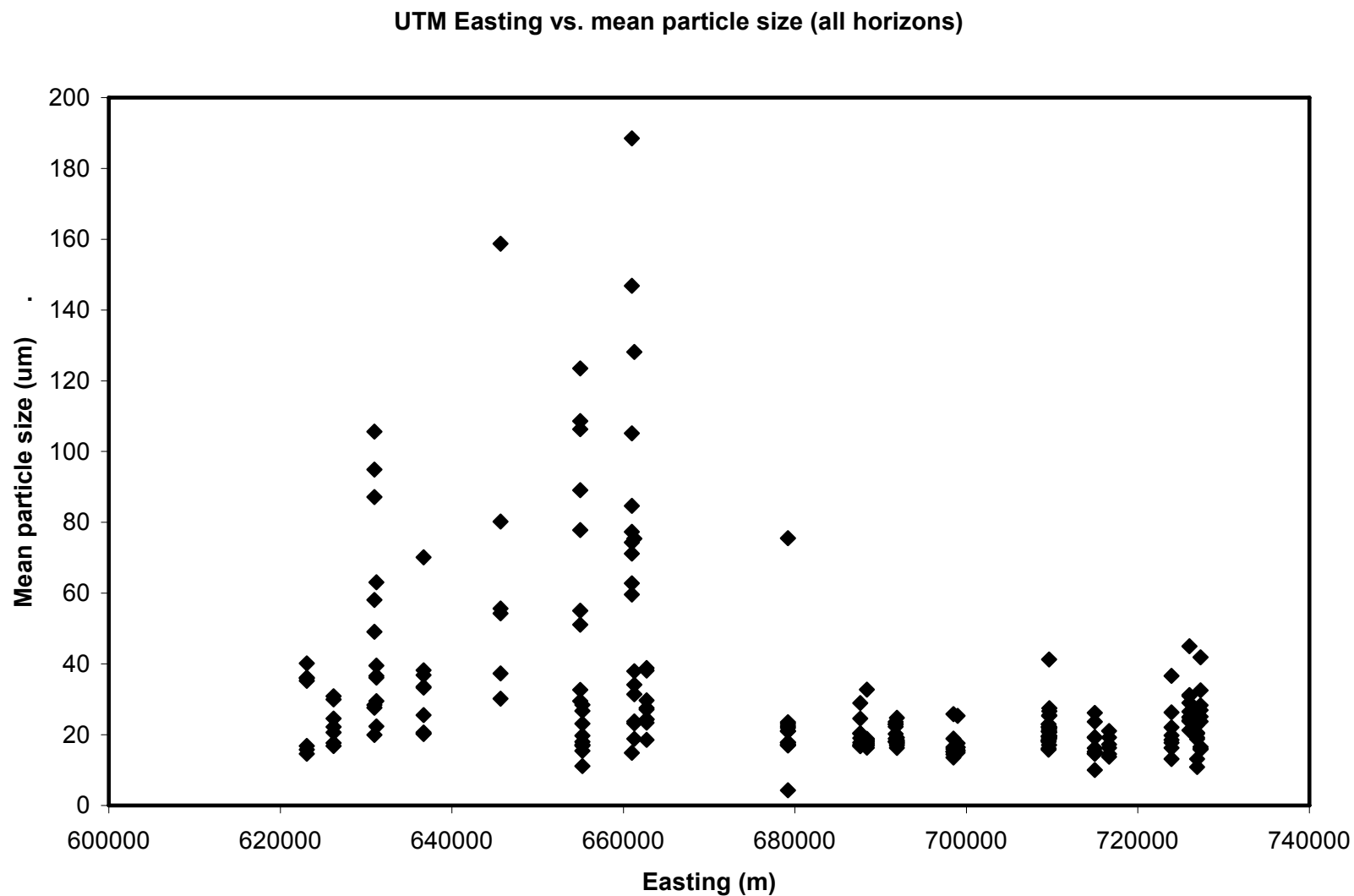


Figure 5.22. Mean particle size (μm) for all horizons plotted against geographic location (Universal Transverse Mercator northing, Zone 14N).

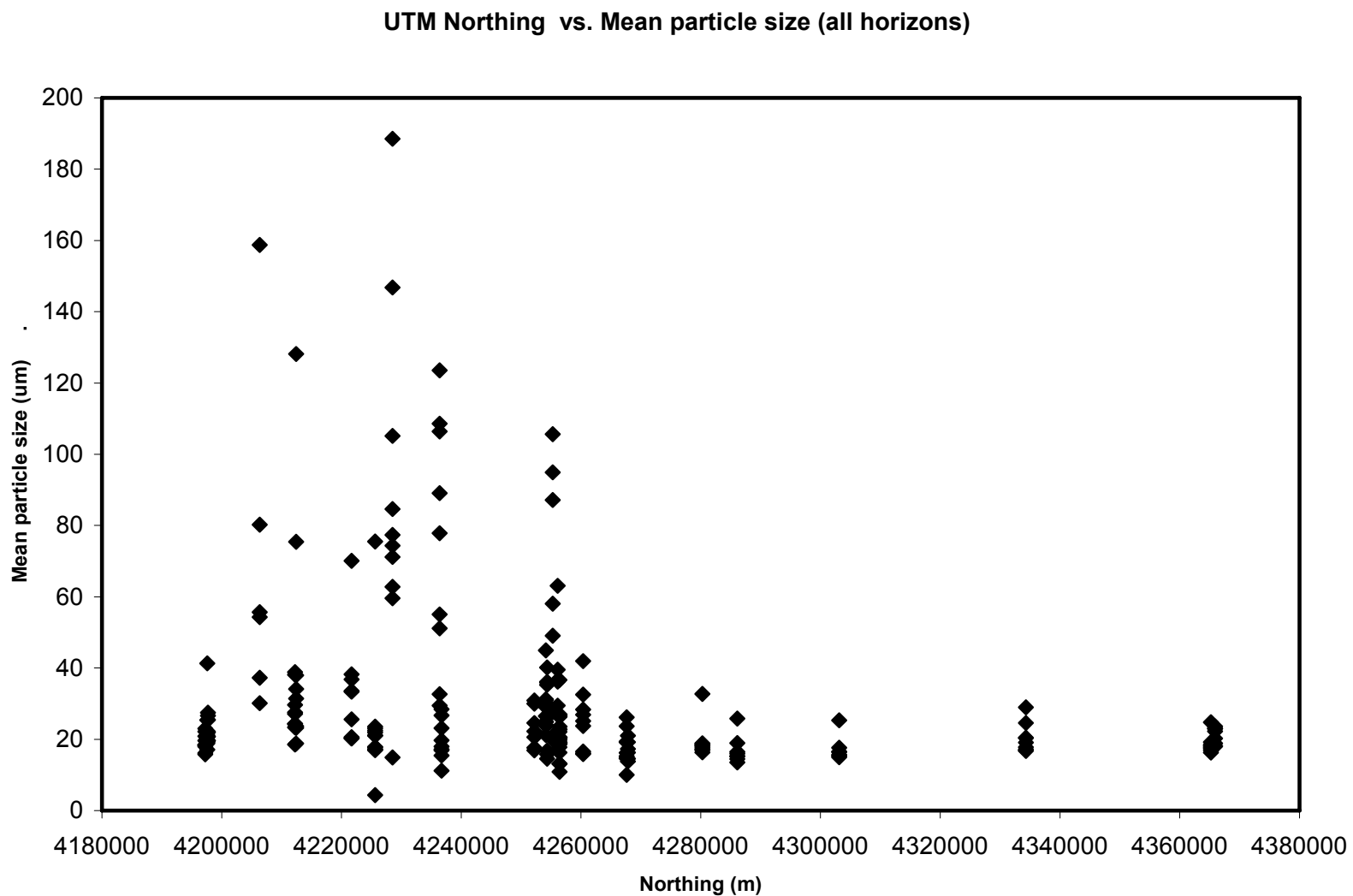


Figure 5.23. Mean particle size south of 425600 meters N and west of 68000 meters E (indicated by a star symbol) are different in a portion of the profile, where mean particle size values can range from 50 to 200 μm in size. Samples east and north of this point (star symbol) do not exceed 50 μm in mean particle size.

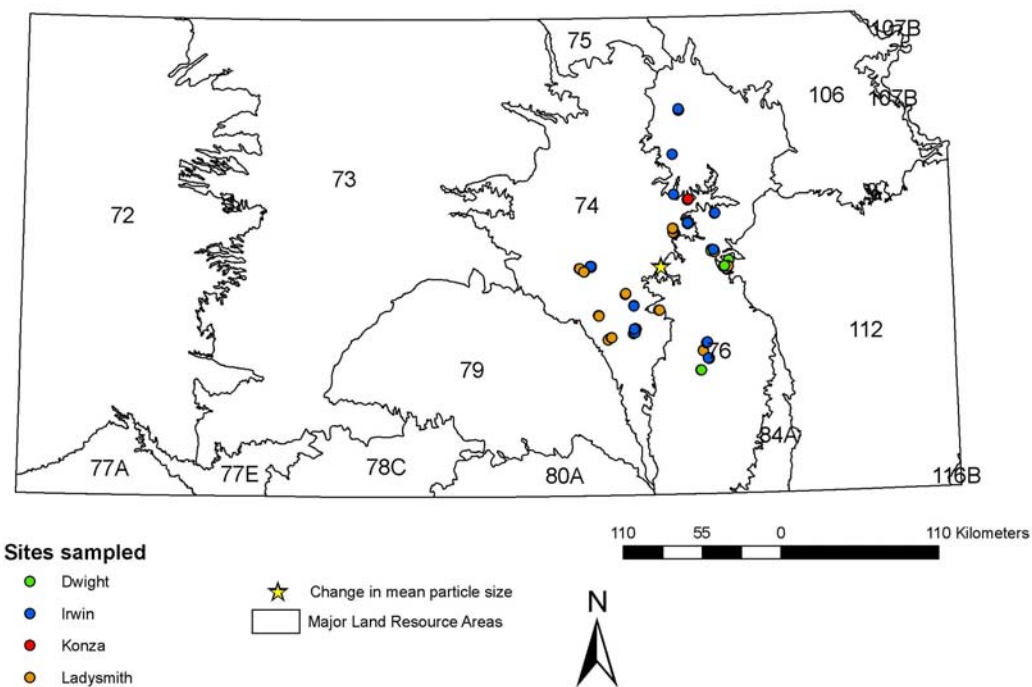


Figure 5.24. Semi-quantitative clay mineralogy of pedon 05KS161001, an Irwin pedon sampled in Riley County, KS. The upper part of the profile is dominated by smectite, and the mineralogy in the lower part of the profile is mixed.

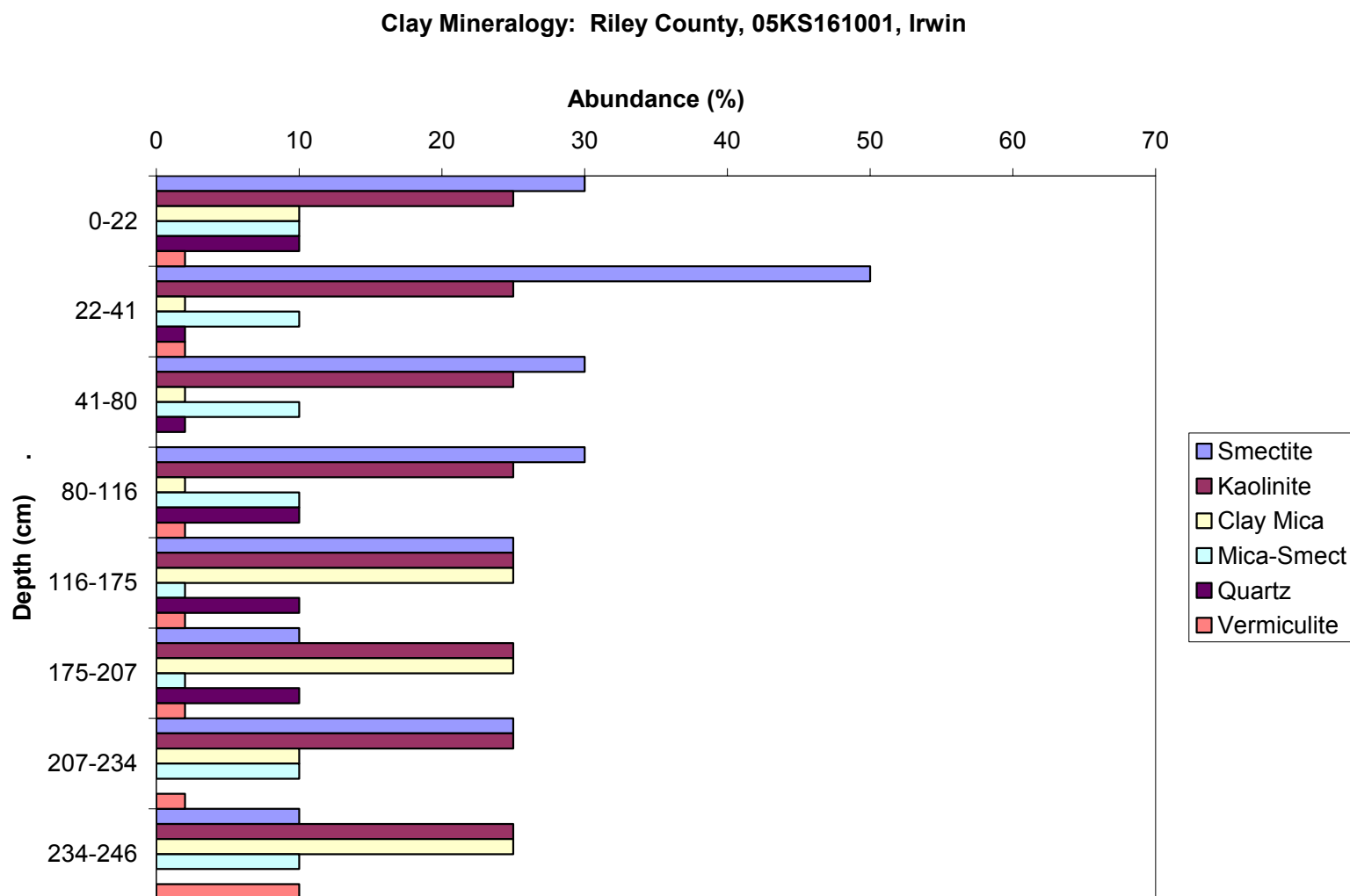


Figure 5.25. Semi-quantitative mineralogy of pedon 05KS061001, an Irwin pedon sampled in southern Geary County, KS. Smectite is more abundant in the upper part of the argillic horizon, and the mineralogy of lower part of pedon is mixed.

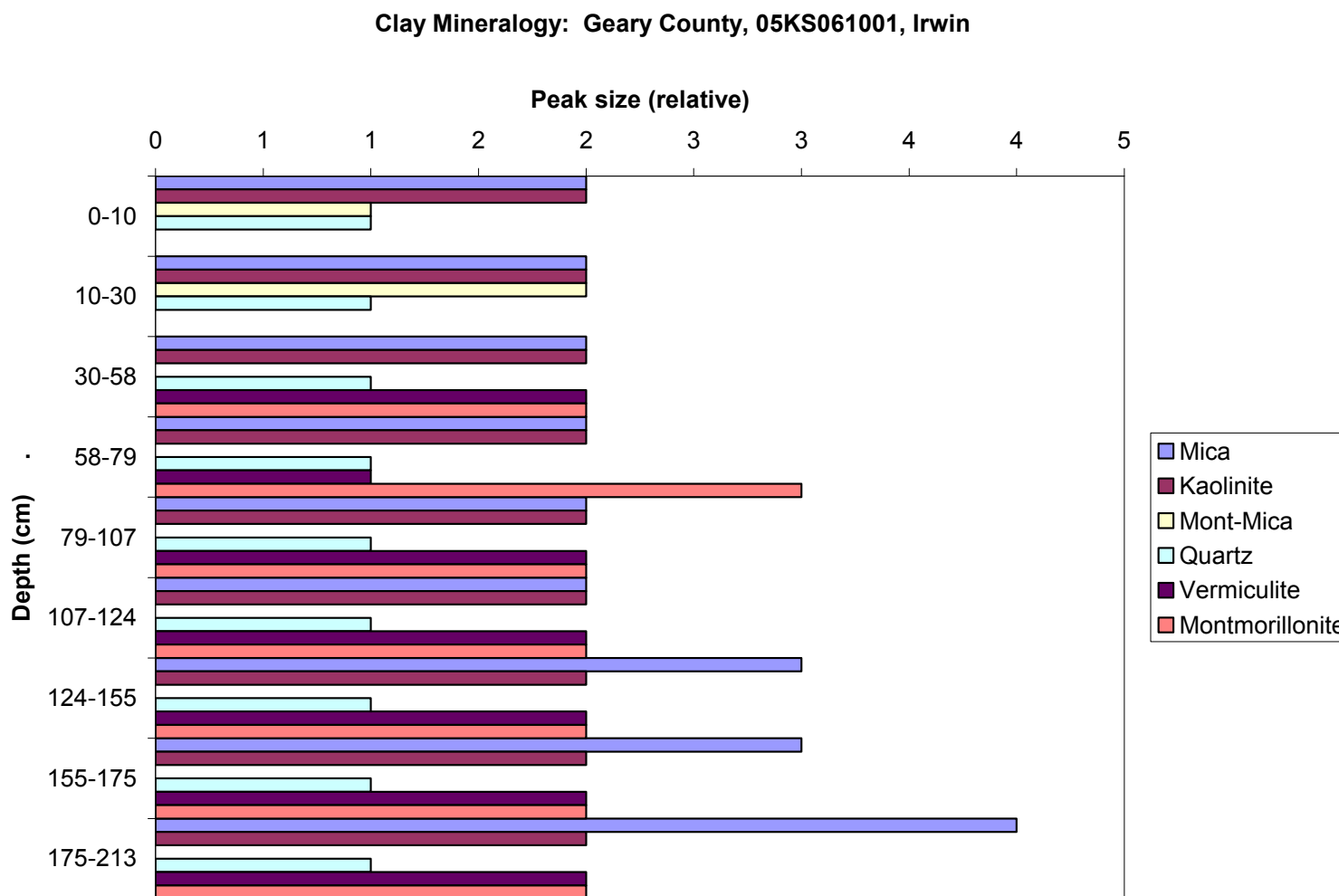


Figure 5.26. Semi-quantitative mineralogy of pedon 06KS017011, an Irwin pedon sampled in Chase County, KS. Smectite is more abundant in the upper part of the argillic horizon, and the mineralogy of lower part of pedon is mixed.

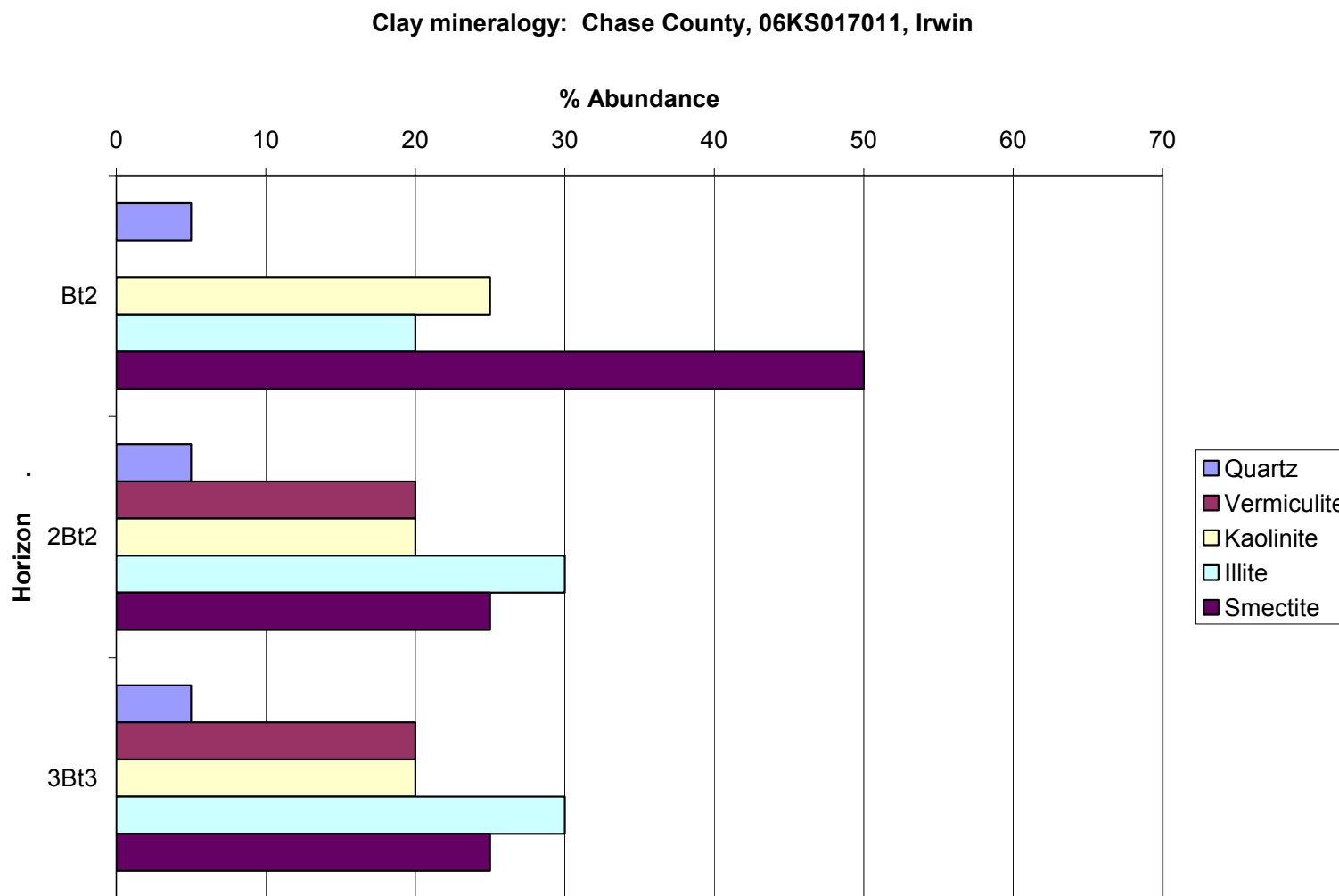


Figure 5.27. Semi-quantitative mineralogy of pedon 06KS015010, a Ladysmith pedon sampled in Butler County, KS. Smectite is the dominant clay mineral throughout the soil profile.

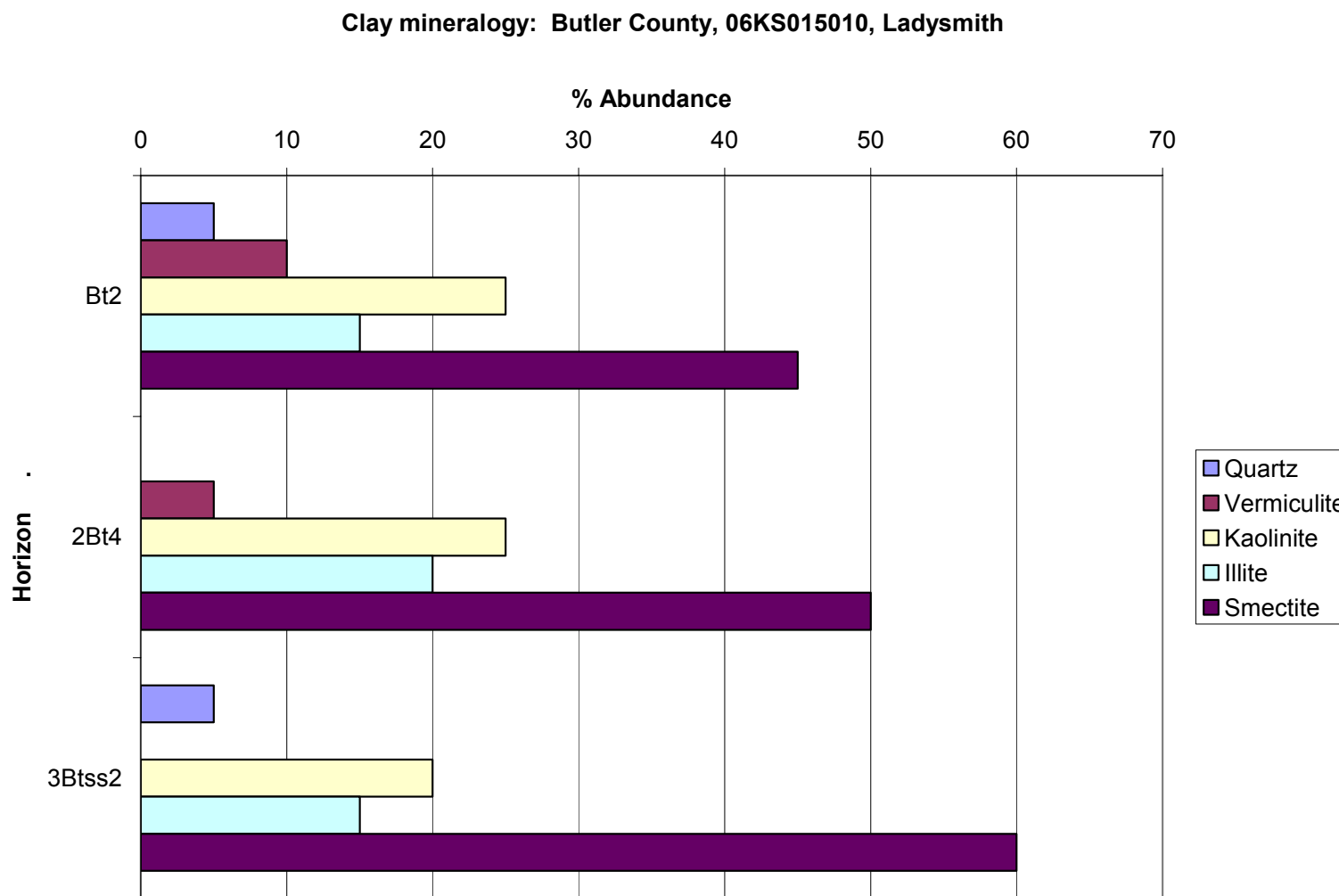


Figure 5.28. Semi-quantitative mineralogy of pedon 06KS115010, an Irwin pedon sampled in Marion County, KS. Smectite is the dominant clay mineral throughout the soil profile, and increases with depth in the profile.

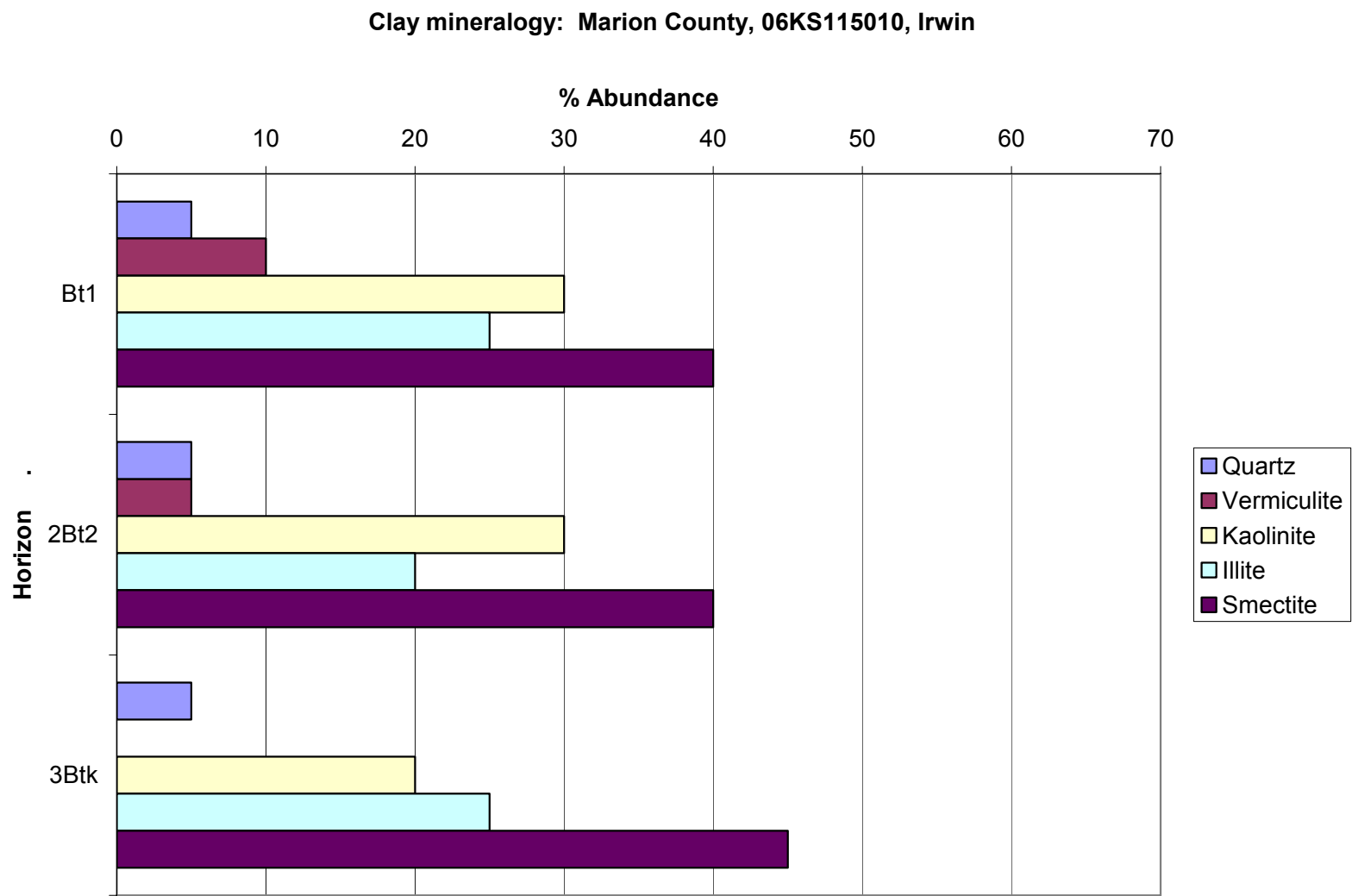


Figure 5.29. Semi-quantitative mineralogy of pedon 06KS113002, a Ladysmith pedon sampled in McPherson County, KS. Smectite is the dominant clay mineral throughout the soil profile.

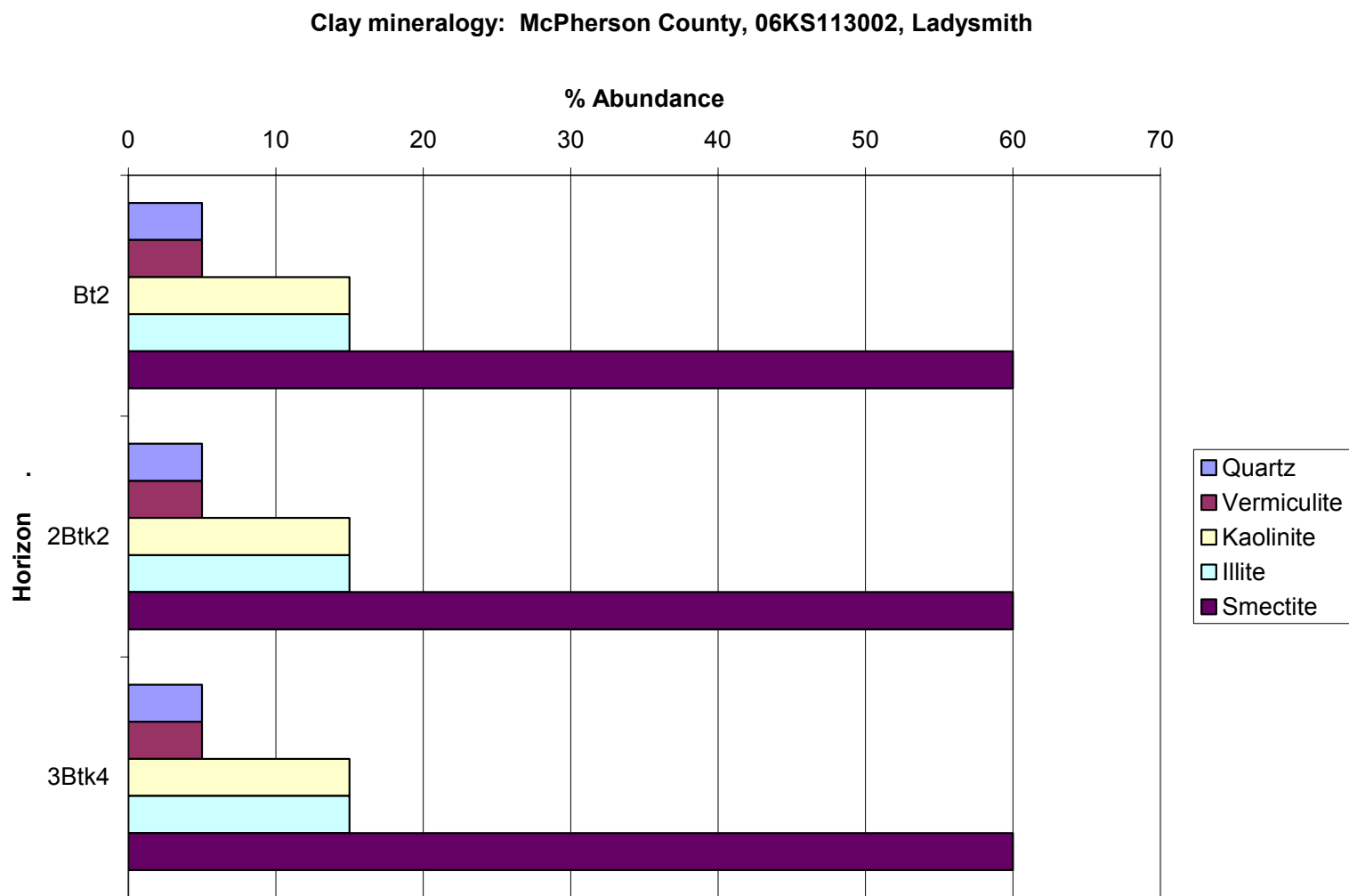


Figure 5.30. Thickness of the mollic epipedon plotted against the Universal Transverse Mercator Zone 14N Easting (m).

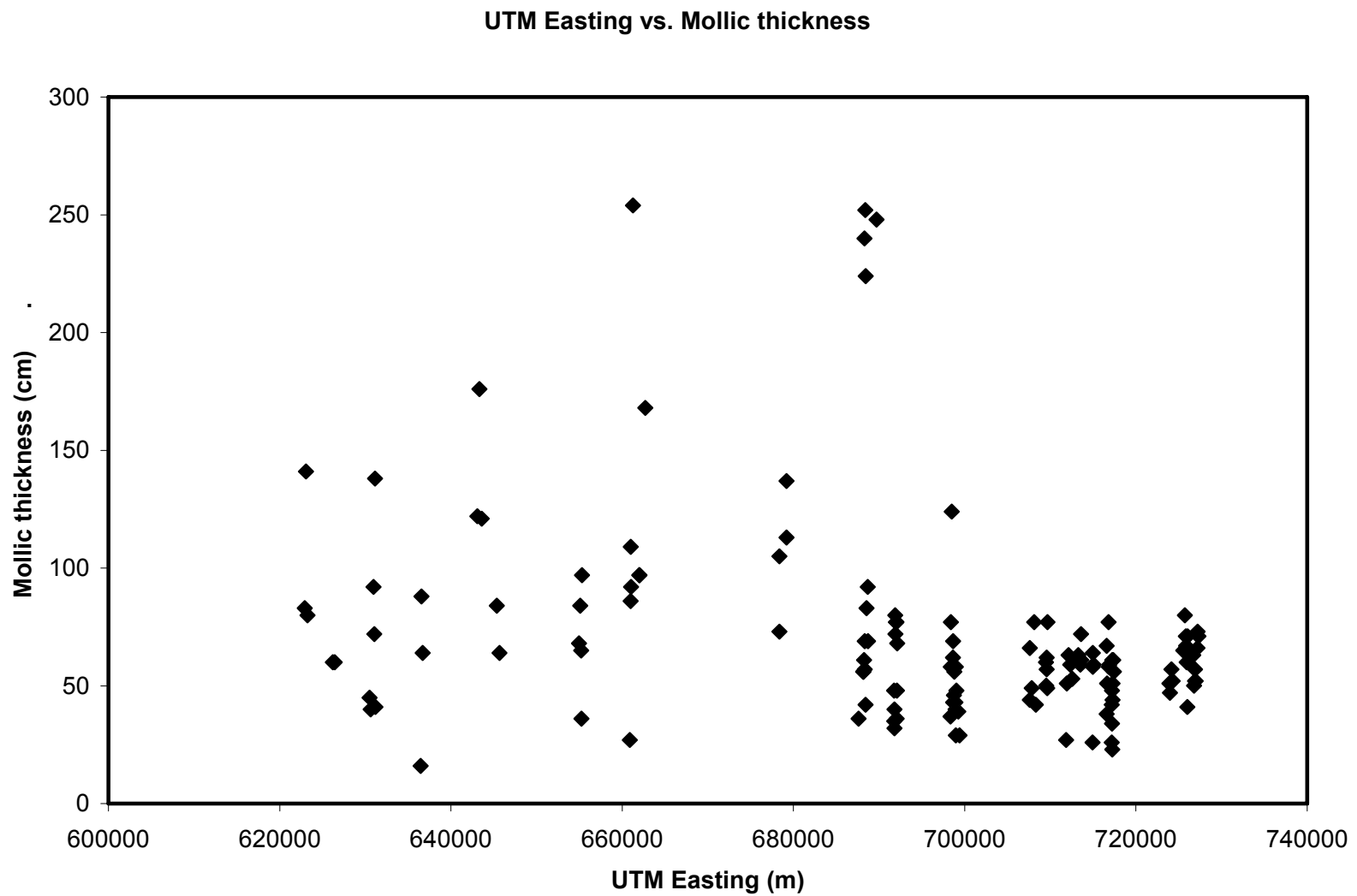


Figure 5.31. Thickness of the mollic epipedon plotted against the Universal Transverse Mercator Zone 14N Northing (m).

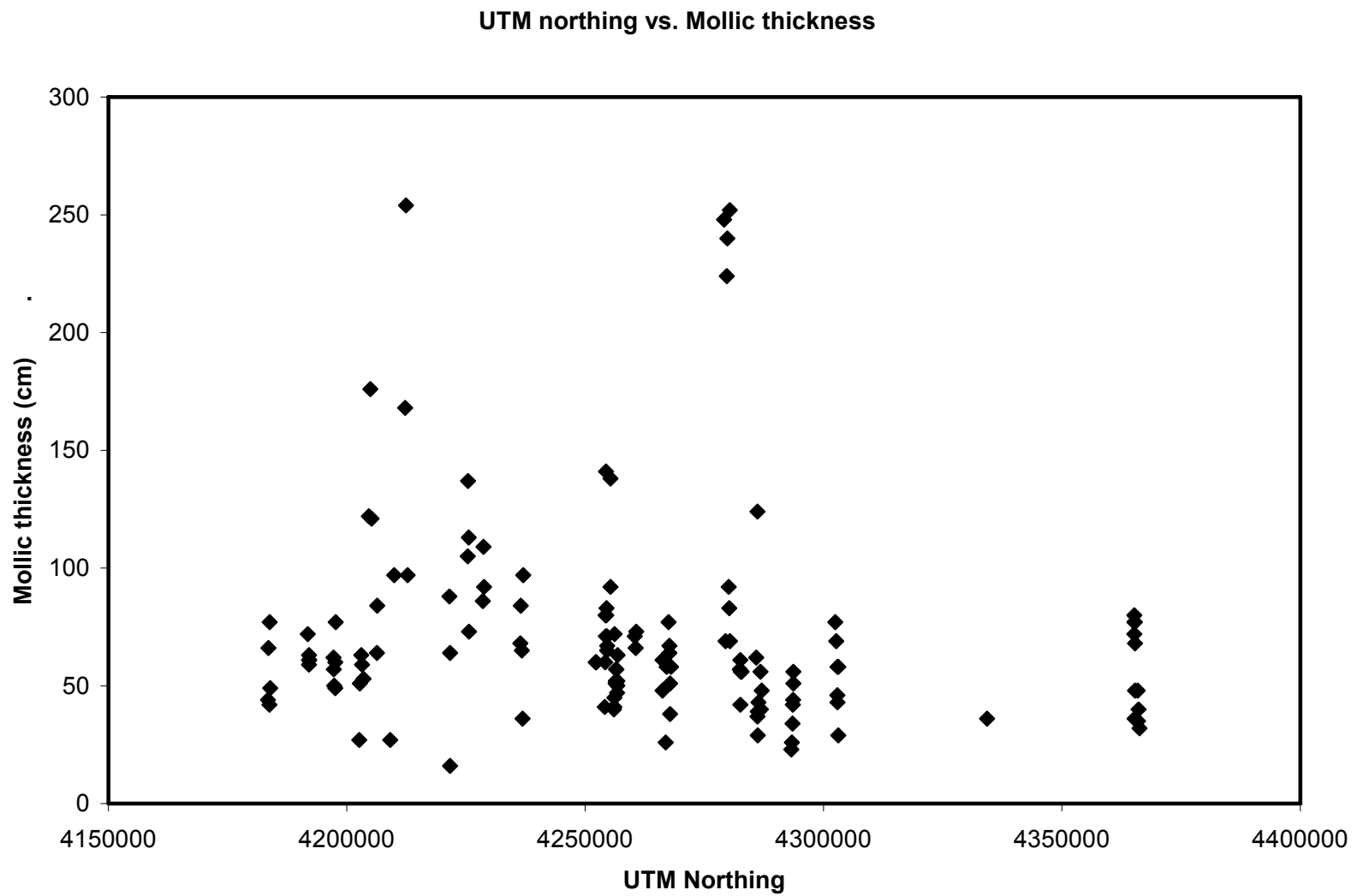


Figure 5.32. Thickness of the mollic epipedon plotted against the Universal Transverse Mercator Zone 14N Easting (m). In this scatterplot, each series is represented by a different colored and shaped data point.

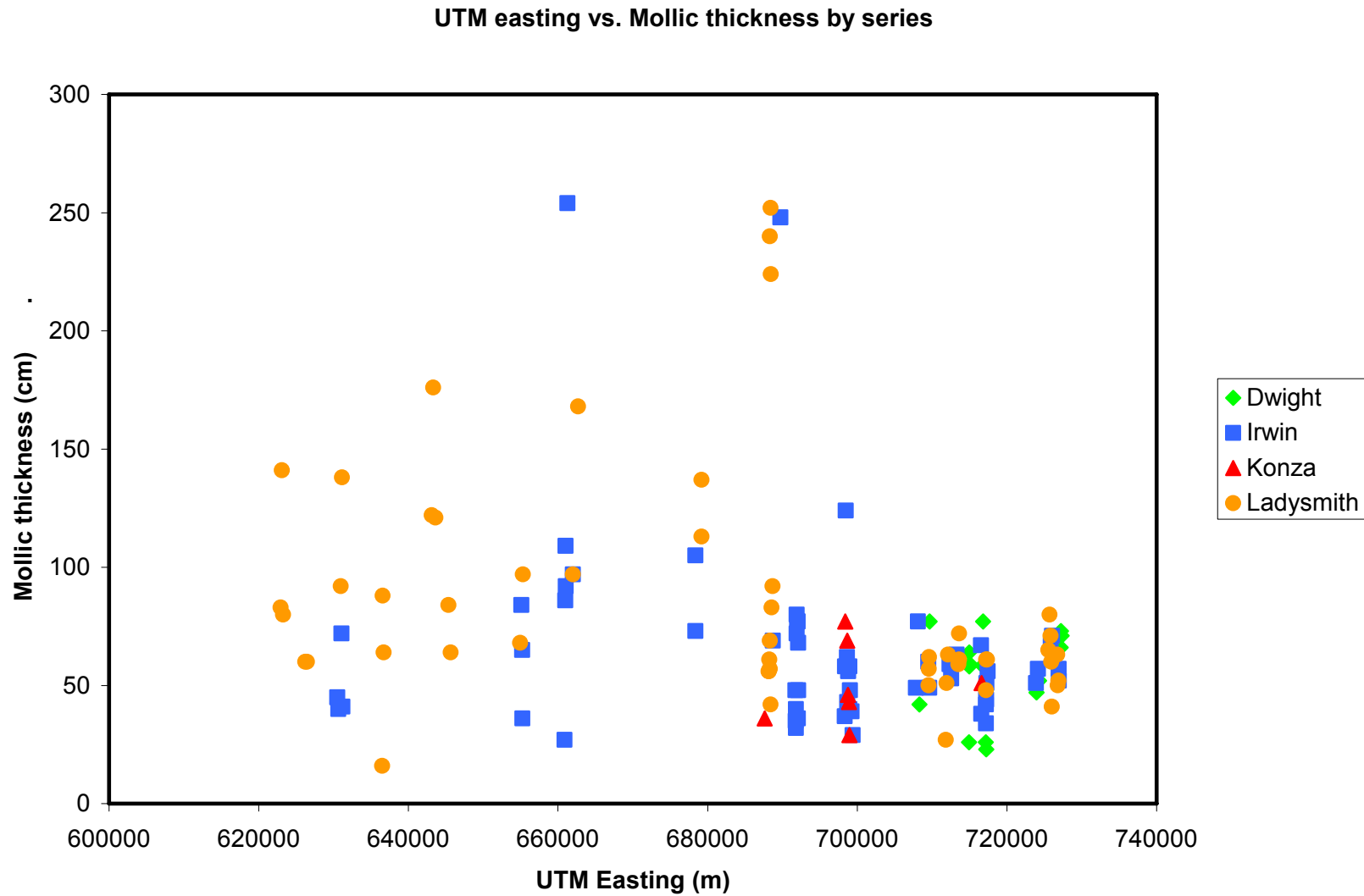


Figure 5.33. Thickness of the mollic epipedon plotted against the Universal Transverse Mercator Zone 14N Northing (m). Each series is represented by a different colored and shaped data point.

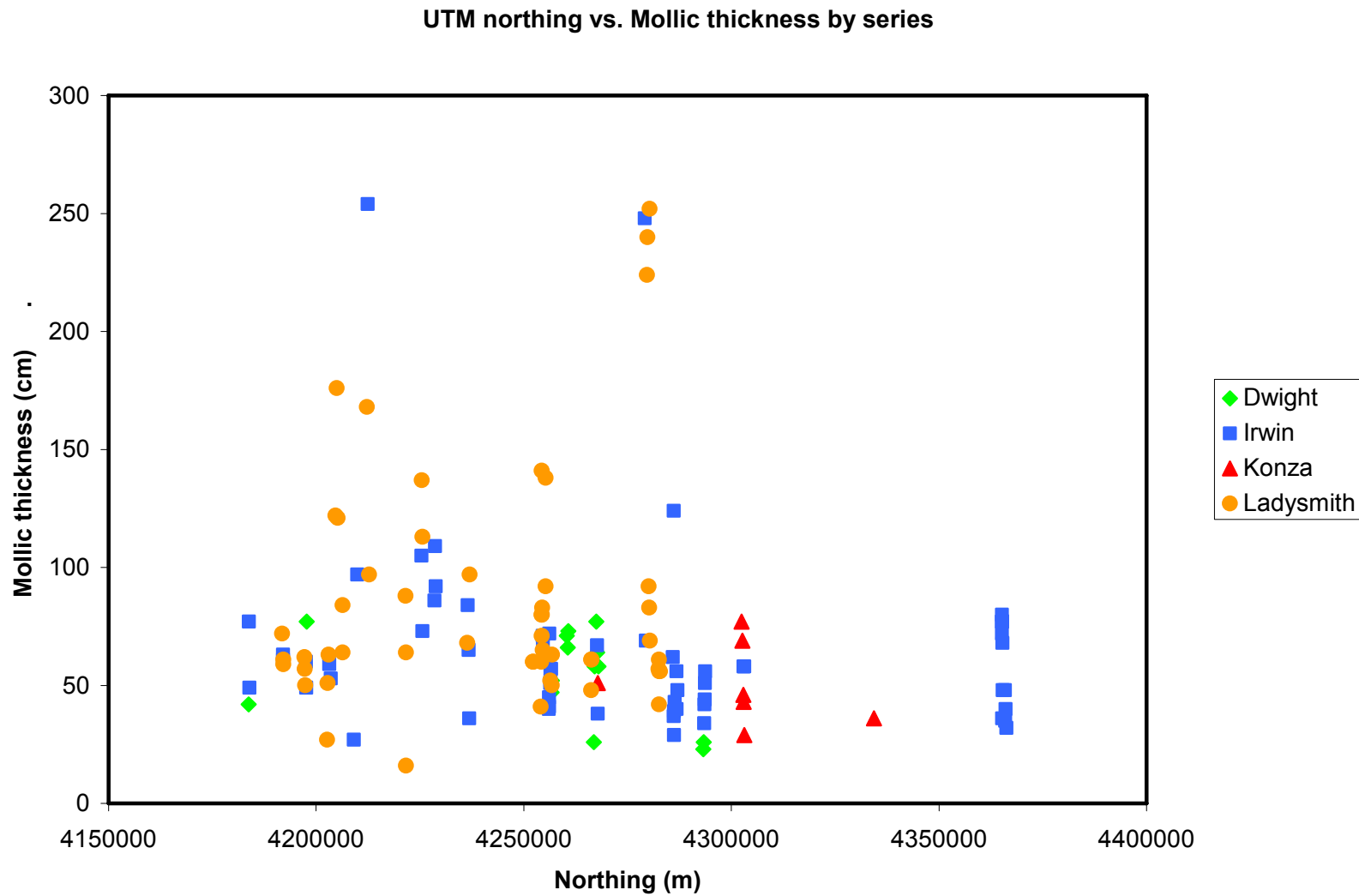


Figure 5.34. The current land use was recorded for all pedons at the time of sampling (n=138). All grasslands were grouped with rangelands.

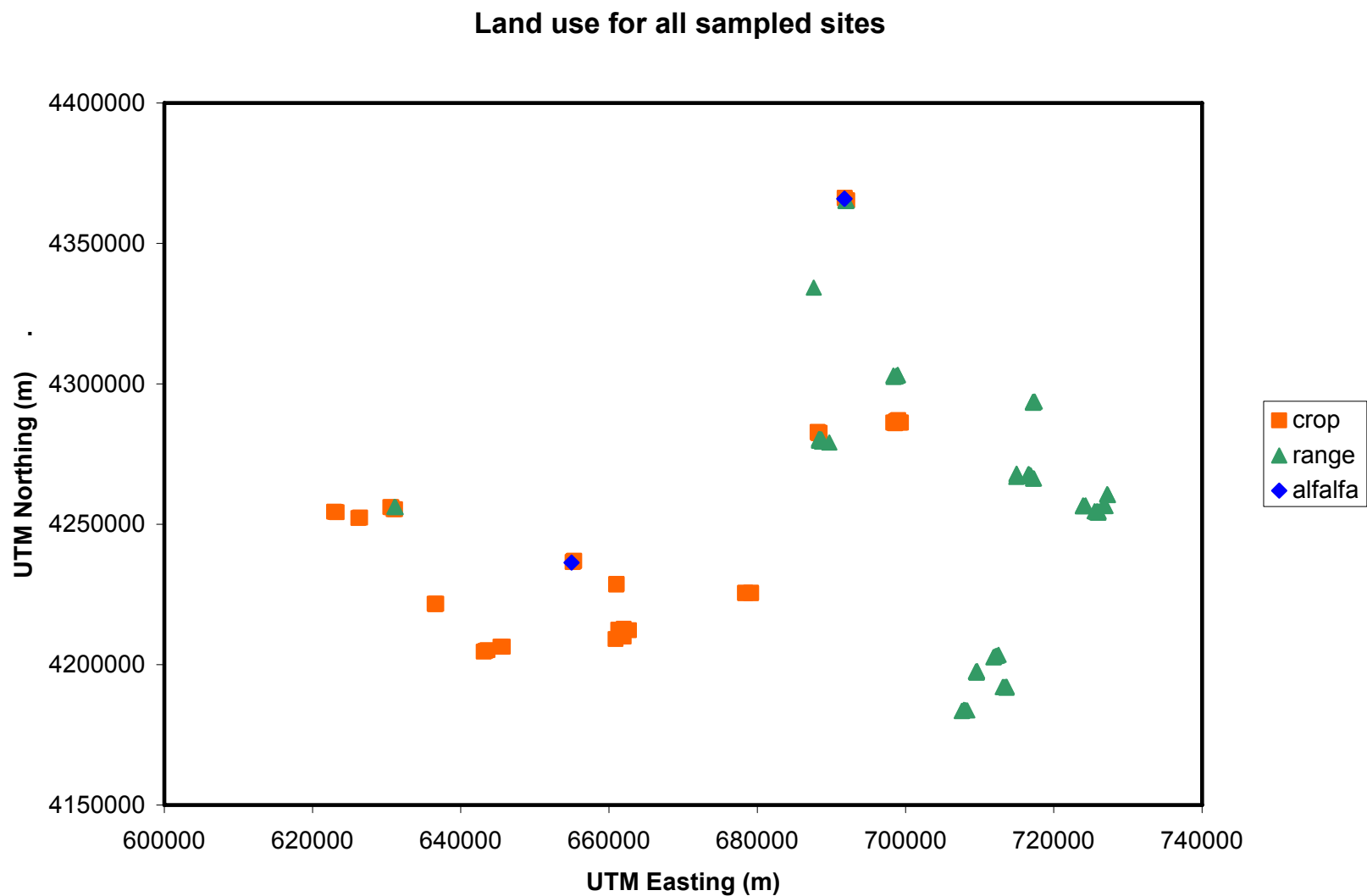


Figure 5.35. Frequency of Pachic conditions in the Ladysmith, Konza, Irwin, and Dwight series. Current land use is characterized as cultivated or rangeland. All current grass lands were grouped into the rangeland category.

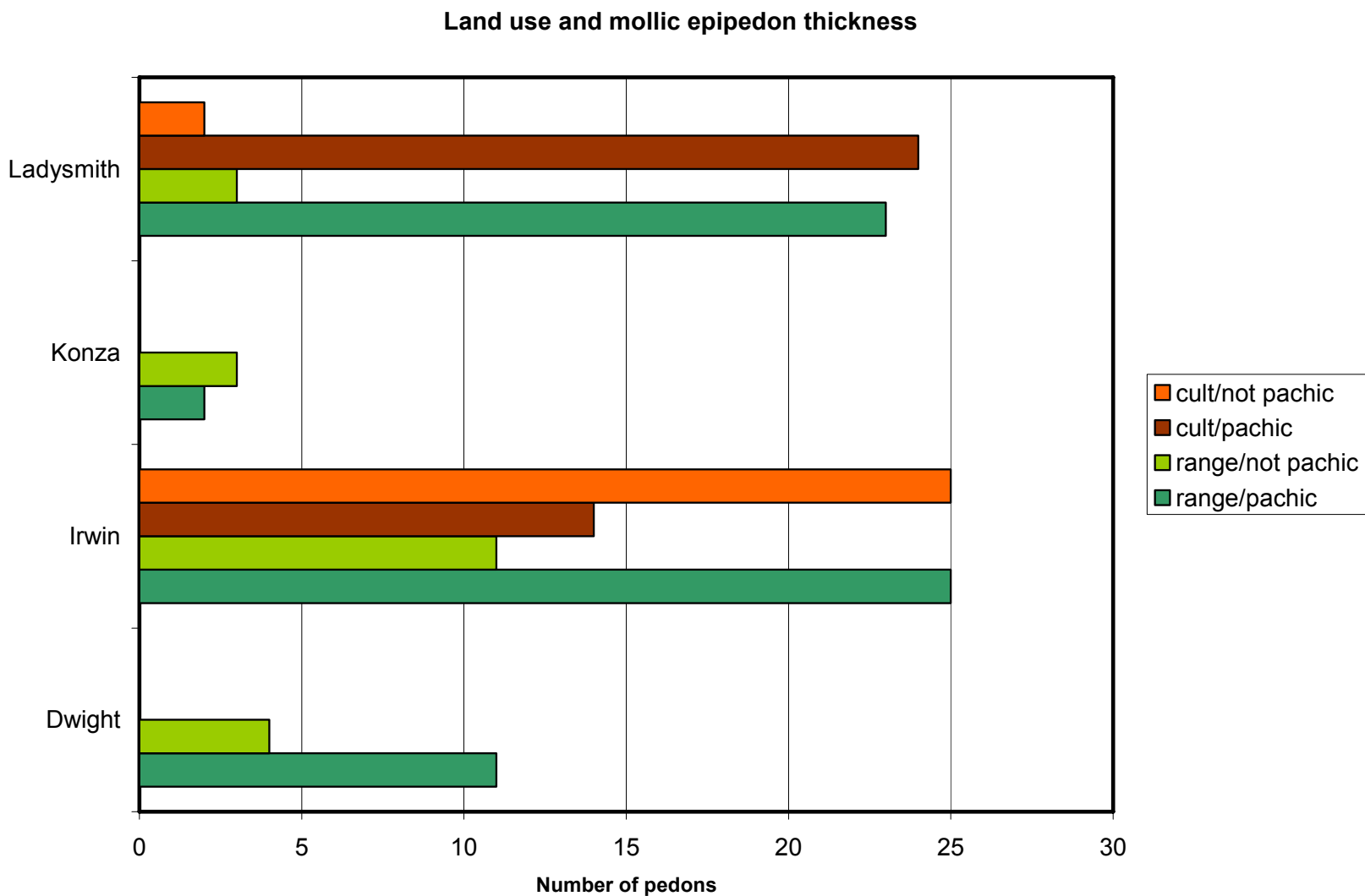


Figure 5.36. Total argillic horizon thickness plotted against geographic location (Universal Transverse Mercator Easting, Zone 14N).

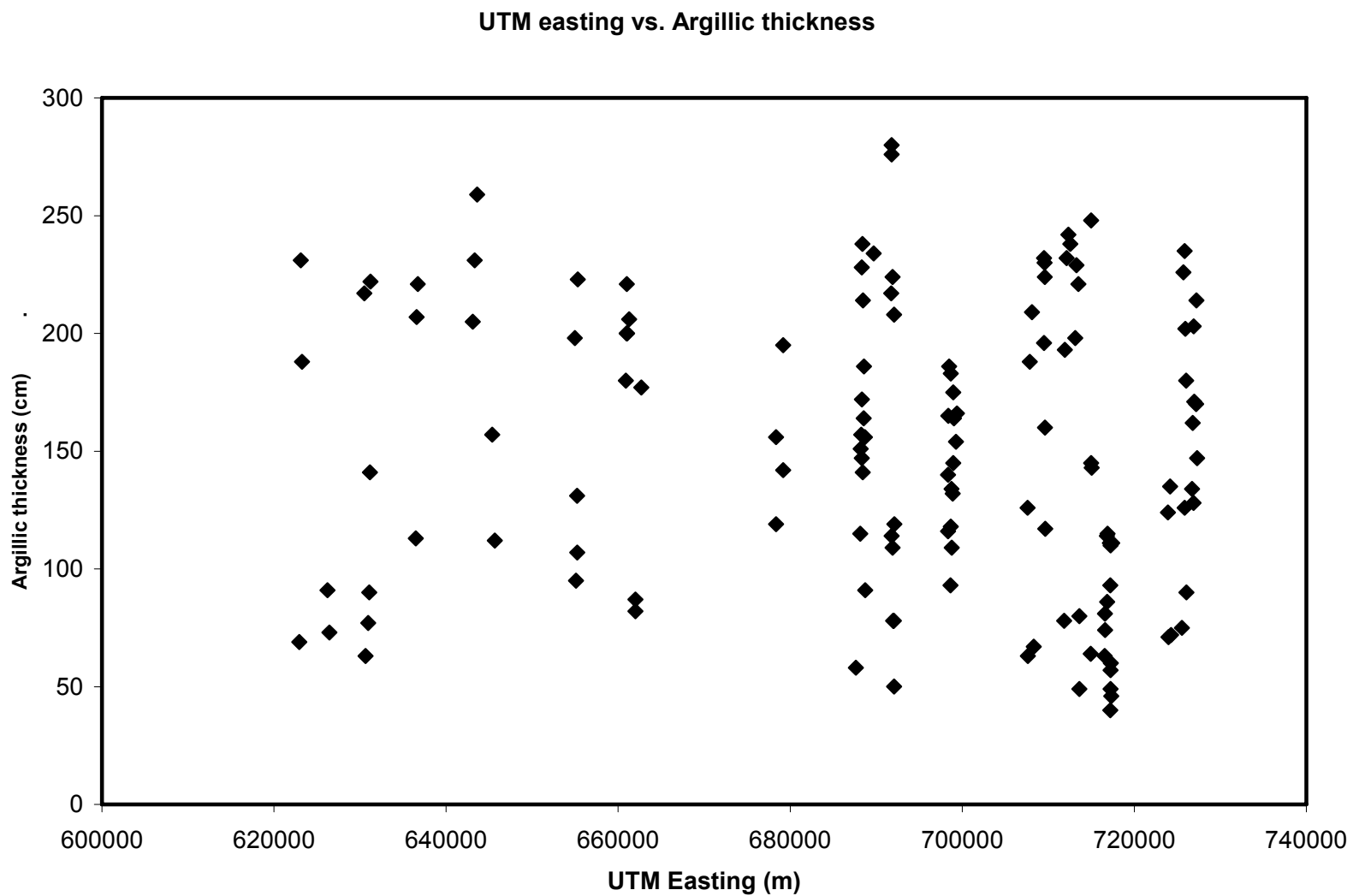


Figure 5.38. Total argillic horizon thickness (shown grouped by series) plotted against geographic location (Universal Transverse Mercator Easting, Zone 14N).

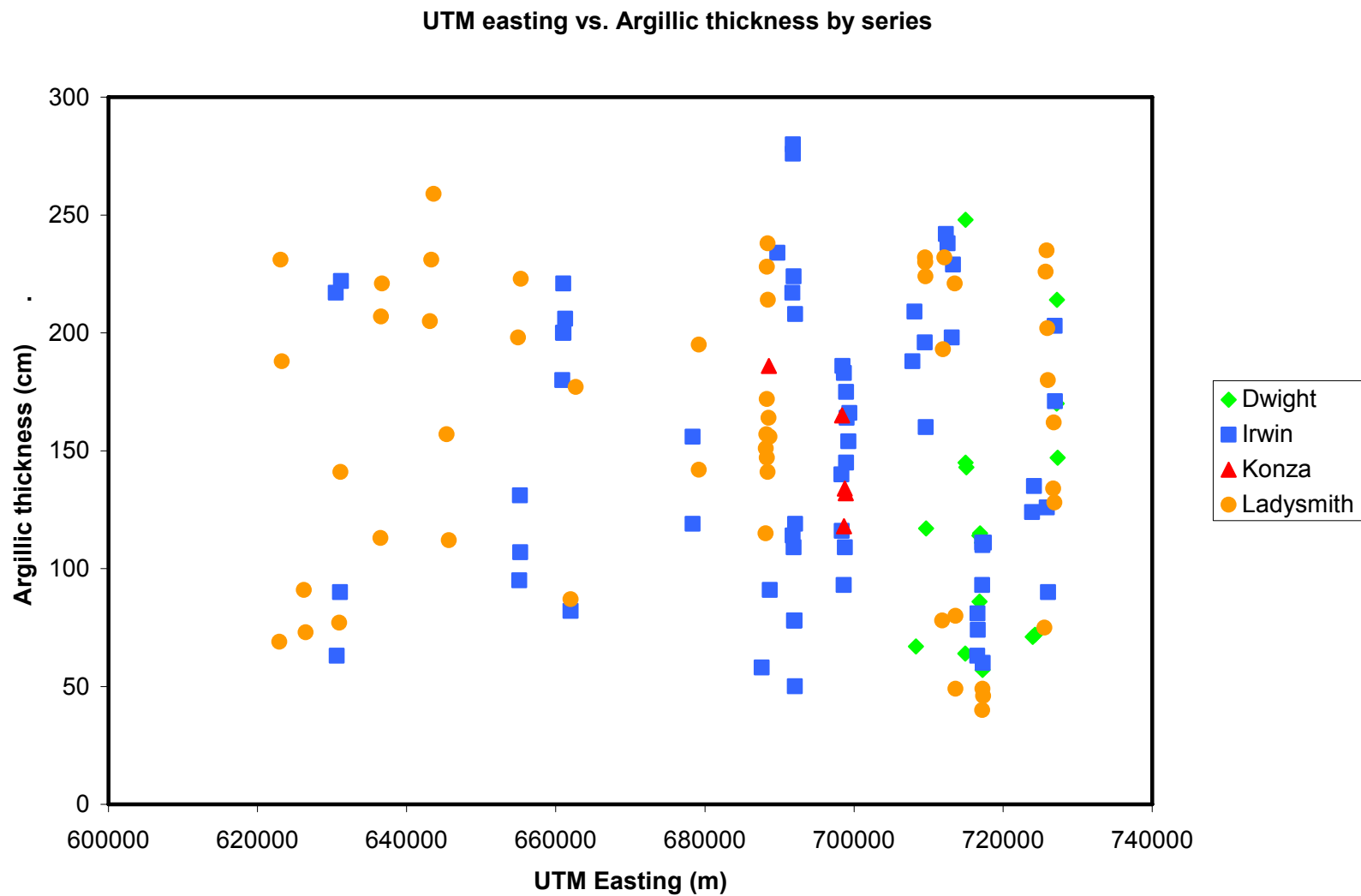


Figure 5.39. Total argillic horizon thickness (shown grouped by series) plotted against geographic location (Universal Transverse Mercator Northing, Zone 14N).

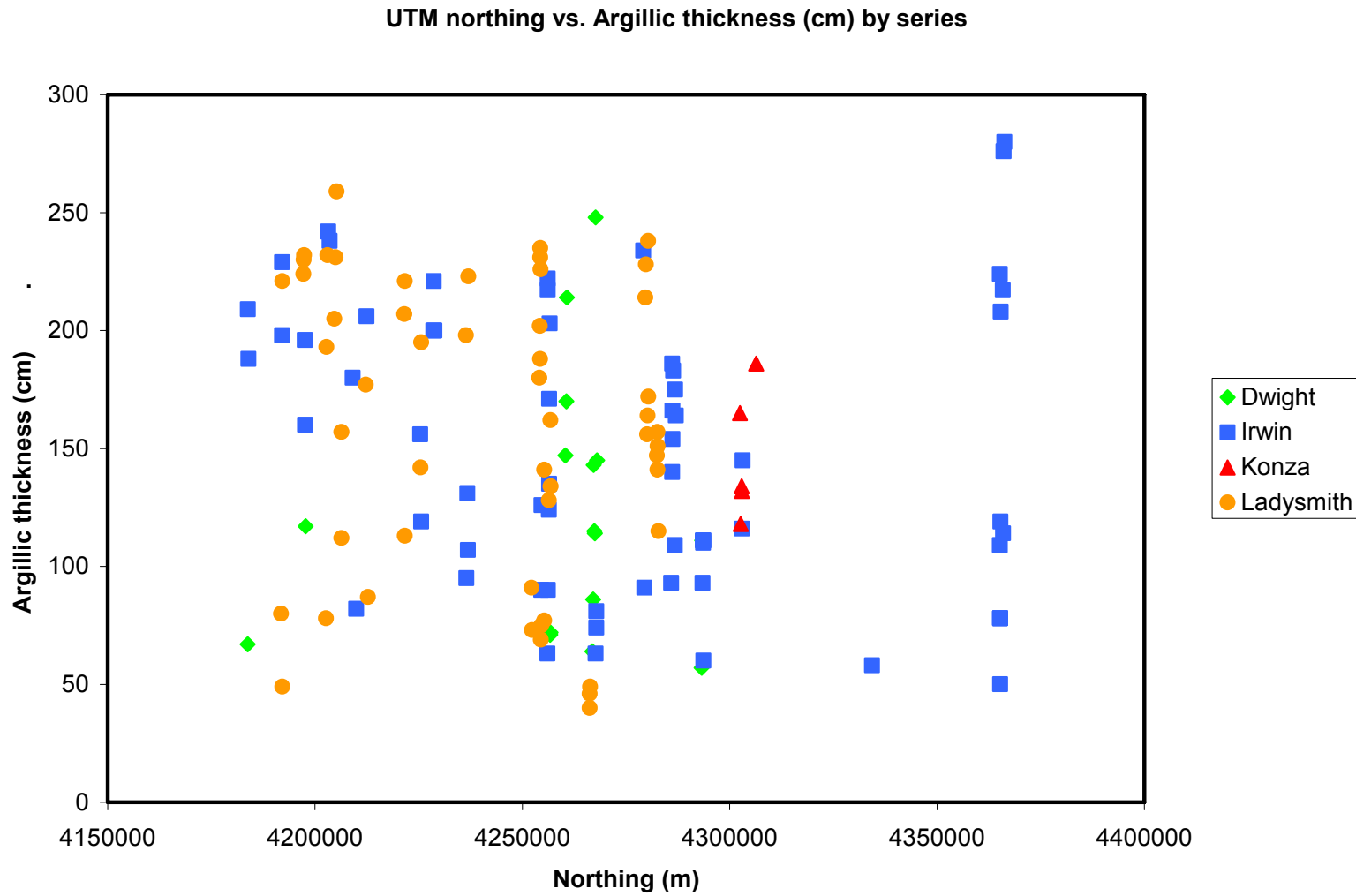


Figure 5.40. Depth to an abrupt textural change with respect to geographic position (Universal Transverse Mercator Easting, Zone 14N).

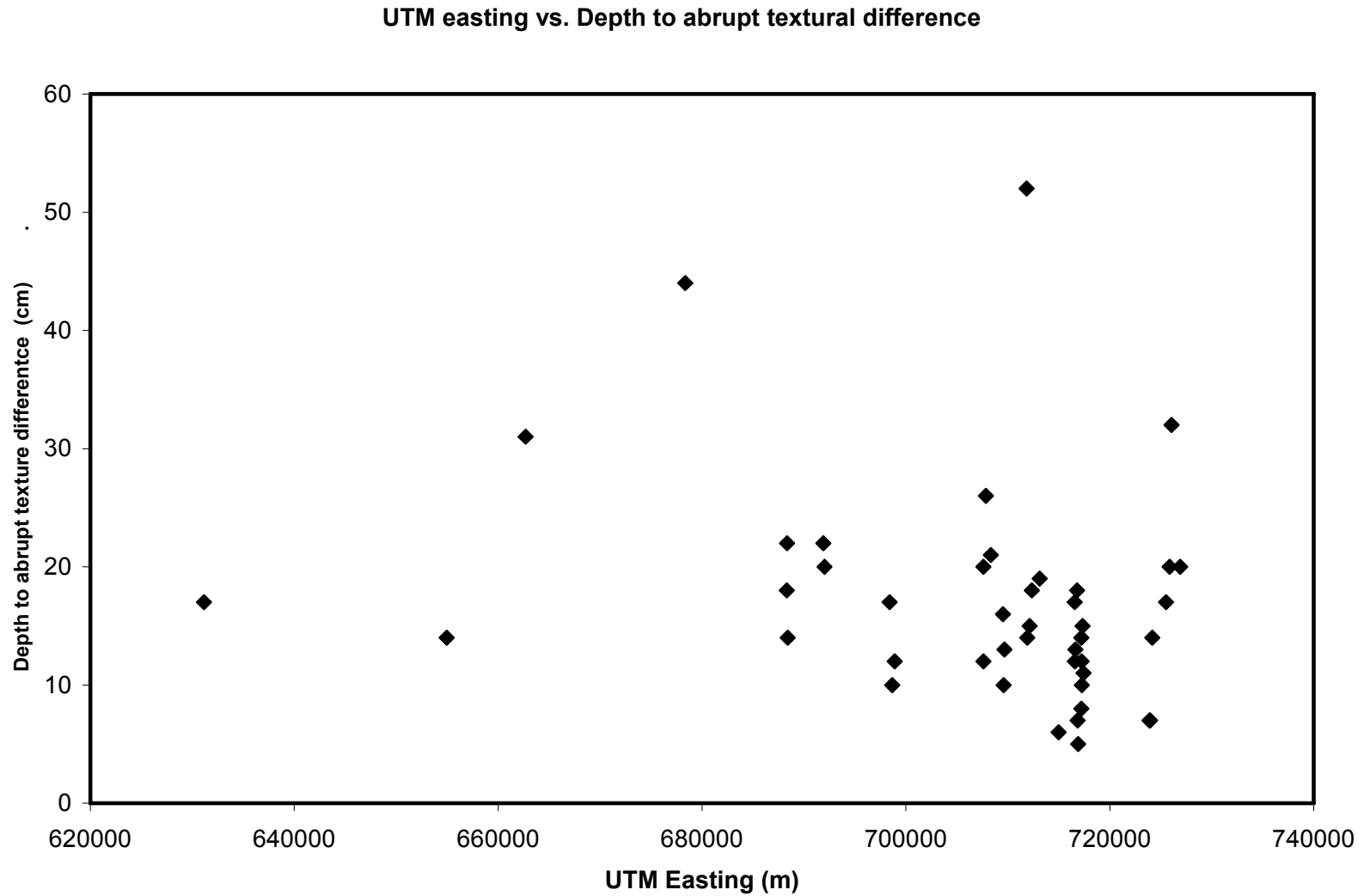


Figure 5.41. Depth to an abrupt textural change with respect to geographic position (Universal Transverse Mercator Northing, Zone 14N).

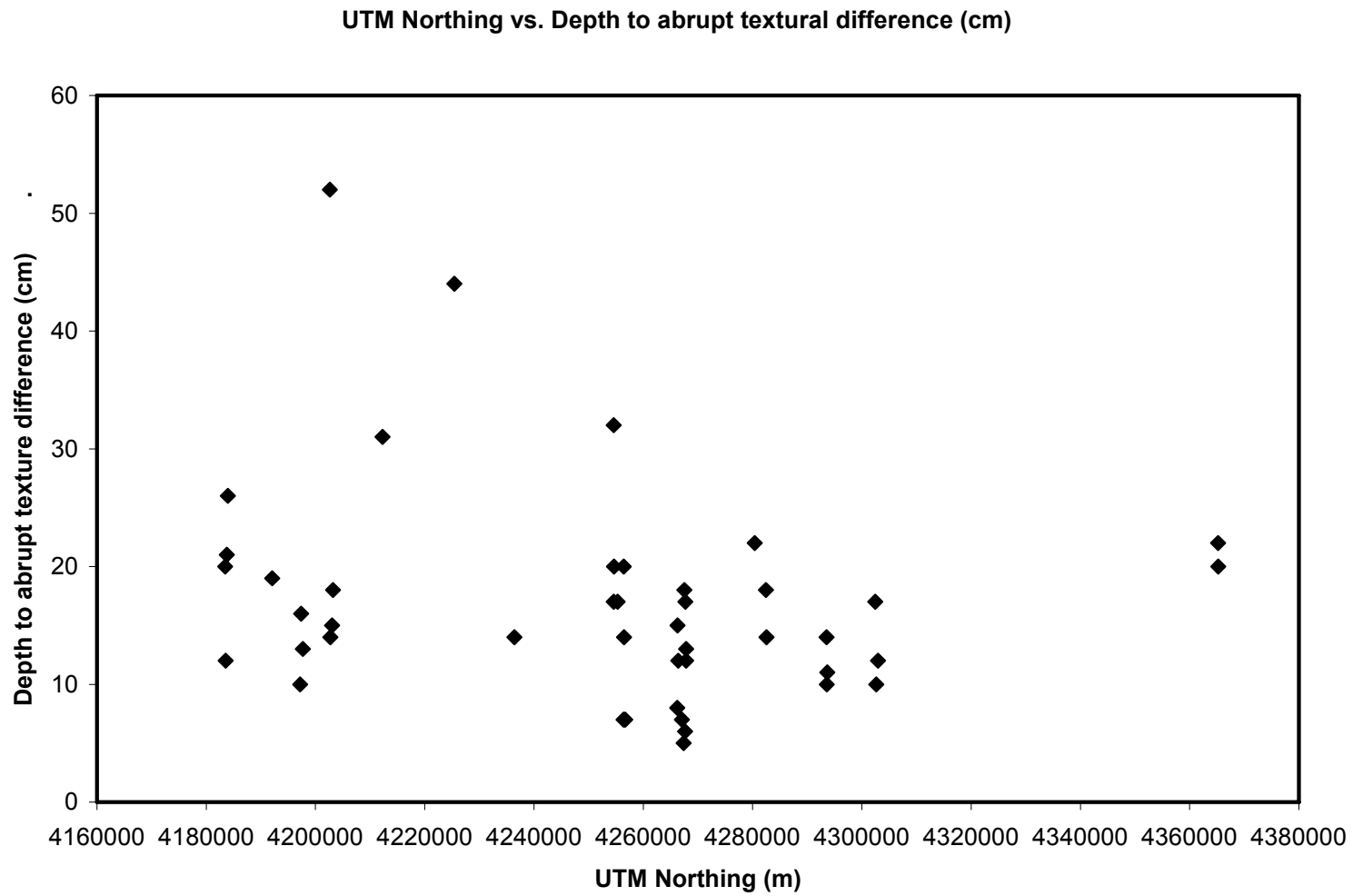


Figure 5.42. Depth to an abrupt textural change with respect to geographic position (Universal Transverse Mercator Easting, Zone 14N). Data is grouped by soil series.

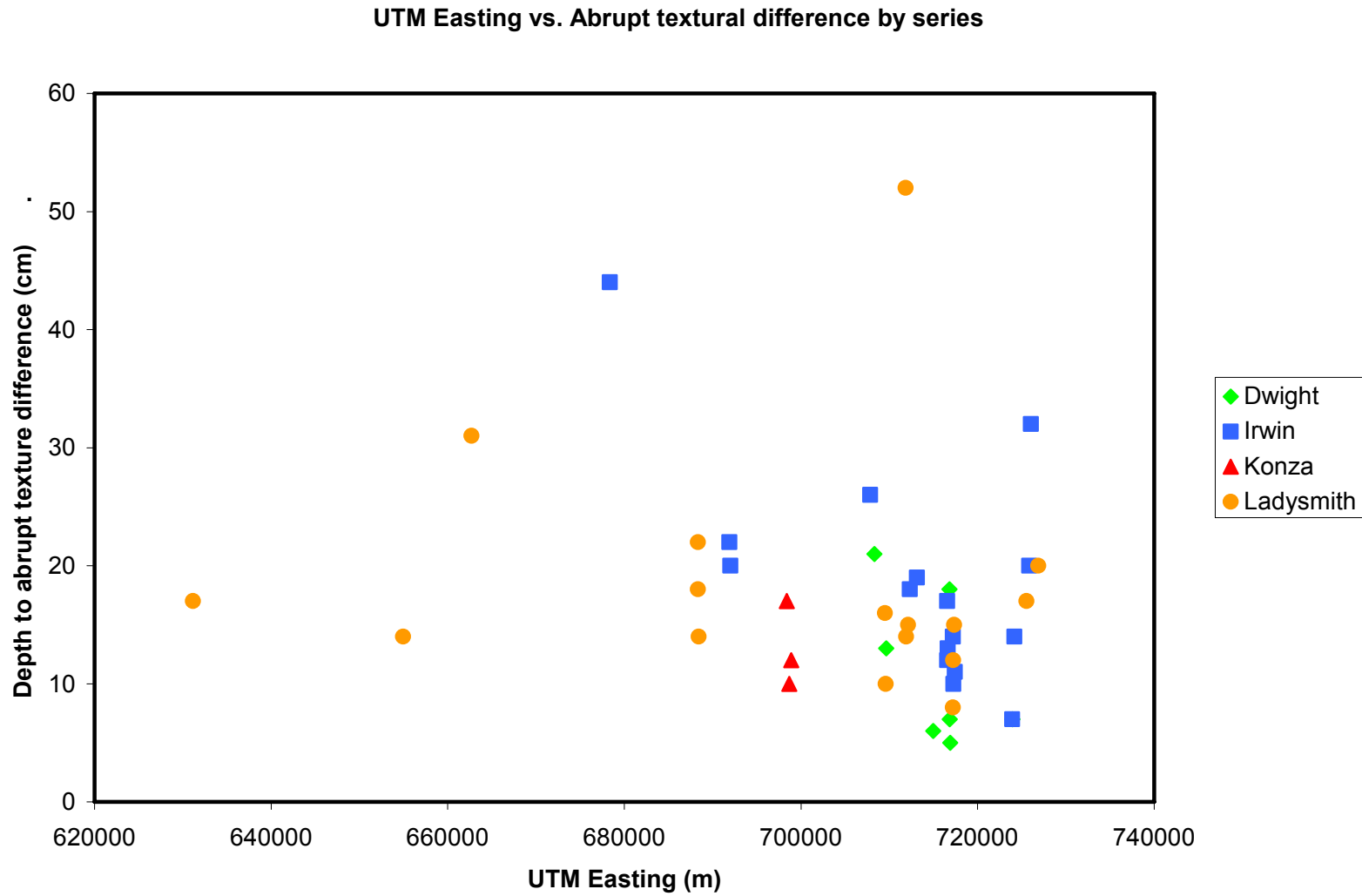


Figure 5.43. Depth to an abrupt textural change with respect to geographic position (Universal Transverse Mercator Northing, Zone 14N). Data is grouped by soil series.

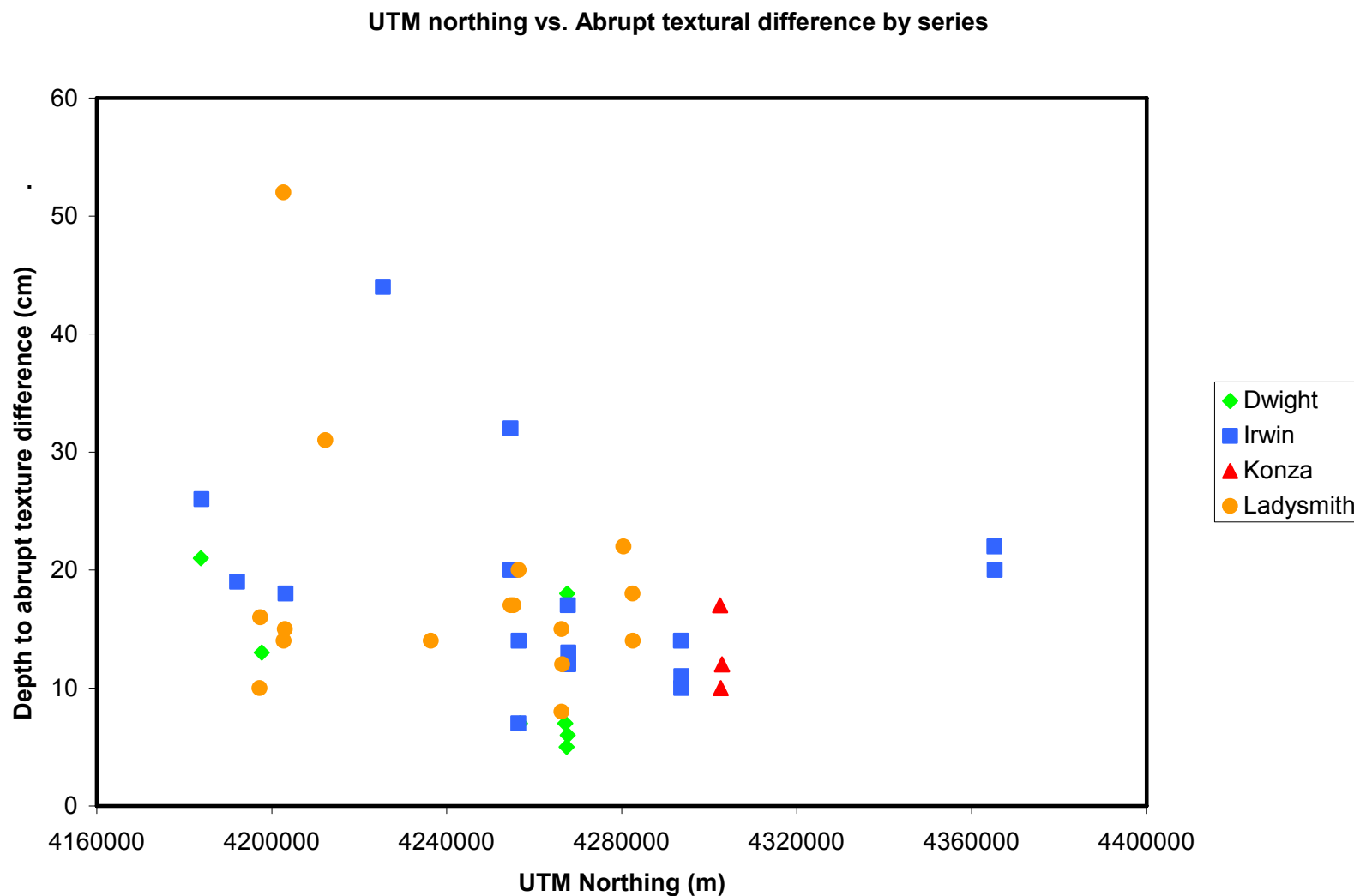


Figure 5.44. Particle size distribution for pedon 06KS161001.

06KS161001 Particle size distribution

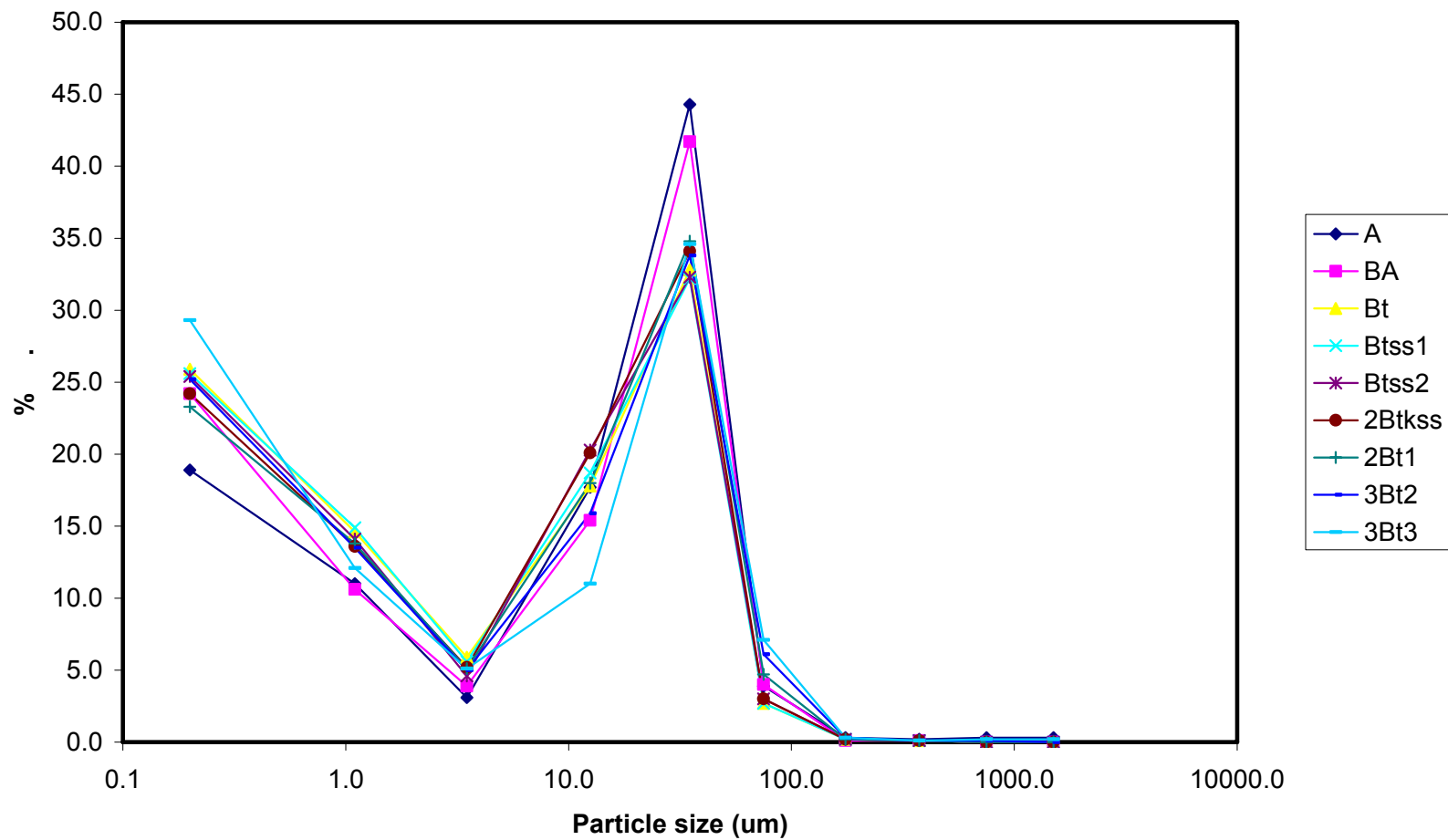


Figure 5.45. Depth to pedogenic carbonate accumulations and geographic location. Data is grouped for all series.

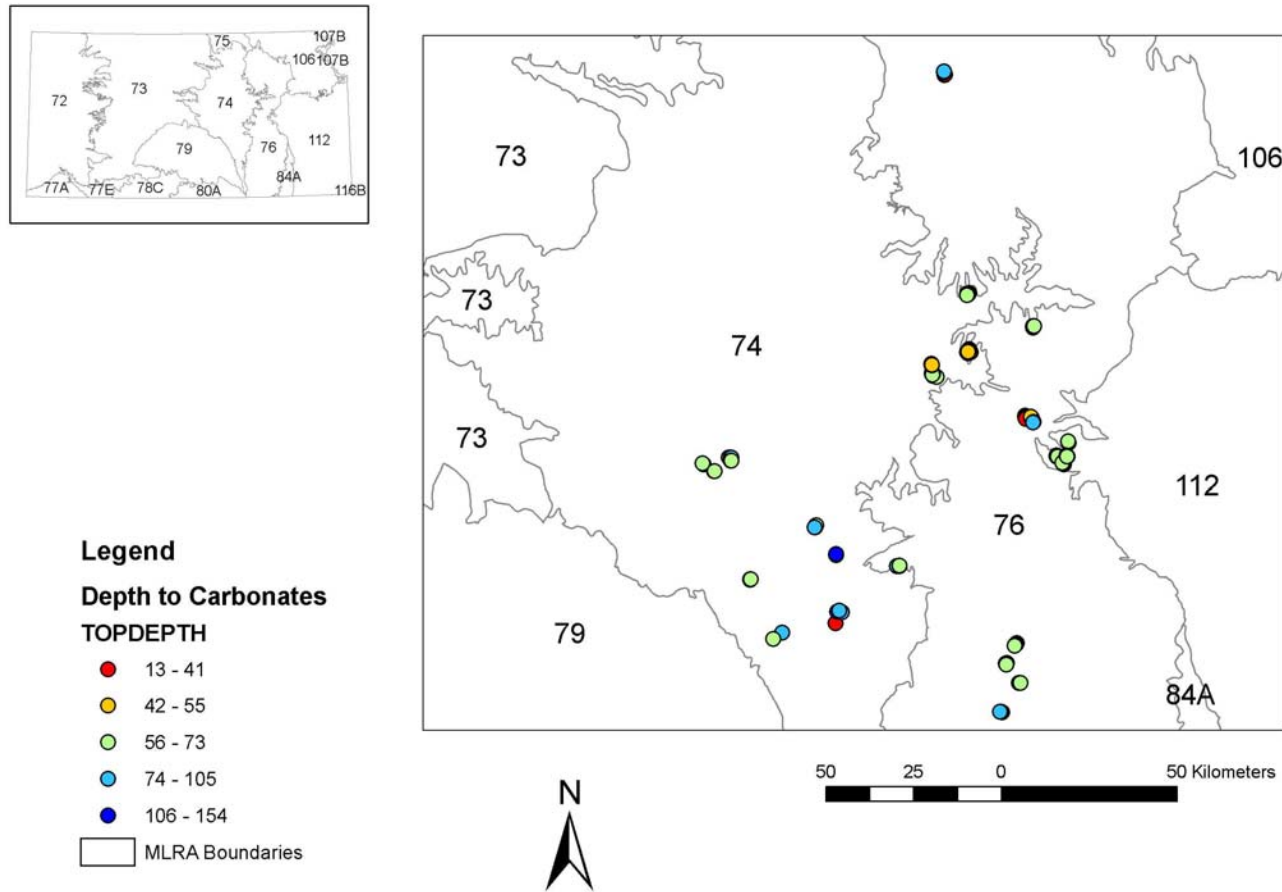


Figure 5.46. Geographic occurrence of gypsum in sampled pedons.

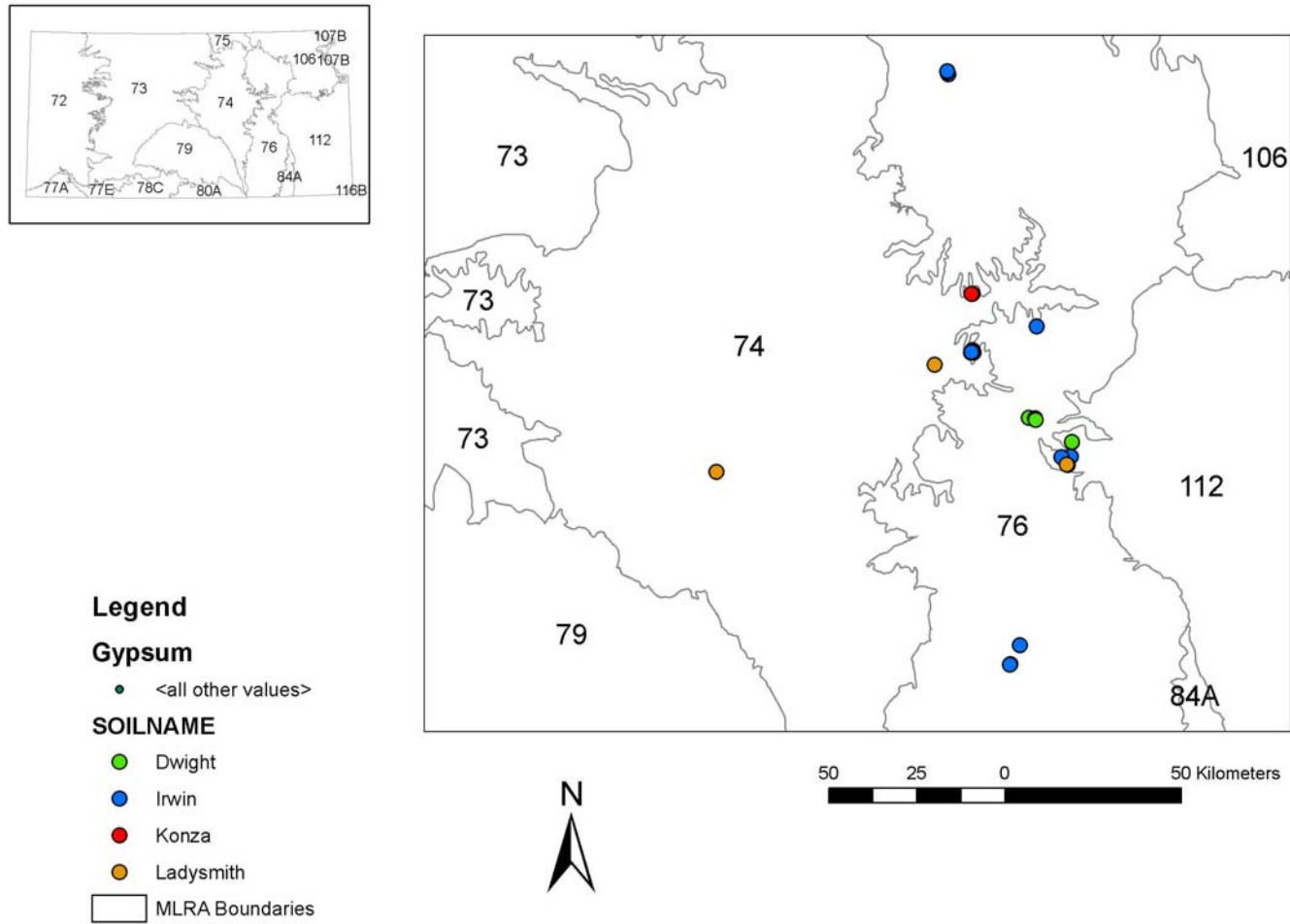
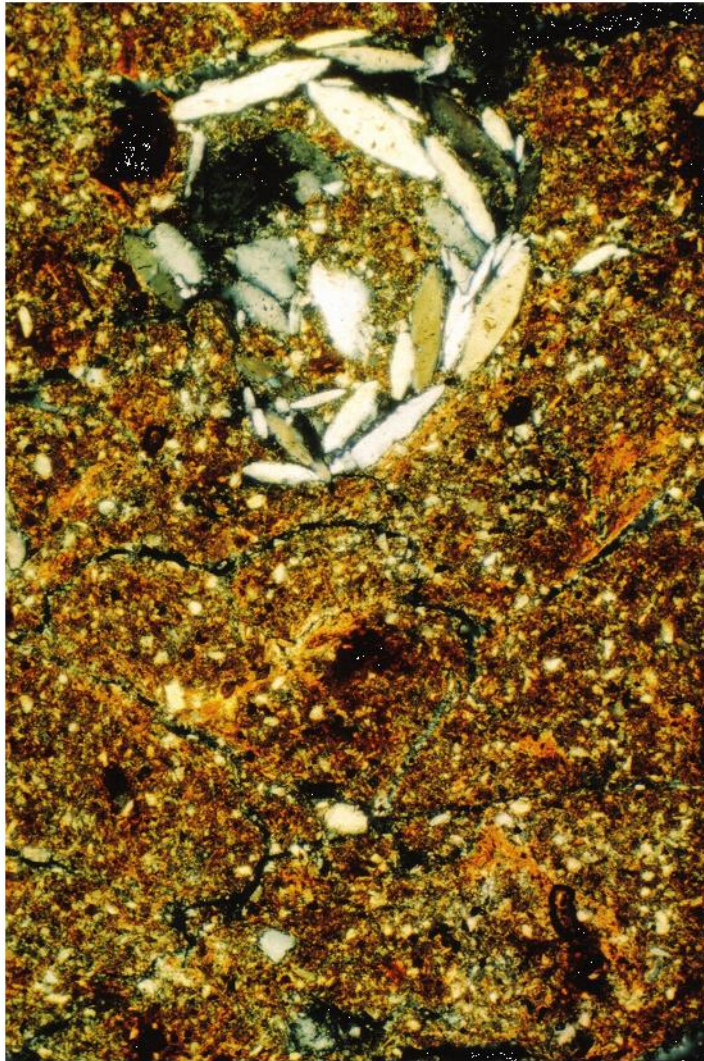


Figure 5.47. Thin section micrograph of the 2Btky horizon (107 – 124 cm) of pedon 05KS061001, an Irwin pedon sampled in Geary County. The oblong white grains are lenticular gypsum crystals, and they occur in a void with an approximate diameter of 1600 μm , equivalent to a very coarse sized sand particle.



200 μm



Figure 5.48. Geographic occurrence of slickensides in sampled pedons.

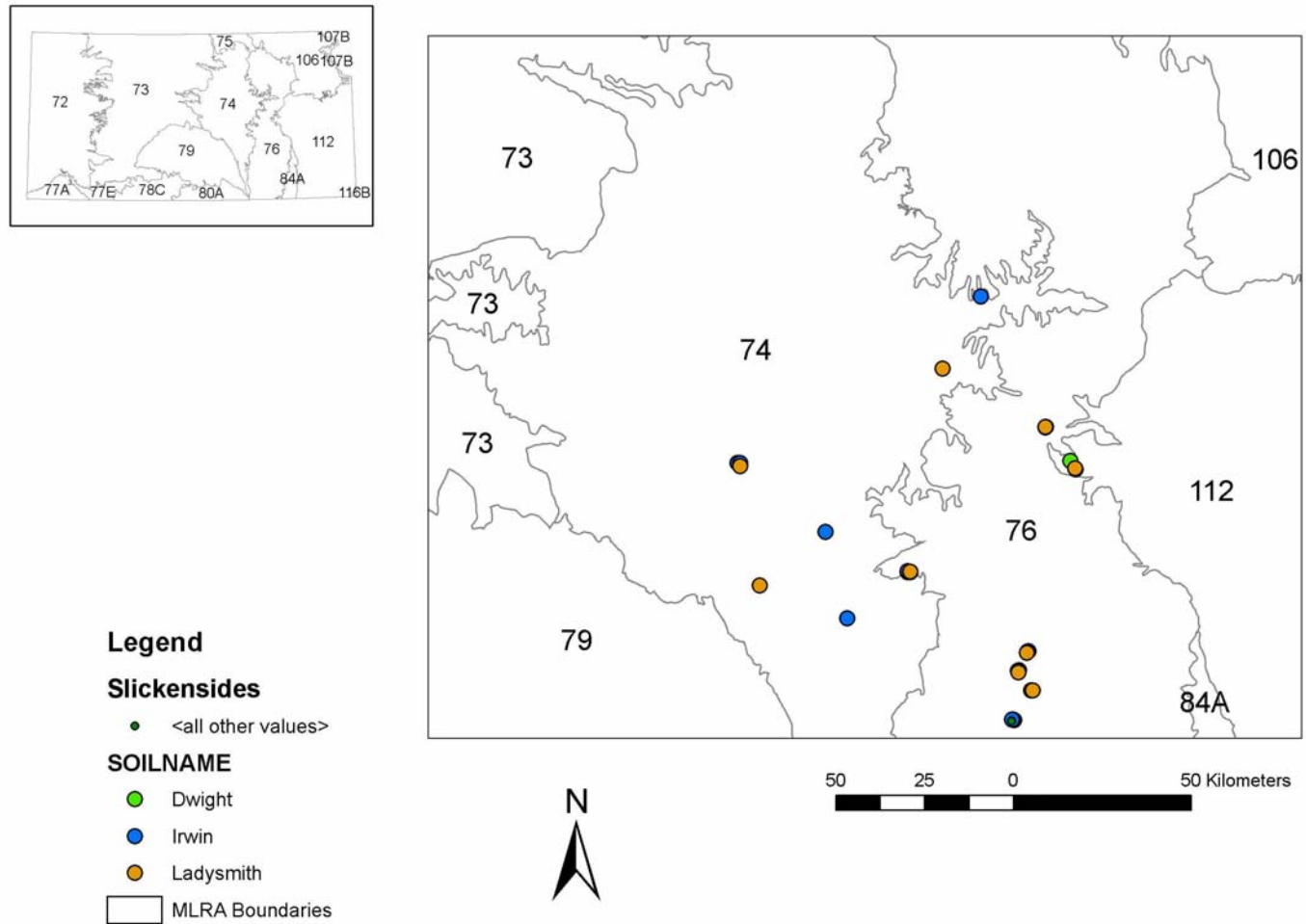


Figure 5.49. Geographic occurrence of redoximorphic depletions in sampled pedons.

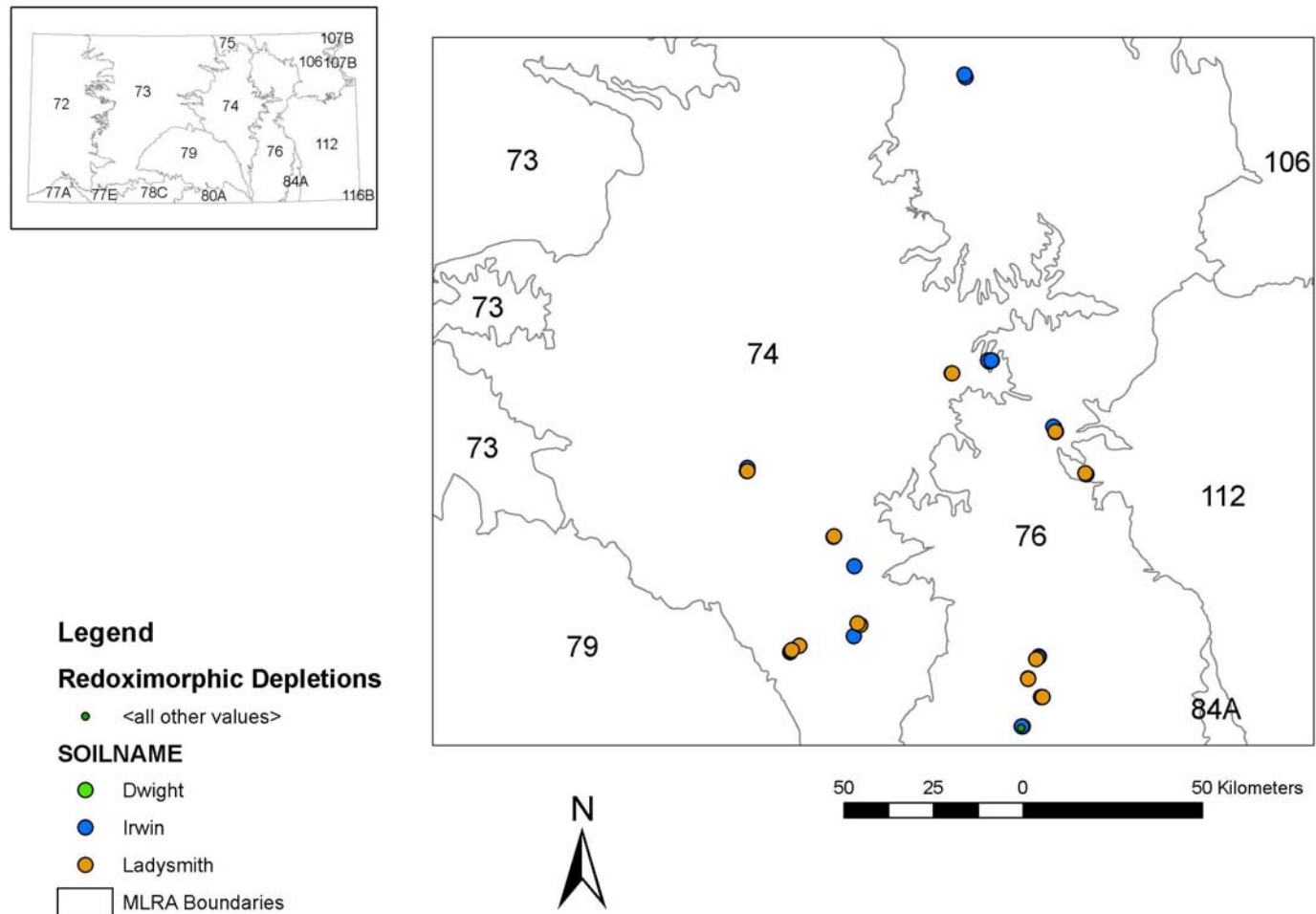


Figure 5.50. Taxonomic classification to the great group level for all 138 pedons sampled.

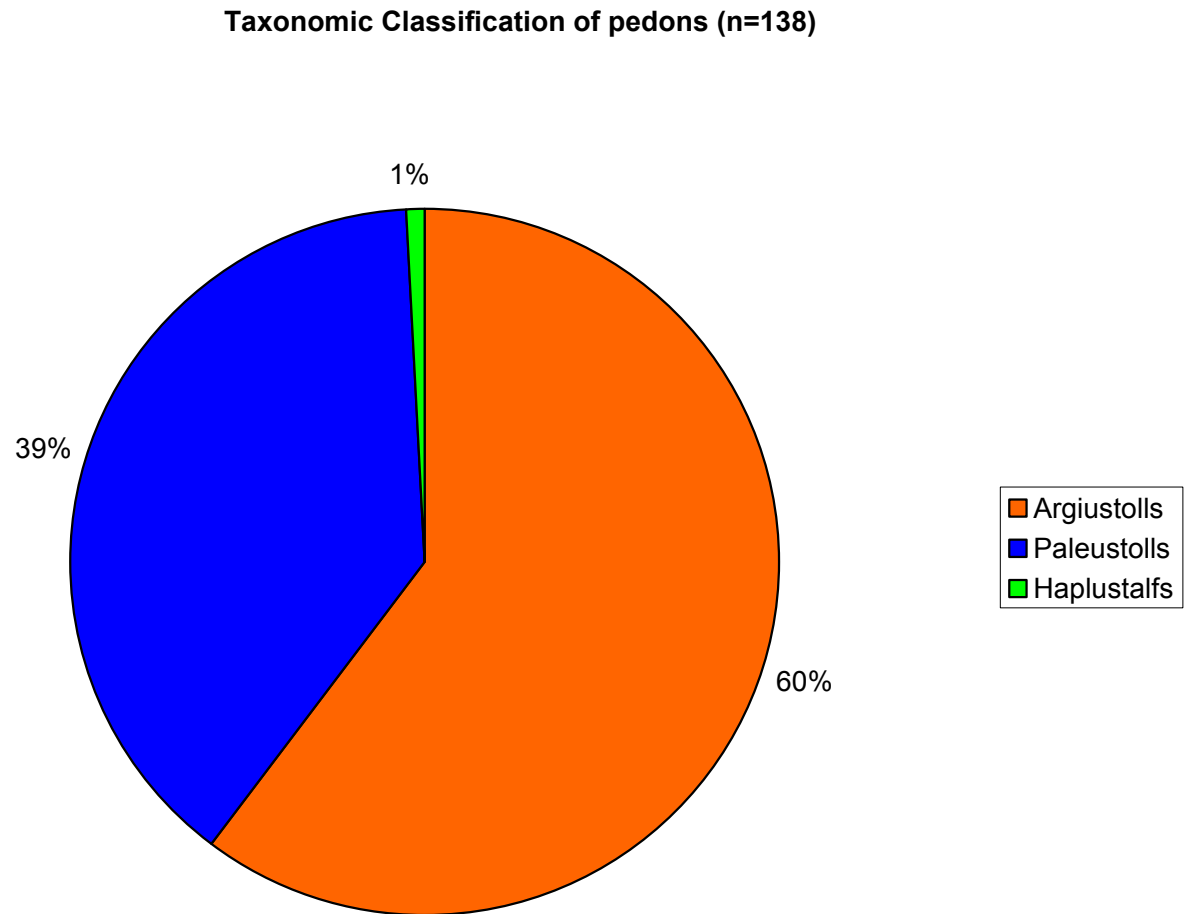


Figure 5.51. Great group classification of all 138 sampled pedons, categorized by the soil series name as sampled.

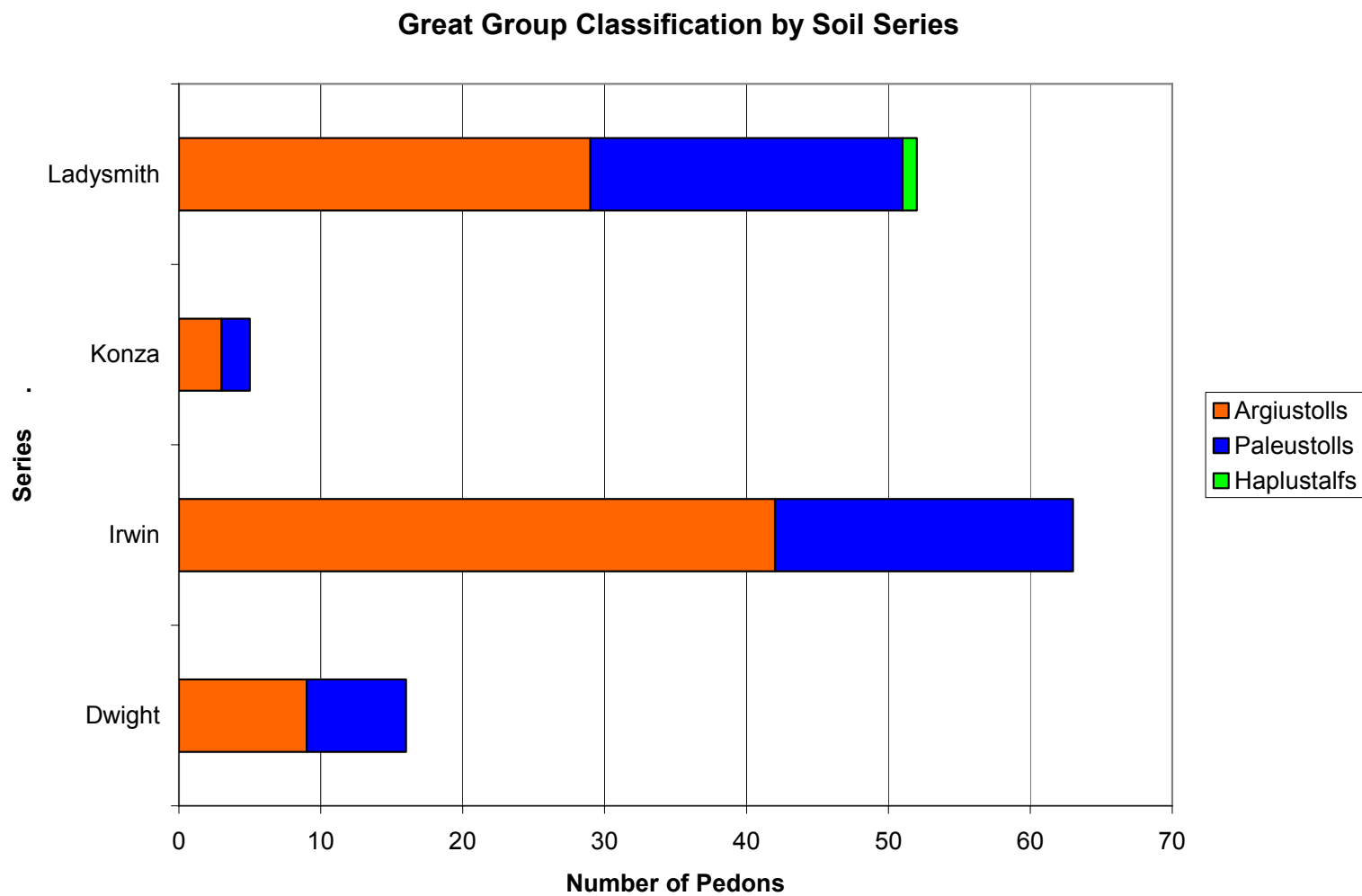


Table 5.1. Family classification of the soil series of interest.

Soil series	Family classification
Irwin	Fine, mixed, superactive mesic Pachic Argiustolls
Ladysmith	Fine, smectitic, mesic Udertic Argiustolls
Dwight	Fine, smectitic, mesic Typic Natrustolls
Konza	Fine, smectitic, mesic Udertic Paleustolls

Table 5.2. Occurrence of Irwin, Ladysmith, and Konza mapping units by Kansas county. Values in acres.

County	4670 Irwin 0-1%	4671 Irwin 1-3%	4672 Irwin 1- 3% eroded	4673 Irwin 3-7%	4674 Irwin 3- 7% eroded	3890 Ladysmith 0- 1%	3891 Ladysmith 1- 3%	3892 Ladysmith 1- 3% eroded	4735 Konza 1-3%
Butler	8444	182400		13852	20005	42307			
Chase		24753	8733	3344	3875	1766	3592	1063	
Comanche		45219							
Dickinson		132412		112087		735			226
Geary				17080		4968			27183
Greenwood		662	6						
Harvey		22964		2163	373	46805			
Lyon		770	174	94	29	45934	34480		
McPherson		17014		10		79774			
Marion		173547		11882		29749	85		
Marshall						67276			
Morris	6956	50233	50440	6701	2204	29851		4716	4545
Reno						836			
Riley		943		18928	28112				
Saline		11837		8829		12			
Sedgwick		39687		1225	1687	2753	195		
Sumner		2339				22			
Wabaunsee		48037		16968		13331	5		2219

Table 5.3. Occurrence of Dwight mapping units by Kansas county. Values in acres.

County	4600 Dwight 0-1%	4605 Dwight 1-3%	4620 Dwight 1-3% eroded	4625 Dwight- Irwin complex	4630 Dwight- Irwin complex eroded	4744 Labette- Dwight complex	8993 Zaar- Dwight complex	8699 Dennis- Dwight complex	7310 Martin- Dwight complex	8751 Eram- Dwight complex
Butler	97766		3870			102964				
Chase	630	20120				29108	5069			
Chautauqua						337		2348	13985	
Comanche	9405					32061				
Dickinson										
Elk	1111					11110				1814
Geary										
Greenwood	4301					31073				
Harvey										
Lyon						13785				
McPherson										
Marion	3490					13517				
Marshall										
Morris		17615				64143				
Riley				16845	13417					

CHAPTER 6 - General Conclusions

The Irwin, Konza, Dwight, and Ladysmith soils were studied in Major Land Resource Areas 76 and 74. In Chapter 3, it was determined that the soils are polygenetic, with up to four loess-derived units occurring in soils that have total solum thicknesses of < 3 m. The proposed stratigraphy is Holocene loess, over colluviated Peoria loess, over two units of colluviated Gilman Canyon Formation, a.k.a., Severance Formation.

At the Saffordville quadrangle study site discussed in Chapter 4, soils occurred on upland bedrock areas, as well as on flatter, Tertiary terraces of the Cottonwood River, as illustrated in the binary geologic model output. Mean CTI values were 3.89 and 4.37 for the Irwin and Ladysmith series, respectively, indicating that Ladysmith is on average mapped on topographically lower landscape positions than Irwin soils, although these values are not significantly different from each other. Both series were located on areas that spanned the scaled CTI range of values from 1 to 9, meaning that in this drainage area the soils were mapped on a wide range of slope positions. Polygenetic upland soils of east central Kansas have been formed through multiple and likely different sets of soil forming factors. Indeed, the lack of relationships between CTI, solum thickness, and mollic epipedon thickness, as well as the presence of two paleosols, are indicative of at least three periods of loess deposition and soil formation. The paleosols had ages indicative of either Gilman Canyon loess or Severance formation colluvium. The dates clustered in two age ranges, which were approximately 19,000 to 20,000 ¹⁴C yr BP and 22,500 to 24,500 ¹⁴C yr BP. The topography of the Saffordville quadrangle is likely a reflection of the paleotopography, later mantled by Wisconsin-aged loess and colluvium. Terrain analysis may not be a useful tool in soil survey updates for the loess-mantled landscapes of east central Kansas where polygenetic soils are common.

There are many conclusions from this study that the Kansas USDA-NRCS may use in future revisions of the soil mapping of MLRA 74 and 76. Some of the information

will be used to revise taxonomy, and some information highlights a geographic area where the properties of the pedons deviate substantially from the series concept.

Pedon properties

The particle size, mineralogy (of the Irwin series), and use and management were different for the Irwin and Ladysmith series that are mapped in the southwestern portion of the study area. Specifically, the mean particle size for the Irwin and Ladysmith series were much coarser west of 68000 meters E and south of 425600 meters N. In other words, all of the Ladysmith and Irwin pedons sampled in MLRA 74 had a coarser particle size than those mapped in MLRA 76. Also, the mineralogy of Irwin in MLRA 76 is smectitic, while the one Irwin pedon sampled in MLRA 74 has mixed mineralogy. The mineralogy family class needs to be reviewed, and more Irwin pedons must be sampled in MLRA 74, with one possible outcome being the creation of a new soil series.

The occurrence of pedogenic carbonate is very common, as it was observed in 80 to 90% of pedons sampled. Gypsum is less common, observed in only 20% of pedons. Sodium was present in many pedons, but only one pedon (out of 138 sampled) contained ESP levels high enough to meet the natric horizon criteria and express the natric horizon morphology, i.e., columnar structure. Slickensides were present in 20 to 30% of the pedons sampled, yet are not mentioned in any of the four official series descriptions, although Konza and Ladysmith are both in Udertic subgroups, meaning that the soils have high shrink-swell potential. The drainage class is overall poorest for Ladysmith, followed by the Irwin and Dwight soils, as indicated by the frequency of redoximorphic depletions and/or a reduced matrix color. All four of the soils of interest are either on average very deep or deep, and the values obtained in this study agree with the official series descriptions.

Taxonomic considerations

One important observation is that the Ladysmith series should be reclassified as belonging to the Pachic Udertic subgroup, as the Pachic criteria were met in 90% of Ladysmith pedons sampled. The Dwight series very rarely meets the natric criteria, despite the commonly observed short sparse vegetation. It seems that only soils

occurring in closed upland depressions will possibly meet this criterion. Perhaps the adoption of a paratatic diagnostic subsurface horizon would be used for landscapes with short vegetation and ESP values < 15%. The current distribution of the Dwight series (Natrustoll) is greatly over-mapped and should be addressed in future soil survey updates. Acres mapped as Dwight should be assessed for their similarity to either the Irwin or Konza series and re-mapped as such. The Konza series is a Paleustoll, and as they are presently defined in Soil Taxonomy, Paleustolls are probably more prevalent than previously expected, as 30% of all pedons sampled met the abrupt textural change criterion for this great group. However, the abrupt textural change criterion should be removed from the classification criteria for Paleustolls as it cannot be applied to cultivated and native soils equally, and may not result from pedogenic processes.

In conclusion, there are a number of improvements that can and should be made to the existing soil survey dataset for Kansas. As stated previously, there are an ever-increasing number of uses and users of soil survey information, and thus it becoming increasingly important that high-quality information is generated and provided by the responsible and knowledgeable soil scientists of Kansas.

Appendix A - Pedon Descriptions

Appendix A1. Pedon descriptions for sites discussed in Chapter 3.

Site 1

USDA - NATURAL RESOURCES CONSERVATION SERVICE Print Date: 12/01/2006

PEDON DESCRIPTION

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161005 Pedon ID: 05KS161005

Site Note:

Pedon Type: outside range of series
Pedon Purpose: research site
Taxon Kind: family

Location Information:

County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area: KS161 -- Riley County, Kansas
Map Unit: 4625 -- Dwight-Irwin complex, 1 to 3 percent slopes

Location Description: Site is located one mile south of the town of Randolph,
Kansas.

Legal Description: S 1/2 of NW 1/4 of Section 28, Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83

UTM Zone: 14, UTM Easting: 691894 meters, UTM Northing: 4365194 meters

Geomorphic Setting: on shoulder of interfluvium of upland

Upslope Shape: linear Cross Slope Shape: convex

Slope: 2.0 percent Aspect: 338 (deg)

Elevation: 1293 feet, 394.0 meters

Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover

Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
calcareous shale residuum

Bedrock Depth: 96.9 inches (246.0 cm)

Particle Size Control Section: 8.7 to 28.3 in. (22 to 72 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	31.5	0	80
Argillic horizon	8.7	96.9	22	246
Abrupt textural change	8.7	9.8	22	25
Redox concentrations	16.1	96.9	41	246
Secondary carbonates	31.5	45.7	80	116
Paralithic contact	96.9		246	

Pedon Notes:

Mineralogy data for this pedon is available from the Kansas State University Soil Characterization Laboratory. Smectite dominates the clay mineral fraction from 0 to 116 cm, which was interpreted to be loess-derived. From 116 to 246 cm the dominant clay minerals are kaolinite, clay mica, and to a lesser degree, smectite. For the upper 116 cm, the mineralogy class is smectite, and for the material from 116 to 246 cm the mineralogy class is mixed.

This pedon was originally called Konza because of the apparent abrupt textural change in the field estimated textures and clay contents. Upon review of particle size analysis data, the clay contents were 42, 53, 49, 43, 41, 49, 45, and 43 % for the A, Bt1, Bt2, Btk, 2Bt1, 2Bt2, 3Bt3, 3Bt4 horizons, respectively. The texture for the entire profile is silty clay.

This pedon just barely misses the Paleustoll criteria for clay contents (with increasing depth, no decrease of more than 20% relative from the maximum clay content...). Also, this profile lacks the abrupt textural change criterion because the clay content starts out so high, much higher than was hand textured.

White, non calcareous masses were observed in the 2Bt1, 2Bt2, and 3Bt3 horizons. Under a microscope at 40x magnification, these masses appeared white and crystalline. More lab work is needed to identify the presence of gypsum. For now, the "y" subscript will not be added to the horizon designations.

A--0 to 9 inches, (0 to 22 cm); very dark gray (10YR 3/1) exterior, silty clay loam, black (10YR 2/1) rubbed, moist; 3 percent sand; 30 percent clay; moderate medium granular structure; friable, slightly hard, moderately sticky, moderately plastic; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--9 to 16 inches, (22 to 41 cm);, silty clay, very dark grayish brown (10YR 3/2) exterior, moist; 3 percent sand; 50 percent clay; moderate medium granular and weak fine subangular blocky structure; very firm, very hard, very sticky, very plastic; many fine roots throughout; many fine dendritic tubular pores; 2 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--16 to 31 inches, (41 to 80 cm);, silty clay, dark brown (10YR 3/3) exterior, moist; 3 percent sand; 46 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; common very fine roots between peds; common fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--31 to 46 inches, (80 to 116 cm);, silty clay loam, brown (10YR 4/3) exterior, moist;

3 percent sand; 36 percent clay; moderate fine prismatic structure; firm, moderately hard, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 10 percent fine black (N 2.5/0), moist, iron-manganese nodules; 1 percent fine distinct spherical carbonate nodules between peds and 1 percent fine faint carbonate masses on faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt1--46 to 69 inches, (116 to 175 cm);, silty clay loam, dark brown (7.5YR 3/3) exterior, moist; 3 percent sand; 36 percent clay; moderate medium subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine faint gypsum masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--69 to 81 inches, (175 to 207 cm);, silty clay loam, dark brown (7.5YR 3/4) exterior, moist; 3 percent sand; 36 percent clay; moderate medium subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; few very fine roots between peds; many fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron in matrix and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules in matrix; 2 percent fine faint gypsum masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt3--81 to 92 inches, (207 to 234 cm);, silty clay, reddish brown (5YR 4/4) exterior, moist; 3 percent sand; 41 percent clay; moderate fine prismatic structure; friable, slightly hard, moderately sticky, moderately plastic; common fine irregular pores; 1 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent fine faint gypsum masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt4--92 to 97 inches, (234 to 246 cm);, silty clay loam, brown (7.5YR 4/4) exterior, moist; 3 percent sand; 34 percent clay; moderate fine prismatic structure; friable, slightly hard, very sticky, very plastic; common fine irregular pores; 2 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 1 percent fine distinct light olive brown (2.5Y 5/3), moist, clay depletions and 2 percent fine distinct iron-manganese nodules and 15 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--97 to 100 inches, (246 to 255 cm); ; strong effervescence, by HCl, 1 normal.

Site 2

USDA - NATURAL RESOURCES CONSERVATION SERVICE Print Date: 12/01/2006
PEDON DESCRIPTION

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated: Irwin
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/06/2006
Describer: P.Abel/D.Presley

Site ID: 06KS161001-pla Pedon ID: 06KS161001

Site Note:

Pedon Type: outside range of series
Pedon Purpose: full pedon description
Taxon Kind: series

Location Information:

County: Riley Quad Sheet Name:
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area: KS161 -- Riley County, Kansas
Map Unit: 4625 -- Dwight-Irwin complex, 1 to 3 percent slopes

Location Description:

Legal Description: SW 1/4 of Section 36, Township 10S, Range 5E

Latitude: 39 degrees 8 minutes 15.87 seconds north
Longitude: 96 degrees 49 minutes 45.17 seconds east

Datum: NAD83
UTM Zone: 14, UTM Easting: 687619 meters, UTM Northing: 4334307 meters

Geomorphic Setting: on backslope of side slope of upland
Upslope Shape: linear Cross Slope Shape: linear
Slope: 2.0 percent Aspect: 180 (deg)
Elevation: feet, meters
Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over clayey pedisegment

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	14.2	0	36
Argillic horizon	7.9	30.7	20	78
Lithologic discontinuity	26.0		66	
Paralithic contact	70.1		178	

Pedon Notes:

A--0 to 5 inches, (0 to 13 cm);, silty clay loam, black (10YR 2/1) exterior, moist; 32 percent clay; weak fine granular structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent; clear smooth boundary.

BA--5 to 8 inches, (13 to 20 cm);, silty clay loam, very dark gray (10YR 3/1) exterior, moist; 38 percent clay; moderate fine subangular blocky structure; firm, moderately hard, moderately sticky, moderately plastic; common fine and medium roots throughout; common fine irregular pores; noneffervescent; abrupt smooth boundary.

Bt--8 to 14 inches, (20 to 36 cm);, silty clay, dark brown (10YR 3/3) exterior, moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; very firm, very hard, very sticky, very plastic; common fine and medium roots throughout; few fine irregular pores; 50 percent continuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine prominent irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; noneffervescent; 10yr 3/1 surface fill in vertical cracks.; gradual wavy boundary.

Btss1--14 to 21 inches, (36 to 53 cm);, silty clay, 40 percent dark brown (10YR 3/3) exterior and 60 percent brown (10YR 4/3) exterior, moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine and medium roots throughout; few fine irregular pores; 15 percent discontinuous very dark grayish brown (10YR 3/2), moist, slickensides (pedogenic) on vertical faces of peds and 40 percent continuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine prominent irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; noneffervescent; 10yr 3/1 surface fill in vertical cracks.; gradual wavy boundary.

Btss2--21 to 26 inches, (53 to 66 cm);, silty clay, brown (10YR 4/3) exterior, moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine and medium roots throughout; few fine irregular pores; 10 percent discontinuous very dark grayish brown (10YR 3/2), moist, slickensides (pedogenic) on vertical faces of peds and 30 percent continuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine iron-manganese concretions throughout and 5 percent fine prominent irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; noneffervescent; 10yr 3/1 surface fill in vertical cracks.; gradual wavy boundary.

2Btkss--26 to 31 inches, (66 to 79 cm);, silty clay, brown (7.5YR 4/2) exterior, moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine and medium roots throughout; few fine irregular pores; 10 percent discontinuous very dark grayish brown (10YR 3/2), moist, slickensides (pedogenic) on vertical faces of peds and 20 percent discontinuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine iron-manganese concretions throughout and 10 percent fine irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; 1 percent fine irregular carbonate concretions throughout; 2 percent nonflat angular 5 to 20 millimeter limestone fragments; noneffervescent; gradual wavy boundary.

2Bt1--31 to 41 inches, (79 to 104 cm);, silty clay, brown (7.5YR 4/3) exterior, moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine and medium roots throughout; few fine irregular pores; 20 percent discontinuous very dark grayish brown (10YR 3/2), moist,

clay films on all faces of peds; 3 percent fine iron-manganese concretions throughout and 10 percent fine irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; 2 percent nonflat angular 5 to 20 millimeter limestone fragments; noneffervescent; gradual wavy boundary.

3Bt2--41 to 52 inches, (104 to 132 cm);, clay, dark brown (7.5YR 3/3) exterior, moist; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 25 percent discontinuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine iron-manganese concretions throughout and 15 percent fine irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; 2 percent nonflat angular 5 to 20 millimeter limestone fragments; noneffervescent; gradual wavy boundary.

3Bt3--52 to 70 inches, (132 to 178 cm);, clay, dark brown (7.5YR 3/3) exterior, moist; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 15 percent discontinuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine iron-manganese concretions throughout and 15 percent fine irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; 3 percent nonflat angular 5 to 20 millimeter limestone fragments; noneffervescent; abrupt smooth boundary.

4Cr--70 to 73 inches, (178 to 185 cm); ; weathered shale.

Site 3

USDA - NATURAL RESOURCES CONSERVATION SERVICE Print Date: 12/01/2006
PEDON DESCRIPTION

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated: Irwin
Classification: Fine, mixed, superactive, mesic Pachic Argiustolls

Description Date: 04/14/2005
Describer: P. Abel, J. McDowell, T. Robertson, C. Watts, J. Warner, C.
Remley, W. Wehmuller, D. Presley

Site ID: 05KS061001 Pedon ID: 05KS061001

Site Note:

Type location for the Irwin series, located in well managed native prairie.
Sampling party includes Pat Abel, Chad Remley, John Warner, Cleveland
Watts, Jim McDowell, Tony Robertson, Bill Wehmuller, P. Schoeneberger,
DeAnn Presley(KSU).

Large diameter cores (25 cm) from three horizons were collected adjacent
to the pit by Gerard Kluitenberg (professor KSU) and graduate students to
study hydraulic conductivity under an agreement with NRCS.

Lab Pedon #: 05N0660 Lab Source ID: SSL

Pedon Type: typical pedon for series
Pedon Purpose: full pedon description
Taxon Kind: series

Location Information:

County: Geary Quad Sheet Name: Wreford, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area: KS061 -- Geary County, Kansas
Map Unit: Id -- IRWIN SILTY CLAY LOAM, 3 TO 7 PERCENT SLOPES
4673 -- Irwin silty clay loam, 3 to 7 percent slopes

Location Description: About 8 miles south and 1 mile east of Junction City,
Kansas.

Legal Description: 2380 feet east and 500 feet north of the southwest
corner of Section 25, Township 13S, Range 5E

Latitude: 38 degrees 53 minutes 9.00 seconds north
Longitude: 96 degrees 49 minutes 34.00 seconds west

Datum: NAD83
UTM Zone: 14, UTM Easting: 688564 meters, UTM Northing: 4306355 meters

Physiographic Division: Interior Plains
Physiographic Province: Central Lowland Province
Physiographic Section: Osage Plain
State Physiographic Area: Flint Hills Upland

Geomorphic Setting: on backslope of side slope of hillslope on upland
Upslope Shape: convex Cross Slope Shape: convex

Slope: 3.0 percent Aspect: 10 (deg)
 Elevation: 1339 feet, 408.0 meters
 Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: loess derived from mixed over pedisegment derived
 from mixed over residuum weathered from calcareous
 shale

Particle Size Control Section: 11.8 to 31.5 in. (30 to 80 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	22.8	0	58
Argillic horizon	11.8	68.9	30	175
Slickensides	22.8	31.1	58	79
Secondary carbonates	31.1	48.8	79	124

Pedon Notes:

This pedon sampled in same general area as 88KS061004. The previous sample was described and collected during the update of the Geary County, Kansas, Soil Survey. 88KS061004 was submitted to the Kansas State University Pedology Laboratory.

There was much discussion about the lowest horizon and whether it was a C or Cr horizon. Because it was not indurated and likely would slake after drying and resubmersion in water it was considered a C horizon.

It was generally agreed the upper part of the pedon formed in material with a strong loess influence. There was much discussion about the second material and whether it should be colluvium, slope alluvium, pedisegment, hillslope sediment, or residuum. It was generally agreed that it is material weathered from the underlying geologic materials and has been reworked and moving across the geomorphic surface.

After laboratory characterization, it seems that this pedon should be reclassified as a fine, smectitic, mesic Pachic Paleustoll. The great group should be revised due to the abrupt textural change between the A2 and Bt1 horizons. Also, the 'y' subscript should be added to the (current) Btk2 horizon, due to the observation of lenticular gypsum crystals in thin section. (This change would also affect the nomenclature of the Btk1 horizon, in that the 1 should be removed). These changes are pending approval by the Kansas USDA-NRCS.

A1--0 to 4 inches, (0 to 10 cm);, silt loam, black (10YR 2/1), moist; 28 percent clay; moderate fine and medium granular structure; friable, slightly hard, slightly sticky, slightly plastic; many fine and medium roots throughout; noneffervescent, by HCl, 1 normal; clear smooth boundary. Lab sample # 05N03581

A2--4 to 12 inches, (10 to 30 cm);, silty clay loam, very dark gray (10YR 3/1), moist; 30 percent clay; moderate fine and medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; many fine roots throughout; noneffervescent, by HCl, 1 normal; abrupt smooth boundary. Lab sample # 05N03582

Bt1--12 to 23 inches, (30 to 58 cm);, silty clay, very dark grayish brown (10YR 3/2) crushed and very dark brown (10YR 2/2), moist; 50 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; firm, hard, moderately sticky, moderately plastic; many very fine and fine roots throughout; 2 percent discontinuous distinct organic stains on faces of peds and 15 percent continuous faint very dark grayish brown (10YR 3/2), moist, clay films on faces of peds; noneffervescent, by HCl, 1 normal; this horizon was very moist with water glistening on some ped faces; gradual wavy boundary. Lab sample # 05N03583

Bt2--23 to 31 inches, (58 to 79 cm);, silty clay, brown (10YR 4/3), moist; 46 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; many very fine roots between peds; 5 percent distinct slickensides (pedogenic) and 30 percent continuous distinct very dark grayish brown (10YR 3/2), moist, clay films on faces of peds; noneffervescent, by HCl, 1 normal; gradual wavy boundary. Lab sample # 05N03584

Btk1--31 to 42 inches, (79 to 107 cm);, silty clay, dark yellowish brown (10YR 4/4), moist; 41 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; common very fine roots throughout; 35 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on faces of peds; 3 percent coarse spherical weakly cemented carbonate masses with clear boundaries in matrix; noneffervescent, by HCl, 1 normal; gradual wavy boundary. Lab sample # 05N03585

Btk2--42 to 49 inches, (107 to 124 cm);, silty clay, dark yellowish brown (10YR 4/4), moist; 40 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; common fine roots throughout; 15 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on faces of peds; 3 percent coarse spherical weakly cemented carbonate masses with clear boundaries in matrix; noneffervescent, by HCl, 1 normal; gradual wavy boundary. Lab sample # 05N03586

2Bt3--49 to 61 inches, (124 to 155 cm);, silty clay loam, dark brown (7.5YR 3/4), moist; 38 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; firm, hard, moderately sticky, moderately plastic; common fine roots throughout; 25 percent discontinuous distinct dark brown (7.5YR 3/3), moist, clay films on faces of peds; 2 percent fine distinct spherical moderately cemented black (10YR 2/1), moist, manganese masses with clear boundaries in matrix; noneffervescent, by HCl, 1 normal; clear wavy boundary. Lab sample # 05N03587

2Bt4--61 to 69 inches, (155 to 175 cm);, silty clay loam, 30 percent dark grayish brown (10YR 4/2) and 70 percent brown (7.5YR 4/4), moist; 38 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; firm, hard, moderately sticky, moderately plastic; common fine roots throughout; 15 percent discontinuous distinct dark brown (7.5YR 3/3), moist, clay films on faces of peds; 2 percent fine distinct spherical moderately cemented black (10YR 2/1), moist, manganese masses with clear boundaries in matrix and 10 percent fine and medium distinct irregular very weakly cemented strong brown (7.5YR 4/6), moist, and strong brown (7.5YR 5/6), moist, masses of oxidized iron with diffuse boundaries infused into matrix along faces of peds; 1 percent nonflat subangular weakly cemented 2 to 20 millimeter noncalcareous shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary. Lab sample # 05N03588

3C--69 to 84 inches, (175 to 213 cm);, silt loam, 20 percent brownish yellow (10YR 6/6) and 80 percent light gray (10YR 7/2), moist; 27 percent clay; ; firm, slightly hard, slightly sticky, slightly plastic; strong effervescence, by HCl, 1 normal; this horizon appears to be highly weathered, calcareous shale that is not indurated enough to meet the definition of paralithic contact, there is some weak platy rock structure related to the

shale visible in some spots, other areas appear massive, there are a few old root channels and pores that have extremely thin, very patchy clay films, there are also a few highly weathered chert fragments 20-75 mm in diameter that are moderately indurated. Lab sample # 05N03589

Site 4a

USDA - NATURAL RESOURCES CONSERVATION SERVICE Print Date: 12/01/2006
PEDON DESCRIPTION

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 09/02/2005
Describer: DeAnn Presley

Site ID: 05KS127008 Pedon ID: 05KS127008

Site Note:
Site was tilled in the past. Terraces present. Site was plowed and reseeded to big bluestem, indian grass, and switchgrass in 1981. Prairie hay is mowed once per year in July.

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Wilsey Se, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Nine miles south of Council Grove on Highway 177.
Legal Description: NW 1/4 of Section 33, Township 17S, Range 8E
Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 714975 meters, UTM Northing: 4267642 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 1.0 percent Aspect: (deg)
Elevation: 1480 feet, 451.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over colluvium
Bedrock Depth: 102.4 inches (260.0 cm)

Particle Size Control Section: 4.7 to 24.4 in. (12 to 62 cm)

Diagnostic Features:
| Top Bottom Top Bottom |

Kind	Depth (in)	Depth (in)	Depth (cm)	Depth (cm)
Mollic epipedon	0.0	25.2	0	64
Abrupt textural change	2.4	2.8	6	7
Argillic horizon	4.7	102.4	12	260
Redox concentrations	15.7	102.4	40	260
Secondary carbonates	25.2	39.0	64	99
Lithologic discontinuity	39.0	63.4	99	161
Gypsum accumulations	39.0	63.4	99	161
Lithologic discontinuity	63.4	102.4	161	260
Lithologic discontinuity	102.4		260	
Paralithic contact	102.4		260	

Pedon Notes:

Ap--0 to 5 inches, (0 to 12 cm);, silt loam, very dark grayish brown (10YR 3/2) rubbed, moist; 25 percent clay; moderate fine granular parting to moderate medium granular structure; friable; many fine roots throughout; common fine dendritic tubular pores; abrupt smooth boundary.

Bt1--5 to 16 inches, (12 to 40 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; firm; common fine roots throughout; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; clear smooth boundary.

Bt2--16 to 25 inches, (40 to 64 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds and common fine roots throughout; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; clear smooth boundary.

Btk--25 to 39 inches, (64 to 99 cm);, silty clay loam, dark grayish brown (10YR 4/2) broken face, moist; 35 percent clay; moderate medium subangular blocky structure; firm; few fine roots between peds; few fine irregular pores; 1 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 25 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 5 percent carbonate, finely disseminated; clear smooth boundary.

2Bty1--39 to 52 inches, (99 to 132 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 32 percent clay; moderate medium subangular blocky structure; friable; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct iron-manganese masses and 25 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 10 percent gypsum masses; clear smooth boundary.

2Bty2--52 to 63 inches, (132 to 161 cm);, silty clay loam, reddish brown (5YR 4/3) broken face, moist; 34 percent clay; moderate medium subangular blocky structure; friable; common fine irregular pores; 5 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct iron-manganese masses and 25 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 5 percent gypsum masses; clear smooth boundary.

3Bt1--63 to 78 inches, (161 to 198 cm);, silty clay, dark reddish brown (5YR 3/4) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 10 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct iron-manganese masses and 10 percent fine distinct reddish brown (5YR 4/4), moist, masses of oxidized iron; 1 percent chert

fragments; clear smooth boundary.

3Bt2--78 to 90 inches, (198 to 228 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 20 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine faint yellowish red (5YR 5/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent chert fragments; clear smooth boundary.

3Bt3--90 to 102 inches, (228 to 260 cm);, silty clay, strong brown (7.5YR 4/6) broken face, moist; 45 percent clay; moderate medium prismatic structure; firm; few fine irregular pores; 10 percent continuous faint reddish brown (5YR 4/3), moist, clay films on all faces of peds; 5 percent fine faint masses of oxidized iron and 10 percent fine distinct iron-manganese masses; 10 percent limestone fragments; clear smooth boundary.

4Cr--102 to 106 inches, (260 to 270 cm); ; limestone fragments.

Site 4b

USDA - NATURAL RESOURCES CONSERVATION SERVICE Print Date: 01/30/2007

PEDON DESCRIPTION

Soil Name as Described/Sampled: Irwin

Soil Name as Correlated:

Classification: Fine, smectitic, mesic Typic Natrustolls

Description Date: 07/27/2006

Describer: DeAnn Presley

Site ID: 06KS127001

Pedon ID: 06KS127001

Site Note:

Pedon Type:

Pedon Purpose: research site

Taxon Kind:

Location Information:

County: Morris

Quad Sheet Name: Wilsey Se, Kansas

State: Kansas

MLRA: 76 -- Bluestem Hills

Soil Survey Area:

Map Unit: --

Location Description:

Legal Description: of Section 34, Township 17S, Range 8E

Latitude: degrees minutes seconds

Longitude: degrees minutes seconds

Datum: NAD83

UTM Zone: 14, UTM Easting: 716622 meters, UTM Northing: 4267819 meters

Geomorphic Setting: on summit of interfluvium of None Assigned

Upslope Shape: concave Cross Slope Shape: concave

Slope: 0.0 percent Aspect: (deg)

Elevation: 1483 feet, 452.0 meters

Drainage class:

Primary Earth Cover: Grass/herbaceous cover

Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum

weathered from limestone

Particle Size Control Section: 5.1 to 24.8 in. (13 to 63 cm)

Diagnostic Features:

	Top	Bottom	Top	Bottom
Kind	Depth (in)	Depth (in)	Depth (cm)	Depth (cm)
Mollic epipedon	0.0	20.1	0	51
Argillic horizon	5.1	34.3	13	87
Abrupt textural change	5.1	5.5	13	14
Redox concentrations	10.2	34.3	26	87
Secondary carbonates	20.1	29.5	51	75
Lithologic discontinuity	29.5	34.3	75	87
Lithologic discontinuity	34.3		87	
Paralithic contact	34.3		87	

Pedon Notes:

Pedon was originally classified as pachic paleustoll, but was revised to typic natrustoll after laboratory characterization by the KSU Pedology lab. Exchangeable sodium percent (ESP) values ranged from 20 to 28 in the B horizons. The "n" was also added to the diagnostic subsurface horizon tables.

A--0 to 5 inches, (0 to 13 cm);, silt loam, very dark grayish brown (10YR 3/2), moist; 20 percent clay; weak medium subangular blocky structure; friable; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btn1--5 to 10 inches, (13 to 26 cm);, silty clay, very dark brown (10YR 2/2), moist; 45 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds;

few fine dendritic tubular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btn2--10 to 17 inches, (26 to 42 cm);, silty clay, very dark brown (10YR 2/2), moist; 45 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine dendritic tubular pores; 20 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btn3--17 to 20 inches, (42 to 51 cm);, silty clay, dark brown (10YR 3/3), moist; 45 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine dendritic tubular pores; 20 percent dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btkn--20 to 30 inches, (51 to 75 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 45 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine dendritic tubular pores; 5 percent dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct strong brown (7.5YR 4/6), moist, iron depletions and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 2 percent carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btn--30 to 34 inches, (75 to 87 cm);, silty clay loam, brown (7.5YR 4/3), moist; 38 percent clay; moderate medium subangular blocky structure; firm; few fine dendritic tubular pores; 5 percent dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct brown (10YR 5/3), moist, iron depletions and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--34 to 35 inches, (87 to 88 cm);, light gray (10YR 7/2), moist; ; violent effervescence, by HCl, 1 normal.

Site 5

USDA - NATURAL RESOURCES CONSERVATION SERVICE Print Date: 12/01/2006

PEDON DESCRIPTION

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 06/18/2006
Describer: DeAnn Presley

Site ID: 06KS115007 Pedon ID: 06KS115007

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Marion Quad Sheet Name: Florence, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: 8 miles east of Peabody, KS
Legal Description: SE 1/4 of of Section 2, Township 22S, Range 4E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 679179 meters, UTM Northing: 4225606 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 2.0 percent Aspect: (deg)
Elevation: 1421 feet, 433.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Other grass/herbaceous cover

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from shale over residuum
weathered from calcareous shale

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	44.5	0	113
Argillic horizon	7.9	84.6	20	215

Redox concentrations	7.9	93.3	20	237
Lithologic discontinuity	24.0	44.5	61	113
Secondary carbonates	24.0	44.5	61	113
Lithologic discontinuity	44.5	84.6	113	215
Slickensides	44.5	84.6	113	215
Lithologic discontinuity	84.6	93.3	215	237
Lithologic discontinuity	93.3		237	
Paralithic contact	93.3		237	

Pedon Notes:

Ap1--0 to 4 inches, (0 to 10 cm);, silt loam, very dark grayish brown (10YR 3/2), moist; 26 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Ap2--4 to 8 inches, (10 to 20 cm);, silty clay loam, very dark grayish brown (10YR 3/2), moist; 35 percent clay; weak medium subangular blocky structure; firm, very sticky, very plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--8 to 24 inches, (20 to 61 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between pedis; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of pedis; 1 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk--24 to 44 inches, (61 to 113 cm);, silty clay, dark brown (10YR 3/3), moist; 46 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between pedis; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of pedis; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct pale brown (10YR 6/3), moist, carbonate nodules and 1 percent medium distinct pale brown (10YR 6/3), moist, carbonate nodules; 2 percent 2 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btss1--44 to 61 inches, (113 to 155 cm);, silty clay, brown (7.5YR 4/3), moist; 48 percent clay; -- Error in Exists On -- structure; very firm, very sticky, very plastic; few fine roots between pedis; few fine irregular pores; 5 percent slickensides (pedogenic) on all faces of pedis and 10 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of pedis; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct reddish brown (5YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btss2--61 to 85 inches, (155 to 215 cm);, silty clay, brown (7.5YR 4/4), moist; 48 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 10 percent slickensides (pedogenic) and 50 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of pedis; 5 percent fine faint reddish brown (5YR 4/4), moist, masses of oxidized iron and 30 percent medium prominent black (N 2.5/), moist, iron-manganese masses; 1 percent 2 to 5 millimeter shale fragments and 1 percent 2 to 5 millimeter limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4C1--85 to 89 inches, (215 to 226 cm);, silty clay, olive (5Y 5/3), moist; 45 percent clay; structureless massive; very firm, very sticky, very plastic; 10 percent medium prominent black (N 2.5/), moist, iron-manganese masses; 40 percent shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4C2--89 to 93 inches, (226 to 237 cm);, silty clay, 25 percent light gray (10YR 7/2) and 75 percent olive (5Y 5/3), moist; 45 percent clay; structureless massive; very firm, very sticky, very plastic; 20 percent medium prominent black (N 2.5/), moist, iron-manganese masses; 40 percent calcareous shale fragments; strong effervescence, by HCl, 1 normal; abrupt smooth boundary.

5Cr--93 to 95 inches, (237 to 242 cm); white (10YR 8/1), light gray (10YR 7/2), moist; ; strong effervescence, by HCl, 1 normal.

Site 6

USDA - NATURAL RESOURCES CONSERVATION SERVICE Print Date: 12/01/2006
PEDON DESCRIPTION

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 02/25/2006
Describer: DeAnn Presley

Site ID: 06KS015010 Pedon ID: 06KS015010
Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Rosalia Ne, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: of Section 1, Township 25S, Range 7E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 709574 meters, UTM Northing: 4197274 meters

Geomorphic Setting: None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 0.5 percent Aspect: (deg)
Elevation: 1489 feet, 454.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 8.3 to 28.0 in. (21 to 71 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	22.4	0	57
Redox concentrations	3.1		8	

Argillic horizon	8.3		21	
Lithologic discontinuity	32.7	44.5	83	113
Lithologic discontinuity	44.5		113	
Slickensides	44.5		113	

Pedon Notes:

A--0 to 3 inches, (0 to 8 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 20 percent clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--3 to 8 inches, (8 to 21 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 30 percent clay; moderate fine subangular blocky structure; firm, moderately sticky, moderately plastic; common fine roots throughout; few fine dendritic tubular pores; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--8 to 22 inches, (21 to 57 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent continuous faint very dark brown (10YR 2/2), moist, organoargillans; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--22 to 28 inches, (57 to 72 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--28 to 33 inches, (72 to 83 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt4--33 to 44 inches, (83 to 113 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btss1--44 to 62 inches, (113 to 158 cm);, silty clay, reddish brown (5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 25 percent continuous faint brown (7.5YR 4/3), moist, clay films; 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 25 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron; 2 percent

chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btss2--62 to 85 inches, (158 to 217 cm);, silty clay, reddish brown (5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 50 percent continuous faint brown (7.5YR 4/3), moist, clay films; 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 25 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btss3--85 to 99 inches, (217 to 251 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 44 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 50 percent continuous faint brown (7.5YR 4/3), moist, clay films; 5 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 2 percent chert fragments; noneffervescent, by HCl, 1 normal.

Appendix A2. Chase County Pedon Descriptions.

USDA - NATURAL RESOURCES CONSERVATION SERVICE Print Date: 12/01/2006
PEDON DESCRIPTION

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 11/22/2005
Describer: DeAnn Presley

Site ID: 05KS017001 Pedon ID: 05KS017001

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: NE 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 726042 meters, UTM Northing: 4254570 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: concave
Slope: 4.0 percent Aspect: 0 (deg)
Elevation: 1178 feet, 359.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Hayland

Parent Material: colluvium over colluvium over residuum weathered
from cherty limestone
Bedrock Depth: 48.0 inches (122.0 cm)

Particle Size Control Section: 12.6 to 28.3 in. (32 to 72 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	28.0	0	71
Argillic horizon	12.6	48.0	32	122
Abrupt textural change	12.6	13.0	32	33
Secondary carbonates	28.0	42.5	71	108
Lithologic discontinuity	42.5	48.0	108	122
Lithologic discontinuity	48.0		122	
Paralithic contact	48.0		122	

Pedon Notes:

A--0 to 13 inches, (0 to 32 cm);, silt loam, very dark gray (10YR 3/1) rubbed, moist; 3 percent sand; 15 percent clay; weak subangular blocky structure; friable; common fine roots throughout; noneffervescent, by HCl, 1 normal; clear boundary.

Bt--13 to 28 inches, (32 to 71 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 3 percent sand; 41 percent clay; moderate prismatic structure; very firm; few fine roots throughout; 10 percent continuous distinct very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear boundary.

Btk--28 to 43 inches, (71 to 108 cm);, silty clay, dark yellowish brown (10YR 4/4) broken face, moist; 3 percent sand; 44 percent clay; moderate prismatic structure; very firm; 10 percent continuous distinct dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine pale brown (10YR 6/3), moist, carbonate masses; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear boundary.

2Bt--43 to 48 inches, (108 to 122 cm);, clay loam, strong brown (7.5YR 4/6) broken face, moist; 25 percent sand; 35 percent clay; moderate subangular blocky structure; very firm; 10 percent continuous distinct dark brown (10YR 3/3), moist, clay films on all faces of peds; 10 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear boundary.

3Cr--48 inches, (122 to cm); ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 11/22/2005
 Descriptor: DeAnn Presley

Site ID: 05KS017002 Pedon ID: 05KS017002

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: NE 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 725856 meters, UTM Northing: 4254616 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: concave
 Slope: 4.0 percent Aspect: 23 (deg)
 Elevation: 1178 feet, 359.0 meters
 Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Hayland

Parent Material: colluvium over colluvium over colluvium over
 residuum weathered from cherty limestone
 Bedrock Depth: 82.7 inches (210.0 cm)

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	26.4	0	67

Argillic horizon	7.9	57.5	20	146
Abrupt textural change	7.9	8.3	20	21
Redox concentrations	22.4	82.7	57	210
Lithologic discontinuity	38.6	57.5	98	146
Lithologic discontinuity	57.5	82.7	146	210
Paralithic contact	82.7		210	
Lithologic discontinuity	82.7		210	

Pedon Notes:

A--0 to 8 inches, (0 to 20 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 3 percent sand; 25 percent clay; weak fine granular structure; friable; many fine roots throughout; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

BA--8 to 22 inches, (20 to 57 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 3 percent sand; 41 percent clay; moderate medium angular blocky structure; very firm; common fine roots throughout; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear boundary.

Bt1--22 to 39 inches, (57 to 98 cm);, silty clay, dark yellowish brown (10YR 4/4) broken face, moist; 3 percent sand; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; 15 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

2Bt2--39 to 57 inches, (98 to 146 cm);, clay loam, yellowish brown (10YR 5/4) broken face, moist; 25 percent sand; 37 percent clay; moderate medium subangular blocky structure; very firm; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 15 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

3BC--57 to 83 inches, (146 to 210 cm);, clay loam, yellowish brown (10YR 5/4) broken face, moist; 25 percent sand; 35 percent clay; moderate medium subangular blocky structure; very firm; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 25 percent fine distinct black (N 2.5/), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; abrupt boundary.

4Cr--83 inches, (210 to cm); ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 11/22/2005
 Descriptor: DeAnn Presley

Site ID: 05KS017003 Pedon ID: 05KS017003

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SE 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 726014 meters, UTM Northing: 4254126 meters

Geomorphic Setting: on footslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: concave
 Slope: 2.0 percent Aspect: 158 (deg)
 Elevation: 1175 feet, 358.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Hayland

Parent Material: clayey loess over old clayey alluvium

Particle Size Control Section: 10.2 to 29.9 in. (26 to 76 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	16.1	0	41
Redox concentrations	10.2		26	
Argillic horizon	10.2		26	

Reduced matrix	39.4		100
Lithologic discontinuity	39.4		100

Pedon Notes:

A--0 to 7 inches, (0 to 17 cm);, silt loam, black (10YR 2/1) rubbed, moist; 21 percent clay; moderate fine granular structure; friable, slightly hard, slightly sticky, slightly plastic; fine roots throughout and medium roots throughout; many fine dendritic tubular pores; clear smooth boundary.

BA--7 to 10 inches, (17 to 26 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 32 percent clay; weak fine granular and moderate fine subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; common fine roots throughout; common fine dendritic tubular pores; abrupt smooth boundary.

Bt1--10 to 16 inches, (26 to 41 cm);, silty clay loam, 50 percent dark brown (10YR 3/3) broken face and 50 percent very dark grayish brown (10YR 3/2) broken face, moist; 38 percent clay; moderate medium subangular blocky structure; firm, hard, very sticky, very plastic; common fine roots throughout; common fine dendritic tubular pores; 20 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; clear smooth boundary.

Bt2--16 to 22 inches, (41 to 55 cm);, silty clay loam, 50 percent dark grayish brown (10YR 4/2) broken face and 50 percent brown (10YR 4/3) broken face, moist; 38 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; common fine dendritic tubular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2/0), moist, iron-manganese nodules and 8 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; clear smooth boundary.

Bt3--22 to 30 inches, (55 to 77 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; few fine dendritic tubular pores; 8 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 8 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2/0), moist, iron-manganese nodules; 1 percent chert fragments; gradual smooth boundary.

Bt4--30 to 39 inches, (77 to 100 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 34 percent clay; moderate fine prismatic structure; firm, hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 2 percent patchy faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 15 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 20 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent chert fragments; abrupt smooth boundary.

2Btg1--39 to 65 inches, (100 to 165 cm);, clay, weak red (2.5YR 5/2) broken face, moist; 50 percent clay; moderate medium prismatic parting to moderate fine angular blocky structure; extremely firm, extremely hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 30 percent medium strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent 5 to 10 millimeter chert fragments; gradual smooth boundary.

2Btg2--65 to 79 inches, (165 to 200 cm);, clay, 50 percent weak red (2.5YR 5/2) broken face and 50 percent pale red (2.5YR 6/2) broken face, moist; 50 percent clay; moderate fine angular blocky and moderate medium prismatic structure; extremely firm, extremely hard, very sticky, very plastic; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 30 percent medium strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent 2 to 5 millimeter chert fragments; clear smooth boundary.

2Btg3--79 to 81 inches, (200 to 206 cm);, clay, 50 percent pale red (2.5YR 6/2) broken face and 50 percent light reddish brown (2.5YR 6/3) broken face, moist; 50 percent clay; moderate medium prismatic parting to moderate fine angular blocky structure; extremely firm, extremely hard, very sticky, very plastic; few fine irregular pores; 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 30 percent medium strong brown (7.5YR 4/6), moist, masses of oxidized iron; 10 percent chert fragments.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 11/22/2005
 Descriptor: DeAnn Presley

Site ID: 05KS017004 Pedon ID: 05KS017004

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:

County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:

Legal Description: SE 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 725924 meters, UTM Northing: 4254213 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: concave
 Slope: 3.0 percent Aspect: 180 (deg)
 Elevation: 1181 feet, 360.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Hayland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 10.6 to 30.3 in. (27 to 77 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	23.6	0	60
Redox concentrations	10.6		27	
Argillic horizon	23.6		60	
Secondary carbonates	31.5	55.9	80	142
Lithologic discontinuity	55.9		142	

|_____||_____||_____||_____||_____||

Pedon Notes:

A--0 to 7 inches, (0 to 17 cm);, silt loam; 25 percent clay; moderate fine granular structure; friable, moderately hard, moderately sticky, nonplastic; many fine roots throughout and common medium roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--7 to 11 inches, (17 to 27 cm);, silty clay loam; 35 percent clay; moderate fine subangular blocky structure; firm, very hard, moderately sticky, moderately plastic; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--11 to 24 inches, (27 to 60 cm);, silty clay; 45 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; few fine dendritic tubular pores; 2 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--24 to 31 inches, (60 to 80 cm);, silty clay; 45 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine dendritic tubular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--31 to 39 inches, (80 to 98 cm);, silty clay; 45 percent clay; moderate fine subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron and 20 percent medium prominent (7.5YR 4/8), moist, masses of oxidized iron; 2 percent fine distinct pale brown (10YR 6/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk2--39 to 56 inches, (98 to 142 cm);, silty clay; 42 percent clay; moderate fine subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct and 1 percent fine distinct black (N 2/0), moist, iron-manganese masses; slight effervescence, by HCl, 1 normal; gradual smooth boundary.

2Bt1--56 to 83 inches, (142 to 211 cm);, silty clay; 50 percent clay; moderate fine prismatic parting to moderate fine subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 20 percent continuous faint dark brown (10YR 3/3), moist, clay films; 20 percent medium prominent black (N 2/0), moist, iron-manganese masses and 25 percent medium prominent (7.5YR 4/8), moist, masses of oxidized iron and 25 percent medium prominent weak red (2.5YR 4/2), moist, masses of reduced iron; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--83 to 103 inches, (211 to 262 cm);, silty clay; 50 percent clay; moderate fine

prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 20 percent medium prominent black (N 2/0), moist, iron-manganese masses and 25 percent medium prominent pale red (2.5YR 6/2), moist, masses of reduced iron and 25 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 11/22/2005
 Descriptor: DeAnn Presley

Site ID: 05KS017005 Pedon ID: 05KS017005

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SE 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 725839 meters, UTM Northing: 4254316 meters

Geomorphic Setting: on footslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 3.0 percent Aspect: 158 (deg)
 Elevation: 1191 feet, 363.0 meters
 Drainage class: somewhat poorly

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Hayland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	28.0	0	71
Argillic horizon	5.9		15	
Redox concentrations	28.0		71	

Secondary carbonates	28.0	62.2	71	158
Redox depletions with chroma 2 or less	28.0		71	
Lithologic discontinuity	62.2	74.8	158	190
Lithologic discontinuity	74.8		190	

Pedon Notes:

Ap--0 to 6 inches, (0 to 15 cm);, silty clay loam, black (10YR 2/1) rubbed, moist; 3 percent sand; 33 percent clay; weak fine subangular blocky structure; firm, moderately sticky, moderately plastic; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt--6 to 28 inches, (15 to 71 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 3 percent sand; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 10 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear boundary.

Btk1--28 to 51 inches, (71 to 129 cm);, silty clay loam, 50 percent brown (10YR 4/3) broken face and 50 percent dark grayish brown (10YR 4/2) broken face, moist; 3 percent sand; 39 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions; 1 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear boundary.

Btk2--51 to 62 inches, (129 to 158 cm);, silty clay, dark yellowish brown (10YR 4/4) broken face, moist; 3 percent sand; 44 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions; 1 percent fine distinct carbonate nodules; slight effervescence, by HCl, 1 normal; clear boundary.

2Bt1--62 to 75 inches, (158 to 190 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 6 percent sand; 45 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; 25 percent continuous distinct dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions; noneffervescent, by HCl, 1 normal; clear boundary.

3Bt2--75 to 98 inches, (190 to 250 cm);, silty clay, dark brown (7.5YR 3/4) broken face, moist; 6 percent sand; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 30 percent continuous distinct dark brown (7.5YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 25 percent fine prominent light brownish gray (2.5Y 6/2), moist, iron depletions; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 11/22/2005
Describer: DeAnn Presley

Site ID: 05KS017006 Pedon ID: 05KS017006

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: NW 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 725708 meters, UTM Northing: 4254421 meters

Geomorphic Setting: on summit of None Assigned
Upslope Shape: linear Cross Slope Shape: concave
Slope: 1.0 percent Aspect: 135 (deg)
Elevation: 1191 feet, 363.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Hayland

Parent Material: clayey loess over colluvium over colluvium over
colluvium

Particle Size Control Section: 7.5 to 27.2 in. (19 to 69 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	31.5	0	80
Redox concentrations	7.5		19	

Argillic horizon	7.5		19	
Secondary carbonates	28.3	38.2	72	97
Lithologic discontinuity	31.5	59.8	80	152
Reduced matrix	38.2	66.5	97	169
Lithologic discontinuity	59.8	66.5	152	169
Slickensides	66.5		169	
Redox depletions with chroma 2 or less	66.5		169	
Lithologic discontinuity	66.5		169	

Pedon Notes:

Ap--0 to 7 inches, (0 to 19 cm); dark gray (10YR 4/1) broken face, silty clay loam, black (10YR 2/1) rubbed, moist; 33 percent clay; moderate fine subangular blocky structure; firm, hard, moderately sticky, moderately plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--7 to 20 inches, (19 to 52 cm);, silty clay, black (10YR 2/1) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent very fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--20 to 28 inches, (52 to 72 cm);, silty clay, very dark gray (10YR 3/1) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent very fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--28 to 31 inches, (72 to 80 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 40 percent clay; moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 1 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent fine light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk2--31 to 38 inches, (80 to 97 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 45 percent clay; moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 1 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine threadlike light gray (10YR 7/2), moist; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btg1--38 to 60 inches, (97 to 152 cm);, silty clay, weak red (2.5YR 4/2) broken face, moist; 45 percent clay; weak medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent iron-manganese nodules and 20 percent fine prominent iron-manganese masses and 25 percent fine

prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btg2--60 to 67 inches, (152 to 169 cm);, silty clay, weak red (2.5YR 4/2) broken face, moist; 45 percent clay; weak medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 20 percent fine prominent iron-manganese masses and 25 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Btss1--67 to 79 inches, (169 to 200 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 50 percent clay; moderate medium angular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine prominent black (N 2.5/0), moist, iron-manganese masses and 10 percent fine prominent weak red (2.5YR 5/2), moist, masses of reduced iron and 10 percent fine prominent (7.5YR 4/8), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

4Btss2--79 to 96 inches, (200 to 245 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 50 percent clay; moderate medium angular blocky structure; very firm, very hard, very sticky, very plastic; 20 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine prominent black (N 2.5/0), moist, iron-manganese masses and 10 percent fine prominent weak red (2.5YR 5/2), moist, masses of reduced iron and 10 percent fine prominent (7.5YR 4/8), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 11/22/2005
Describer: DeAnn Presley

Site ID: 05KS017007 Pedon ID: 05KS017007

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: NW 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 725524 meters, UTM Northing: 4254591 meters

Geomorphic Setting: on summit of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: (deg)
Elevation: 1201 feet, 366.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 6.7 to 26.4 in. (17 to 67 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	25.6	0	65
Argillic horizon	6.7	36.2	17	92
Abrupt textural change	6.7	7.1	17	18

Redox concentrations	13.8		35	
Secondary carbonates	25.6	36.2	65	92
Reduced matrix	36.2	79.9	92	203
Redox depletions with chroma 2 or less	36.2		92	
Lithologic discontinuity	36.2	79.9	92	203
Slickensides	79.9		203	
Argillic horizon	79.9		203	
Lithologic discontinuity	79.9		203	

Pedon Notes:

Ap--0 to 7 inches, (0 to 17 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 23 percent clay; moderate fine subangular blocky structure; friable; many fine roots throughout and many medium roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--7 to 14 inches, (17 to 35 cm);, silty clay, black (10YR 2/1) broken face, moist; 44 percent clay; moderate fine prismatic structure; very firm; many fine roots throughout; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--14 to 20 inches, (35 to 51 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules; 1 percent fine faint; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--20 to 26 inches, (51 to 65 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--26 to 36 inches, (65 to 92 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 1 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bg1--36 to 66 inches, (92 to 168 cm);, silty clay loam, grayish brown (10YR 5/2) broken face, moist; 32 percent clay; moderate fine subangular blocky structure; friable; few fine roots between peds; common fine irregular pores; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine faint gray (10YR 5/1), moist, masses of reduced iron and 20 percent fine prominent strong brown (7.5YR 5/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bg2--66 to 80 inches, (168 to 203 cm);, silty clay loam, brown (10YR 5/3) broken face, moist; 36 percent clay; moderate fine subangular blocky structure; friable; common fine irregular pores; 5 percent fine faint gray (10YR 5/1), moist, masses of reduced iron and 20 percent fine prominent strong brown (7.5YR 5/6), moist, masses of oxidized iron;

noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btss1--80 to 88 inches, (203 to 224 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 50 percent clay; moderate medium angular blocky structure; very firm; few fine irregular pores; 20 percent discontinuous very dark grayish brown (10YR 3/2), moist, clay films; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btss2--88 to 104 inches, (224 to 264 cm);, silty clay, 50 percent brown (7.5YR 4/3) broken face and 50 percent dark brown (7.5YR 3/3) broken face, moist; 50 percent clay; moderate medium angular blocky structure; very firm; few fine irregular pores; 20 percent discontinuous grayish brown (10YR 5/2), moist, clay films; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
Describer: DeAnn Presley

Site ID: 06KS017001 Pedon ID: 06KS017001

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SE 1/4 of SE 1/4 of Section 22, Township 18S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 727194 meters, UTM Northing: 4260586 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: 225 (deg)
Elevation: 1253 feet, 382.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
non-calcareous residuum weathered from shale over
residuum weathered from calcareous shale
Bedrock Depth: 78.7 inches (200.0 cm)

Particle Size Control Section: 7.5 to 27.2 in. (19 to 69 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	26.0	0	66
Redox concentrations	7.5	78.7	19	200
Argillic horizon	7.5	74.4	19	189
Gypsum accumulations	26.0	74.4	66	189
Secondary carbonates	26.0	37.4	66	95
Lithologic discontinuity	37.4	52.8	95	134
Lithologic discontinuity	52.8	74.4	134	189
Lithologic discontinuity	74.4	78.7	189	200
Paralithic contact	78.7		200	
Lithologic discontinuity	78.7		200	

Pedon Notes:

A1--0 to 4 inches, (0 to 10 cm); dark grayish brown (10YR 4/2) broken face, silt loam, black (10YR 2/1) rubbed, moist; 20 percent clay; weak fine subangular blocky structure; friable; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

A2--4 to 7 inches, (10 to 19 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 36 percent clay; weak fine subangular blocky structure; firm; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--7 to 19 inches, (19 to 49 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--19 to 26 inches, (49 to 66 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 46 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btky--26 to 37 inches, (66 to 95 cm);, silty clay, brown (10YR 4/3) broken face, moist; 44 percent clay; moderate fine subangular blocky structure; firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct light gray (10YR 7/2), moist, gypsum masses and 10 percent medium distinct light gray (10YR 7/2), moist, carbonate masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bty1--37 to 53 inches, (95 to 134 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 32 percent clay; moderate fine subangular blocky structure; friable; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bty2--53 to 74 inches, (134 to 189 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 36 percent clay; moderate fine subangular blocky structure; friable; common fine irregular pores; 50 percent continuous faint dark brown (10YR 3/3), moist, clay

films; 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4BC--74 to 79 inches, (189 to 200 cm);, reddish brown (2.5YR 5/4) broken face, moist; weak fine angular blocky structure; firm; few fine irregular pores; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 10 percent shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

5Cr--79 to 86 inches, (200 to 219 cm);, reddish brown (2.5YR 5/4) broken face, moist; ; calcareous shale fragments; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Dwight
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017002 Pedon ID: 06KS017002

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:

County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:

Legal Description: SE 1/4 of SE 1/4 of Section 22, Township 18S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 727302 meters, UTM Northing: 4260378 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: concave
 Slope: 2.0 percent Aspect: 225 (deg)
 Elevation: 1253 feet, 382.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from calcareous shale
 Bedrock Depth: 70.9 inches (180.0 cm)

Particle Size Control Section: 8.7 to 28.3 in. (22 to 72 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	28.0	0	71
Redox concentrations	8.7	70.9	22	180

Argillic horizon	8.7	66.5	22	169
Secondary carbonates	35.0	56.3	89	143
Lithologic discontinuity	45.7	56.3	116	143
Lithologic discontinuity	56.3	66.5	143	169
Lithologic discontinuity	66.5		169	
Paralithic contact	70.9		180	

Pedon Notes:

A1--0 to 6 inches, (0 to 14 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 24 percent clay; weak fine subangular blocky structure; friable; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

A2--6 to 9 inches, (14 to 22 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 38 percent clay; moderate fine subangular blocky structure; firm; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--9 to 22 inches, (22 to 55 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt2--22 to 28 inches, (55 to 71 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--28 to 35 inches, (71 to 89 cm);, silty clay, brown (10YR 4/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--35 to 46 inches, (89 to 116 cm);, silty clay loam, brown (7.5YR 4/4) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 1 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btk2--46 to 56 inches, (116 to 143 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 36 percent clay; moderate fine subangular blocky structure; very firm; few fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt--56 to 67 inches, (143 to 169 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 42 percent clay; moderate fine subangular blocky structure; very firm; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate masses; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4BC--67 to 71 inches, (169 to 180 cm);, silty clay, yellowish brown (10YR 5/4) broken face, moist; 45 percent clay; weak fine subangular blocky structure; very firm; few fine irregular pores; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--71 to 79 inches, (180 to 200 cm); ; 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; calcareous shale fragments.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
Describer: DeAnn Presley

Site ID: 06KS017003 Pedon ID: 06KS017003

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SE 1/4 of SE 1/4 of Section 22, Township 18S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 727219 meters, UTM Northing: 4260717 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 2.0 percent Aspect: 203 (deg)
Elevation: 1257 feet, 383.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
colluvium over residuum weathered from shale over
residuum weathered from calcareous shale
Bedrock Depth: 105.5 inches (268.0 cm)

Particle Size Control Section: 10.2 to 29.9 in. (26 to 76 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	28.7	0	73
Redox concentrations	10.2	105.5	26	268
Argillic horizon	10.2	94.5	26	240
Secondary carbonates	28.7	53.1	73	135
Lithologic discontinuity	37.0	53.1	94	135
Gypsum accumulations	37.0	63.0	94	160
Lithologic discontinuity	53.1	63.0	135	160
Lithologic discontinuity	63.0	94.5	160	240
Lithologic discontinuity	94.5	105.5	240	268
Paralithic contact	105.5		268	
Lithologic discontinuity	105.5		268	

Pedon Notes:

A1--0 to 7 inches, (0 to 18 cm);, silt loam, black (10YR 2/1) rubbed, moist; 23 percent clay; moderate fine subangular blocky structure; friable; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

A2--7 to 10 inches, (18 to 26 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 38 percent clay; moderate fine subangular blocky structure; firm; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--10 to 17 inches, (26 to 44 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; common fine roots between pedis; few fine irregular pores; 5 percent discontinuous faint organoargillans; 1 percent black (N 2/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--17 to 29 inches, (44 to 73 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm; common very fine roots between pedis; few fine irregular pores; 5 percent discontinuous faint organoargillans; 1 percent black (N 2/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--29 to 37 inches, (73 to 94 cm);, silty clay, brown (10YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few very fine roots between pedis; few fine irregular pores; 2 percent discontinuous faint clay films; 2 percent black (N 2/0), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent medium faint carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btky--37 to 53 inches, (94 to 135 cm);, silty clay loam, (7.5YR 4/5) broken face, moist; 38 percent clay; moderate medium subangular blocky structure; firm; few fine irregular pores; 2 percent discontinuous faint clay films; 2 percent black (N 2/0), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent gypsum masses and 1 percent medium faint carbonate masses; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bty--53 to 63 inches, (135 to 160 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 38 percent clay; moderate medium subangular blocky structure; firm; few fine

irregular pores; 2 percent discontinuous faint clay films; 1 percent black (N 2/0), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 5 percent gypsum masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

4Bt--63 to 94 inches, (160 to 240 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm; common fine irregular pores; 20 percent continuous faint clay films; 2 percent black (N 2/0), moist, iron-manganese masses and 20 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

5CB--94 to 98 inches, (240 to 250 cm);, silty clay, light olive brown (2.5Y 5/3) broken face, moist; 42 percent clay; weak medium prismatic structure; very firm; 1 percent black (N 2/0), moist, iron-manganese masses and 20 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 50 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

5C--98 to 106 inches, (250 to 268 cm);, silty clay loam, olive (5Y 5/3) broken face, moist; 36 percent clay; medium angular blocky structure; firm; 20 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

6Cr--106 to 110 inches, (268 to 280 cm);, pale olive (5Y 6/3) broken face, moist; ; calcareous shale fragments.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
Describer: DeAnn Presley

Site ID: 06KS017004 Pedon ID: 06KS017004
Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SE 1/4 of NW 1/4 of Section 3, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 726709 meters, UTM Northing: 4256815 meters

Geomorphic Setting: on shoulder of None Assigned
Upslope Shape: linear Cross Slope Shape: concave
Slope: 1.0 percent Aspect: 270 (deg)
Elevation: 1204 feet, 367.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
noncalcareous residuum weathered from shale over
residuum weathered from cherty limestone
Bedrock Depth: 61.8 inches (157.0 cm)

Particle Size Control Section: 5.1 to 24.8 in. (13 to 63 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.8	0	63

Redox concentrations	5.1	61.8	13	157
Argillic horizon	5.1	57.9	13	147
Secondary carbonates	24.8	38.6	63	98
Lithologic discontinuity	31.9	38.6	81	98
Gypsum accumulations	31.9	57.9	81	147
Lithologic discontinuity	38.6	57.9	98	147
Lithologic discontinuity	57.9	61.8	147	157
Paralithic contact	61.8	65.0	157	165
Lithologic discontinuity	61.8	65.0	157	165
Lithic contact	65.0		165	

Pedon Notes:

A--0 to 5 inches, (0 to 13 cm);, silt loam, black (10YR 2/1) rubbed, moist; 24 percent clay; moderate fine subangular blocky structure; friable; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--5 to 18 inches, (13 to 45 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine distinct iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--18 to 25 inches, (45 to 63 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine distinct iron-manganese masses; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--25 to 32 inches, (63 to 81 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 36 percent clay; moderate fine subangular blocky and moderate fine prismatic structure; very firm; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 3 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btky--32 to 39 inches, (81 to 98 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 39 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct iron-manganese masses; 1 percent threadlike gypsum masses and 3 percent medium distinct carbonate nodules; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bty--39 to 58 inches, (98 to 147 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 46 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 25 percent continuous distinct dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, manganese masses and 5 percent fine distinct iron-manganese nodules; 5 percent threadlike gypsum masses; 5 percent chert

fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

4BC--58 to 62 inches, (147 to 157 cm);, silty clay, 50 percent light olive brown (2.5Y 5/3) broken face and 50 percent dark brown (7.5YR 3/2) broken face, moist; 46 percent clay; weak medium prismatic structure; very firm; few fine irregular pores; 25 percent continuous distinct grayish brown (10YR 5/2), moist, clay films and 25 percent continuous distinct dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct iron-manganese nodules; 3 percent shale fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

5Cr--62 to 65 inches, (157 to 165 cm);, light gray (2.5Y 7/2) broken face, moist; ; limestone fragments; abrupt smooth boundary.

5R--65 inches, (165 to cm); .

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 01/05/2006
Describer: DeAnn Presley

Site ID: 06KS017005 Pedon ID: 06KS017005

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SE 1/4 of NW 1/4 of Section 3, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 726781 meters, UTM Northing: 4256759 meters

Geomorphic Setting: on shoulder of None Assigned
Upslope Shape: linear Cross Slope Shape: concave
Slope: 1.0 percent Aspect: 270 (deg)
Elevation: 1207 feet, 368.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over residuum
weathered from shale over residuum weathered from
calcareous shale
Bedrock Depth: 69.3 inches (176.0 cm)

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	19.7	0	50
Argillic horizon	5.5	69.3	14	176
Redox concentrations	19.7	73.2	50	186
Lithologic discontinuity	26.0	46.9	66	119
Secondary carbonates	26.0	34.3	66	87
Lithologic discontinuity	46.9	73.2	119	186
Paralithic contact	73.2		186	
Lithologic discontinuity	73.2		186	

Pedon Notes:

A--0 to 6 inches, (0 to 14 cm);, silty clay loam, very dark brown (10YR 2/2) rubbed, moist; 28 percent clay; weak medium granular structure; friable, slightly hard, moderately sticky, moderately plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 13 inches, (14 to 33 cm);, silty clay, black (10YR 2/1) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--13 to 20 inches, (33 to 50 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--20 to 26 inches, (50 to 66 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btk--26 to 34 inches, (66 to 87 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct black (N 2/0), moist, iron-manganese masses and 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine light gray (10YR 7/2), moist, carbonate nodules and 1 percent medium light gray (10YR 7/2), moist, carbonate nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bty--34 to 47 inches, (87 to 119 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron; 5 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses; 3 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Bt--47 to 69 inches, (119 to 176 cm);, silty clay loam, dark brown (7.5YR 3/2) broken

face, moist; 38 percent clay; moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 25 percent continuous distinct dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3BC--69 to 73 inches, (176 to 186 cm);, silty clay loam, 50 percent dark brown (7.5YR 3/2) broken face and 50 percent light olive brown (2.5Y 5/3) broken face, moist; 36 percent clay; weak medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron; 50 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4Cr--73 to 84 inches, (186 to 213 cm);, light yellowish brown (2.5Y 6/3) broken face, moist; ; calcareous shale fragments; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 01/05/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017006 Pedon ID: 06KS017006
 Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SE 1/4 of NW 1/4 of Section 3, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 726886 meters, UTM Northing: 4256435 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 4.0 percent Aspect: 270 (deg)
 Elevation: 1207 feet, 368.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over residuum
 weathered from shale over residuum weathered from
 calcareous shale

Bedrock Depth: 65.7 inches (167.0 cm)

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	20.5	0	52

Argillic horizon	7.9	58.3	20	148
Abrupt textural change	7.9	8.3	20	21
Redox concentrations	13.0	74.4	33	189
Secondary carbonates	27.2	42.5	69	108
Gypsum accumulations	27.2	42.5	69	108
Lithologic discontinuity	42.5	58.3	108	148
Lithologic discontinuity	58.3	74.4	148	189
Lithologic discontinuity	74.4		189	
Paralithic contact	74.4		189	

Pedon Notes:

A--0 to 8 inches, (0 to 20 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 23 percent clay; weak fine subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--8 to 13 inches, (20 to 33 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 5 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--13 to 20 inches, (33 to 52 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--20 to 27 inches, (52 to 69 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btky--27 to 43 inches, (69 to 108 cm);, silty clay, brown (10YR 4/3) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses and 1 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Bt--43 to 58 inches, (108 to 148 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 42 percent clay; moderate medium subangular blocky structure; firm, very hard, very sticky, very plastic; few fine irregular pores; 25 percent patchy faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth

boundary.

3CB--58 to 66 inches, (148 to 167 cm);, silty clay, 25 percent dark brown (7.5YR 3/3) broken face and 75 percent light olive brown (2.5Y 5/3) broken face, moist; 44 percent clay; weak medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 5 percent chert fragments and 75 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3C--66 to 74 inches, (167 to 189 cm);, silty clay, olive gray (5Y 5/2) broken face, moist; 44 percent clay; medium angular blocky structure; very firm, very hard, very sticky, very plastic; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--74 to 81 inches, (189 to 207 cm);, olive gray (5Y 5/2) broken face, moist; ; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; calcareous shale fragments; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017007 Pedon ID: 06KS017007

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SW 1/4 of NE 1/4 of Section 3, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 726906 meters, UTM Northing: 4256562 meters
 Geomorphic Setting: on shoulder of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: 270 (deg)
 Elevation: 1207 feet, 368.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from shale over residuum
 weathered from calcareous shale
 Bedrock Depth: 87.4 inches (222.0 cm)

Particle Size Control Section: 7.5 to 27.2 in. (19 to 69 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	22.4	0	57
Argillic horizon	7.5	87.4	19	222

Redox concentrations	11.8	93.3	30	237
Secondary carbonates	28.3	49.6	72	126
Lithologic discontinuity	36.2	49.6	92	126
Gypsum accumulations	36.2	49.6	92	126
Lithologic discontinuity	49.6	87.4	126	222
Lithologic discontinuity	87.4	93.3	222	237
Paralithic contact	93.3		237	
Lithologic discontinuity	93.3		237	

Pedon Notes:

A--0 to 7 inches, (0 to 19 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 23 percent clay; weak fine subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--7 to 12 inches, (19 to 30 cm);, silty clay, black (10YR 2/1) broken face, moist; 42 percent clay; moderate fine subangular blocky structure; firm, hard, very sticky, very plastic; common fine roots throughout; common fine dendritic tubular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt2--12 to 22 inches, (30 to 57 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--22 to 28 inches, (57 to 72 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--28 to 36 inches, (72 to 92 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct (10YR 4/8), moist, masses of oxidized iron; 2 percent medium very pale brown (10YR 7/3), moist, carbonate nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btky--36 to 50 inches, (92 to 126 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 39 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct (10YR 4/8), moist, masses of oxidized iron; 1 percent fine light gray (10YR 7/2), moist, carbonate nodules and 5 percent fine brown (10YR 5/3), moist, gypsum masses; 5 percent chert fragments; noneffervescent, by HCl, 1

normal; clear smooth boundary.

3Bt1--50 to 69 inches, (126 to 175 cm);, silty clay, dark brown (7.5YR 3/2) broken face, moist; 42 percent clay; moderate fine subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct (10YR 4/8), moist, masses of oxidized iron; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt2--69 to 87 inches, (175 to 222 cm);, silty clay loam, brown (7.5YR 5/2) broken face, moist; 39 percent clay; moderate fine subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 50 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4C--87 to 93 inches, (222 to 237 cm);, clay, olive gray (5Y 5/2) broken face, moist; 60 percent clay; medium angular blocky structure; very firm, very hard, very sticky, very plastic; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

5Cr--93 to 98 inches, (237 to 250 cm);, yellowish brown (10YR 5/6) broken face, moist; ; limestone fragments; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017008 Pedon ID: 06KS017008

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SW 1/4 of NE 1/4 of Section 3, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 726970 meters, UTM Northing: 4256470 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 3.0 percent Aspect: 225 (deg)
 Elevation: 1207 feet, 368.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	20.5	0	52
Argillic horizon	5.9		15	
Redox concentrations	11.8		30	

Secondary carbonates	20.5	35.4	52	90
Lithologic discontinuity	35.4	47.2	90	120
Lithologic discontinuity	47.2		120	

Pedon Notes:

Ap--0 to 6 inches, (0 to 15 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 30 percent clay; moderate fine subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--6 to 12 inches, (15 to 30 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; common fine dendritic tubular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--12 to 20 inches, (30 to 52 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Btk--20 to 35 inches, (52 to 90 cm);, silty clay, brown (10YR 4/3) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent fine very pale brown (10YR 7/3), moist, carbonate nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt1--35 to 47 inches, (90 to 120 cm);, silty clay, dark brown (7.5YR 3/4) broken face, moist; 42 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt2--47 to 73 inches, (120 to 186 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 50 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Dwight
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Udertic Argiustolls

Description Date: 02/07/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017009 Pedon ID: 06KS017009

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: NE 1/4 of NE 1/4 of Section 5, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 724275 meters, UTM Northing: 4256757 meters

Geomorphic Setting: on summit of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: 315 (deg)
 Elevation: 1263 feet, 385.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
 hard cherty limestone
 Bedrock Depth: 31.9 inches (81.0 cm)

Particle Size Control Section: 3.5 to 23.2 in. (9 to 59 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	20.5	0	52

Argillic horizon	3.5	31.9	9	81
Redox concentrations	8.3	31.9	21	81
Lithologic discontinuity	20.5	27.6	52	70
Slickensides	20.5	27.6	52	70
Lithologic discontinuity	27.6	31.9	70	81
Lithic contact	31.9		81	
Lithologic discontinuity	31.9		81	

Pedon Notes:

A--0 to 4 inches, (0 to 9 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 24 percent clay; moderate fine granular structure; friable, slightly sticky, slightly plastic; many fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--4 to 8 inches, (9 to 21 cm);, silty clay loam, very dark grayish brown (10YR 3/2) broken face, moist; 32 percent clay; weak fine subangular blocky parting to weak fine granular structure; friable, moderately sticky, moderately plastic; many fine roots throughout; common fine dendritic tubular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--8 to 20 inches, (21 to 52 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; many fine roots throughout; common fine dendritic tubular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btss--20 to 28 inches, (52 to 70 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots between peds; few fine irregular pores; 10 percent; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt--28 to 32 inches, (70 to 81 cm);, silty clay, dark brown (7.5YR 3/4) broken face, moist; 42 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; common fine roots between peds; few fine irregular pores; 25 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4R--32 inches, (81 to cm); ; limestone fragments.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 02/07/2006
Describer: DeAnn Presley

Site ID: 06KS017010 Pedon ID: 06KS017010

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: NE 1/4 of SW 1/4 of NE 1/4 of Section 5, Township 19S,
Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 723959 meters, UTM Northing: 4256710 meters

Geomorphic Setting: on summit of None Assigned
Upslope Shape: concave Cross Slope Shape: linear
Slope: 1.0 percent Aspect: (deg)
Elevation: 1250 feet, 381.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
soft residuum weathered from cherty limestone over
hard cherty limestone
Bedrock Depth: 34.3 inches (87.0 cm)

Particle Size Control Section: 6.3 to 26.0 in. (16 to 66 cm)

Diagnostic Features:
| Top Bottom Top Bottom |

Kind	Depth (in)	Depth (in)	Depth (cm)	Depth (cm)
Mollic epipedon	0.0	18.5	0	47
Abrupt textural change	2.8	3.1	7	8
Argillic horizon	6.3	34.3	16	87
Redox concentrations	11.4	22.8	29	58
Secondary carbonates	11.4	22.8	29	58
Lithologic discontinuity	18.5	22.8	47	58
Lithologic discontinuity	22.8	34.3	58	87
Paralithic contact	34.3	34.6	87	88
Lithologic discontinuity	34.3	34.6	87	88
Lithic contact	34.6		88	
Lithologic discontinuity	34.6		88	

Pedon Notes:

A--0 to 3 inches, (0 to 7 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 18 percent clay; weak fine subangular blocky structure; friable, moderately hard, slightly sticky, slightly plastic; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--3 to 6 inches, (7 to 16 cm);, silty clay, black (10YR 2/1) broken face, moist; 40 percent clay; moderate fine subangular blocky structure; very firm, very sticky, very plastic; common fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--6 to 11 inches, (16 to 29 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots throughout; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--11 to 19 inches, (29 to 47 cm);, silty clay loam, dark brown (10YR 3/3) broken face, moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between pedes; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk2--19 to 23 inches, (47 to 58 cm);, silty clay loam, dark brown (7.5YR 3/4) broken face, moist; 36 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine roots between pedes; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt--23 to 34 inches, (58 to 87 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between pedes; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules and 2 percent medium distinct very pale brown (10YR 7/3), moist,

carbonate nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4C--34 to 35 inches, (87 to 88 cm);, dark yellowish brown (10YR 4/4) broken face, moist; ; few fine irregular pores; limestone fragments; slight effervescence, by HCl, 1 normal; abrupt smooth boundary.

5Rr--35 inches, (88 to cm); ; limestone fragments.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 02/07/2006
Describer: DeAnn Presley

Site ID: 06KS017011 Pedon ID: 06KS017011

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SW 1/4 of NE 1/4 of Section 5, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 723907 meters, UTM Northing: 4256398 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 2.0 percent Aspect: 180 (deg)
Elevation: 1234 feet, 376.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
non-calcareous residuum weathered from shale
Bedrock Depth: 54.3 inches (138.0 cm)

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	20.1	0	51

Abrupt textural change	2.8	3.1	7	8
Argillic horizon	5.5	54.3	14	138
Redox concentrations	13.8	54.3	35	138
Secondary carbonates	20.1	28.7	51	73
Lithologic discontinuity	32.7	39.0	83	99
Lithologic discontinuity	39.0	54.3	99	138
Paralithic contact	54.3		138	
Lithologic discontinuity	54.3		138	

Pedon Notes:

A--0 to 3 inches, (0 to 7 cm);, silt loam, black (10YR 2/1) rubbed, moist; 20 percent clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--3 to 6 inches, (7 to 14 cm);, silty clay loam, black (10YR 2/1) broken face, moist; 38 percent clay; moderate fine subangular blocky structure; firm, moderately sticky, moderately plastic; many fine roots throughout; common fine irregular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--6 to 14 inches, (14 to 35 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots throughout; few fine irregular pores; 5 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--14 to 20 inches, (35 to 51 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots between peds; few fine irregular pores; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, organoargillans; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--20 to 29 inches, (51 to 73 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent fine light gray (10YR 7/2), moist, carbonate nodules and medium light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--29 to 33 inches, (73 to 83 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 38 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, organoargillans; 2 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--33 to 39 inches, (83 to 99 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 40 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 25 percent continuous faint dark brown (10YR 3/3), moist, clay films; 10 percent fine distinct black (N 2.5/0),

moist, iron-manganese masses and 15 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt3--39 to 54 inches, (99 to 138 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 35 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 50 percent continuous faint dark brown (7.5YR 3/2), moist, clay films; 10 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 25 percent fine prominent (7.5YR 4/8), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--54 to 56 inches, (138 to 143 cm);, yellowish brown (10YR 5/4) broken face, moist; ; shale fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 02/07/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017012 Pedon ID: 06KS017012

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:
 Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SE 1/4 of NE 1/4 of Section 5, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 724157 meters, UTM Northing: 4256467 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: 180 (deg)
 Elevation: 1234 feet, 376.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
 non-calcareous residuum weathered from shale over
 residuum weathered from calcareous shale

Bedrock Depth: 58.7 inches (149.0 cm)

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	22.4	0	57

Redox concentrations	5.5	68.1	14	173
Argillic horizon	5.5	58.7	14	149
Abrupt textural change	5.5	5.9	14	15
Secondary carbonates	22.4	36.6	57	93
Lithologic discontinuity	29.1	36.6	74	93
Lithologic discontinuity	36.6	58.7	93	149
Gypsum accumulations	36.6	52.8	93	134
Lithologic discontinuity	58.7	68.1	149	173
Paralithic contact	68.1		173	
Lithologic discontinuity	68.1		173	

Pedon Notes:

A--0 to 6 inches, (0 to 14 cm);, silt loam, black (10YR 2/1) rubbed, moist; 20 percent clay; moderate fine subangular blocky structure; friable, slightly sticky, slightly plastic; many fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 8 inches, (14 to 21 cm);, silty clay, black (10YR 2/1) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; many fine roots between ped; common fine dendritic tubular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt2--8 to 14 inches, (21 to 36 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots between ped; few fine dendritic tubular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--14 to 22 inches, (36 to 57 cm);, silty clay loam, very dark grayish brown (10YR 3/2) broken face, moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots between ped; few fine dendritic tubular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--22 to 29 inches, (57 to 74 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between ped; few fine dendritic tubular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk2--29 to 37 inches, (74 to 93 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between ped; few fine dendritic tubular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black

(N 2.5/0), moist, iron-manganese nodules; 5 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules and 2 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bty--37 to 53 inches, (93 to 134 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 43 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine dendritic tubular pores; 20 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 2 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 5 percent fine distinct brown (10YR 5/3), moist, gypsum masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3BC--53 to 59 inches, (134 to 149 cm);, silty clay loam, 25 percent dark brown (7.5YR 3/3) broken face and 75 percent light olive brown (2.5Y 5/3) broken face, moist; 38 percent clay; moderate fine subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 25 percent shale fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

4C--59 to 68 inches, (149 to 173 cm);, silty clay loam, olive (5Y 5/3) broken face, moist; 38 percent clay; medium angular blocky structure; very firm, very sticky, very plastic; 20 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

5Cr--68 to 69 inches, (173 to 176 cm);, light olive gray (5Y 6/2) broken face, moist; ; calcareous shale fragments; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 06/27/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017013 Pedon ID: 06KS017013

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Wilsey Se, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: 9 miles south of Council Grove
 Legal Description: NW 1/4 of NE 1/4 of Section 3, Township 185, Range 8E
 Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 717336 meters, UTM Northing: 4266238 meters

Geomorphic Setting: on shoulder of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 3.0 percent Aspect: 0 (deg)
 Elevation: 1489 feet, 454.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.0	0	61
Argillic horizon	5.9	24.0	15	61
Abrupt textural change	5.9	6.3	15	16
Redox concentrations	16.5		42	
Secondary carbonates	24.0	33.5	61	85

Argillic horizon	32.3		82	
Lithologic discontinuity	32.3	43.3	82	110
Slickensides	43.3		110	
Redox depletions with chroma 2 or less	43.3		110	
Lithologic discontinuity	43.3		110	

Pedon Notes:

A--0 to 6 inches, (0 to 15 cm);, silt loam, very dark brown (10YR 2/2), moist; 22 percent clay; moderate fine subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt1--6 to 17 inches, (15 to 42 cm);, silty clay, very dark brown (10YR 2/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear boundary.

Bt2--17 to 24 inches, (42 to 61 cm);, silty clay loam, dark brown (10YR 3/3), moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

BcK--24 to 32 inches, (61 to 82 cm);, silt loam, brown (10YR 5/3), moist; 24 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; slight effervescence, by HCl, 1 normal; clear boundary.

2Bt--32 to 43 inches, (82 to 110 cm);, silt loam, brown (7.5YR 5/3), moist; 24 percent clay; moderate medium subangular blocky structure; friable, moderately sticky, moderately plastic; common fine irregular pores; 5 percent patchy faint brown (10YR 4/3), moist, clay films on all faces of peds; 10 percent fine prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt boundary.

3Btss--43 to 93 inches, (110 to 237 cm);, silty clay, dark brown (7.5YR 3/3), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 10 percent slickensides (pedogenic) and 50 percent continuous faint brown (7.5YR 4/2), moist, clay films on all faces of peds; 5 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 06/27/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017014 Pedon ID: 06KS017014

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Wilsey Se, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: 9 miles south of Council Grove
 Legal Description: NW 1/4 of NE 1/4 of Section 3, Township 185, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 717209 meters, UTM Northing: 4266230 meters

Geomorphic Setting: on summit of None Assigned
 Upslope Shape: concave Cross Slope Shape: linear
 Slope: 0.0 percent Aspect: 225 (deg)
 Elevation: 1489 feet, 454.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland
 Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from cherty limestone
 Bedrock Depth: 90.9 inches (231.0 cm)

Particle Size Control Section: 3.1 to 22.8 in. (8 to 58 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	18.9	0	48
Argillic horizon	3.1	18.9	8	48

Abrupt textural change	3.1	3.5	8	9
Redox concentrations	11.8	90.9	30	231
Secondary carbonates	31.5	37.0	80	94
Argillic horizon	37.0	90.9	94	231
Lithologic discontinuity	37.0	44.1	94	112
Redox depletions with chroma 2 or less	44.1	90.9	112	231
Slickensides	44.1	90.9	112	231
Lithologic discontinuity	44.1	90.9	112	231
Paralithic contact	90.9		231	
Lithologic discontinuity	90.9		231	

Pedon Notes:

A--0 to 3 inches, (0 to 8 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 28 percent clay; moderate fine subangular blocky structure; friable, moderately sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt1--3 to 12 inches, (8 to 30 cm);, silty clay, very dark brown (10YR 2/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear boundary.

Bt2--12 to 19 inches, (30 to 48 cm);, silty clay loam, dark brown (10YR 3/3), moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, organoargillans on all faces of peds; 1 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

Bw--19 to 31 inches, (48 to 80 cm);, silt loam, brown (10YR 5/3), moist; 24 percent clay; weak fine subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

BCK--31 to 37 inches, (80 to 94 cm);, silt loam, brown (7.5YR 5/3), moist; 24 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; common fine irregular pores; 10 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; slight effervescence, by HCl, 1 normal; clear boundary.

2Bt--37 to 44 inches, (94 to 112 cm);, silt loam, light brown (7.5YR 6/3), moist; 24 percent clay; moderate medium subangular blocky structure; friable, moderately sticky, moderately plastic; common fine irregular pores; 10 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt boundary.

3Btss--44 to 91 inches, (112 to 231 cm);, silty clay, dark brown (7.5YR 3/4), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 10 percent slickensides (pedogenic) and 50 percent continuous faint brown (7.5YR 4/2),

moist, clay films on all faces of peds; 5 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

4Cr--91 to 97 inches, (231 to 246 cm);, very pale brown (10YR 7/3), moist; ; limestone fragments; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 06/27/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017015 Pedon ID: 06KS017015

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Wilsey Se, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: 9 miles south of Council Grove
 Legal Description: NW 1/4 of NE 1/4 of Section 3, Township 185, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 717234 meters, UTM Northing: 4266372 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 4.0 percent Aspect: 225 (deg)
 Elevation: 1489 feet, 454.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 4.7 to 24.4 in. (12 to 62 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.0	0	61
Argillic horizon	4.7	24.0	12	61
Abrupt textural change	4.7	5.1	12	13

Redox concentrations	16.5		42	
Redox depletions with chroma 2 or less	53.1		135	
Slickensides	53.1		135	
Argillic horizon	53.1		135	
Lithologic discontinuity	53.1		135	

Pedon Notes:

A--0 to 5 inches, (0 to 12 cm);, silt loam, very dark brown (10YR 2/2), moist; 22 percent clay; moderate fine subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--5 to 17 inches, (12 to 42 cm);, silty clay, very dark brown (10YR 2/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--17 to 24 inches, (42 to 61 cm);, silty clay loam, dark brown (10YR 3/3), moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

BC--24 to 53 inches, (61 to 135 cm);, silt loam, brown (10YR 5/3), moist; 24 percent clay; weak fine subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 10 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btss--53 to 96 inches, (135 to 245 cm);, silty clay, dark brown (7.5YR 3/3), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 10 percent slickensides (pedogenic) and 50 percent continuous faint dark grayish brown (10YR 4/2), moist, clay films on all faces of peds; 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct dark grayish brown (10YR 4/2), moist, iron depletions and 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 1 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal.

Appendix A3. All 138 Pedon Descriptions.

In order:

Riley County

05KS161001

05KS161002

05KS161003

05KS161004

05KS161005

05KS161006

05KS161007

05KS161008

05KS161009

05KS161010

05KS161011

05KS161012

06KS161001

Geary County

05KS061001

Morris County

05KS127001

05KS127002

05KS127003

05KS127004

05KS127005

05KS127006

05KS127007

05KS127008

05KS127009
05KS127010
05KS127011
05KS127012
05KS127013
05KS127014
05KS127015
05KS127016
05KS127017
05KS127018
05KS127019
05KS127020
05KS127021
05KS127022
05KS127023
05KS127024
05KS127025
05KS127026
05KS127027
05KS127028
05KS127029
05KS127030
05KS127031
05KS127032
05KS127033
05KS127034
05KS127035
05KS127036
05KS127037
05KS127038
05KS127039

05KS127040
05KS127041
05KS127042
05KS127043
05KS127044
06KS127001

Chase County

05KS017001
05KS017002
05KS017003
05KS017004
05KS017005
05KS017006
05KS017007
06KS017001
06KS017002
06KS017003
06KS017004
06KS017005
06KS017006
06KS017007
06KS017008
06KS017009
06KS017010
06KS017011
06KS017012
06KS017013
06KS017014
06KS017015

Butler County

06KS015001

06KS015002

06KS015003

06KS015004

06KS015005

06KS015006

06KS015007

06KS015008

06KS015009

06KS015010

06KS015011

06KS015012

06KS015013

06KS015014

06KS015015

06KS015016

06KS015017

06KS015018

06KS015019

06KS015020

06KS015021

06KS015022

Marion County

06KS115001

06KS115002

06KS115003

06KS115004

06KS115005

06KS115006

06KS115007

06KS115008

06KS115009

06KS115010

06KS115011

06KS115012

McPherson County

06KS113001

06KS113002

06KS113003

06KS113004

06KS113005

06KS113006

06KS113007

06KS113008

06KS113009

06KS113010

06KS113011

Harvey County

06KS079001

06KS079002

06KS079003

06KS079004

06KS079005

06KS079006

06KS079007

06KS079008

06KS079009

06KS079010

06KS079011

USDA - NATURAL RESOURCES CONSERVATION SERVICE Print Date: 12/01/2006
PEDON DESCRIPTION

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated: Irwin
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161001 Pedon ID: 05KS161001

Site Note:

Pedon Type: within range of series
Pedon Purpose: research site
Taxon Kind: family

Location Information:

County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area: KS161 -- Riley County, Kansas
Map Unit: 4625 -- Dwight-Irwin complex, 1 to 3 percent slopes

Location Description: Site is located one mile south of the town of Randolph,
Kansas.

Legal Description: 350 m E and 700 m S of NW corner of Section 28,
Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 692030 meters, UTM Northing: 4365253 meters

Geomorphic Setting: on shoulder of interfluvium of upland
Upslope Shape: linear Cross Slope Shape: convex
Slope: 1.0 percent Aspect: 338 (deg)
Elevation: 1286 feet, 392.0 meters
Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess

Particle Size Control Section: 4.7 to 24.4 in. (12 to 62 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	30.3	0	77
Argillic horizon	4.7		12	
Redox concentrations	23.6		60	
Secondary carbonates	23.6		60	

Pedon Notes:

A--0 to 5 inches, (0 to 12 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 3 percent sand; 26 percent clay; moderate medium granular structure; friable, slightly hard, slightly sticky, slightly plastic; many fine roots throughout; fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--5 to 15 inches, (12 to 37 cm);, silty clay loam, very dark brown (10YR 2/2) exterior, moist; 3 percent sand; 30 percent clay; moderate fine subangular blocky structure; firm, moderately hard, slightly sticky, slightly plastic; many fine roots throughout; common fine dendritic tubular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--15 to 24 inches, (37 to 60 cm);, silty clay, very dark grayish brown (10YR 3/2) exterior, moist; 3 percent sand; 44 percent clay; moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; common very fine roots between peds; common fine irregular pores; 10 percent discontinuous faint black (10YR 2/1), moist, clay films on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--24 to 30 inches, (60 to 77 cm);, silty clay, dark brown (10YR 3/3) exterior, moist; 3 percent sand; 40 percent clay; moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; common fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; 2 percent fine distinct masses of oxidized iron in matrix and 5 percent fine distinct spherical moderately cemented iron-manganese nodules between peds; 5 percent medium distinct spherical weakly cemented carbonate nodules with clear boundaries between peds; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk2--30 to 35 inches, (77 to 90 cm);, silty clay loam, brown (10YR 4/3) exterior, moist; 3 percent sand; 34 percent clay; moderate medium subangular blocky structure; firm, moderately hard, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct masses of oxidized iron in matrix and 5 percent fine distinct spherical moderately cemented iron-manganese nodules between peds; 2 percent medium distinct spherical weakly cemented carbonate nodules with clear boundaries between peds; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161002 Pedon ID: 05KS161002

Site Note:

Pedon Type: within range of series
Pedon Purpose: research site
Taxon Kind: family

Location Information:

County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area: KS161 -- Riley County, Kansas
Map Unit: 4625 -- Dwight-Irwin complex, 1 to 3 percent slopes

Location Description: Site is located one mile south of the town of Randolph,
Kansas.

Legal Description: 300 m E and 750 m S of NW corner of Section 28,
Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 692015 meters, UTM Northing: 4365258 meters

Geomorphic Setting: on shoulder of interfluvium of upland
Upslope Shape: linear Cross Slope Shape: convex
Slope: 3.0 percent Aspect: 338 (deg)
Elevation: 1293 feet, 394.0 meters
Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	30.3	0	77

Argillic horizon	7.9		20	
Abrupt textural change	7.9	8.3	20	21
Redox concentrations	24.4		62	
Secondary carbonates	30.3		77	

Pedon Notes:

A--0 to 8 inches, (0 to 20 cm); very dark gray (10YR 3/1) exterior, silt loam, black (10YR 2/1) rubbed, moist; 3 percent sand; 26 percent clay; moderate medium granular structure; friable, slightly hard, slightly sticky, slightly plastic; many very fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--8 to 11 inches, (20 to 27 cm);, silty clay loam, very dark grayish brown (10YR 3/2) exterior, moist; 3 percent sand; 30 percent clay; weak fine subangular blocky structure; firm, moderately hard, moderately sticky, moderately plastic; common very fine roots throughout; many fine dendritic tubular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--11 to 18 inches, (27 to 45 cm);, silty clay, very dark grayish brown (10YR 3/2) exterior, moist; 3 percent sand; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common very fine roots throughout; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--18 to 24 inches, (45 to 62 cm);, silty clay, very dark grayish brown (10YR 3/2) exterior, moist; 3 percent sand; 40 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots throughout; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt4--24 to 30 inches, (62 to 77 cm);, silty clay, dark brown (10YR 3/3), moist; 3 percent sand; 46 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine faint iron-manganese nodules in matrix; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--30 to 39 inches, (77 to 98 cm);, silty clay loam, brown (10YR 4/3) exterior, moist; 3 percent sand; 34 percent clay; moderate medium prismatic structure; firm, moderately hard, moderately sticky, moderately plastic; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6) masses of oxidized iron in matrix and 5 percent fine distinct black (N 2.5/0) iron-manganese nodules in matrix; 5 percent medium distinct spherical weakly cemented carbonate nodules with clear boundaries between peds; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161003 Pedon ID: 05KS161003

Site Note:

Pedon Type: within range of series
Pedon Purpose: research site
Taxon Kind: family

Location Information:

County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area: KS161 -- Riley County, Kansas
Map Unit: 4625 -- Dwight-Irwin complex, 1 to 3 percent slopes

Location Description: Site is located one mile south of the town of Randolph,
Kansas.

Legal Description: 400 m E and 700 m S of NW corner of Section 28,
Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 691973 meters, UTM Northing: 4365217 meters

Geomorphic Setting: on shoulder of interfluvium of upland
Upslope Shape: linear Cross Slope Shape: convex
Slope: 2.0 percent Aspect: 338 (deg)
Elevation: 1293 feet, 394.0 meters
Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over calcareous shale
residuum
Bedrock Depth: 60.6 inches (154.0 cm)

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

| Top Bottom Top Bottom |

Kind	Depth (in)	Depth (in)	Depth (cm)	Depth (cm)
Mollic epipedon	0.0	30.3	0	77
Argillic horizon	4.7	35.4	12	90
Redox concentrations	23.6	35.4	60	90
Secondary carbonates	23.6	35.4	60	90
Paralithic contact	60.6		154	

Pedon Notes:

A--0 to 6 inches, (0 to 15 cm); very dark gray (10YR 3/1) exterior, silty clay loam, black (10YR 2/1) rubbed, moist; 3 percent sand; 35 percent clay; moderate medium granular structure; friable, slightly hard, moderately sticky, moderately plastic; common very fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--6 to 15 inches, (15 to 38 cm); dark grayish brown (10YR 4/2) exterior, silty clay, very dark grayish brown (10YR 3/2) exterior, moist; 3 percent sand; 44 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; common very fine roots throughout; many fine dendritic tubular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--15 to 26 inches, (38 to 67 cm); brown (10YR 4/3) exterior, silty clay, dark brown (10YR 3/3) exterior, moist; 3 percent sand; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--26 to 33 inches, (67 to 84 cm); brown (10YR 4/3) exterior, silty clay, dark brown (10YR 3/3) exterior, moist; 3 percent sand; 46 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules in matrix; 2 percent medium spherical carbonate nodules between peds; 3 percent angular cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk2--33 to 42 inches, (84 to 107 cm); dark yellowish brown (10YR 4/4) exterior, silty clay, brown (10YR 4/3) exterior, moist; 3 percent sand; 46 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct brown (10YR 5/3), moist, iron depletions in matrix and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron in matrix and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules in matrix; 5 percent medium spherical carbonate nodules between peds; 3 percent angular cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt--42 to 62 inches, (107 to 157 cm); brown (7.5YR 4/4) exterior, silty clay, brown (7.5YR 4/3) exterior, moist; 3 percent sand; 40 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint clay films on all faces of

ped; 1 percent fine distinct iron depletions in matrix and 10 percent fine distinct iron-manganese nodules in matrix and 20 percent medium prominent masses of oxidized iron in matrix; 2 percent angular cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--61 to 62 inches, (154 to 157 cm); ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/09/2005
 Descriptor: DeAnn Presley

Site ID: 05KS161004 Pedon ID: 05KS161004

Site Note:

Pedon Type: within range of series
 Pedon Purpose: research site
 Taxon Kind: family

Location Information:

County: Riley Quad Sheet Name: Randolph, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area: KS161 -- Riley County, Kansas
 Map Unit: 4625 -- Dwight-Irwin complex, 1 to 3 percent slopes

Location Description: Site is located one mile south of the town of Randolph, Kansas.

Legal Description: S 1/2 of NW 1/4 of Section 28, Township 7S, Range 6E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 691913 meters, UTM Northing: 4365195 meters

Geomorphic Setting: on shoulder of interfluvium of upland
 Upslope Shape: linear Cross Slope Shape: convex
 Slope: 2.0 percent Aspect: 338 (deg)
 Elevation: 1293 feet, 394.0 meters
 Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 7.5 to 27.2 in. (19 to 69 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	28.3	0	72
Argillic horizon	7.5		19	
Redox concentrations	28.3		72	

Secondary carbonates	28.3	39.0	72	99
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Pedon Notes:

A--0 to 7 inches, (0 to 19 cm); very dark gray (10YR 3/1) exterior, silty clay loam, black (10YR 2/1) rubbed, moist; 3 percent sand; 30 percent clay; moderate medium granular structure; friable, slightly hard, moderately sticky, moderately plastic; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--7 to 11 inches, (19 to 28 cm);, silty clay, very dark gray (10YR 3/1) exterior, moist; 3 percent sand; 42 percent clay; moderate fine prismatic structure; firm, hard, very sticky, very plastic; common fine roots throughout; many fine dendritic tubular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--11 to 19 inches, (28 to 48 cm);, silty clay, very dark grayish brown (10YR 3/2) exterior, moist; 3 percent sand; 50 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; common fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--19 to 28 inches, (48 to 72 cm);, silty clay, dark brown (10YR 3/3) exterior, moist; 3 percent sand; 46 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; common fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent angular cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--31 to 39 inches, (79 to 99 cm);, silty clay, brown (10YR 4/3) exterior, moist; 3 percent sand; 42 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules in matrix; 2 percent fine spherical carbonate nodules between peds and 3 percent fine threadlike light gray (10YR 7/2), moist, carbonate masses in cracks; 2 percent angular cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Bt--39 to 50 inches, (99 to 128 cm);, silty clay loam, brown (7.5YR 4/3) exterior, moist; 3 percent sand; 39 percent clay; moderate medium prismatic structure; firm, hard, moderately sticky, moderately plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on vertical faces of peds; 1 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions in matrix and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules in matrix and 5 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron in matrix; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161005 Pedon ID: 05KS161005

Site Note:

Pedon Type: outside range of series
Pedon Purpose: research site
Taxon Kind: family

Location Information:

County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area: KS161 -- Riley County, Kansas
Map Unit: 4625 -- Dwight-Irwin complex, 1 to 3 percent slopes

Location Description: Site is located one mile south of the town of Randolph,
Kansas.

Legal Description: S 1/2 of NW 1/4 of Section 28, Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83

UTM Zone: 14, UTM Easting: 691894 meters, UTM Northing: 4365194 meters

Geomorphic Setting: on shoulder of interfluvium of upland

Upslope Shape: linear Cross Slope Shape: convex

Slope: 2.0 percent Aspect: 338 (deg)

Elevation: 1293 feet, 394.0 meters

Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover

Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
calcareous shale residuum

Bedrock Depth: 96.9 inches (246.0 cm)

Particle Size Control Section: 8.7 to 28.3 in. (22 to 72 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	31.5	0	80
Argillic horizon	8.7	96.9	22	246

Abrupt textural change	8.7	9.8	22	25
Redox concentrations	16.1	96.9	41	246
Secondary carbonates	31.5	45.7	80	116
Paralithic contact	96.9		246	

Pedon Notes:

Mineralogy data for this pedon is available from the Kansas State University Soil Characterization Laboratory. Smectite dominates the clay mineral fraction from 0 to 116 cm, which was interpreted to be loess-derived. From 116 to 246 cm the dominant clay minerals are kaolinite, clay mica, and to a lesser degree, smectite. For the upper 116 cm, the mineralogy class is smectite, and for the material from 116 to 246 cm the mineralogy class is mixed.

This pedon was originally called Konza because of the apparent abrupt textural change in the field estimated textures and clay contents. Upon review of particle size analysis data, the clay contents were 42, 53, 49, 43, 41, 49, 45, and 43 % for the A, Bt1, Bt2, Btk, 2Bt1, 2Bt2, 3Bt3, 3Bt4 horizons, respectively. The texture for the entire profile is silty clay.

This pedon just barely misses the Paleustoll criteria for clay contents (with increasing depth, no decrease of more than 20% relative from the maximum clay content...). Also, this profile lacks the abrupt textural change criterion because the clay content starts out so high, much higher than was hand textured.

White, non calcareous masses were observed in the 2Bt1, 2Bt2, and 3Bt3 horizons. Under a microscope at 40x magnification, these masses appeared white and crystalline. More lab work is needed to identify the presence of gypsum. For now, the "y" subscript will not be added to the horizon designations.

A--0 to 9 inches, (0 to 22 cm); very dark gray (10YR 3/1) exterior, silty clay loam, black (10YR 2/1) rubbed, moist; 3 percent sand; 30 percent clay; moderate medium granular structure; friable, slightly hard, moderately sticky, moderately plastic; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--9 to 16 inches, (22 to 41 cm);, silty clay, very dark grayish brown (10YR 3/2) exterior, moist; 3 percent sand; 50 percent clay; moderate medium granular and weak fine subangular blocky structure; very firm, very hard, very sticky, very plastic; many fine roots throughout; many fine dendritic tubular pores; 2 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--16 to 31 inches, (41 to 80 cm);, silty clay, dark brown (10YR 3/3) exterior, moist; 3 percent sand; 46 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; common very fine roots between peds; common fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--31 to 46 inches, (80 to 116 cm);, silty clay loam, brown (10YR 4/3) exterior, moist; 3 percent sand; 36 percent clay; moderate fine prismatic structure; firm, moderately hard, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine dark yellowish brown (10YR 4/6), moist, masses of

oxidized iron and 10 percent fine black (N 2.5/0), moist, iron-manganese nodules; 1 percent fine distinct spherical carbonate nodules between peds and 1 percent fine faint carbonate masses on faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt1--46 to 69 inches, (116 to 175 cm);, silty clay loam, dark brown (7.5YR 3/3) exterior, moist; 3 percent sand; 36 percent clay; moderate medium subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine faint gypsum masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--69 to 81 inches, (175 to 207 cm);, silty clay loam, dark brown (7.5YR 3/4) exterior, moist; 3 percent sand; 36 percent clay; moderate medium subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; few very fine roots between peds; many fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron in matrix and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules in matrix; 2 percent fine faint gypsum masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt3--81 to 92 inches, (207 to 234 cm);, silty clay, reddish brown (5YR 4/4) exterior, moist; 3 percent sand; 41 percent clay; moderate fine prismatic structure; friable, slightly hard, moderately sticky, moderately plastic; common fine irregular pores; 1 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent fine faint gypsum masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt4--92 to 97 inches, (234 to 246 cm);, silty clay loam, brown (7.5YR 4/4) exterior, moist; 3 percent sand; 34 percent clay; moderate fine prismatic structure; friable, slightly hard, very sticky, very plastic; common fine irregular pores; 2 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 1 percent fine distinct light olive brown (2.5Y 5/3), moist, clay depletions and 2 percent fine distinct iron-manganese nodules and 15 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--97 to 100 inches, (246 to 255 cm); ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161006 Pedon ID: 05KS161006

Site Note:
Field has been cropped since 1880's and seems to be very eroded, based on thin mollic epipedon and mixing of colors in the second horizon.

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Site is located one mile south of the town of Randolph, Kansas.
Legal Description: S 1/2 of NW 1/4 of Section 28, Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 692072 meters, UTM Northing: 4365235 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: linear Cross Slope Shape: convex
Slope: 1.0 percent Aspect: 338 (deg)
Elevation: 1296 feet, 395.0 meters
Drainage class: moderately well

Primary Earth Cover: Crop cover
Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over colluvium over
clayey shale residuum
Bedrock Depth: 63.8 inches (162.0 cm)

Particle Size Control Section: 2.0 to 21.7 in. (5 to 55 cm)

Diagnostic Features:
| Top Bottom Top Bottom |

Kind	Depth (in)	Depth (in)	Depth (cm)	Depth (cm)
Mollic epipedon	0.0	14.2	0	36
Argillic horizon	2.0	21.7	5	55
Redox concentrations	14.2	63.8	36	162
Secondary carbonates	20.9	33.1	53	84
Paralithic contact	63.8		162	

Pedon Notes:

Ap--0 to 2 inches, (0 to 5 cm); brown (10YR 5/3) broken face, silty clay loam, dark brown (10YR 3/3) rubbed, moist; 3 percent sand; 32 percent clay; weak medium subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; few very fine roots throughout; few very fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--2 to 14 inches, (5 to 36 cm);, silty clay, 25 percent dark grayish brown (10YR 4/2) broken face and 75 percent very dark grayish brown (10YR 3/2) broken face, moist; 3 percent sand; 44 percent clay; moderate coarse prismatic structure; friable, hard, moderately sticky, moderately plastic; few very fine roots between peds; few very fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt2--14 to 21 inches, (36 to 53 cm);, silty clay, 25 percent very dark grayish brown (10YR 3/2) broken face and 75 percent brown (10YR 4/3) broken face, moist; 3 percent sand; 44 percent clay; moderate medium prismatic structure; friable, hard, moderately sticky, moderately plastic; few very fine roots between peds; few very fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--21 to 33 inches, (53 to 84 cm);, silty clay, brown (10YR 4/3) broken face, moist; 3 percent sand; 42 percent clay; moderate medium subangular blocky structure; friable, hard, moderately sticky, moderately plastic; few very fine roots between peds; common very fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent medium faint brown (10YR 5/3), moist, iron depletions and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent fine distinct light gray (10YR 7/2), moist, carbonate masses and 1 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt1--33 to 47 inches, (84 to 119 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 3 percent sand; 38 percent clay; moderate medium subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent medium faint brown (10YR 5/3), moist, iron depletions and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt2--47 to 64 inches, (119 to 162 cm);, silty clay loam, dark brown (10YR 3/3) broken face, moist; 3 percent sand; 38 percent clay; moderate medium subangular blocky structure;

friable, slightly hard, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint brown (10YR 4/3), moist, iron depletions and 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 3 percent nonflat angular chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--64 to 66 inches, (162 to 168 cm); .

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161007 Pedon ID: 05KS161007

Site Note:
Field has been cropped since 1880's and seems to be eroded. The surface horizon had a silty clay loam texture, and similar, less eroded soils usually have silt loam textures in the surface horizon.

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Site is located one mile south of the town of Randolph, Kansas.

Legal Description: S 1/2 of NW 1/4 of Section 28, Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 692090 meters, UTM Northing: 4365370 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 2.0 percent Aspect: (deg)
Elevation: 1293 feet, 394.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over colluvium over
clayey shale residuum
Bedrock Depth: 83.9 inches (213.0 cm)

Particle Size Control Section: 2.0 to 21.7 in. (5 to 55 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	18.9	0	48
Argillic horizon	2.0	83.9	5	213
Redox concentrations	18.9	83.9	48	213
Secondary carbonates	18.9	31.5	48	80
Paralithic contact	83.9		213	

Pedon Notes:

Ap--0 to 2 inches, (0 to 5 cm); brown (10YR 4/3) broken face, silty clay loam, dark brown (10YR 3/3) rubbed, moist; 3 percent sand; 32 percent clay; weak medium subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; few very fine roots throughout; few very fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--2 to 19 inches, (5 to 48 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 3 percent sand; 44 percent clay; moderate medium prismatic structure; firm, hard, moderately sticky, moderately plastic; few very fine roots between peds; few very fine irregular pores; 10 percent continuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--19 to 31 inches, (48 to 80 cm);, silty clay, brown (10YR 4/3) broken face, moist; 3 percent sand; 46 percent clay; moderate medium prismatic structure; firm, hard, moderately sticky, moderately plastic; few very fine roots between peds; few very fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 2 percent fine distinct carbonate masses and 3 percent medium distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bty--31 to 77 inches, (80 to 196 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 3 percent sand; 42 percent clay; moderate medium prismatic structure; firm, hard, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 2 percent patchy faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 3 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent medium distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 5 percent medium distinct brown (10YR 5/3), moist, gypsum masses; 3 percent nonflat angular chert fragments; noneffervescent, by HCl, 1 normal; Light colored, non-calcareous masses were examined under microscope at 40x magnification. Appear to be crystalline. Concluded to be gypsum.; clear smooth boundary.

3Bt--77 to 84 inches, (196 to 213 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 3 percent sand; 44 percent clay; moderate medium prismatic structure; firm, hard, moderately sticky, moderately plastic; few very fine roots between peds; few fine irregular pores; 2 percent patchy faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent medium distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--84 to 87 inches, (213 to 220 cm); .

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161008 Pedon ID: 05KS161008

Site Note:
Field has been cropped since 1880's and seems to be eroded. The surface horizon had a silty clay loam texture, and similar, less eroded soils usually have silt loam textures in the surface horizon.

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Site is located one mile south of the town of Randolph, KS.

Legal Description: S 1/2 of NW 1/4 of Section 28, Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 692108 meters, UTM Northing: 4365327 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1289 feet, 393.0 meters
Drainage class: moderately well

Primary Earth Cover: Crop cover
Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over colluvium over calcareous shale residuum
Bedrock Depth: 51.6 inches (131.0 cm)

Particle Size Control Section: 2.0 to 21.7 in. (5 to 55 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	26.8	0	68
Argillic horizon	2.0	48.8	5	124
Gypsum accumulations	2.0	13.8	5	35
Redox concentrations	13.8	51.6	35	131
Secondary carbonates	13.8	26.8	35	68
Redox depletions with chroma 2 or less	48.8	51.6	124	131
Paralithic contact	51.6		131	

Pedon Notes:

The 2Bt1 and 3Bt2 horizons are much more porous than the overlying horizons.

Ap--0 to 2 inches, (0 to 5 cm); brown (10YR 4/3) broken face, silty clay loam, dark brown (10YR 3/3) rubbed, moist; 3 percent sand; 33 percent clay; weak fine subangular blocky structure; friable, hard; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt--2 to 14 inches, (5 to 35 cm); dark brown (10YR 3/3) broken face, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 3 percent sand; 44 percent clay; moderate coarse prismatic parting to moderate medium prismatic structure; very firm, very hard; few very fine roots between peds; few very fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; abrupt boundary.

Btky--14 to 27 inches, (35 to 68 cm); brown (10YR 4/3) broken face, silty clay, dark brown (10YR 3/3) broken face, moist; 3 percent sand; 42 percent clay; moderate coarse prismatic structure; very firm, very hard; few very fine roots between peds; few very fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 1 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent fine faint gypsum masses between peds and 2 percent fine distinct carbonate nodules and 5 percent medium distinct carbonate masses; noneffervescent, by HCl, 1 normal; Horizon contains white, non-calcareous masses that are thought to be gypsum accumulations.; clear boundary.

2Bt1--27 to 43 inches, (68 to 108 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 3 percent sand; 39 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; firm, hard; few very fine roots between peds; common fine irregular and common very fine irregular pores; 10 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual boundary.

3Bt2--43 to 49 inches, (108 to 124 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 3 percent sand; 43 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; firm, hard; few very fine roots between peds; common fine irregular and common very fine irregular pores; 5 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 4 percent fine prominent brown (10YR 5/3), moist, iron depletions lining pores and 10 percent fine prominent strong brown (7.5YR 5/6), moist, masses of oxidized iron in matrix; noneffervescent, by HCl, 1 normal; clear boundary.

3Bc--49 to 52 inches, (124 to 131 cm);, silty clay, light olive brown (2.5Y 5/3) broken

face, moist; 3 percent sand; 47 percent clay; weak medium subangular blocky structure; very firm, very hard; few very fine irregular pores; 10 percent medium distinct grayish brown (2.5Y 5/2), moist, iron depletions and 25 percent medium prominent strong brown (7.5YR 5/8), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt boundary.

4Cr--52 to 55 inches, (131 to 140 cm); .

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161009 Pedon ID: 05KS161009

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Site is located one mile south of the town of Randolph,
Kansas.
Legal Description: NW 1/4 of NW 1/4 of Section 28, Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 691781 meters, UTM Northing: 4365949 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1247 feet, 380.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Hayland

Parent Material: clayey loess

Particle Size Control Section: 4.3 to 24.0 in. (11 to 61 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	13.8	0	35
Argillic horizon	4.3		11	

Redox concentrations	13.8		35	
Secondary carbonates	28.0		71	

Pedon Notes:

Ap--0 to 4 inches, (0 to 11 cm); dark grayish brown (10YR 4/2) broken face, silty clay loam, dark brown (10YR 3/3) rubbed, moist; 33 percent clay; weak fine subangular blocky structure; firm, hard; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--4 to 14 inches, (11 to 35 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard; few fine roots between peds; few fine irregular pores; 10 percent continuous distinct black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--14 to 28 inches, (35 to 71 cm);, silty clay, dark brown (10YR 3/3) broken face and brown (10YR 4/3) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm, very hard; few fine roots between peds; few fine irregular pores; 10 percent continuous distinct very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine distinct iron-manganese nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--28 to 45 inches, (71 to 115 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 36 percent clay; moderate medium prismatic structure; very firm, very hard; few very fine roots between peds; few fine irregular pores; 5 percent continuous distinct dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese masses and 10 percent medium prominent dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules and 5 percent fine distinct carbonate masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Btk2--45 to 49 inches, (115 to 125 cm);, silty clay loam, dark yellowish brown (10YR 4/4) broken face, moist; 36 percent clay; weak medium subangular blocky structure; friable, hard; few very fine roots between peds; few fine irregular pores; 1 percent patchy faint brown (10YR 4/3), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese masses and 20 percent medium prominent dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules and 5 percent fine distinct carbonate masses; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161010 Pedon ID: 05KS161010

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Site is located one mile south of the town of Randolph,
Kansas.
Legal Description: NW 1/4 of NW 1/4 of Section 28, Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 691739 meters, UTM Northing: 4365897 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1247 feet, 380.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Hayland

Parent Material: clayey loess over colluvium over colluvium over
residuum
Bedrock Depth: 95.3 inches (242.0 cm)

Particle Size Control Section: 9.8 to 29.5 in. (25 to 75 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	18.9	0	48
Redox concentrations	9.8	95.3	25	242
Argillic horizon	9.8	95.3	25	242
Secondary carbonates	29.9	44.9	76	114
Lithologic discontinuity	44.9	69.7	114	177
Gypsum accumulations	44.9	85.0	114	216
Lithologic discontinuity	69.7	95.3	177	242
Paralithic contact	95.3		242	
Lithologic discontinuity	95.3		242	

Pedon Notes:

Ap--0 to 10 inches, (0 to 25 cm); very dark gray (10YR 3/1) broken face, silty clay loam; 35 percent clay; moderate fine subangular blocky parting to moderate medium subangular blocky structure; friable, slightly hard; common fine roots top of horizon; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--10 to 19 inches, (25 to 48 cm);, silty clay, dark grayish brown (10YR 4/2) broken face and very dark grayish brown (10YR 3/2) broken face, moist; 42 percent clay; moderate fine prismatic structure; friable, moderately hard; few fine roots top of horizon; few fine irregular pores; 5 percent continuous distinct very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine distinct iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--19 to 30 inches, (48 to 76 cm);, clay, dark grayish brown (10YR 4/2) broken face, moist; 55 percent clay; moderate medium prismatic structure; very firm, very hard; few very fine roots between peds; few fine irregular pores; 10 percent continuous distinct dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine distinct iron-manganese masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--30 to 45 inches, (76 to 114 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; firm, moderately hard; few very fine roots between peds; few fine irregular pores; 10 percent continuous distinct dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint brown (10YR 5/3), moist, iron-manganese masses and 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine dendritic carbonate masses and 5 percent fine dendritic carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt--45 to 55 inches, (114 to 140 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 40 percent clay; moderate fine prismatic structure; friable, slightly hard; few very fine roots between peds; common fine irregular pores; 10 percent continuous distinct dark brown (7.5YR 3/2), moist, clay films on all faces of peds; 5 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses; 5 percent; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bty1--55 to 70 inches, (140 to 177 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 40 percent clay; moderate medium subangular blocky structure; friable, slightly hard; few very fine roots between peds; common fine irregular pores; 10 percent continuous distinct dark brown (7.5YR 3/2), moist, clay films on all faces of peds; 5 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses; noneffervescent, by HCl, 1

normal; gradual smooth boundary.

3Bty2--70 to 85 inches, (177 to 216 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 40 percent clay; moderate fine prismatic structure; very firm, very hard; few very fine roots between peds; common fine irregular pores; 10 percent continuous distinct dark reddish brown (5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct masses of oxidized iron; 1 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt--85 to 95 inches, (216 to 242 cm);, clay, reddish brown (5YR 4/4) broken face and yellowish red (5YR 4/6) broken face, moist; 50 percent clay; weak fine subangular blocky structure; extremely firm, extremely hard; few very fine roots between peds; few fine irregular pores; 10 percent continuous distinct dark reddish brown (5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

4Cr--95 to 100 inches, (242 to 255 cm); ; few very fine roots between peds; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161011 Pedon ID: 05KS161011

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Site is located one mile south of the town of Randolph,
Kansas.
Legal Description: SW 1/4 of SW 1/4 of Section 21, Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 691792 meters, UTM Northing: 4366055 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1257 feet, 383.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from limestone and shale
Bedrock Depth: 116.1 inches (295.0 cm)

Particle Size Control Section: 7.5 to 23.2 in. (19 to 59 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	15.7	0	40
Argillic horizon	7.5	116.1	19	295
Redox depletions with chroma 2 or less	37.4	61.8	95	157
Redox concentrations	37.4	116.1	95	295
Secondary carbonates	44.5	61.8	113	157
Lithologic discontinuity	61.8	84.6	157	215
Lithologic discontinuity	84.6	116.1	215	295
Gypsum accumulations	84.6	116.1	215	295
Paralithic contact	116.1		295	
Lithologic discontinuity	116.1		295	

Pedon Notes:

Ap--0 to 7 inches, (0 to 19 cm); dark grayish brown (10YR 4/2) broken face, silty clay loam; 36 percent clay; weak medium subangular blocky structure; friable, hard; few fine roots top of horizon; many fine dendritic tubular and many medium dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--7 to 16 inches, (19 to 40 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 45 percent clay; moderate medium prismatic parting to moderate coarse prismatic structure; firm; few fine roots between peds; common fine irregular pores; 5 percent continuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--16 to 37 inches, (40 to 95 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 45 percent clay; moderate medium prismatic parting to moderate coarse prismatic structure; firm; few fine roots between peds; common fine irregular pores; 5 percent continuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--37 to 44 inches, (95 to 113 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 2 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine distinct grayish brown (10YR 5/2), moist, iron-manganese masses and 2 percent fine faint masses of oxidized iron and 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, iron depletions; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--44 to 62 inches, (113 to 157 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 34 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; friable; few very fine roots between peds; few fine irregular pores; 2 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 5 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions; 2 percent fine distinct carbonate masses and 2 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt--62 to 85 inches, (157 to 215 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 36 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; friable; few very fine roots between peds; common fine irregular pores; 5 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct masses of oxidized iron and 2 percent fine distinct strong brown (7.5YR 4/6), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; gradual

smooth boundary.

3Bty--85 to 116 inches, (215 to 295 cm);, silty clay loam, dark reddish brown (5YR 3/3) broken face, moist; 35 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; firm; few very fine roots between peds; common fine irregular pores; 5 percent continuous faint dark reddish brown (5YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct gypsum masses; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

4Cr--116 to 117 inches, (295 to 298 cm); .

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 07/09/2005
Describer: DeAnn Presley

Site ID: 05KS161012 Pedon ID: 05KS161012

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Riley Quad Sheet Name: Randolph, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Site is located one mile south of the town of Randolph,
Kansas.
Legal Description: SW 1/4 of SW 1/4 of Section 21, Township 7S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 691803 meters, UTM Northing: 4366253 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1257 feet, 383.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	12.6	0	32
Argillic horizon	7.9		20	

Redox concentrations	12.6		32	
Secondary carbonates	35.0	60.2	89	153
Lithologic discontinuity	60.2	103.5	153	263
Gypsum accumulations	60.2	103.5	153	263
Lithologic discontinuity	103.5		263	

Pedon Notes:

Ap--0 to 8 inches, (0 to 20 cm); dark gray (10YR 4/1) broken face, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 36 percent clay; weak fine subangular blocky parting to weak medium subangular blocky structure; firm, hard; common fine roots top of horizon; many fine dendritic tubular and many medium dendritic tubular pores; abrupt smooth boundary.

Bt1--8 to 13 inches, (20 to 32 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate fine prismatic structure; very firm; few fine roots between peds; common fine irregular pores; 2 percent continuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; clear smooth boundary.

Bt2--13 to 28 inches, (32 to 70 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 50 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; few fine irregular pores; 5 percent continuous distinct very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine distinct iron-manganese masses; clear smooth boundary.

Bt3--28 to 35 inches, (70 to 89 cm);, silty clay, brown (10YR 4/3) broken face, moist; 48 percent clay; moderate medium prismatic parting to moderate coarse prismatic structure; firm; few very fine roots between peds; few very fine irregular pores; 10 percent continuous faint dark grayish brown (10YR 4/2), moist, clay films on all faces of peds; 1 percent fine distinct iron-manganese masses and 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; abrupt smooth boundary.

Btk--35 to 60 inches, (89 to 153 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; friable; few very fine roots between peds; common fine irregular pores; 5 percent continuous faint dark grayish brown (10YR 4/2), moist, clay films on all faces of peds; 1 percent fine distinct and 2 percent fine distinct and 2 percent fine distinct iron-manganese masses and 2 percent fine faint brown (10YR 5/3), moist, iron depletions and 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct carbonate nodules and 2 percent fine distinct carbonate masses; gradual smooth boundary.

2Bty1--60 to 69 inches, (153 to 175 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; friable; few very fine roots between peds; common fine irregular pores; 2 percent patchy faint very dark brown (7.5YR 2/2), moist, clay films on all faces of peds; 1 percent fine faint iron-manganese masses and 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent gypsum masses; gradual smooth boundary.

2Bty2--69 to 104 inches, (175 to 263 cm);, silty clay, dark brown (7.5YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 2 percent patchy faint very dark brown (7.5YR 2/2), moist, clay films on all faces of peds; 1 percent fine faint iron-manganese masses and 10 percent fine prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; 2

percent gypsum masses; gradual smooth boundary.

3Bt--104 to 118 inches, (263 to 300 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 42 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 5 percent continuous faint brown (7.5YR 4/3), moist, clay films on all faces of peds; 2 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct iron-manganese nodules; 5 percent cherty limestone fragments.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated: Irwin
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/06/2006
 Descriptor: P.Abel/D.Presley

Site ID: 06KS161001-pla Pedon ID: 06KS161001

Site Note:

Pedon Type: outside range of series
 Pedon Purpose: full pedon description
 Taxon Kind: series

Location Information:

County: Riley Quad Sheet Name:
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area: KS161 -- Riley County, Kansas
 Map Unit: 4625 -- Dwight-Irwin complex, 1 to 3 percent slopes

Location Description:

Legal Description: SW 1/4 of Section 36, Township 10S, Range 5E

Latitude: 39 degrees 8 minutes 15.87 seconds north
 Longitude: 96 degrees 49 minutes 45.17 seconds east

Datum: NAD83

UTM Zone: 14, UTM Easting: 687619 meters, UTM Northing: 4334307 meters

Geomorphic Setting: on backslope of side slope of upland

Upslope Shape: linear Cross Slope Shape: linear

Slope: 2.0 percent Aspect: 180 (deg)

Elevation: feet, meters

Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover

Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over clayey pedisegment

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	14.2	0	36
Argillic horizon	7.9	30.7	20	78
Lithologic discontinuity	26.0		66	
Paralithic contact	70.1		178	

Pedon Notes:

A--0 to 5 inches, (0 to 13 cm);, silty clay loam, black (10YR 2/1) exterior, moist; 32 percent clay; weak fine granular structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent; clear smooth boundary.

BA--5 to 8 inches, (13 to 20 cm);, silty clay loam, very dark gray (10YR 3/1) exterior, moist; 38 percent clay; moderate fine subangular blocky structure; firm, moderately hard, moderately sticky, moderately plastic; common fine and medium roots throughout; common fine irregular pores; noneffervescent; abrupt smooth boundary.

Bt--8 to 14 inches, (20 to 36 cm);, silty clay, dark brown (10YR 3/3) exterior, moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; very firm, very hard, very sticky, very plastic; common fine and medium roots throughout; few fine irregular pores; 50 percent continuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine prominent irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; noneffervescent; 10yr 3/1 surface fill in vertical cracks.; gradual wavy boundary.

Btss1--14 to 21 inches, (36 to 53 cm);, silty clay, 40 percent dark brown (10YR 3/3) exterior and 60 percent brown (10YR 4/3) exterior, moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine and medium roots throughout; few fine irregular pores; 15 percent discontinuous very dark grayish brown (10YR 3/2), moist, slickensides (pedogenic) on vertical faces of peds and 40 percent continuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine prominent irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; noneffervescent; 10yr 3/1 surface fill in vertical cracks.; gradual wavy boundary.

Btss2--21 to 26 inches, (53 to 66 cm);, silty clay, brown (10YR 4/3) exterior, moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine and medium roots throughout; few fine irregular pores; 10 percent discontinuous very dark grayish brown (10YR 3/2), moist, slickensides (pedogenic) on vertical faces of peds and 30 percent continuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine iron-manganese concretions throughout and 5 percent fine prominent irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; noneffervescent; 10yr 3/1 surface fill in vertical cracks.; gradual wavy boundary.

2Btkss--26 to 31 inches, (66 to 79 cm);, silty clay, brown (7.5YR 4/2) exterior, moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine and medium roots throughout; few fine irregular pores; 10 percent discontinuous very dark grayish brown (10YR 3/2), moist, slickensides (pedogenic) on vertical faces of peds and 20 percent discontinuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine iron-manganese concretions throughout and 10 percent fine irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; 1 percent fine irregular carbonate concretions throughout; 2 percent nonflat angular 5 to 20 millimeter limestone fragments; noneffervescent; gradual wavy boundary.

2Bt1--31 to 41 inches, (79 to 104 cm);, silty clay, brown (7.5YR 4/3) exterior, moist; moderate medium prismatic parting to moderate fine and medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine and medium roots throughout; few

fine irregular pores; 20 percent discontinuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 3 percent fine iron-manganese concretions throughout and 10 percent fine irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; 2 percent nonflat angular 5 to 20 millimeter limestone fragments; noneffervescent; gradual wavy boundary.

3Bt2--41 to 52 inches, (104 to 132 cm);, clay, dark brown (7.5YR 3/3) exterior, moist; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 25 percent discontinuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine iron-manganese concretions throughout and 15 percent fine irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; 2 percent nonflat angular 5 to 20 millimeter limestone fragments; noneffervescent; gradual wavy boundary.

3Bt3--52 to 70 inches, (132 to 178 cm);, clay, dark brown (7.5YR 3/3) exterior, moist; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 15 percent discontinuous very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine iron-manganese concretions throughout and 15 percent fine irregular strong brown (7.5YR 4/6), moist, masses of oxidized iron throughout; 3 percent nonflat angular 5 to 20 millimeter limestone fragments; noneffervescent; abrupt smooth boundary.

4Cr--70 to 73 inches, (178 to 185 cm); ; weathered shale.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated: Irwin
Classification: Fine, mixed, superactive, mesic Pachic Argiustolls

Description Date: 04/14/2005
Describer: P. Abel, J. McDowell, T. Robertson, C. Watts, J. Warner, C.
Remley, W. Wehmueller, D. Presley

Site ID: 05KS061001 Pedon ID: 05KS061001

Site Note:

Type location for the Irwin series, located in well managed native prairie.
Sampling party includes Pat Abel, Chad Remley, John Warner, Cleveland
Watts, Jim McDowell, Tony Robertson, Bill Wehmueller, P. Schoeneberger,
DeAnn Presley(KSU).

Large diameter cores (25 cm) from three horizons were collected adjacent
to the pit by Gerard Kluitenberg (professor KSU) and graduate students to
study hydraulic conductivity under an agreement with NRCS.

Lab Pedon #: 05N0660 Lab Source ID: SSL

Pedon Type: typical pedon for series
Pedon Purpose: full pedon description
Taxon Kind: series

Location Information:

County: Geary Quad Sheet Name: Wreford, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area: KS061 -- Geary County, Kansas
Map Unit: Id -- IRWIN SILTY CLAY LOAM, 3 TO 7 PERCENT SLOPES
4673 -- Irwin silty clay loam, 3 to 7 percent slopes

Location Description: About 8 miles south and 1 mile east of Junction City,
Kansas.

Legal Description: 2380 feet east and 500 feet north of the southwest
corner of Section 25, Township 13S, Range 5E

Latitude: 38 degrees 53 minutes 9.00 seconds north
Longitude: 96 degrees 49 minutes 34.00 seconds west

Datum: NAD83
UTM Zone: 14, UTM Easting: 688564 meters, UTM Northing: 4306355 meters

Physiographic Division: Interior Plains
Physiographic Province: Central Lowland Province
Physiographic Section: Osage Plain
State Physiographic Area: Flint Hills Upland

Geomorphic Setting: on backslope of side slope of hillslope on upland
Upslope Shape: convex Cross Slope Shape: convex
Slope: 3.0 percent Aspect: 10 (deg)
Elevation: 1339 feet, 408.0 meters

Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover

Secondary Earth Cover: Grassland rangeland

Parent Material: loess derived from mixed over pedisegment derived
from mixed over residuum weathered from calcareous
shale

Particle Size Control Section: 11.8 to 31.5 in. (30 to 80 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	22.8	0	58
Argillic horizon	11.8	68.9	30	175
Slickensides	22.8	31.1	58	79
Secondary carbonates	31.1	48.8	79	124

Pedon Notes:

This pedon sampled in same general area as 88KS061004. The previous sample was described and collected during the update of the Geary County, Kansas, Soil Survey. 88KS061004 was submitted to the Kansas State University Pedology Laboratory.

There was much discussion about the lowest horizon and whether it was a C or Cr horizon. Because it was not indurated and likely would slake after drying and resubmersion in water it was considered a C horizon.

It was generally agreed the upper part of the pedon formed in material with a strong loess influence. There was much discussion about the second material and whether it should be colluvium, slope alluvium, pedisegment, hillslope sediment, or residuum. It was generally agreed that it is material weathered from the underlying geologic materials and has been reworked and moving across the geomorphic surface.

A1--0 to 4 inches, (0 to 10 cm);, silt loam, black (10YR 2/1), moist; 28 percent clay; moderate fine and medium granular structure; friable, slightly hard, slightly sticky, slightly plastic; many fine and medium roots throughout; noneffervescent, by HCl, 1 normal; clear smooth boundary. Lab sample # 05N03581

A2--4 to 12 inches, (10 to 30 cm);, silty clay loam, very dark gray (10YR 3/1), moist; 30 percent clay; moderate fine and medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; many fine roots throughout; noneffervescent, by HCl, 1 normal; abrupt smooth boundary. Lab sample # 05N03582

Bt1--12 to 23 inches, (30 to 58 cm);, silty clay, very dark grayish brown (10YR 3/2) crushed and very dark brown (10YR 2/2), moist; 50 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; firm, hard, moderately sticky, moderately plastic; many very fine and fine roots throughout; 2 percent discontinuous distinct organic stains on faces of peds and 15 percent continuous faint very dark grayish brown (10YR 3/2), moist, clay films on faces of peds; noneffervescent, by HCl, 1 normal; this horizon was very moist with water glistening on some ped faces; gradual wavy

boundary. Lab sample # 05N03583

Bt2--23 to 31 inches, (58 to 79 cm);, silty clay, brown (10YR 4/3), moist; 46 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; many very fine roots between peds; 5 percent distinct slickensides (pedogenic) and 30 percent continuous distinct very dark grayish brown (10YR 3/2), moist, clay films on faces of peds; noneffervescent, by HCl, 1 normal; gradual wavy boundary. Lab sample # 05N03584

Btk1--31 to 42 inches, (79 to 107 cm);, silty clay, dark yellowish brown (10YR 4/4), moist; 41 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; common very fine roots throughout; 35 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on faces of peds; 3 percent coarse spherical weakly cemented carbonate masses with clear boundaries in matrix; noneffervescent, by HCl, 1 normal; gradual wavy boundary. Lab sample # 05N03585

Btk2--42 to 49 inches, (107 to 124 cm);, silty clay, dark yellowish brown (10YR 4/4), moist; 40 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; common fine roots throughout; 15 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on faces of peds; 3 percent coarse spherical weakly cemented carbonate masses with clear boundaries in matrix; noneffervescent, by HCl, 1 normal; gradual wavy boundary. Lab sample # 05N03586

2Bt3--49 to 61 inches, (124 to 155 cm);, silty clay loam, dark brown (7.5YR 3/4), moist; 38 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; firm, hard, moderately sticky, moderately plastic; common fine roots throughout; 25 percent discontinuous distinct dark brown (7.5YR 3/3), moist, clay films on faces of peds; 2 percent fine distinct spherical moderately cemented black (10YR 2/1), moist, manganese masses with clear boundaries in matrix; noneffervescent, by HCl, 1 normal; clear wavy boundary. Lab sample # 05N03587

2Bt4--61 to 69 inches, (155 to 175 cm);, silty clay loam, 30 percent dark grayish brown (10YR 4/2) and 70 percent brown (7.5YR 4/4), moist; 38 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; firm, hard, moderately sticky, moderately plastic; common fine roots throughout; 15 percent discontinuous distinct dark brown (7.5YR 3/3), moist, clay films on faces of peds; 2 percent fine distinct spherical moderately cemented black (10YR 2/1), moist, manganese masses with clear boundaries in matrix and 10 percent fine and medium distinct irregular very weakly cemented strong brown (7.5YR 4/6), moist, and strong brown (7.5YR 5/6), moist, masses of oxidized iron with diffuse boundaries infused into matrix along faces of peds; 1 percent nonflat subangular weakly cemented 2 to 20 millimeter noncalcareous shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary. Lab sample # 05N03588

3C--69 to 84 inches, (175 to 213 cm);, silt loam, 20 percent brownish yellow (10YR 6/6) and 80 percent light gray (10YR 7/2), moist; 27 percent clay; ; firm, slightly hard, slightly sticky, slightly plastic; strong effervescence, by HCl, 1 normal; this horizon appears to be highly weathered, calcareous shale that is not indurated enough to meet the definition of paralithic contact, there is some weak platy rock structure related to the shale visible in some spots, other areas appear massive, there are a few old root channels and pores that have extremely thin, very patchy clay films, there are also a few highly weathered chert fragments 20-75 mm in diameter that are moderately indurated. Lab sample # 05N03589

Soil Name as Described/Sampled: Konza
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 08/18/2005
Describer: DeAnn Presley

Site ID: 05KS127001 Pedon ID: 05KS127001

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: White City, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Four miles north of White City, Kansas.
Legal Description: NE 1/4 of Section 12, Township 14S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 698966 meters, UTM Northing: 4303105 meters

Geomorphic Setting: on shoulder of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1421 feet, 433.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
weathered from limestone and shale
Bedrock Depth: 84.6 inches (215.0 cm)

Particle Size Control Section: 11.4 to 31.1 in. (29 to 79 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	11.4	0	29

Argillic horizon	11.4	84.6	29	215
Redox concentrations	11.4	84.6	29	215
Secondary carbonates	18.9	35.0	48	89
Lithologic discontinuity	35.0	84.6	89	215
Lithologic discontinuity	84.6		215	
Paralithic contact	84.6		215	

Pedon Notes:

Ap--0 to 4 inches, (0 to 10 cm); brown (10YR 5/3) broken face, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 36 percent clay; weak fine subangular blocky parting to weak medium subangular blocky structure; very firm, very hard; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

BA--4 to 11 inches, (10 to 29 cm); dark grayish brown (10YR 4/2) broken face, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 50 percent clay; moderate medium subangular blocky structure; extremely firm, extremely hard; few fine roots throughout; few fine dendritic tubular pores; 2 percent continuous distinct black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--11 to 19 inches, (29 to 48 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 48 percent clay; moderate medium prismatic parting to moderate coarse prismatic structure; extremely firm; few fine roots between peds; few very fine irregular pores; 4 percent continuous distinct very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese masses; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--19 to 35 inches, (48 to 89 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 40 percent clay; moderate coarse prismatic structure; extremely firm; few fine roots between peds; few very fine irregular pores; 2 percent continuous distinct dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct iron-manganese masses; 2 percent fine carbonate masses and 2 percent medium carbonate nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Bt1--35 to 48 inches, (89 to 122 cm);, silty clay loam, brown (7.5YR 4/4) broken face, moist; 34 percent clay; moderate medium prismatic parting to moderate coarse prismatic structure; very firm; few very fine roots between peds; few very fine irregular pores; 1 percent continuous distinct dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine distinct iron-manganese masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--48 to 61 inches, (122 to 156 cm);, silty clay loam, dark reddish brown (5YR 3/3) broken face, moist; 36 percent clay; moderate medium prismatic parting to moderate coarse prismatic structure; firm; few very fine roots between peds; few very fine irregular pores; 3 percent continuous distinct dark brown (7.5YR 3/2), moist, clay films on all faces of peds; 5 percent fine distinct iron-manganese masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt3--61 to 85 inches, (156 to 215 cm);, silty clay, 50 percent dark reddish brown (5YR 3/4) broken face and 50 percent dark reddish brown (5YR 3/3) broken face, moist; 40

percent clay; moderate coarse prismatic structure; extremely firm; few very fine irregular pores; 2 percent continuous distinct dark brown (7.5YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese masses; 5 percent shale fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Cr--85 to 91 inches, (215 to 230 cm); ; limestone fragments.

Soil Name as Described/Sampled: Konza
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 08/18/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127002 Pedon ID: 05KS127002

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: White City, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Four miles north of White City, Kansas.
 Legal Description: NE 1/4 of Section 12, Township 14S, Range 6E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 698904 meters, UTM Northing: 4302960 meters
 Geomorphic Setting: on shoulder of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 2.0 percent Aspect: (deg)
 Elevation: 1414 feet, 431.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
 weathered from limestone and shale
 Bedrock Depth: 56.7 inches (144.0 cm)

Particle Size Control Section: 16.9 to 36.6 in. (43 to 93 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	16.9	0	43
Argillic horizon	4.7	56.7	12	144
Abrupt textural change	4.7	5.1	12	13
Redox concentrations	16.9	56.7	43	144
Lithologic discontinuity	23.6	49.2	60	125

Gypsum accumulations	49.2	56.7	125	144
Lithologic discontinuity	56.7		144	
Paralithic contact	56.7		144	

Pedon Notes:

Ap--0 to 5 inches, (0 to 12 cm); brown (10YR 5/3) broken face, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 30 percent clay; weak fine subangular blocky parting to weak medium subangular blocky structure; friable, slightly hard; common fine roots throughout; few fine dendritic tubular pores; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--5 to 17 inches, (12 to 43 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 45 percent clay; moderate medium subangular blocky structure; firm, hard; common fine roots throughout; few fine irregular pores; 5 percent continuous faint black (10YR 2/1), moist, organoargillans; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--17 to 24 inches, (43 to 60 cm);, silty clay, dark brown (7.5YR 3/4) broken face and very dark grayish brown (10YR 3/2) broken face, moist; 42 percent clay; moderate fine prismatic structure; firm; few very fine roots between peds; few very fine irregular pores; 5 percent continuous faint very dark brown (10YR 2/2), moist, clay films; 1 percent fine distinct iron-manganese nodules and 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt2--24 to 32 inches, (60 to 81 cm);, silty clay, brown (7.5YR 4/4) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few very fine irregular pores; 3 percent continuous faint dark brown (7.5YR 3/3), moist, clay films; 1 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 3 percent fine distinct iron-manganese nodules; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt3--32 to 49 inches, (81 to 125 cm);, silty clay, dark reddish brown (5YR 3/4) broken face, moist; 42 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; few very fine irregular pores; 2 percent continuous faint dark reddish brown (5YR 3/3), moist, clay films; 1 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 3 percent medium distinct iron-manganese nodules and 3 percent fine distinct iron-manganese nodules; 10 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bty--49 to 57 inches, (125 to 144 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 40 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; few very fine irregular pores; 5 percent continuous faint dark reddish brown (5YR 3/4), moist, clay films; 1 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 3 percent medium distinct iron-manganese nodules and 3 percent fine distinct iron-manganese nodules; 2 percent medium gypsum masses; 5 percent shale fragments and 5 percent limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--57 to 59 inches, (144 to 150 cm);, silty clay; ; 100 percent limestone fragments.

Soil Name as Described/Sampled: Konza
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 08/18/2005
Describer: DeAnn Presley

Site ID: 05KS127003 Pedon ID: 05KS127003

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: White City, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Four miles north of White City, Kansas.
Legal Description: NE 1/4 of Section 12, Township 14S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 698743 meters, UTM Northing: 4302878 meters

Geomorphic Setting: on shoulder of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1414 feet, 431.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
weathered from limestone and shale
Bedrock Depth: 57.1 inches (145.0 cm)

Particle Size Control Section: 18.1 to 37.8 in. (46 to 96 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	18.1	0	46

Argillic horizon	4.3	57.1	11	145
Secondary carbonates	18.1	44.1	46	112
Redox concentrations	18.1	57.1	46	145
Lithologic discontinuity	44.1	57.1	112	145
Gypsum accumulations	44.1	52.0	112	132
Lithologic discontinuity	57.1		145	
Paralithic contact	57.1		145	

Pedon Notes:

Ap--0 to 4 inches, (0 to 11 cm); brown (10YR 5/3) broken face, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 38 percent clay; weak fine subangular blocky structure; firm, moderately hard; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--4 to 18 inches, (11 to 46 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 48 percent clay; moderate fine subangular blocky structure; firm, hard; few fine roots throughout; few fine irregular pores; 2 percent continuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--18 to 24 inches, (46 to 60 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 44 percent clay; moderate fine prismatic structure; firm; few fine roots between peds; few fine irregular pores; 2 percent continuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 1 percent fine faint iron-manganese masses and 1 percent fine faint iron-manganese nodules; 1 percent fine distinct carbonate masses; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk2--24 to 44 inches, (60 to 112 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; few fine irregular pores; 2 percent continuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 3 percent fine distinct iron-manganese masses and 3 percent fine distinct iron-manganese nodules; 5 percent fine distinct carbonate masses and 5 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bty--44 to 52 inches, (112 to 132 cm);, silty clay, brown (7.5YR 4/4) broken face, moist; 40 percent clay; moderate medium prismatic structure; friable; few very fine roots between peds; few fine irregular pores; 4 percent continuous faint brown (7.5YR 4/3), moist, clay films; 5 percent fine distinct iron-manganese nodules and 5 percent fine distinct iron-manganese masses and 10 percent fine faint masses of oxidized iron; 1 percent fine faint gypsum masses; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt--52 to 57 inches, (132 to 145 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 45 percent clay; moderate medium prismatic structure; friable; few very fine roots between peds; few fine irregular pores; 5 percent continuous faint reddish brown (5YR 4/3), moist, clay films; 1 percent fine faint masses of oxidized iron and 10 percent fine distinct iron-manganese masses and 10 percent fine distinct iron-manganese nodules; 5 percent limestone fragments and 5 percent shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--57 to 71 inches, (145 to 180 cm); ; 100 percent limestone fragments.

Soil Name as Described/Sampled: Konza
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 08/18/2005
Describer: DeAnn Presley

Site ID: 05KS127004 Pedon ID: 05KS127004

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: White City, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Four miles north of White City, Kansas.
Legal Description: NE 1/4 of Section 12, Township 14S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 698662 meters, UTM Northing: 4302658 meters

Geomorphic Setting: on shoulder of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 1.0 percent Aspect: (deg)
Elevation: 1417 feet, 432.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
weathered from limestone and shale
Bedrock Depth: 50.4 inches (128.0 cm)

Particle Size Control Section: 3.9 to 23.6 in. (10 to 60 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	27.2	0	69

Argillic horizon	3.9	50.4	10	128
Abrupt textural change	3.9	4.3	10	11
Secondary carbonates	16.1	27.2	41	69
Redox concentrations	16.1	50.4	41	128
Lithologic discontinuity	39.8	50.4	101	128
Lithologic discontinuity	50.4		128	
Paralithic contact	50.4		128	

Pedon Notes:

Ap--0 to 4 inches, (0 to 10 cm); dark grayish brown (10YR 4/2) broken face, silty clay loam, very dark brown (10YR 2/2) rubbed, moist; 30 percent clay; weak fine subangular blocky structure; friable, moderately hard; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--4 to 16 inches, (10 to 41 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 48 percent clay; moderate medium subangular blocky structure; firm; common very fine roots throughout; few fine irregular pores; 2 percent continuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--16 to 27 inches, (41 to 69 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 45 percent clay; moderate fine prismatic structure; extremely firm; few very fine roots between peds; few very fine irregular pores; 2 percent continuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine faint iron-manganese masses; 5 percent medium carbonate nodules and 5 percent coarse carbonate masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--27 to 40 inches, (69 to 101 cm);, silty clay, brown (10YR 4/3) broken face, moist; 40 percent clay; moderate fine prismatic structure; firm; few very fine roots between peds; few very fine irregular pores; 1 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt2--40 to 50 inches, (101 to 128 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 43 percent clay; moderate medium prismatic structure; extremely firm; few very fine roots between peds; few very fine irregular pores; 10 percent continuous faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; 10 percent fine distinct iron-manganese masses; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--50 to 55 inches, (128 to 140 cm); ; 100 percent limestone fragments.

Soil Name as Described/Sampled: Konza
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 08/18/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127005 Pedon ID: 05KS127005

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: White City, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Four miles north of White City, Kansas.
 Legal Description: NE 1/4 of Section 12, Township 14S, Range 6E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 698386 meters, UTM Northing: 4302481 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 1.0 percent Aspect: (deg)
 Elevation: 1421 feet, 433.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
 weathered from limestone and shale
 Bedrock Depth: 71.7 inches (182.0 cm)

Particle Size Control Section: 6.7 to 26.4 in. (17 to 67 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	30.3	0	77

Argillic horizon	6.7	71.7	17	182
Abrupt textural change	6.7	7.1	17	18
Secondary carbonates	25.6	46.5	65	118
Redox concentrations	25.6	71.7	65	182
Lithologic discontinuity	46.5	71.7	118	182
Lithologic discontinuity	71.7		182	
Paralithic contact	71.7		182	

Pedon Notes:

Ap--0 to 7 inches, (0 to 17 cm); grayish brown (10YR 5/2) broken face, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 28 percent clay; weak fine subangular blocky structure; very friable, moderately hard; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--7 to 26 inches, (17 to 65 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 50 percent clay; moderate medium prismatic and moderate medium subangular blocky structure; extremely firm; few fine roots throughout; few fine irregular pores; 4 percent continuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; 2 percent shale fragments and 2 percent limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--26 to 30 inches, (65 to 77 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 48 percent clay; moderate medium prismatic structure; extremely firm; few fine roots between peds; few fine irregular pores; 6 percent continuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine faint iron-manganese masses and 1 percent fine faint iron-manganese nodules; 2 percent fine distinct carbonate nodules and 2 percent fine distinct carbonate masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk2--30 to 46 inches, (77 to 118 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; common fine irregular pores; 8 percent continuous distinct dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese nodules and 2 percent fine distinct iron-manganese masses; 10 percent fine distinct carbonate nodules and 10 percent fine distinct carbonate masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt--46 to 72 inches, (118 to 182 cm);, silty clay, dark yellowish brown (10YR 4/4) broken face, moist; 42 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 1 percent continuous distinct dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese nodules and 2 percent fine distinct iron-manganese masses; shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--72 to 78 inches, (182 to 197 cm); ; shale fragments and limestone fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 08/18/2005
Describer: DeAnn Presley

Site ID: 05KS127006 Pedon ID: 05KS127006

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: White City, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Four miles north of White City, Kansas.
Legal Description: NE 1/4 of Section 12, Township 14S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 698365 meters, UTM Northing: 4302955 meters

Geomorphic Setting: on shoulder of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 3.0 percent Aspect: (deg)
Elevation: 1411 feet, 430.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
weathered from limestone and shale
Bedrock Depth: 50.8 inches (129.0 cm)

Particle Size Control Section: 5.1 to 24.8 in. (13 to 63 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	22.8	0	58

Argillic horizon	5.1	50.8	13	129
Redox concentrations	5.1	50.8	13	129
Secondary carbonates	22.8	36.2	58	92
Lithologic discontinuity	36.2	50.8	92	129
Lithologic discontinuity	50.8		129	
Paralithic contact	50.8		129	

Pedon Notes:

Ap--0 to 5 inches, (0 to 13 cm);, silty clay; 42 percent clay; weak fine subangular blocky structure; very firm, hard; many fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--5 to 23 inches, (13 to 58 cm);, silty clay; 50 percent clay; moderate medium subangular blocky structure; very firm; common fine roots throughout; few fine irregular pores; 1 percent continuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine distinct iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--23 to 36 inches, (58 to 92 cm);, silty clay; 46 percent clay; moderate fine prismatic structure; very firm; common fine roots between peds; few very fine irregular pores; 2 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine distinct iron-manganese masses; 2 percent fine distinct carbonate masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt--36 to 51 inches, (92 to 129 cm);, silty clay loam; 38 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; few very fine irregular pores; 5 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint iron-manganese masses; 1 percent fine distinct carbonate masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--51 to 65 inches, (129 to 165 cm); ; limestone fragments.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 09/02/2005
Describer: DeAnn Presley

Site ID: 05KS127007 Pedon ID: 05KS127007

Site Note:
Site was tilled in the past. Terraces present. Site was plowed and
reseeded to big bluestem, indian grass, and switchgrass in 1981. Prairie
hay is mowed once per year in July.

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Wilsey Se, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Nine miles south of Council Grove on Highway 177.
Legal Description: NW 1/4 of Section 33, Township 17S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 714980 meters, UTM Northing: 4268027 meters

Geomorphic Setting: on shoulder of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 1.0 percent Aspect: (deg)
Elevation: 1480 feet, 451.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from limestone
Bedrock Depth: 59.4 inches (151.0 cm)

Particle Size Control Section: 2.4 to 22.0 in. (6 to 56 cm)

Diagnostic Features:
| Top Bottom Top Bottom |

Kind	Depth (in)	Depth (in)	Depth (cm)	Depth (cm)
Mollic epipedon	0.0	22.8	0	58
Argillic horizon	2.4	59.4	6	151
Redox concentrations	2.4	59.4	6	151
Secondary carbonates	31.5	55.1	80	140
Lithologic discontinuity	43.7	55.1	111	140
Lithologic discontinuity	55.1	59.4	140	151
Lithic contact	59.4		151	
Lithologic discontinuity	59.4		151	

Pedon Notes:

This pedon was characterized by the Kansas State University Department of Agronomy Soil Characterization Laboratory. Lab numbers rs 1018-1026.

Ap--0 to 2 inches, (0 to 6 cm);, silty clay loam, very dark brown (10YR 2/2) rubbed, moist; 29 percent clay; moderate fine granular structure; friable; many fine roots throughout; many fine dendritic tubular pores; clear smooth boundary.

Bt1--2 to 15 inches, (6 to 37 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 45 percent clay; moderate fine subangular blocky parting to moderate fine granular structure; firm; common fine roots throughout; few fine irregular pores; 4 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; 1 percent fine faint iron-manganese nodules; 1 percent chert fragments; clear smooth boundary.

Bt2--15 to 23 inches, (37 to 58 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 42 percent clay; moderate fine subangular blocky parting to moderate fine granular structure; firm; common fine roots throughout; few fine irregular pores; 4 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine distinct iron-manganese nodules; clear smooth boundary.

Bt3--23 to 31 inches, (58 to 80 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 40 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine distinct iron-manganese nodules; 1 percent chert fragments; clear smooth boundary.

Btk1--31 to 44 inches, (80 to 111 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 37 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few very fine irregular pores; 1 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine distinct iron-manganese nodules; 1 percent carbonate nodules and 3 percent carbonate, finely disseminated; clear smooth boundary.

2Btk2--44 to 55 inches, (111 to 140 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few very fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine distinct iron-manganese nodules; clear smooth boundary.

3Bt--55 to 59 inches, (140 to 151 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 40 percent clay; moderate medium platy structure; firm; few very fine roots between

peds; few very fine irregular pores; 2 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct iron-manganese masses and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct iron-manganese nodules; 10 percent shale fragments; abrupt smooth boundary.

4R--59 inches, (151 to cm); .

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 09/02/2005
Describer: DeAnn Presley

Site ID: 05KS127008 Pedon ID: 05KS127008

Site Note:
Site was tilled in the past. Terraces present. Site was plowed and reseeded to big bluestem, indian grass, and switchgrass in 1981. Prairie hay is mowed once per year in July.

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Wilsey Se, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Nine miles south of Council Grove on Highway 177.
Legal Description: NW 1/4 of Section 33, Township 17S, Range 8E
Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 714975 meters, UTM Northing: 4267642 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 1.0 percent Aspect: (deg)
Elevation: 1480 feet, 451.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over colluvium
Bedrock Depth: 102.4 inches (260.0 cm)

Particle Size Control Section: 4.7 to 24.4 in. (12 to 62 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	25.2	0	64

Abrupt textural change	2.4	2.8	6	7
Argillic horizon	4.7	102.4	12	260
Redox concentrations	15.7	102.4	40	260
Secondary carbonates	25.2	39.0	64	99
Lithologic discontinuity	39.0	63.4	99	161
Gypsum accumulations	39.0	63.4	99	161
Lithologic discontinuity	63.4	102.4	161	260
Lithologic discontinuity	102.4		260	
Paralithic contact	102.4		260	

Pedon Notes:

Ap--0 to 5 inches, (0 to 12 cm);, silt loam, very dark grayish brown (10YR 3/2) rubbed, moist; 25 percent clay; moderate fine granular parting to moderate medium granular structure; friable; many fine roots throughout; common fine dendritic tubular pores; abrupt smooth boundary.

Bt1--5 to 16 inches, (12 to 40 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; firm; common fine roots throughout; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; clear smooth boundary.

Bt2--16 to 25 inches, (40 to 64 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds and common fine roots throughout; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; clear smooth boundary.

Btk--25 to 39 inches, (64 to 99 cm);, silty clay loam, dark grayish brown (10YR 4/2) broken face, moist; 35 percent clay; moderate medium subangular blocky structure; firm; few fine roots between peds; few fine irregular pores; 1 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 25 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 5 percent carbonate, finely disseminated; clear smooth boundary.

2Bty1--39 to 52 inches, (99 to 132 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 32 percent clay; moderate medium subangular blocky structure; friable; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct iron-manganese masses and 25 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 10 percent gypsum masses; clear smooth boundary.

2Bty2--52 to 63 inches, (132 to 161 cm);, silty clay loam, reddish brown (5YR 4/3) broken face, moist; 34 percent clay; moderate medium subangular blocky structure; friable; common fine irregular pores; 5 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct iron-manganese masses and 25 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 5 percent gypsum masses; clear smooth boundary.

3Bt1--63 to 78 inches, (161 to 198 cm);, silty clay, dark reddish brown (5YR 3/4) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 10 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct iron-manganese masses and 10 percent fine

distinct reddish brown (5YR 4/4), moist, masses of oxidized iron; 1 percent chert fragments; clear smooth boundary.

3Bt2--78 to 90 inches, (198 to 228 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 20 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine faint yellowish red (5YR 5/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent chert fragments; clear smooth boundary.

3Bt3--90 to 102 inches, (228 to 260 cm);, silty clay, strong brown (7.5YR 4/6) broken face, moist; 45 percent clay; moderate medium prismatic structure; firm; few fine irregular pores; 10 percent continuous faint reddish brown (5YR 4/3), moist, clay films on all faces of peds; 5 percent fine faint masses of oxidized iron and 10 percent fine distinct iron-manganese masses; 10 percent limestone fragments; clear smooth boundary.

4Cr--102 to 106 inches, (260 to 270 cm); ; limestone fragments.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 09/02/2005
Describer: DeAnn Presley

Site ID: 05KS127009 Pedon ID: 05KS127009

Site Note:
Site was tilled in the past. Terraces present. Site was plowed and
reseeded to big bluestem, indian grass, and switchgrass in 1981. Prairie
hay is mowed once per year in July.

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Wilsey Se, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Nine miles south of Council Grove on Highway 177.
Legal Description: NE 1/4 of SW 1/4 of Section 33, Township 17S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 715055 meters, UTM Northing: 4267206 meters

Geomorphic Setting: on shoulder of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1476 feet, 450.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
weathered from limestone
Bedrock Depth: 61.4 inches (156.0 cm)

Particle Size Control Section: 5.1 to 24.8 in. (13 to 63 cm)

Diagnostic Features:
| Top Bottom Top Bottom |

Kind	Depth (in)	Depth (in)	Depth (cm)	Depth (cm)
Mollic epipedon	0.0	23.2	0	59
Argillic horizon	5.1	61.4	13	156
Secondary carbonates	5.1	13.4	13	34
Redox concentrations	13.4	61.4	34	156
Lithologic discontinuity	31.5	61.4	80	156
Lithologic discontinuity	61.4		156	
Paralithic contact	61.4		156	

Pedon Notes:

Ap--0 to 5 inches, (0 to 13 cm);, silt loam, black (10YR 2/1) rubbed, moist; 20 percent clay; moderate medium granular structure; very friable; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--5 to 13 inches, (13 to 34 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 42 percent clay; moderate fine prismatic structure; firm; common fine roots between peds; few fine irregular pores; 10 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--13 to 23 inches, (34 to 59 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent very fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint iron-manganese nodules; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--23 to 31 inches, (59 to 80 cm);, silty clay, brown (10YR 4/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint iron-manganese masses and 2 percent fine faint iron-manganese nodules; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt4--31 to 39 inches, (80 to 100 cm);, silty clay loam, reddish brown (5YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent patchy faint dark reddish brown (5YR 3/3), moist, clay films on all faces of peds; 10 percent iron-manganese nodules and 10 percent iron-manganese masses; 1 percent limestone fragments and 1 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt5--39 to 61 inches, (100 to 156 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 5 percent discontinuous faint dark reddish brown (5YR 3/3), moist, clay films on all faces of peds; 1 percent cherty limestone fragments and 1 percent shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--61 to 64 inches, (156 to 163 cm); ; limestone fragments.

Soil Name as Described/Sampled: Dwight
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 09/02/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127010 Pedon ID: 05KS127010

Site Note:
 Site was tilled in the past. Terraces present. Site was plowed and
 reseeded to big bluestem, indian grass, and switchgrass in 1981. Prairie
 hay is mowed once per year in July.

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Wilsey Se, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Nine miles south of Council Grove on Highway 177.
 Legal Description: S 1/2 of SW 1/4 of Section 33, Township 17S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 714932 meters, UTM Northing: 4266882 meters

Geomorphic Setting: on shoulder of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 2.0 percent Aspect: (deg)
 Elevation: 1470 feet, 448.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
 weathered from limestone
 Bedrock Depth: 28.7 inches (73.0 cm)

Particle Size Control Section: 3.5 to 23.2 in. (9 to 59 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	10.2	0	26
Argillic horizon	3.5	28.7	9	73
Redox concentrations	3.5	28.7	9	73
Lithologic discontinuity	10.2	28.7	26	73
Paralithic contact	28.7		73	
Lithologic discontinuity	28.7		73	

Pedon Notes:

Ap--0 to 4 inches, (0 to 9 cm);, silt loam, very dark grayish brown (10YR 3/2) rubbed, moist; 24 percent clay; moderate fine granular parting to moderate medium granular structure; friable; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--4 to 10 inches, (9 to 26 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face and dark brown (10YR 3/3) broken face, moist; 40 percent clay; moderate fine subangular blocky and weak fine granular parting to weak medium granular structure; friable; many fine roots throughout; common fine dendritic tubular pores; 10 percent continuous faint very dark brown (10YR 2/2), moist, clay films on all faces of peds and 10 percent continuous faint organoargillans on all faces of peds; 2 percent fine faint iron-manganese nodules; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt2--10 to 19 inches, (26 to 47 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; firm; common fine roots between peds; few fine irregular pores; 10 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese nodules; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt3--19 to 29 inches, (47 to 73 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 50 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; few fine irregular pores; 15 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese nodules; 3 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--29 to 35 inches, (73 to 90 cm); ; limestone fragments.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 09/02/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127011 Pedon ID: 05KS127011

Site Note:
 Site is used for grazing cattle.

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Wilsey Se, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Nine miles south of Council Grove on Highway 177.
 Legal Description: NW 1/4 of Section 34, Township 17S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 716569 meters, UTM Northing: 4267814 meters

Geomorphic Setting: on shoulder of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 2.0 percent Aspect: (deg)
 Elevation: 1476 feet, 450.0 meters
 Drainage class:
 Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from cherty limestone
 Bedrock Depth: 36.6 inches (93.0 cm)

Particle Size Control Section: 4.7 to 24.4 in. (12 to 62 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	15.0	0	38
Redox concentrations	4.7	36.6	12	93

Argillic horizon	4.7	36.6	12	93
Abrupt textural change	4.7	5.1	12	13
Secondary carbonates	15.0	23.2	38	59
Lithologic discontinuity	15.0	23.2	38	59
Lithologic discontinuity	23.2	36.6	59	93
Lithologic discontinuity	36.6		93	
Lithic contact	36.6		93	

Pedon Notes:

Ap--0 to 5 inches, (0 to 12 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 20 percent clay; moderate fine granular parting to moderate medium granular structure; friable; many fine roots throughout and many medium roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--5 to 15 inches, (12 to 38 cm);, silty clay, dark brown (10YR 3/3) broken face and very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; weak medium granular and moderate fine subangular blocky structure; firm; common fine roots throughout; common fine dendritic tubular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint iron-manganese masses; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk--15 to 23 inches, (38 to 59 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint iron-manganese masses and 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; 2 percent fine carbonate nodules and 2 percent medium carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt1--23 to 32 inches, (59 to 82 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 55 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 10 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine faint iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt2--32 to 37 inches, (82 to 93 cm);, clay, red (2.5YR 4/6) broken face, moist; 60 percent clay; moderate medium prismatic structure; extremely firm; few fine roots between peds; few fine irregular pores; 10 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine faint iron-manganese masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4R--37 inches, (93 to cm); .

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 09/02/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127012 Pedon ID: 05KS127012

Site Note:
 Site is used for grazing cattle.

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Wilsey Se, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Nine miles south of Council Grove on Highway 177.
 Legal Description: NW 1/4 of Section 34, Township 17S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 716562 meters, UTM Northing: 4267668 meters
 Geomorphic Setting: on summit of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 1.0 percent Aspect: (deg)
 Elevation: 1489 feet, 454.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
 weathered from cherty limestone
 Bedrock Depth: 36.6 inches (93.0 cm)

Particle Size Control Section: 6.7 to 26.4 in. (17 to 67 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	26.4	0	67
Argillic horizon	6.7	31.5	17	80
Abrupt textural change	6.7	7.1	17	18

Redox concentrations	14.2	36.6	36	93
Secondary carbonates	26.4	36.6	67	93
Lithologic discontinuity	26.4	36.6	67	93
Redox depletions with chroma 2 or less	31.5	36.6	80	93
Lithologic discontinuity	36.6		93	
Lithic contact	36.6		93	

Pedon Notes:

Ap--0 to 7 inches, (0 to 17 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 18 percent clay; moderate medium granular structure; friable; common fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--7 to 14 inches, (17 to 36 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate fine prismatic structure; firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--14 to 26 inches, (36 to 67 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 46 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; 1 percent fine faint iron-manganese masses and 2 percent fine faint brown (7.5YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk--26 to 31 inches, (67 to 80 cm);, silty clay, 50 percent dark brown (10YR 3/3) broken face and 50 percent brown (10YR 4/3) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 10 percent continuous distinct very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine faint brown (7.5YR 4/4), moist, masses of oxidized iron and 5 percent fine faint iron-manganese masses; 1 percent fine distinct carbonate nodules; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bck--31 to 37 inches, (80 to 93 cm);, silty clay loam, brown (10YR 5/3) broken face, moist; 30 percent clay; weak fine subangular blocky parting to weak medium subangular blocky structure; firm; few fine roots between peds; few fine irregular pores; 2 percent fine faint grayish brown (10YR 5/2), moist, masses of oxidized iron and 5 percent fine faint iron-manganese masses and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 5 percent medium distinct carbonate nodules; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3R--37 inches, (93 to cm); .

Soil Name as Described/Sampled: Dwight
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 09/02/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127013 Pedon ID: 05KS127013

Site Note:
 Site is used for grazing cattle.

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Wilsey Se, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Nine miles south of Council Grove on Highway 177.
 Legal Description: NE 1/4 of SW 1/4 of Section 34, Township 17S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 716804 meters, UTM Northing: 4267504 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 2.0 percent Aspect: (deg)
 Elevation: 1489 feet, 454.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from limestone and shale
 Bedrock Depth: 55.1 inches (140.0 cm)

Particle Size Control Section: 7.1 to 26.8 in. (18 to 68 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	30.3	0	77
Argillic horizon	7.1	52.0	18	132

Redox concentrations	7.1	55.1	18	140
Abrupt textural change	7.1	7.5	18	19
Secondary carbonates	30.3	38.2	77	97
Lithologic discontinuity	30.3	38.2	77	97
Lithologic discontinuity	38.2	55.1	97	140
Redox depletions with chroma 2 or less	38.2	55.1	97	140
Gypsum accumulations	38.2	52.0	97	132
Lithologic discontinuity	55.1		140	
Paralithic contact	55.1		140	

Ap--0 to 7 inches, (0 to 18 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 20 percent clay; moderate fine granular parting to moderate medium granular structure; friable; many fine roots throughout; many fine dendritic tubular pores; abrupt smooth boundary.

Bt1--7 to 22 inches, (18 to 56 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; firm; common fine roots between peds; few fine dendritic tubular pores; 4 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine faint iron-manganese masses; clear smooth boundary.

Bt2--22 to 30 inches, (56 to 77 cm);, silty clay loam, dark brown (10YR 3/3) broken face, moist; 36 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine faint iron-manganese nodules and 2 percent fine faint iron-manganese masses; clear smooth boundary.

2Btk--30 to 38 inches, (77 to 97 cm);, silty clay loam, brown (7.5YR 4/4) broken face, moist; 32 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint iron-manganese nodules and 2 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine faint iron-manganese masses; 5 percent fine faint carbonate nodules and 5 percent medium faint carbonate nodules; clear smooth boundary.

3Bty--38 to 52 inches, (97 to 132 cm);, silty clay loam, reddish brown (5YR 4/4) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 20 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 1 percent fine distinct brown (7.5YR 5/2), moist, masses of reduced iron and 5 percent fine faint iron-manganese nodules and 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine faint gypsum masses; clear smooth boundary.

3BC--52 to 55 inches, (132 to 140 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 44 percent clay; moderate fine subangular blocky parting to moderate medium subangular blocky structure; very firm; few fine irregular pores; 10 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct brown (7.5YR 5/2), moist, masses of reduced iron and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 20 percent fine distinct iron-manganese masses; 40 percent limestone fragments and 40 percent shale fragments; abrupt smooth boundary.

4Cr--55 to 56 inches, (140 to 143 cm); .

Soil Name as Described/Sampled: Dwight
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 09/02/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127014 Pedon ID: 05KS127014

Site Note:
 Site is used for grazing cattle.

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Wilsey Se, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Nine miles south of Council Grove on Highway 177.
 Legal Description: NE 1/4 of SW 1/4 of Section 34, Township 17S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 716898 meters, UTM Northing: 4267386 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 1.0 percent Aspect: (deg)
 Elevation: 1476 feet, 450.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from cherty limestone
 Bedrock Depth: 47.2 inches (120.0 cm)

Particle Size Control Section: 2.0 to 21.7 in. (5 to 55 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	23.2	0	59

Argillic horizon	2.0	47.2	5	120
Redox concentrations	2.0	47.2	5	120
Abrupt textural change	2.0	2.4	5	6
Secondary carbonates	18.9	47.2	48	120
Lithologic discontinuity	23.2	33.1	59	84
Lithologic discontinuity	33.1	47.2	84	120
Redox depletions with chroma 2 or less	33.1	47.2	84	120
Lithologic discontinuity	47.2		120	
Lithic contact	47.2		120	

Pedon Notes:

Ap--0 to 2 inches, (0 to 5 cm);, silt loam, very dark grayish brown (10YR 3/2) rubbed, moist; 16 percent clay; moderate fine granular structure; friable; common fine roots throughout; common fine dendritic tubular pores; abrupt smooth boundary.

Bt--2 to 19 inches, (5 to 48 cm);, silty clay, 50 percent dark brown (10YR 3/3) broken face and 50 percent very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent patchy faint black (10YR 2/1), moist, organoargillans on all faces of peds; 1 percent fine faint iron-manganese masses; clear smooth boundary.

Btk1--19 to 23 inches, (48 to 59 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 38 percent clay; moderate medium prismatic and moderate medium subangular blocky structure; firm; few fine roots between peds; few fine irregular pores; 1 percent patchy faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint iron-manganese masses; 1 percent fine faint carbonate masses; clear smooth boundary.

2Btk2--23 to 33 inches, (59 to 84 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 35 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; firm; few very fine roots between peds; few fine irregular pores; 5 percent continuous distinct dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint brown (7.5YR 4/4), moist, masses of oxidized iron and 5 percent fine distinct iron-manganese masses; 2 percent fine distinct carbonate nodules and 2 percent medium distinct carbonate nodules; clear smooth boundary.

3Btk3--33 to 47 inches, (84 to 120 cm);, silty clay loam, 50 percent dark reddish brown (5YR 3/3) broken face and 50 percent reddish brown (5YR 4/3) broken face, moist; 39 percent clay; ; very firm; few very fine roots between peds; few fine irregular pores; 5 percent continuous distinct dark reddish brown (5YR 3/2), moist, clay films on all faces of peds; 2 percent fine faint dark reddish gray (5YR 4/2), moist, masses of reduced iron and 2 percent fine faint iron-manganese masses and 3 percent fine faint reddish brown (5YR 4/4), moist, masses of oxidized iron; 5 percent fine distinct carbonate nodules and 2 percent medium distinct threadlike carbonate nodules; shale fragments and limestone fragments and 5 percent chert fragments; abrupt smooth boundary.

4R--47 inches, (120 to cm); ; 100 percent limestone fragments.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 09/02/2005
Describer: DeAnn Presley

Site ID: 05KS127015 Pedon ID: 05KS127015

Site Note:
Site is used for grazing cattle.

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Wilsey Se, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Nine miles south of Council Grove on Highway 177.
Legal Description: SW 1/4 of Section 34, Township 17S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 716847 meters, UTM Northing: 4267081 meters

Geomorphic Setting: on shoulder of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 3.0 percent Aspect: (deg)
Elevation: 1476 feet, 450.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from cherty limestone
Bedrock Depth: 36.6 inches (93.0 cm)

Particle Size Control Section: 2.8 to 22.4 in. (7 to 57 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	22.8	0	58
Argillic horizon	2.8	36.6	7	93
Abrupt textural change	2.8	3.1	7	8
Redox concentrations	12.6	36.6	32	93
Secondary carbonates	22.8	29.9	58	76
Lithologic discontinuity	22.8	29.9	58	76
Gypsum accumulations	22.8	36.6	58	93
Lithologic discontinuity	29.9	36.6	76	93
Redox depletions with chroma 2 or less	29.9	36.6	76	93
Lithologic discontinuity	36.6		93	
Lithic contact	36.6		93	

Pedon Notes:

Ap--0 to 3 inches, (0 to 7 cm);, silt loam, very dark grayish brown (10YR 3/2) rubbed, moist; 14 percent clay; moderate fine granular parting to moderate medium granular structure; very friable; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--3 to 13 inches, (7 to 32 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm; common fine roots between pedis; few fine irregular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of pedis; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt2--13 to 23 inches, (32 to 58 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm; common fine roots between pedis; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of pedis; 1 percent fine faint iron-manganese masses and 4 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btky--23 to 30 inches, (58 to 76 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 37 percent clay; moderate medium prismatic structure; firm; few fine roots between pedis; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of pedis; 5 percent fine faint brown (7.5YR 4/4), moist, masses of oxidized iron and 5 percent fine distinct iron-manganese masses; 2 percent fine distinct carbonate masses and 5 percent medium distinct brown (7.5YR 5/3), moist, gypsum masses; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bty--30 to 37 inches, (76 to 93 cm);, silty clay loam, dark reddish brown (5YR 3/3) broken face, moist; 35 percent clay; moderate medium prismatic structure; firm; few fine roots between pedis; few fine irregular pores; 10 percent continuous faint dark reddish brown (5YR 3/2), moist, clay films on all faces of pedis; 5 percent fine distinct dark reddish gray (5YR 4/2), moist, masses of reduced iron and 5 percent fine faint iron-manganese masses and 10 percent fine faint reddish brown (5YR 4/4), moist, masses of oxidized iron; 2 percent fine distinct brown (7.5YR 5/3), moist, gypsum masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4R--37 inches, (93 to cm); ; limestone fragments.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 09/20/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127016 Pedon ID: 05KS127016

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Delavan, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: Site is one mile west and one mile south of Delavan,
 Kansas.
 Legal Description: NW 1/4 of Section 24, Township 16S, Range 5E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 688330 meters, UTM Northing: 4280368 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 2.0 percent Aspect: (deg)
 Elevation: 1489 feet, 454.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 8.7 to 28.3 in. (22 to 72 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	27.2	0	69
Argillic horizon	8.7		22	

Abrupt textural change	8.7	9.1	22	23
Secondary carbonates	27.2	46.9	69	119
Redox concentrations	27.2		69	
Lithologic discontinuity	46.9		119	

Pedon Notes:

Ap--0 to 9 inches, (0 to 22 cm);, silt loam, black (10YR 2/1) rubbed, moist; 24 percent clay; weak medium granular structure; friable; common fine roots throughout; few very fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--9 to 27 inches, (22 to 69 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate fine prismatic structure; firm; few fine roots between peds; few very fine irregular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--27 to 47 inches, (69 to 119 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 38 percent clay; moderate fine prismatic structure; firm; few fine roots between peds; few very fine irregular pores; 1 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 4 percent fine distinct iron-manganese masses; 2 percent fine carbonate nodules and 2 percent medium carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt--47 to 76 inches, (119 to 194 cm);, silty clay loam, very dark grayish brown (10YR 3/2) broken face, moist; 36 percent clay; moderate medium prismatic structure; firm; few very fine irregular pores; 7 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; 10 percent fine distinct iron-manganese masses and 10 percent fine distinct iron-manganese nodules; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 09/20/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127017 Pedon ID: 05KS127017

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Delavan, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: Site is one mile west and one mile south of Delavan,
 Kansas.
 Legal Description: NW 1/4 of Section 24, Township 16S, Range 5E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds
 Datum: NAD83
 UTM Zone: 14, UTM Easting: 688401 meters, UTM Northing: 4280306 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 0.0 percent Aspect: (deg)
 Elevation: 1489 feet, 454.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0		0	
Argillic horizon	5.5		14	
Redox concentrations	15.4		39	

Secondary carbonates	23.6	36.2	60	92
Lithologic discontinuity	36.2		92	

Pedon Notes:

Ap--0 to 6 inches, (0 to 14 cm); dark grayish brown (10YR 4/2) broken face, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 38 percent clay; moderate fine granular structure; friable; many fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 15 inches, (14 to 39 cm); dark grayish brown (10YR 4/2) broken face, silty clay, very dark brown (10YR 2/2) broken face, moist; 42 percent clay; moderate fine subangular blocky structure; very firm; many fine roots throughout; common fine dendritic tubular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--15 to 24 inches, (39 to 60 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 48 percent clay; moderate fine prismatic parting to moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 1 percent patchy faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; 1 percent fine distinct black (N 2/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--24 to 36 inches, (60 to 92 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 1 percent patchy faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine distinct iron-manganese masses; 2 percent fine distinct light gray (10YR 7/2), moist, carbonate masses and 1 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt1--36 to 78 inches, (92 to 199 cm);, silty clay, black (10YR 2/1) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; common fine irregular pores; 5 percent continuous faint black (10YR 2/1), moist, clay films on all faces of peds; 1 percent fine faint black (N 2/0), moist, iron-manganese nodules and 10 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--78 to 99 inches, (199 to 252 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 46 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 5 percent continuous faint black (10YR 2/1), moist, clay films on all faces of peds; 1 percent fine faint black (N 2/0), moist, iron-manganese nodules and 2 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 09/20/2005
Describer: DeAnn Presley

Site ID: 05KS127018 Pedon ID: 05KS127018

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Delavan, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is one mile west and one mile south of Delavan,
Kansas.
Legal Description: NW 1/4 of Section 24, Township 16S, Range 5E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 688549 meters, UTM Northing: 4280208 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 0.5 percent Aspect: (deg)
Elevation: 1489 feet, 454.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from limestone
Bedrock Depth: 72.4 inches (184.0 cm)

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	32.7	0	83
Argillic horizon	7.9	72.4	20	184
Secondary carbonates	32.7	42.5	83	108
Redox concentrations	32.7	72.4	83	184
Lithologic discontinuity	42.5	65.0	108	165
Lithologic discontinuity	65.0	72.4	165	184
Lithologic discontinuity	72.4		184	
Paralithic contact	72.4		184	

Ap--0 to 8 inches, (0 to 20 cm);, silty clay loam, black (10YR 2/1) rubbed, moist; 36 percent clay; moderate fine granular structure; firm; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--8 to 26 inches, (20 to 66 cm);, silty clay, black (10YR 2/1) broken face, moist; 46 percent clay; moderate fine subangular blocky structure; very firm; common fine roots throughout; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--26 to 33 inches, (66 to 83 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 1 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Btk--33 to 43 inches, (83 to 108 cm);, silty clay, brown (10YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 1 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese masses and 11 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt1--43 to 50 inches, (108 to 126 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 36 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 1 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt2--50 to 65 inches, (126 to 165 cm);, silty clay, dark brown (7.5YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; firm; common fine irregular pores; 5 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese masses and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt3--65 to 72 inches, (165 to 184 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; firm; few fine irregular pores; 7 percent continuous faint dark brown (7.5YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--72 to 73 inches, (184 to 185 cm); moderate medium prismatic structure.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 09/20/2005
Describer: DeAnn Presley

Site ID: 05KS127019 Pedon ID: 05KS127019

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Delavan, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is one mile west and one mile south of Delavan,
Kansas.
Legal Description: NW 1/4 of Section 24, Township 16S, Range 5E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 688682 meters, UTM Northing: 4280115 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 1.0 percent Aspect: (deg)
Elevation: 1486 feet, 453.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from limestone
Bedrock Depth: 65.4 inches (166.0 cm)

Particle Size Control Section: 3.9 to 23.6 in. (10 to 60 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
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Mollic epipedon	0.0	36.2	0	92
Argillic horizon	3.9	65.4	10	166
Secondary carbonates	24.0	36.2	61	92
Lithologic discontinuity	36.2	55.9	92	142
Redox concentrations	36.2	65.4	92	166
Lithologic discontinuity	55.9	65.4	142	166
Lithologic discontinuity	65.4		166	
Paralithic contact	65.4		166	

Pedon Notes:

Ap--0 to 4 inches, (0 to 10 cm);, silty clay loam, very dark brown (10YR 2/2) rubbed, moist; 35 percent clay; moderate fine granular structure; friable; common fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--4 to 24 inches, (10 to 61 cm);, silty clay, black (10YR 2/1) broken face, moist; 46 percent clay; moderate fine prismatic structure; firm; few fine roots between peds; few fine irregular pores; 2 percent patchy faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--24 to 36 inches, (61 to 92 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 46 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 1 percent patchy faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; 4 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt1--36 to 56 inches, (92 to 142 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 39 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 4 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine distinct black (N 2/0), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt2--56 to 65 inches, (142 to 166 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 39 percent clay; moderate medium prismatic structure; friable; few very fine roots between peds; few fine irregular pores; 4 percent patchy faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2/0), moist, iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--65 to 74 inches, (166 to 189 cm); ; limestone fragments.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 09/20/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127020 Pedon ID: 05KS127020

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Delavan, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: Site is one mile west and one mile south of Delavan,
 Kansas.
 Legal Description: NW 1/4 of Section 24, Township 16S, Range 5E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 688309 meters, UTM Northing: 4279824 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 0.0 percent Aspect: (deg)
 Elevation: 1486 feet, 453.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 4.7 to 24.4 in. (12 to 62 cm)

Diagnostic Features:

Kind	Top	Bottom	Top	Bottom
	Depth (in)	Depth (in)	Depth (cm)	Depth (cm)
Mollic epipedon	0.0		0	
Argillic horizon	4.7		12	

Secondary carbonates	20.1	30.7	51	78
Redox concentrations	20.1		51	
Lithologic discontinuity	30.7		78	

Pedon Notes:

Ap--0 to 5 inches, (0 to 12 cm);, silty clay loam, very dark brown (10YR 2/2) rubbed, moist; 36 percent clay; moderate fine subangular blocky structure; friable; many fine roots throughout; many fine dendritic tubular pores; abrupt smooth boundary.

Bt--5 to 20 inches, (12 to 51 cm);, silty clay, black (10YR 2/1) broken face, moist; 45 percent clay; moderate fine prismatic parting to moderate fine subangular blocky structure; firm; common fine roots throughout; many fine dendritic tubular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; clear smooth boundary.

Btk--20 to 31 inches, (51 to 78 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 1 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; 2 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; gradual smooth boundary.

2Bt1--31 to 41 inches, (78 to 104 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 80 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine faint black (N 2/0), moist, iron-manganese nodules; gradual smooth boundary.

2Bt2--41 to 85 inches, (104 to 217 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 46 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, clay films; 1 percent fine faint black (N 2/0), moist, iron-manganese nodules and 1 percent fine faint black (10YR 2/1), moist, iron-manganese masses and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; gradual smooth boundary.

2Bt3--85 to 94 inches, (217 to 240 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; common fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films; 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 09/20/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127021 Pedon ID: 05KS127021

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Delavan, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: Site is located one mile west and one mile south of
 Delavan, Kansas.
 Legal Description: SW 1/4 of NW 1/4 of Section 24, Township 16S, Range 5E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 688455 meters, UTM Northing: 4279694 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 1.0 percent Aspect: (deg)
 Elevation: 1483 feet, 452.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 3.9 to 23.6 in. (10 to 60 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0		0	
Argillic horizon	3.9		10	

Secondary carbonates	26.0	35.0	66	89
Redox concentrations	26.8		68	
Lithologic discontinuity	35.0	52.0	89	132
Lithologic discontinuity	52.0		132	

Pedon Notes:

Ap--0 to 4 inches, (0 to 10 cm);, silty clay loam, very dark brown (10YR 2/2) rubbed, moist; 34 percent clay; moderate fine granular structure; firm; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--4 to 16 inches, (10 to 41 cm);, silty clay, black (10YR 2/1) broken face, moist; 40 percent clay; moderate fine prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--16 to 27 inches, (41 to 68 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 46 percent clay; moderate fine prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--27 to 35 inches, (68 to 89 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 1 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent fine light gray (10YR 7/2), moist, carbonate nodules and 1 percent medium light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt1--35 to 52 inches, (89 to 132 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; common fine irregular pores; 4 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 4 percent fine distinct black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt2--52 to 88 inches, (132 to 224 cm);, silty clay loam, dark brown (7.5YR 3/2) broken face, moist; 36 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; common fine irregular pores; 8 percent discontinuous faint very dark brown (7.5YR 2.5/3), moist, clay films on all faces of peds; 4 percent fine faint black (N 2/0), moist, iron-manganese masses and 5 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 09/20/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127022 Pedon ID: 05KS127022

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Delavan, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: Site is located one mile west and one mile south of
 Delavan, Kansas.

Legal Description: SW 1/4 of NW 1/4 of Section 24, Township 16S, Range 5E
 Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 688704 meters, UTM Northing: 4279451 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 1.0 percent Aspect: (deg)
 Elevation: 1480 feet, 451.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Tame pastureland

Parent Material: loess derived colluvium over residuum weathered
 from limestone
 Bedrock Depth: 49.6 inches (126.0 cm)

Particle Size Control Section: 5.1 to 24.8 in. (13 to 63 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	27.2	0	69

Argillic horizon	5.1	40.9	13	104
Secondary carbonates	27.2	40.9	69	104
Redox concentrations	27.2	49.6	69	126
Paralithic contact	49.6		126	
Lithologic discontinuity	49.6		126	

Pedon Notes:

Ap--0 to 5 inches, (0 to 13 cm);, silty clay loam, black (10YR 2/1) rubbed, moist; 28 percent clay; moderate fine granular structure; friable; common fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--5 to 9 inches, (13 to 24 cm);, silty clay loam, black (10YR 2/1) broken face, moist; 38 percent clay; moderate fine subangular blocky structure; friable; common fine roots throughout; common fine dendritic tubular pores; 1 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt2--9 to 27 inches, (24 to 69 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 1 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--27 to 41 inches, (69 to 104 cm);, silty clay, brown (10YR 4/3) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, clay films on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese masses; 4 percent fine light gray (10YR 7/2), moist, carbonate nodules and 4 percent medium light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

BC--41 to 50 inches, (104 to 126 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 30 percent clay; weak medium subangular blocky structure; friable; few fine roots between peds; common fine irregular pores; 2 percent fine distinct black (N 2/0), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Cr--50 to 56 inches, (126 to 142 cm); ; limestone fragments.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 09/20/2005
Describer: DeAnn Presley

Site ID: 05KS127023 Pedon ID: 05KS127023

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Delavan, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is located one mile west and one mile south of
Delavan, Kansas.
Legal Description: SE 1/4 of SE 1/4 of Section 24, Township 16S, Range 5E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 689724 meters, UTM Northing: 4279132 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 3.0 percent Aspect: (deg)
Elevation: 1473 feet, 449.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0		0	
Argillic horizon	5.5		14	

Redox concentrations	13.4		34	
Secondary carbonates	22.4	34.3	57	87
Lithologic discontinuity	34.3		87	

Ap--0 to 6 inches, (0 to 14 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 32 percent clay; weak fine granular structure; friable; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 13 inches, (14 to 34 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 42 percent clay; moderate fine subangular blocky structure; very firm; common fine roots throughout; common fine dendritic tubular pores; 2 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--13 to 22 inches, (34 to 57 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btk--22 to 34 inches, (57 to 87 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2/0), moist, iron-manganese masses; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt1--34 to 46 inches, (87 to 116 cm);, silty clay, dark brown (7.5YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark brown (7.5YR 2/2), moist, clay films on all faces of peds; 2 percent fine distinct brown (7.5YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt2--46 to 74 inches, (116 to 187 cm);, silty clay, dark brown (7.5YR 3/2) broken face, moist; 50 percent clay; moderate medium subangular blocky structure; very firm; few fine roots between peds; common fine irregular pores; 5 percent continuous faint very dark brown (7.5YR 2/2), moist, clay films on all faces of peds; 5 percent fine faint black (N 2/0), moist, iron-manganese masses and 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt3--74 to 98 inches, (187 to 248 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 36 percent clay; moderate medium subangular blocky structure; firm; common fine irregular pores; 5 percent continuous faint dark brown (7.5YR 3/2), moist, clay films on all faces of peds; 4 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine faint black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 10/31/2005
Describer: DeAnn Presley

Site ID: 05KS127024 Pedon ID: 05KS127024

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Wilsey, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is 5 miles north and 2 miles west of Wilsey,
Kansas.
Legal Description: SW 1/4 of Section 36, Township 15S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 698632 meters, UTM Northing: 4285909 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1460 feet, 445.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium

Particle Size Control Section: 6.3 to 26.0 in. (16 to 66 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.4	0	62
Argillic horizon	6.3		16	

Redox concentrations	16.5		42	
Secondary carbonates	24.4		62	
Redox depletions with chroma 2 or less	38.6		98	
Lithologic discontinuity	38.6		98	

Pedon Notes:

Ap--0 to 6 inches, (0 to 16 cm);, silty clay loam, very dark brown (10YR 2/2) rubbed, moist; 32 percent clay; weak fine subangular blocky structure; friable; few fine roots throughout; common fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 11 inches, (16 to 28 cm);, silty clay, black (10YR 2/1) broken face, moist; 40 percent clay; moderate fine subangular blocky structure; firm; few very fine roots throughout; few fine irregular pores; 2 percent discontinuous faint black (N 2/0), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--11 to 17 inches, (28 to 42 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 42 percent clay; moderate medium subangular blocky structure; firm; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--17 to 24 inches, (42 to 62 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films; 1 percent fine distinct black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--24 to 39 inches, (62 to 98 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; firm; few fine irregular pores; 1 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct black (N 2/0), moist, iron-manganese masses; 2 percent fine spherical light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk2--39 to 43 inches, (98 to 109 cm);, silty clay, brown (10YR 4/3) broken face, moist; 40 percent clay; moderate medium prismatic structure; friable; few fine irregular pores; 4 percent continuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct black (N 2/0), moist, iron-manganese nodules and 4 percent fine distinct dark yellowish brown (10YR 3/6), moist, masses of oxidized iron and 4 percent fine distinct dark grayish brown (10YR 4/2), moist, masses of reduced iron and 5 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent fine threadlike light gray (10YR 7/2), moist, carbonate masses; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 10/31/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127025 Pedon ID: 05KS127025

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Wilsey, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: Site is 5 miles north and 2 miles west of Wilsey,
 Kansas.
 Legal Description: SW 1/4 of Section 36, Township 15S, Range 6E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 698477 meters, UTM Northing: 4286126 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 2.0 percent Aspect: (deg)
 Elevation: 1470 feet, 448.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from limestone and shale

Particle Size Control Section: 2.0 to 21.7 in. (5 to 55 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	48.8	0	124

Argillic horizon	2.0	75.2	5	191
Redox concentrations	15.4		39	
Secondary carbonates	21.7	35.8	55	91
Lithologic discontinuity	21.7	35.8	55	91
Gypsum accumulations	35.8	65.4	91	166
Lithologic discontinuity	35.8	86.6	91	220
Redox depletions with chroma 2 or less	65.4	86.6	166	220
Lithologic discontinuity	86.6		220	

Pedon Notes:

Ap--0 to 2 inches, (0 to 5 cm);, silty clay loam, very dark brown (10YR 2/2) rubbed, moist; 35 percent clay; weak fine subangular blocky structure; friable; few fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--2 to 15 inches, (5 to 39 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 42 percent clay; moderate fine subangular blocky structure; firm; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--15 to 22 inches, (39 to 55 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films; 10 percent fine distinct black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btk--22 to 36 inches, (55 to 91 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 4 percent continuous faint very dark grayish brown (10YR 3/2), moist, clay films; 10 percent fine distinct black (N 2/0), moist, iron-manganese masses; 4 percent fine spherical light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Bty1--36 to 49 inches, (91 to 124 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 45 percent clay; moderate medium subangular blocky structure; very firm; few very fine roots between peds; common fine irregular pores; 10 percent continuous faint very dark grayish brown (10YR 3/2), moist, clay films; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent fine threadlike gypsum masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bty2--49 to 65 inches, (124 to 166 cm);, silty clay, dark brown (7.5YR 3/4) broken face, moist; 45 percent clay; moderate medium subangular blocky structure; firm; few very fine roots between peds; common fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine faint black (N 2/0), moist, iron-manganese masses; 2 percent fine threadlike gypsum masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bty3--65 to 75 inches, (166 to 191 cm);, silty clay, brown (7.5YR 4/4) broken face, moist; 45 percent clay; moderate medium prismatic structure; firm; few fine irregular pores; 5 percent continuous dark brown (7.5YR 3/3), moist, clay films; 1 percent fine

distinct dark grayish brown (10YR 4/2), moist, masses of reduced iron and 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese masses; 2 percent fine gypsum masses; 1 percent chert fragments and 1 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3BC--75 to 87 inches, (191 to 220 cm);, silty clay loam, brown (7.5YR 4/4) broken face, moist; 34 percent clay; weak medium prismatic structure; friable; few fine irregular pores; 5 percent continuous dark brown (7.5YR 3/3), moist, clay films; 2 percent 4/2, moist, masses of reduced iron and 2 percent 5/3, moist, masses of reduced iron and 4 percent 4/6, moist, masses of oxidized iron and 5 percent black (N 2/0), moist, iron-manganese masses; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4C--87 to 117 inches, (220 to 297 cm);, silt loam, pale red (2.5YR 7/2) broken face, moist; 20 percent clay; massive; friable; common fine irregular pores; 5 percent continuous dark brown (7.5YR 3/3), moist, clay films; 5 percent fine prominent black (N 2/0), moist, iron-manganese masses and 10 percent fine prominent yellowish brown (10YR 5/8), moist.; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 10/31/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127026 Pedon ID: 05KS127026

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Wilsey, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: Site is 5 miles north and 2 miles west of Wilsey,
 Kansas.
 Legal Description: SW 1/4 of Section 36, Township 15S, Range 6E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 698343 meters, UTM Northing: 4286150 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 2.0 percent Aspect: (deg)
 Elevation: 1467 feet, 447.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 2.0 to 21.7 in. (5 to 55 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	14.6	0	37
Argillic horizon	2.0		5	

Redox concentrations	2.0		5	
Secondary carbonates	14.6	40.2	37	102
Lithologic discontinuity	28.0	40.2	71	102
Redox depletions with chroma 2 or less	28.0	40.2	71	102
Lithologic discontinuity	40.2		102	

Pedon Notes:

Ap--0 to 2 inches, (0 to 5 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 29 percent clay; weak fine platy structure; firm; few very fine roots throughout; few fine irregular pores; 1 percent chert fragments; abrupt smooth boundary.

Bt1--2 to 9 inches, (5 to 24 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 42 percent clay; moderate fine subangular blocky parting to moderate medium subangular blocky structure; firm; few very fine roots throughout; few fine irregular pores; 1 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; 1 percent fine faint black (N 2/0), moist, iron-manganese nodules; clear smooth boundary.

Bt2--9 to 15 inches, (24 to 37 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 45 percent clay; moderate fine subangular blocky parting to moderate medium subangular blocky structure; firm; few very fine roots between peds; few fine irregular pores; 1 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine faint black (N 2/0), moist, iron-manganese nodules; abrupt smooth boundary.

Btk1--15 to 28 inches, (37 to 71 cm);, silty clay, brown (10YR 4/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint black (N 2/0), moist, iron-manganese nodules; 3 percent medium prominent light gray (10YR 7/2), moist, carbonate nodules; clear smooth boundary.

2Btk2--28 to 40 inches, (71 to 102 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 34 percent clay; moderate medium subangular blocky structure; friable; few very fine roots between peds; common fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine distinct iron-manganese masses and 2 percent fine distinct dark grayish brown (10YR 4/2), moist, masses of reduced iron and 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; 1 percent fine very pale brown (10YR 7/3), moist, carbonate masses; gradual smooth boundary.

3Bt--40 to 57 inches, (102 to 145 cm);, silty clay loam, dark brown (7.5YR 3/2) broken face, moist; 36 percent clay; moderate medium subangular blocky structure; friable; few very fine roots between peds; common fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine distinct yellowish brown (10YR 5/4), moist, masses of oxidized iron and 3 percent fine distinct very dark brown (10YR 2/2), moist, masses of reduced iron.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 10/31/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127027 Pedon ID: 05KS127027

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Wilsey, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: Site is 5 miles north and 2 miles west of Wilsey,
 Kansas.

Legal Description: SE 1/4 of Section 36, Township 15S, Range 6E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 699388 meters, UTM Northing: 4286216 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 1.0 percent Aspect: (deg)
 Elevation: 1450 feet, 442.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from shale over residuum
 weathered from limestone

Bedrock Depth: 74.0 inches (188.0 cm)

Particle Size Control Section: 3.9 to 23.6 in. (10 to 60 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	11.4	0	29
Argillic horizon	3.9	69.3	10	176

Redox concentrations	3.9	74.0	10	188
Secondary carbonates	20.1	35.8	51	91
Lithologic discontinuity	20.1	35.8	51	91
Redox depletions with chroma 2 or less	20.1	35.8	51	91
Lithologic discontinuity	35.8	69.3	91	176
Lithologic discontinuity	69.3	74.0	176	188
Redox depletions with chroma 2 or less	69.3	74.0	176	188
Paralithic contact	74.0		188	
Lithologic discontinuity	74.0		188	

Ap--0 to 4 inches, (0 to 10 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 35 percent clay; weak fine subangular blocky structure; very friable; common fine roots throughout; few fine irregular pores; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--4 to 11 inches, (10 to 29 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 45 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; few fine irregular pores; 2 percent continuous faint very dark brown (10YR 2/2), moist, clay films; 1 percent fine distinct black (N 2/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt2--11 to 20 inches, (29 to 51 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 45 percent clay; moderate medium prismatic structure; firm; few fine roots between peds; few fine irregular pores; 2 percent continuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk--20 to 36 inches, (51 to 91 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 45 percent clay; moderate fine prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 5 percent continuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine faint dark grayish brown (10YR 4/2), moist, masses of reduced iron and 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 4 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent fine very pale brown (10YR 7/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Bt--36 to 69 inches, (91 to 176 cm);, silty clay, dark reddish brown (5YR 3/3) broken face, moist; 40 percent clay; strong fine subangular blocky parting to strong medium subangular blocky structure; very firm; few very fine roots between peds; common fine irregular pores; 10 percent continuous faint dark brown (7.5YR 3/2), moist, clay films; 8 percent fine faint reddish brown (5YR 4/4), moist, masses of oxidized iron and 10 percent fine distinct black (N 2/0), moist, iron-manganese masses; 5 percent to 2 millimeter chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4C--69 to 74 inches, (176 to 188 cm);, silty clay loam, yellowish brown (10YR 5/4) broken face, moist; 34 percent clay; moderate fine platy structure; firm; 5 percent fine distinct dark grayish brown (10YR 4/2), moist, masses of reduced iron and 5 percent fine prominent black (N 2/0), moist, iron-manganese masses and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 10 percent shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

5Cr--74 to 75 inches, (188 to 190 cm);, light gray (10YR 7/2) broken face, moist; ; limestone fragments.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 10/31/2005
Describer: DeAnn Presley

Site ID: 05KS127028 Pedon ID: 05KS127028

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Wilsey, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is 5 miles north and 2 miles west of Wilsey,
Kansas.
Legal Description: SE 1/4 of Section 36, Township 15S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 699256 meters, UTM Northing: 4286213 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 3.0 percent Aspect: (deg)
Elevation: 1450 feet, 442.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from limestone and shale
Bedrock Depth: 63.8 inches (162.0 cm)

Particle Size Control Section: 3.1 to 22.8 in. (8 to 58 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	15.4	0	39
Argillic horizon	3.1	63.8	8	162
Secondary carbonates	15.4	49.2	39	125
Redox concentrations	15.4	63.8	39	162
Lithologic discontinuity	30.7	39.4	78	100
Redox depletions with chroma 2 or less	30.7	49.2	78	125
Gypsum accumulations	30.7	39.4	78	100
Lithologic discontinuity	39.4	63.8	100	162
Paralithic contact	63.8		162	
Lithologic discontinuity	63.8		162	

Pedon Notes:

Ap--0 to 3 inches, (0 to 8 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 36 percent clay; weak fine subangular blocky structure; firm; common fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--3 to 12 inches, (8 to 30 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate fine prismatic structure; firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--12 to 15 inches, (30 to 39 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 40 percent clay; moderate fine prismatic structure; firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--15 to 31 inches, (39 to 78 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine distinct black (N 2/0), moist, iron-manganese masses; 4 percent fine carbonate nodules and 4 percent medium carbonate nodules and 4 percent coarse carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btky--31 to 39 inches, (78 to 100 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 34 percent clay; moderate medium subangular blocky structure; very firm; common fine irregular pores; 4 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint dark grayish brown (10YR 4/2), moist, masses of reduced iron and 4 percent fine faint brown (7.5YR 4/4), moist, masses of oxidized iron and 5 percent fine distinct black (N 2/0), moist, iron-manganese nodules and 5 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent fine distinct carbonate masses and 2 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Btk--39 to 49 inches, (100 to 125 cm);, silty clay loam, dark reddish brown (5YR 3/3) broken face, moist; 38 percent clay; strong fine angular blocky parting to strong medium angular blocky structure; very firm; common fine irregular pores; 20 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint grayish brown (10YR 5/2), moist, masses of reduced iron and 5 percent fine distinct black (N 2/0), moist, iron-manganese nodules and 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 5 percent fine distinct brown (7.5YR 4/4), moist, masses of

oxidized iron; 1 percent fine distinct threadlike carbonate masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt--49 to 64 inches, (125 to 162 cm);, silty clay loam, dark reddish brown (5YR 3/3) broken face, moist; 32 percent clay; moderate medium subangular blocky structure; firm; common fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 5 percent fine distinct black (N 2/0), moist, iron-manganese nodules and 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 10 percent medium prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--64 to 68 inches, (162 to 173 cm);, light reddish brown (2.5YR 6/4) broken face, moist; .

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 11/02/2005
Describer: DeAnn Presley

Site ID: 05KS127029 Pedon ID: 05KS127029

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Wilsey, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is 5 miles north and 2 miles west of Wilsey,
Kansas.
Legal Description: NE 1/4 of Section 36, Township 15S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 699026 meters, UTM Northing: 4287049 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1457 feet, 444.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from limestone
Bedrock Depth: 66.1 inches (168.0 cm)

Particle Size Control Section: 1.6 to 21.3 in. (4 to 54 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	18.9	0	48
Argillic horizon	1.6	66.1	4	168
Redox concentrations	1.6	66.1	4	168
Secondary carbonates	18.9	35.8	48	91
Lithologic discontinuity	35.8	58.3	91	148
Lithologic discontinuity	58.3	66.1	148	168
Lithologic discontinuity	66.1		168	
Paralithic contact	66.1		168	
Lithic contact	68.1		173	

Pedon Notes:

Ap--0 to 2 inches, (0 to 4 cm); brown (10YR 4/3) broken face, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 34 percent clay; weak fine subangular blocky structure; friable; few fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--2 to 19 inches, (4 to 48 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 40 percent clay; moderate fine prismatic structure; firm; few fine roots between peds; few fine irregular pores; 2 percent patchy faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 1 percent fine distinct black (N 2/0), moist, iron-manganese nodules; 2 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--19 to 36 inches, (48 to 91 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate fine prismatic structure; very firm; few fine roots throughout; few fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 3/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 5 percent fine distinct black (N 2/0), moist, iron-manganese nodules; 2 percent fine threadlike light brownish gray (10YR 6/2), moist, carbonate masses and 5 percent medium carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt1--36 to 58 inches, (91 to 148 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 36 percent clay; strong medium subangular blocky structure; firm; common fine irregular pores; 5 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt2--58 to 66 inches, (148 to 168 cm);, silty clay loam, reddish brown (5YR 4/3) broken face and dark reddish brown (5YR 3/3) broken face, moist; 36 percent clay; strong medium subangular blocky structure; firm; common fine irregular pores; 10 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--66 to 68 inches, (168 to 173 cm); ; limestone fragments; violent effervescence, by HCl, 1 normal.

4R--68 inches, (173 to cm); ; limestone fragments.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 11/02/2005
Describer: DeAnn Presley

Site ID: 05KS127030 Pedon ID: 05KS127030

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Wilsey, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is 5 miles north and 2 miles west of Wilsey,
Kansas.
Legal Description: NE 1/4 of Section 36, Township 15S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 698941 meters, UTM Northing: 4286868 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 3.0 percent Aspect: (deg)
Elevation: 1457 feet, 444.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from limestone and shale
Bedrock Depth: 70.1 inches (178.0 cm)

Particle Size Control Section: 1.2 to 20.9 in. (3 to 53 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
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Mollic epipedon	0.0	15.7	0	40
Argillic horizon	1.2	70.1	3	178
Redox concentrations	1.2	70.1	3	178
Secondary carbonates	15.7	42.9	40	109
Lithologic discontinuity	31.5	42.9	80	109
Lithologic discontinuity	42.9	70.1	109	178
Gypsum accumulations	42.9	70.1	109	178
Lithologic discontinuity	70.1	73.2	178	186
Lithologic discontinuity	73.2		186	

Pedon Notes:

Ap--0 to 1 inches, (0 to 3 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 38 percent clay; weak fine subangular blocky structure; friable; few very fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--1 to 16 inches, (3 to 40 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine faint black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--16 to 31 inches, (40 to 80 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate fine prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine distinct black (N 2/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 5 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules and 5 percent fine distinct light gray (10YR 7/2), moist, carbonate masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk2--31 to 43 inches, (80 to 109 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 34 percent clay; moderate fine prismatic parting to moderate fine angular blocky structure; firm; few fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 4 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent fine distinct threadlike light gray (10YR 7/2), moist, carbonate masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Bty1--43 to 59 inches, (109 to 151 cm);, silty clay loam, dark reddish brown (5YR 3/3) broken face, moist; 32 percent clay; moderate fine subangular blocky structure; very firm; common fine irregular pores; 5 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint black (N 2/0), moist, iron-manganese nodules; 1 percent fine distinct threadlike pale brown (10YR 6/3), moist, gypsum masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Bty2--59 to 70 inches, (151 to 178 cm);, silty clay, 50 percent dark reddish brown (5YR 3/3) broken face and 50 percent reddish brown (5YR 4/3) broken face, moist; 42 percent clay; moderate fine prismatic structure; very firm; few fine irregular pores; 5 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 4 percent fine distinct strong brown (7.5YR 4/6), moist, iron-manganese masses; 1 percent fine distinct

pale brown (10YR 6/3), moist, gypsum masses; 25 percent shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--70 to 73 inches, (178 to 186 cm);, brownish yellow (10YR 6/6) broken face and light gray (10YR 7/2) broken face, moist; ; limestone fragments; violent effervescence, by HCl, 1 normal; abrupt smooth boundary.

5Cr--73 to 77 inches, (186 to 196 cm);, reddish gray (5YR 5/2) broken face, moist; ; shale fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 11/02/2005
Describer: DeAnn Presley

Site ID: 05KS127031 Pedon ID: 05KS127031

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Wilsey, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is 5 miles north and 2 miles west of Wilsey,
Kansas.
Legal Description: NE 1/4 of Section 36, Township 15S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 698794 meters, UTM Northing: 4286755 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 3.0 percent Aspect: (deg)
Elevation: 1470 feet, 448.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from limestone
Bedrock Depth: 44.1 inches (112.0 cm)

Particle Size Control Section: 1.2 to 20.9 in. (3 to 53 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
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Mollic epipedon	0.0	22.0	0	56
Argillic horizon	1.2	44.1	3	112
Secondary carbonates	18.1	33.9	46	86
Redox concentrations	18.1	44.1	46	112
Lithologic discontinuity	22.0	33.9	56	86
Lithologic discontinuity	33.9	44.1	86	112
Gypsum accumulations	33.9	44.1	86	112
Lithologic discontinuity	44.1		112	
Lithic contact	44.1		112	

Pedon Notes:

Ap--0 to 1 inches, (0 to 3 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 34 percent clay; moderate fine subangular blocky structure; firm; few fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--1 to 18 inches, (3 to 46 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--18 to 22 inches, (46 to 56 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium subangular blocky structure; very firm; few fine roots between peds; few fine irregular pores; 1 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2/0), moist, iron-manganese masses; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk2--22 to 34 inches, (56 to 86 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 40 percent clay; moderate medium subangular blocky structure; very firm; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine faint black (N 2/0), moist, iron-manganese masses; 5 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bty--34 to 44 inches, (86 to 112 cm);, silty clay, dark reddish brown (5YR 3/2) broken face, moist; 42 percent clay; moderate medium subangular blocky structure; firm; common fine irregular pores; 10 percent continuous faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; 1 percent fine faint black (N 2/0), moist, iron-manganese masses and 6 percent fine prominent strong brown (7.5YR 5/6), moist, masses of oxidized iron; 1 percent fine distinct pale brown (10YR 6/3), moist, gypsum masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4R--44 inches, (112 to cm); ; limestone fragments.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 11/02/2005
Describer: DeAnn Presley

Site ID: 05KS127032 Pedon ID: 05KS127032

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Wilsey, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is 5 miles north and 2 miles west of Wilsey,
Kansas.
Legal Description: NW 1/4 of Section 36, Township 15S, Range 6E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 698656 meters, UTM Northing: 4286377 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1467 feet, 447.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from limestone
Bedrock Depth: 73.2 inches (186.0 cm)

Particle Size Control Section: 1.2 to 20.9 in. (3 to 53 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	16.9	0	43
Argillic horizon	1.2	73.2	3	186
Secondary carbonates	16.9	31.5	43	80
Redox concentrations	16.9	73.2	43	186
Lithologic discontinuity	23.2	38.2	59	97
Gypsum accumulations	31.5	38.2	80	97
Lithologic discontinuity	38.2	66.9	97	170
Lithologic discontinuity	66.9		170	
Lithic contact	73.2		186	

Pedon Notes:

Ap--0 to 1 inches, (0 to 3 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 34 percent clay; weak fine subangular blocky structure; firm; few fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--1 to 17 inches, (3 to 43 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 46 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--17 to 23 inches, (43 to 59 cm);, silty clay, brown (10YR 4/3) broken face, moist; 44 percent clay; moderate fine prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2/0), moist, iron-manganese masses; 2 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk2--23 to 31 inches, (59 to 80 cm);, silty clay, brown (10YR 4/3) broken face, moist; 44 percent clay; moderate medium subangular blocky structure; very firm; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine faint brown (10YR 5/3), moist, masses of reduced iron and 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2/0), moist, iron-manganese masses; 1 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bty--31 to 38 inches, (80 to 97 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 39 percent clay; moderate medium subangular blocky structure; firm; few very fine roots between peds; few fine irregular pores; 3 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine faint iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine faint yellowish brown (10YR 5/4), moist, gypsum masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt1--38 to 67 inches, (97 to 170 cm);, silty clay loam, dark reddish brown (5YR 3/2) broken face, moist; 36 percent clay; moderate medium subangular blocky structure; friable; common fine irregular pores; 5 percent discontinuous faint gray (5YR 5/1), moist, clay films; 8 percent fine prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Bt2--67 to 73 inches, (170 to 186 cm);, silty clay loam, dark yellowish brown (10YR 4/4) broken face, moist; 39 percent clay; weak medium subangular blocky structure; firm; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine prominent reddish brown (2.5YR 5/3), moist, masses of reduced iron and 5 percent fine prominent strong brown (7.5YR 5/8), moist, masses of oxidized iron and 10 percent fine prominent black (N 2/0), moist, iron-manganese masses; 25 percent limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4R--73 inches, (186 to cm); .

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 11/03/2005
Describer: DeAnn Presley

Site ID: 05KS127033 Pedon ID: 05KS127033

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Delavan, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is located 2 miles west and one mile north of
Delavan, Kansas.
Legal Description: SW 1/4 of of Section 12, Township 16S, Range 5E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 688143 meters, UTM Northing: 4282824 meters

Geomorphic Setting: None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 0.5 percent Aspect: (deg)
Elevation: 1483 feet, 452.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over residuum
weathered from limestone
Bedrock Depth: 52.4 inches (133.0 cm)

Particle Size Control Section: 4.7 to 24.4 in. (12 to 62 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	22.0	0	56
Argillic horizon	4.7	50.0	12	127
Redox concentrations	9.8	50.0	25	127
Secondary carbonates	22.0	30.3	56	77
Lithologic discontinuity	42.5	50.0	108	127
Lithologic discontinuity	50.0		127	
Paralithic contact	50.0		127	

Pedon Notes:

Ap--0 to 5 inches, (0 to 12 cm);, silty clay, very dark grayish brown (10YR 3/2) rubbed, moist; 42 percent clay; weak fine subangular blocky structure; very firm; few fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--5 to 10 inches, (12 to 25 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 42 percent clay; moderate fine prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent patchy faint black (10YR 2/1), moist, organoargillans; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt2--10 to 22 inches, (25 to 56 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 2 percent patchy faint black (10YR 2/1), moist, clay films; 1 percent fine faint black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--22 to 30 inches, (56 to 77 cm);, silty clay, brown (10YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films and 5 percent continuous faint dark brown (10YR 3/3), moist, clay films on top faces of peds and 20 percent continuous faint dark brown (10YR 3/3), moist, clay films on bottom faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine distinct black (N 2/0), moist, iron-manganese nodules and 1 percent fine distinct black (N 2/0), moist, iron-manganese masses; 2 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--30 to 43 inches, (77 to 108 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 39 percent clay; moderate fine prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 25 percent fine distinct black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Bt2--43 to 50 inches, (108 to 127 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 39 percent clay; moderate medium angular blocky structure; friable; few very fine roots between peds; few fine irregular pores; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--50 to 74 inches, (127 to 187 cm); ; limestone fragments.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Udertic Argiustolls

Description Date: 11/03/2005
Describer: DeAnn Presley

Site ID: 05KS127034 Pedon ID: 05KS127034

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Delavan, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is located 2 miles west and one mile north of
Delavan, Kansas.
Legal Description: SW 1/4 of of Section 12, Township 16S, Range 5E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 688193 meters, UTM Northing: 4282662 meters

Geomorphic Setting: None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 0.5 percent Aspect: (deg)
Elevation: 1483 feet, 452.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from limestone
Bedrock Depth: 52.4 inches (133.0 cm)

Particle Size Control Section: 2.4 to 22.0 in. (6 to 56 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	22.0	0	56
Argillic horizon	2.4	61.8	6	157
Redox concentrations	2.4	61.8	6	157
Secondary carbonates	16.9	25.6	43	65
Lithologic discontinuity	25.6	37.4	65	95
Lithologic discontinuity	37.4	61.8	95	157
Slickensides	37.4	47.2	95	120
Gypsum accumulations	37.4	47.2	95	120
Paralithic contact	61.8		157	
Lithologic discontinuity	61.8		157	

Pedon Notes:

Ap--0 to 2 inches, (0 to 6 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 36 percent clay; weak fine subangular blocky structure; friable; few very fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--2 to 11 inches, (6 to 28 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 50 percent clay; moderate fine prismatic structure; very firm; few very fine roots throughout; few fine irregular pores; 2 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans; 1 percent fine faint black (N 2/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--11 to 17 inches, (28 to 43 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm; few very fine roots throughout; few fine irregular pores; 2 percent patchy faint very dark grayish brown (10YR 3/2), moist, clay films; 1 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine faint iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--17 to 26 inches, (43 to 65 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm; few very fine roots throughout; few fine irregular pores; 2 percent patchy faint dark brown (10YR 3/3), moist, clay films; 1 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine distinct black (N 2/0), moist, iron-manganese nodules; 2 percent fine prominent very pale brown (10YR 7/3), moist, carbonate nodules and 1 percent medium prominent very pale brown (10YR 7/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk2--26 to 37 inches, (65 to 95 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm; few very fine roots throughout; few fine irregular pores; 4 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese nodules; 4 percent coarse prominent very pale brown (10YR 7/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btssy--37 to 47 inches, (95 to 120 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 36 percent clay; strong fine prismatic parting to strong fine angular blocky structure; very firm; few very fine roots throughout; common fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2/0), moist, iron-manganese masses; 2 percent fine distinct light gray (10YR 7/2),

moist, gypsum masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt1--47 to 59 inches, (120 to 150 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 36 percent clay; moderate fine prismatic parting to moderate fine subangular blocky structure; very firm; few very fine roots throughout; common fine irregular pores; 20 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Bt2--59 to 62 inches, (150 to 157 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 36 percent clay; moderate fine prismatic structure; very firm; few very fine roots throughout; few fine irregular pores; 20 percent continuous faint dark brown (10YR 3/3), moist, clay films; 15 percent medium prominent black (N 2/0), moist, iron-manganese masses and 25 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 5 percent limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--62 to 72 inches, (157 to 184 cm); ; 10 percent limestone fragments; violent effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 11/03/2005
Describer: DeAnn Presley

Site ID: 05KS127035 Pedon ID: 05KS127035

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Delavan, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is located 2 miles west and one mile north of
Delavan, Kansas.
Legal Description: SW 1/4 of of Section 12, Township 16S, Range 5E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 688245 meters, UTM Northing: 4282553 meters

Geomorphic Setting: None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 0.5 percent Aspect: (deg)
Elevation: 1483 feet, 452.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from limestone
Bedrock Depth: 52.4 inches (133.0 cm)

Particle Size Control Section: 3.5 to 23.2 in. (9 to 59 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.0	0	61

Argillic horizon	3.5	65.4	9	166
Redox concentrations	3.5	83.9	9	213
Secondary carbonates	24.0	40.6	61	103
Lithologic discontinuity	40.6	57.9	103	147
Redox depletions with chroma 2 or less	40.6	65.4	103	166
Lithologic discontinuity	57.9	83.9	147	213
Paralithic contact	83.9		213	
Lithologic discontinuity	83.9		213	

Pedon Notes:

Ap--0 to 4 inches, (0 to 9 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 30 percent clay; weak fine subangular blocky structure; friable; few very fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--4 to 16 inches, (9 to 40 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 40 percent clay; moderate fine prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 2 percent patchy faint black (10YR 2/1), moist, organoargillans on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--16 to 24 inches, (40 to 61 cm);, silty clay, dark brown (10YR 3/3) broken face and brown (10YR 4/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 2 percent patchy faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 10 percent fine distinct black (N 2/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--24 to 41 inches, (61 to 103 cm);, silty clay, brown (10YR 4/3) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 2 percent patchy faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 5 percent fine distinct black (N 2/0), moist, iron-manganese nodules; 2 percent medium prominent very pale brown (10YR 7/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt1--41 to 58 inches, (103 to 147 cm);, silty clay loam, dark grayish brown (10YR 4/2) broken face, moist; 36 percent clay; moderate fine subangular blocky structure; very firm; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron and 4 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt2--58 to 65 inches, (147 to 166 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 34 percent clay; moderate fine subangular blocky structure; firm; few very fine roots between peds; few fine irregular pores; 15 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron and 5 percent fine

distinct black (N 2/0), moist, iron-manganese masses and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3BC--65 to 84 inches, (166 to 213 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 32 percent clay; weak medium subangular blocky structure; friable; few very fine roots between peds; few fine irregular pores; 15 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 1 percent fine distinct black (N 2/0), moist, iron-manganese masses and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 75 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--84 to 89 inches, (213 to 226 cm); ; cherty limestone fragments.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 11/03/2005
Describer: DeAnn Presley

Site ID: 05KS127036 Pedon ID: 05KS127036

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Delavan, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is located 2 miles west and one mile north of
Delavan, Kansas.
Legal Description: SW 1/4 of of Section 12, Township 16S, Range 5E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 688327 meters, UTM Northing: 4282462 meters

Geomorphic Setting: None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 0.5 percent Aspect: (deg)
Elevation: 1483 feet, 452.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over residuum
weathered from limestone
Bedrock Depth: 52.4 inches (133.0 cm)

Particle Size Control Section: 7.1 to 26.8 in. (18 to 68 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	22.4	0	57
Argillic horizon	7.1	65.0	18	165
Redox concentrations	7.1	65.0	18	165
Abrupt textural change	7.1	7.5	18	19
Secondary carbonates	22.4	35.4	57	90
Lithologic discontinuity	55.1	65.0	140	165
Lithologic discontinuity	65.0		165	
Paralithic contact	65.0		165	

Pedon Notes:

Ap--0 to 7 inches, (0 to 18 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 24 percent clay; weak fine subangular blocky structure; friable; few fine roots throughout; few fine irregular pores; abrupt smooth boundary.

Bt--7 to 22 inches, (18 to 57 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 4 percent patchy faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese nodules; clear smooth boundary.

Btk--22 to 35 inches, (57 to 90 cm);, silty clay, dark grayish brown (10YR 4/2) broken face and brown (10YR 4/3) broken face, moist; 46 percent clay; moderate medium prismatic structure; very firm; few very fine roots between peds; few fine irregular pores; 2 percent patchy faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese nodules; 1 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules; clear smooth boundary.

Bt1--35 to 43 inches, (90 to 109 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 35 percent clay; moderate fine prismatic structure; friable; few very fine roots between peds; few fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese nodules; clear smooth boundary.

Bt2--43 to 55 inches, (109 to 140 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; few fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese nodules; clear smooth boundary.

2Bt3--55 to 65 inches, (140 to 165 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 8 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films; 4 percent fine prominent (10YR 4/8), moist, masses of oxidized iron and 5 percent fine distinct black (N 2/0), moist, iron-manganese masses; 2 percent chert fragments; abrupt smooth boundary.

3Cr--65 to 79 inches, (165 to 200 cm); ; limestone fragments.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 11/03/2005
Describer: DeAnn Presley

Site ID: 05KS127037 Pedon ID: 05KS127037

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Delavan, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Site is located 2 miles west and one mile north of
Delavan, Kansas.
Legal Description: SW 1/4 of of Section 12, Township 16S, Range 5E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 688420 meters, UTM Northing: 4282553 meters

Geomorphic Setting: None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 0.5 percent Aspect: (deg)
Elevation: 1483 feet, 452.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over residuum
weathered from limestone
Bedrock Depth: 52.4 inches (133.0 cm)

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	16.5	0	42
Argillic horizon	5.5	61.0	14	155
Redox concentrations	5.5	70.5	14	179
Abrupt textural change	5.5	5.9	14	15
Redox depletions with chroma 2 or less	13.8	36.2	35	92
Secondary carbonates	16.5	61.0	42	155
Lithologic discontinuity	36.2	61.0	92	155
Lithologic discontinuity	61.0		155	
Paralithic contact	70.5		179	

Pedon Notes:

Ap--0 to 6 inches, (0 to 14 cm);, silty clay loam, very dark brown (10YR 2/2) rubbed, moist; 32 percent clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 14 inches, (14 to 35 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine faint black (N 2/0), moist, iron-manganese nodules and 1 percent very fine prominent (10YR 4/8), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--14 to 17 inches, (35 to 42 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron and 1 percent fine faint black (N 2/0), moist, iron-manganese nodules and 1 percent very fine prominent (10YR 4/8), moist, masses of oxidized iron; 1 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--17 to 29 inches, (42 to 74 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 43 percent clay; moderate fine prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent patchy faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron and 1 percent fine prominent (10YR 4/8), moist, masses of oxidized iron and 2 percent fine faint black (N 2/0), moist, iron-manganese nodules; 15 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk2--29 to 36 inches, (74 to 92 cm);, silty clay, brown (10YR 4/3) broken face, moist; 45 percent clay; moderate fine prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron and 2 percent fine distinct (10YR 4/8), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese masses; 5 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btk3--36 to 61 inches, (92 to 155 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky,

very plastic; few very fine roots between peds; few fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 3 percent fine distinct black (N 2/0), moist, iron-manganese masses and 5 percent fine distinct (10YR 4/8), moist, masses of oxidized iron; 1 percent fine distinct threadlike carbonate, finely disseminated; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3C--61 to 70 inches, (155 to 179 cm);, silty clay loam, brown (10YR 5/3) broken face and dark grayish brown (10YR 4/2) broken face, moist; 28 percent clay; medium angular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; few fine irregular pores; 50 percent 2 to 4 millimeter cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--70 to 76 inches, (179 to 192 cm);, pink (2.5YR 8/3) broken face, moist; ; few fine irregular pores; limestone fragments.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 11/14/2005
Describer: DeAnn Presley

Site ID: 05KS127038 Pedon ID: 05KS127038

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Alta Vista, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Pasture is located on the east side of Highway 177 8
miles north of Council Grove, Kansas.
Legal Description: NW 1/4 of of Section 11, Township 15S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 717224 meters, UTM Northing: 4293229 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1388 feet, 423.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
weathered from limestone

Particle Size Control Section: 9.1 to 28.7 in. (23 to 73 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	9.1	0	23

Argillic horizon	9.1	31.5	23	80
Redox concentrations	9.1	47.2	23	120
Secondary carbonates	13.0	31.5	33	80
Lithologic discontinuity	20.9	31.5	53	80
Lithologic discontinuity	31.5		80	
Paralithic contact	47.2		120	

Pedon Notes:

Ap--0 to 9 inches, (0 to 23 cm); dark grayish brown (10YR 4/2) broken face, silty clay loam, black (10YR 2/1) rubbed, moist; 35 percent clay; moderate fine granular structure; firm, hard, very sticky, moderately plastic; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--9 to 13 inches, (23 to 33 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 40 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots throughout; common fine dendritic tubular pores; 5 percent continuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine distinct black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--13 to 21 inches, (33 to 53 cm);, silty clay, brown (10YR 4/3) broken face, moist; 44 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; common fine dendritic tubular pores; 5 percent continuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese masses; 5 percent fine carbonate nodules and 1 percent coarse carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk2--21 to 31 inches, (53 to 80 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; firm, hard, very sticky, very plastic; few fine roots between peds; few fine dendritic tubular pores; 5 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron; 2 percent fine carbonate nodules; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3C--31 to 47 inches, (80 to 120 cm);, silt loam, light reddish brown (2.5YR 6/3) broken face and pale red (2.5YR 6/2) broken face, moist; 23 percent clay; weak medium angular blocky structure; friable, soft, slightly sticky, nonplastic; few fine irregular pores; 3 percent fine distinct yellowish brown (10YR 5/6), moist, masses of oxidized iron; 20 percent cherty limestone fragments; violent effervescence, by HCl, 1 normal; abrupt smooth boundary.

3Cr--47 to 49 inches, (120 to 124 cm);, pink (5YR 7/3) broken face, moist; ; limestone fragments; violent effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 11/14/2005
Describer: DeAnn Presley

Site ID: 05KS127039 Pedon ID: 05KS127039

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Alta Vista, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Pasture is located on the east side of Highway 177 8
miles north of Council Grove, Kansas.
Legal Description: NW 1/4 of of Section 11, Township 15S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 717176 meters, UTM Northing: 4293348 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1398 feet, 426.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
weathered from limestone and shale

Particle Size Control Section: 2.8 to 22.4 in. (7 to 57 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	10.2	0	26

Argillic horizon	2.8	46.5	7	118
Redox concentrations	2.8	72.4	7	184
Secondary carbonates	27.6	46.5	70	118
Lithologic discontinuity	27.6	46.5	70	118
Lithologic discontinuity	46.5		118	
Paralithic contact	72.4		184	

Pedon Notes:

Ap--0 to 3 inches, (0 to 7 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 25 percent clay; moderate fine granular structure; friable, soft, slightly sticky, slightly plastic; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--3 to 10 inches, (7 to 26 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 36 percent clay; moderate fine prismatic structure; firm, slightly hard, very sticky, very plastic; common fine roots throughout; common fine dendritic tubular pores; 2 percent patchy faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--10 to 20 inches, (26 to 52 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate fine prismatic structure; firm, slightly hard, very sticky, very plastic; common fine roots throughout; common fine dendritic tubular pores; 4 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 4 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--20 to 28 inches, (52 to 70 cm);, silty clay, brown (10YR 4/3) broken face, moist; 44 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots throughout; few fine dendritic tubular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 4 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 4 percent fine distinct black (N 2/0), moist, iron-manganese masses; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btk--28 to 46 inches, (70 to 118 cm);, silty clay, dark brown (7.5YR 3/3) broken face and brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; few fine dendritic tubular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine faint brown (10YR 5/3), moist, masses of reduced iron and 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 20 percent fine distinct black (N 2/0), moist, iron-manganese masses; 2 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules and 1 percent coarse distinct light gray (10YR 7/2), moist, carbonate nodules; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3BC--46 to 48 inches, (118 to 123 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; weak fine subangular blocky structure; firm, hard, very sticky, very plastic; few fine irregular pores; 2 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 20 percent fine distinct black (N 2/0), moist, iron-manganese masses and 25 percent fine prominent (7.5YR 4/8), moist, masses of oxidized iron; shale

fragments and 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3C--48 to 72 inches, (123 to 184 cm);, silt loam, light reddish brown (2.5YR 6/3) broken face, moist; 22 percent clay; medium angular blocky structure; friable, soft, nonsticky, nonplastic; few fine irregular pores; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 4 percent fine faint brown (10YR 5/3), moist, masses of reduced iron; 25 percent calcareous shale fragments; violent effervescence, by HCl, 1 normal.

3Cr--72 inches, (184 to cm); ; 5 percent fine distinct black (N 2/0), moist, iron-manganese masses; limestone fragments.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 11/14/2005
Describer: DeAnn Presley

Site ID: 05KS127040 Pedon ID: 05KS127040

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Alta Vista, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Pasture is on east side of KS177, about 8 miles north
of Council Grove, KS.
Legal Description: 550 m S and 100 m E of NW corner of Section 11,
Township 15S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 717201 meters, UTM Northing: 4293501 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: 202 (deg)
Elevation: 1411 feet, 430.0 meters
Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over calcareous shale
residuum
Bedrock Depth: 42.1 inches (107.0 cm)

Particle Size Control Section: 6.7 to 26.4 in. (17 to 67 cm)

Diagnostic Features:
| Top Bottom Top Bottom |

Kind	Depth (in)	Depth (in)	Depth (cm)	Depth (cm)
Mollic epipedon	0.0	13.4	0	34
Argillic horizon	5.5	42.1	14	107
Redox concentrations	13.4	42.1	34	107
Secondary carbonates	13.4	30.3	34	77
Lithologic discontinuity	21.3	42.1	54	107
Paralithic contact	42.1		107	
Lithologic discontinuity	42.1		107	

Pedon Notes:

Pedon described during Agronomy 515 laboratory by Daniel Unruh, Jason Clough, Jeff Mei, Katie Wilson, John Czarek, and Miranda Brown.

Ap--0 to 6 inches, (0 to 14 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 3 percent sand; 34 percent clay; ; friable, hard, moderately sticky, moderately plastic; common fine roots throughout; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--6 to 13 inches, (14 to 34 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 3 percent sand; 40 percent clay; ; very firm, very hard, very sticky, very plastic; common fine roots throughout; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--13 to 21 inches, (34 to 54 cm);, silty clay, 50 percent brown (7.5YR 4/2) broken face and 50 percent dark grayish brown (10YR 4/2) broken face, moist; 3 percent sand; 42 percent clay; ; very firm, very hard, very sticky, very plastic; common fine roots between peds; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent fine distinct pale brown (10YR 6/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk2--21 to 30 inches, (54 to 77 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 3 percent sand; 42 percent clay; ; very firm, very hard, very sticky, very plastic; few fine roots between peds; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent fine distinct pale brown (10YR 6/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt--30 to 42 inches, (77 to 107 cm);, silty clay, dark brown (7.5YR 3/2) broken face, moist; 3 percent sand; 42 percent clay; ; very firm, very hard, very sticky, very plastic; 10 percent continuous faint clay films on all faces of peds; 2 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine prominent black (N 2.5/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--42 inches, (107 to cm); ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 11/14/2005
 Descriptor: DeAnn Presley

Site ID: 05KS127041 Pedon ID: 05KS127041

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Morris Quad Sheet Name: Alta Vista, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Pasture is located on the east side of Highway 177 8
 miles north of Council Grove, Kansas.
 Legal Description: NW 1/4 of of Section 11, Township 15S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 717192 meters, UTM Northing: 4293556 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 2.0 percent Aspect: (deg)
 Elevation: 1411 feet, 430.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over residuum
 weathered from limestone and shale

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	16.5	0	42

Argillic horizon	5.5	49.2	14	125
Redox concentrations	5.5	49.2	14	125
Abrupt textural change	5.5	5.9	14	15
Secondary carbonates	16.5	43.3	42	110
Lithologic discontinuity	31.1	49.2	79	125
Lithologic discontinuity	49.2		125	
Paralithic contact	49.2		125	

Pedon Notes:

Ap--0 to 6 inches, (0 to 14 cm); dark grayish brown (10YR 4/2) broken face, silt loam, very dark brown (10YR 2/2) rubbed, moist; 24 percent clay; weak medium subangular blocky structure; friable, slightly hard, nonsticky, nonplastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--6 to 17 inches, (14 to 42 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 42 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; common fine dendritic tubular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--17 to 31 inches, (42 to 79 cm);, silty clay, brown (10YR 4/3) broken face, moist; 40 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; common fine dendritic tubular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/), moist, iron-manganese masses; 5 percent fine carbonate nodules and medium carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk2--31 to 43 inches, (79 to 110 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 38 percent clay; moderate fine prismatic parting to moderate fine angular blocky structure; firm, hard, very sticky, very plastic; common fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine strong brown (7.5YR 4/6), moist, masses of oxidized iron and 3 percent fine black (N 2.5/), moist, iron-manganese masses; 1 percent threadlike; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btk3--43 to 49 inches, (110 to 125 cm);, silty clay, dark reddish brown (5YR 3/3) broken face, moist; 40 percent clay; moderate fine prismatic parting to moderate fine angular blocky structure; firm, hard, very sticky, very plastic; common fine irregular pores; 15 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent threadlike; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--49 to 50 inches, (125 to 126 cm);, strong brown (7.5YR 5/6) broken face, moist; ; calcareous shale fragments; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 11/14/2005
Describer: DeAnn Presley

Site ID: 05KS127042 Pedon ID: 05KS127042

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Alta Vista, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Pasture is located on the east side of Highway 177 8
miles north of Council Grove, Kansas.
Legal Description: NW 1/4 of of Section 11, Township 15S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 717250 meters, UTM Northing: 4293592 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1404 feet, 428.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
weathered from limestone

Particle Size Control Section: 3.9 to 23.6 in. (10 to 60 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	17.3	0	44

Argillic horizon	3.9	47.2	10	120
Abrupt textural change	3.9	4.3	10	11
Redox concentrations	11.8	47.2	30	120
Secondary carbonates	17.3	27.6	44	70
Lithologic discontinuity	27.6	47.2	70	120
Gypsum accumulations	27.6	47.2	70	120
Lithologic discontinuity	47.2		120	
Paralithic contact	47.2		120	

Pedon Notes:

A--0 to 4 inches, (0 to 10 cm); dark grayish brown (10YR 4/2) broken face, silt loam, very dark brown (10YR 2/2) rubbed, moist; 23 percent clay; moderate medium granular structure; friable, slightly hard, slightly sticky, slightly plastic; many fine roots throughout and many medium roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--4 to 12 inches, (10 to 30 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots throughout; common fine dendritic tubular pores; 2 percent patchy faint black (10YR 2/1), moist, organoargillans; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt2--12 to 17 inches, (30 to 44 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; common fine dendritic tubular pores; 2 percent patchy faint very dark grayish brown (10YR 3/2), moist, clay films; 1 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 1 percent fine distinct black (N 2/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--17 to 28 inches, (44 to 70 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine dendritic tubular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese masses; 4 percent fine distinct carbonate nodules and 1 percent medium distinct very pale brown (10YR 7/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt--28 to 37 inches, (70 to 95 cm);, silty clay loam, brown (7.5YR 4/4) broken face, moist; 38 percent clay; moderate fine prismatic parting to moderate medium subangular blocky structure; firm, hard, very sticky, very plastic; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct yellowish brown (10YR 5/4), moist, masses of oxidized iron and 2 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent fine distinct brown (10YR 5/3), moist, gypsum masses; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bty--37 to 47 inches, (95 to 120 cm);, silty clay loam, dark brown (7.5YR 3/4) broken face, moist; 38 percent clay; moderate medium subangular blocky and moderate fine prismatic structure; firm, hard, very sticky, very plastic; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct yellowish brown (10YR 5/4), moist, masses of oxidized iron and 2 percent fine faint strong brown (7.5YR 4/6),

moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent fine distinct brown (10YR 5/3), moist, gypsum masses; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--47 to 49 inches, (120 to 125 cm); very pale brown (10YR 8/3) broken face, very pale brown (10YR 7/4) broken face, moist; ; limestone fragments; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 11/14/2005
Describer: DeAnn Presley

Site ID: 05KS127043 Pedon ID: 05KS127043

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Alta Vista, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Pasture is located on the east side of Highway 177 8
miles north of Council Grove, Kansas.
Legal Description: NW 1/4 of of Section 11, Township 15S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 717262 meters, UTM Northing: 4293647 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1401 feet, 427.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
weathered from limestone

Particle Size Control Section: 12.2 to 31.9 in. (31 to 81 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	20.1	0	51

Argillic horizon	12.2	35.8	31	91
Redox concentrations	12.2	35.8	31	91
Lithologic discontinuity	26.0	35.8	66	91
Paralithic contact	35.8		91	
Lithologic discontinuity	35.8		91	

Pedon Notes:

A--0 to 9 inches, (0 to 23 cm); dark grayish brown (10YR 4/2) broken face, silty clay loam, black (10YR 2/1) rubbed, moist; 28 percent clay; weak medium granular structure; friable, slightly hard, moderately sticky, moderately plastic; common fine roots throughout; many fine dendritic tubular pores; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

BA--9 to 12 inches, (23 to 31 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 35 percent clay; moderate fine subangular blocky structure; firm, hard, moderately sticky, moderately plastic; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--12 to 20 inches, (31 to 51 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; common fine roots throughout; common fine dendritic tubular pores; 2 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--20 to 26 inches, (51 to 66 cm);, silty clay, 50 percent dark grayish brown (10YR 4/2) broken face and 50 percent brown (10YR 4/3) broken face, moist; 46 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 2 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 4 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt3--26 to 36 inches, (66 to 91 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 6 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Cr--36 to 37 inches, (91 to 93 cm);, light yellowish brown (10YR 6/4) broken face, moist; ; limestone fragments.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 11/14/2005
Describer: DeAnn Presley

Site ID: 05KS127044 Pedon ID: 05KS127044

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Morris Quad Sheet Name: Alta Vista, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Pasture is located on the east side of Highway 177 8
miles north of Council Grove, Kansas.
Legal Description: NW 1/4 of of Section 11, Township 15S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 717430 meters, UTM Northing: 4293686 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 2.0 percent Aspect: (deg)
Elevation: 1391 feet, 424.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum
weathered from limestone and shale

Particle Size Control Section: 4.3 to 24.0 in. (11 to 61 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	22.0	0	56

Argillic horizon	4.3	48.0	11	122
Redox concentrations	4.3	58.7	11	149
Abrupt textural change	4.3	4.7	11	12
Secondary carbonates	22.0	35.4	56	90
Lithologic discontinuity	35.4	48.0	90	122
Lithologic discontinuity	48.0		122	
Paralithic contact	58.7		149	

A--0 to 4 inches, (0 to 11 cm); dark grayish brown (10YR 4/2) broken face, silt loam, very dark brown (10YR 2/2) rubbed, moist; 24 percent clay; weak medium granular structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--4 to 18 inches, (11 to 46 cm);, silty clay, black (10YR 2/1) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots throughout; few fine irregular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent very fine distinct yellowish brown (10YR 5/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--18 to 22 inches, (46 to 56 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; few fine irregular pores; 4 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films; 1 percent very fine distinct yellowish brown (10YR 5/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--22 to 35 inches, (56 to 90 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 1 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films; 1 percent fine distinct yellowish brown (10YR 5/6), moist, masses of oxidized iron and 4 percent fine distinct black (N 2/0), moist, iron-manganese nodules; 10 percent medium carbonate nodules and 5 percent coarse pale brown (10YR 6/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt--35 to 48 inches, (90 to 122 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2/0), moist, iron-manganese masses; chert fragments and 1 percent shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3BC--48 to 59 inches, (122 to 149 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 34 percent clay; weak medium subangular blocky structure; firm, hard, moderately sticky, moderately plastic; many fine vesicular pores; 40 percent calcareous shale fragments; violent effervescence, by HCl, 1 normal; abrupt smooth boundary.

3Cr--59 to 63 inches, (149 to 159 cm); very pale brown (10YR 7/3) broken face, pale brown (10YR 6/3) broken face, moist; ; calcareous shale fragments.

PEDON DESCRIPTION

Soil Name as Described/Sampled: Irwin

Soil Name as Correlated:

Classification: Fine, smectitic, mesic Typic Natrustolls

Description Date: 07/27/2006

Describer: DeAnn Presley

Site ID: 06KS127001

Pedon ID: 06KS127001

Site Note:

Pedon Type:

Pedon Purpose: research site

Taxon Kind:

Location Information:

County: Morris

Quad Sheet Name: Wilsey Se, Kansas

State: Kansas

MLRA: 76 -- Bluestem Hills

Soil Survey Area:

Map Unit: --

Location Description:

Legal Description: of Section 34, Township 17S, Range 8E

Latitude: degrees minutes seconds

Longitude: degrees minutes seconds

Datum: NAD83

UTM Zone: 14, UTM Easting: 716622 meters, UTM Northing: 4267819 meters

Geomorphic Setting: on summit of interfluvium of None Assigned

Upslope Shape: concave Cross Slope Shape: concave

Slope: 0.0 percent Aspect: (deg)

Elevation: 1483 feet, 452.0 meters

Drainage class:

Primary Earth Cover: Grass/herbaceous cover

Secondary Earth Cover: Tame pastureland

Parent Material: clayey loess over colluvium over residuum

weathered from limestone

Particle Size Control Section: 5.1 to 24.8 in. (13 to 63 cm)

Diagnostic Features:

	Top	Bottom	Top	Bottom
Kind	Depth (in)	Depth (in)	Depth (cm)	Depth (cm)
Mollic epipedon	0.0	20.1	0	51
Argillic horizon	5.1	34.3	13	87
Abrupt textural change	5.1	5.5	13	14
Redox concentrations	10.2	34.3	26	87
Secondary carbonates	20.1	29.5	51	75
Lithologic discontinuity	29.5	34.3	75	87
Lithologic discontinuity	34.3		87	
Paralithic contact	34.3		87	

Pedon Notes:

Pedon was originally classified as pachic paleustoll, but was revised to typic natrustoll after laboratory characterization by the KSU Pedology lab.

Exchangeable sodium percent (ESP) values ranged from 20 to 28 in the B horizons. The "n" was also added to the diagnostic subsurface horzion tables.

A--0 to 5 inches, (0 to 13 cm);, silt loam, very dark grayish brown (10YR 3/2), moist; 20 percent clay; weak medium subangular blocky structure; friable; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btn1--5 to 10 inches, (13 to 26 cm);, silty clay, very dark brown (10YR 2/2), moist; 45 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds;

few fine dendritic tubular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btn2--10 to 17 inches, (26 to 42 cm);, silty clay, very dark brown (10YR 2/2), moist; 45 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine dendritic tubular pores; 20 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btn3--17 to 20 inches, (42 to 51 cm);, silty clay, dark brown (10YR 3/3), moist; 45 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine dendritic tubular pores; 20 percent dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btkn--20 to 30 inches, (51 to 75 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 45 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine dendritic tubular pores; 5 percent dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct strong brown (7.5YR 4/6), moist, iron depletions and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 2 percent carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btn--30 to 34 inches, (75 to 87 cm);, silty clay loam, brown (7.5YR 4/3), moist; 38 percent clay; moderate medium subangular blocky structure; firm; few fine dendritic tubular pores; 5 percent dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct brown (10YR 5/3), moist, iron depletions and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--34 to 35 inches, (87 to 88 cm);, light gray (10YR 7/2), moist; ; violent effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 11/22/2005
 Descriptor: DeAnn Presley

Site ID: 05KS017001 Pedon ID: 05KS017001

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: NE 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 726042 meters, UTM Northing: 4254570 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: concave
 Slope: 4.0 percent Aspect: 0 (deg)
 Elevation: 1178 feet, 359.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Hayland

Parent Material: colluvium over colluvium over residuum weathered
 from cherty limestone
 Bedrock Depth: 48.0 inches (122.0 cm)

Particle Size Control Section: 12.6 to 28.3 in. (32 to 72 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	28.0	0	71

Argillic horizon	12.6	48.0	32	122
Abrupt textural change	12.6	13.0	32	33
Secondary carbonates	28.0	42.5	71	108
Lithologic discontinuity	42.5	48.0	108	122
Lithologic discontinuity	48.0		122	
Paralithic contact	48.0		122	

Pedon Notes:

A--0 to 13 inches, (0 to 32 cm);, silt loam, very dark gray (10YR 3/1) rubbed, moist; 3 percent sand; 15 percent clay; weak subangular blocky structure; friable; common fine roots throughout; noneffervescent, by HCl, 1 normal; clear boundary.

Bt--13 to 28 inches, (32 to 71 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 3 percent sand; 41 percent clay; moderate prismatic structure; very firm; few fine roots throughout; 10 percent continuous distinct very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear boundary.

Btk--28 to 43 inches, (71 to 108 cm);, silty clay, dark yellowish brown (10YR 4/4) broken face, moist; 3 percent sand; 44 percent clay; moderate prismatic structure; very firm; 10 percent continuous distinct dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine pale brown (10YR 6/3), moist, carbonate masses; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear boundary.

2Bt--43 to 48 inches, (108 to 122 cm);, clay loam, strong brown (7.5YR 4/6) broken face, moist; 25 percent sand; 35 percent clay; moderate subangular blocky structure; very firm; 10 percent continuous distinct dark brown (10YR 3/3), moist, clay films on all faces of peds; 10 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear boundary.

3Cr--48 inches, (122 to cm); ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 11/22/2005
 Descriptor: DeAnn Presley

Site ID: 05KS017002 Pedon ID: 05KS017002

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: NE 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 725856 meters, UTM Northing: 4254616 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: concave
 Slope: 4.0 percent Aspect: 23 (deg)
 Elevation: 1178 feet, 359.0 meters
 Drainage class: moderately well

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Hayland

Parent Material: colluvium over colluvium over colluvium over
 residuum weathered from cherty limestone
 Bedrock Depth: 82.7 inches (210.0 cm)

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	26.4	0	67

Argillic horizon	7.9	57.5	20	146
Abrupt textural change	7.9	8.3	20	21
Redox concentrations	22.4	82.7	57	210
Lithologic discontinuity	38.6	57.5	98	146
Lithologic discontinuity	57.5	82.7	146	210
Paralithic contact	82.7		210	
Lithologic discontinuity	82.7		210	

Pedon Notes:

A--0 to 8 inches, (0 to 20 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 3 percent sand; 25 percent clay; weak fine granular structure; friable; many fine roots throughout; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

BA--8 to 22 inches, (20 to 57 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 3 percent sand; 41 percent clay; moderate medium angular blocky structure; very firm; common fine roots throughout; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear boundary.

Bt1--22 to 39 inches, (57 to 98 cm);, silty clay, dark yellowish brown (10YR 4/4) broken face, moist; 3 percent sand; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; 15 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

2Bt2--39 to 57 inches, (98 to 146 cm);, clay loam, yellowish brown (10YR 5/4) broken face, moist; 25 percent sand; 37 percent clay; moderate medium subangular blocky structure; very firm; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 15 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

3BC--57 to 83 inches, (146 to 210 cm);, clay loam, yellowish brown (10YR 5/4) broken face, moist; 25 percent sand; 35 percent clay; moderate medium subangular blocky structure; very firm; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 25 percent fine distinct black (N 2.5/), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; abrupt boundary.

4Cr--83 inches, (210 to cm); ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 11/22/2005
 Descriptor: DeAnn Presley

Site ID: 05KS017003 Pedon ID: 05KS017003

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SE 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 726014 meters, UTM Northing: 4254126 meters

Geomorphic Setting: on footslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: concave
 Slope: 2.0 percent Aspect: 158 (deg)
 Elevation: 1175 feet, 358.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Hayland

Parent Material: clayey loess over old clayey alluvium

Particle Size Control Section: 10.2 to 29.9 in. (26 to 76 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	16.1	0	41
Redox concentrations	10.2		26	
Argillic horizon	10.2		26	

Reduced matrix	39.4		100
Lithologic discontinuity	39.4		100

Pedon Notes:

A--0 to 7 inches, (0 to 17 cm);, silt loam, black (10YR 2/1) rubbed, moist; 21 percent clay; moderate fine granular structure; friable, slightly hard, slightly sticky, slightly plastic; fine roots throughout and medium roots throughout; many fine dendritic tubular pores; clear smooth boundary.

BA--7 to 10 inches, (17 to 26 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 32 percent clay; weak fine granular and moderate fine subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; common fine roots throughout; common fine dendritic tubular pores; abrupt smooth boundary.

Bt1--10 to 16 inches, (26 to 41 cm);, silty clay loam, 50 percent dark brown (10YR 3/3) broken face and 50 percent very dark grayish brown (10YR 3/2) broken face, moist; 38 percent clay; moderate medium subangular blocky structure; firm, hard, very sticky, very plastic; common fine roots throughout; common fine dendritic tubular pores; 20 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; clear smooth boundary.

Bt2--16 to 22 inches, (41 to 55 cm);, silty clay loam, 50 percent dark grayish brown (10YR 4/2) broken face and 50 percent brown (10YR 4/3) broken face, moist; 38 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; common fine dendritic tubular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2/0), moist, iron-manganese nodules and 8 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; clear smooth boundary.

Bt3--22 to 30 inches, (55 to 77 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; few fine dendritic tubular pores; 8 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 8 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2/0), moist, iron-manganese nodules; 1 percent chert fragments; gradual smooth boundary.

Bt4--30 to 39 inches, (77 to 100 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 34 percent clay; moderate fine prismatic structure; firm, hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 2 percent patchy faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 15 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 20 percent fine distinct black (N 2/0), moist, iron-manganese masses; 1 percent chert fragments; abrupt smooth boundary.

2Btg1--39 to 65 inches, (100 to 165 cm);, clay, weak red (2.5YR 5/2) broken face, moist; 50 percent clay; moderate medium prismatic parting to moderate fine angular blocky structure; extremely firm, extremely hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 30 percent medium strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent 5 to 10 millimeter chert fragments; gradual smooth boundary.

2Btg2--65 to 79 inches, (165 to 200 cm);, clay, 50 percent weak red (2.5YR 5/2) broken face and 50 percent pale red (2.5YR 6/2) broken face, moist; 50 percent clay; moderate fine angular blocky and moderate medium prismatic structure; extremely firm, extremely hard, very sticky, very plastic; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 30 percent medium strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent 2 to 5 millimeter chert fragments; clear smooth boundary.

2Btg3--79 to 81 inches, (200 to 206 cm);, clay, 50 percent pale red (2.5YR 6/2) broken face and 50 percent light reddish brown (2.5YR 6/3) broken face, moist; 50 percent clay; moderate medium prismatic parting to moderate fine angular blocky structure; extremely firm, extremely hard, very sticky, very plastic; few fine irregular pores; 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 30 percent medium strong brown (7.5YR 4/6), moist, masses of oxidized iron; 10 percent chert fragments.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 11/22/2005
 Descriptor: DeAnn Presley

Site ID: 05KS017004 Pedon ID: 05KS017004

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SE 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 725924 meters, UTM Northing: 4254213 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: concave
 Slope: 3.0 percent Aspect: 180 (deg)
 Elevation: 1181 feet, 360.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Hayland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 10.6 to 30.3 in. (27 to 77 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	23.6	0	60
Redox concentrations	10.6		27	
Argillic horizon	23.6		60	
Secondary carbonates	31.5	55.9	80	142
Lithologic discontinuity	55.9		142	

|_____||_____||_____||_____||_____||

Pedon Notes:

A--0 to 7 inches, (0 to 17 cm);, silt loam; 25 percent clay; moderate fine granular structure; friable, moderately hard, moderately sticky, nonplastic; many fine roots throughout and common medium roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--7 to 11 inches, (17 to 27 cm);, silty clay loam; 35 percent clay; moderate fine subangular blocky structure; firm, very hard, moderately sticky, moderately plastic; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--11 to 24 inches, (27 to 60 cm);, silty clay; 45 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; few fine dendritic tubular pores; 2 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--24 to 31 inches, (60 to 80 cm);, silty clay; 45 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine dendritic tubular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2/0), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--31 to 39 inches, (80 to 98 cm);, silty clay; 45 percent clay; moderate fine subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron and 20 percent medium prominent (7.5YR 4/8), moist, masses of oxidized iron; 2 percent fine distinct pale brown (10YR 6/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk2--39 to 56 inches, (98 to 142 cm);, silty clay; 42 percent clay; moderate fine subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 1 percent patchy faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct and 1 percent fine distinct black (N 2/0), moist, iron-manganese masses; slight effervescence, by HCl, 1 normal; gradual smooth boundary.

2Bt1--56 to 83 inches, (142 to 211 cm);, silty clay; 50 percent clay; moderate fine prismatic parting to moderate fine subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 20 percent continuous faint dark brown (10YR 3/3), moist, clay films; 20 percent medium prominent black (N 2/0), moist, iron-manganese masses and 25 percent medium prominent (7.5YR 4/8), moist, masses of oxidized iron and 25 percent medium prominent weak red (2.5YR 4/2), moist, masses of reduced iron; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--83 to 103 inches, (211 to 262 cm);, silty clay; 50 percent clay; moderate fine

prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 20 percent medium prominent black (N 2/0), moist, iron-manganese masses and 25 percent medium prominent pale red (2.5YR 6/2), moist, masses of reduced iron and 25 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 11/22/2005
 Descriptor: DeAnn Presley

Site ID: 05KS017005 Pedon ID: 05KS017005

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SE 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 725839 meters, UTM Northing: 4254316 meters

Geomorphic Setting: on footslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 3.0 percent Aspect: 158 (deg)
 Elevation: 1191 feet, 363.0 meters
 Drainage class: somewhat poorly

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Hayland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	28.0	0	71
Argillic horizon	5.9		15	
Redox concentrations	28.0		71	

Secondary carbonates	28.0	62.2	71	158
Redox depletions with chroma 2 or less	28.0		71	
Lithologic discontinuity	62.2	74.8	158	190
Lithologic discontinuity	74.8		190	

Pedon Notes:

Ap--0 to 6 inches, (0 to 15 cm);, silty clay loam, black (10YR 2/1) rubbed, moist; 3 percent sand; 33 percent clay; weak fine subangular blocky structure; firm, moderately sticky, moderately plastic; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt--6 to 28 inches, (15 to 71 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 3 percent sand; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 10 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear boundary.

Btk1--28 to 51 inches, (71 to 129 cm);, silty clay loam, 50 percent brown (10YR 4/3) broken face and 50 percent dark grayish brown (10YR 4/2) broken face, moist; 3 percent sand; 39 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions; 1 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear boundary.

Btk2--51 to 62 inches, (129 to 158 cm);, silty clay, dark yellowish brown (10YR 4/4) broken face, moist; 3 percent sand; 44 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions; 1 percent fine distinct carbonate nodules; slight effervescence, by HCl, 1 normal; clear boundary.

2Bt1--62 to 75 inches, (158 to 190 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 6 percent sand; 45 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; 25 percent continuous distinct dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions; noneffervescent, by HCl, 1 normal; clear boundary.

3Bt2--75 to 98 inches, (190 to 250 cm);, silty clay, dark brown (7.5YR 3/4) broken face, moist; 6 percent sand; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 30 percent continuous distinct dark brown (7.5YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 25 percent fine prominent light brownish gray (2.5Y 6/2), moist, iron depletions; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 11/22/2005
Describer: DeAnn Presley

Site ID: 05KS017006 Pedon ID: 05KS017006

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: NW 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 725708 meters, UTM Northing: 4254421 meters

Geomorphic Setting: on summit of None Assigned
Upslope Shape: linear Cross Slope Shape: concave
Slope: 1.0 percent Aspect: 135 (deg)
Elevation: 1191 feet, 363.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Hayland

Parent Material: clayey loess over colluvium over colluvium over
colluvium

Particle Size Control Section: 7.5 to 27.2 in. (19 to 69 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	31.5	0	80
Redox concentrations	7.5		19	

Argillic horizon	7.5		19	
Secondary carbonates	28.3	38.2	72	97
Lithologic discontinuity	31.5	59.8	80	152
Reduced matrix	38.2	66.5	97	169
Lithologic discontinuity	59.8	66.5	152	169
Slickensides	66.5		169	
Redox depletions with chroma 2 or less	66.5		169	
Lithologic discontinuity	66.5		169	

Pedon Notes:

Ap--0 to 7 inches, (0 to 19 cm); dark gray (10YR 4/1) broken face, silty clay loam, black (10YR 2/1) rubbed, moist; 33 percent clay; moderate fine subangular blocky structure; firm, hard, moderately sticky, moderately plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--7 to 20 inches, (19 to 52 cm);, silty clay, black (10YR 2/1) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent very fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--20 to 28 inches, (52 to 72 cm);, silty clay, very dark gray (10YR 3/1) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent very fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--28 to 31 inches, (72 to 80 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 40 percent clay; moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 1 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent fine light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk2--31 to 38 inches, (80 to 97 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 45 percent clay; moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 1 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine threadlike light gray (10YR 7/2), moist; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btg1--38 to 60 inches, (97 to 152 cm);, silty clay, weak red (2.5YR 4/2) broken face, moist; 45 percent clay; weak medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent iron-manganese nodules and 20 percent fine prominent iron-manganese masses and 25 percent fine

prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btg2--60 to 67 inches, (152 to 169 cm);, silty clay, weak red (2.5YR 4/2) broken face, moist; 45 percent clay; weak medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 20 percent fine prominent iron-manganese masses and 25 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Btss1--67 to 79 inches, (169 to 200 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 50 percent clay; moderate medium angular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine prominent black (N 2.5/0), moist, iron-manganese masses and 10 percent fine prominent weak red (2.5YR 5/2), moist, masses of reduced iron and 10 percent fine prominent (7.5YR 4/8), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

4Btss2--79 to 96 inches, (200 to 245 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 50 percent clay; moderate medium angular blocky structure; very firm, very hard, very sticky, very plastic; 20 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine prominent black (N 2.5/0), moist, iron-manganese masses and 10 percent fine prominent weak red (2.5YR 5/2), moist, masses of reduced iron and 10 percent fine prominent (7.5YR 4/8), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 11/22/2005
 Descriptor: DeAnn Presley

Site ID: 05KS017007 Pedon ID: 05KS017007

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: NW 1/4 of SE 1/4 of Section 9, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 725524 meters, UTM Northing: 4254591 meters

Geomorphic Setting: on summit of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: (deg)
 Elevation: 1201 feet, 366.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 6.7 to 26.4 in. (17 to 67 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	25.6	0	65
Argillic horizon	6.7	36.2	17	92
Abrupt textural change	6.7	7.1	17	18

Redox concentrations	13.8		35	
Secondary carbonates	25.6	36.2	65	92
Reduced matrix	36.2	79.9	92	203
Redox depletions with chroma 2 or less	36.2		92	
Lithologic discontinuity	36.2	79.9	92	203
Slickensides	79.9		203	
Argillic horizon	79.9		203	
Lithologic discontinuity	79.9		203	

Pedon Notes:

Ap--0 to 7 inches, (0 to 17 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 23 percent clay; moderate fine subangular blocky structure; friable; many fine roots throughout and many medium roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--7 to 14 inches, (17 to 35 cm);, silty clay, black (10YR 2/1) broken face, moist; 44 percent clay; moderate fine prismatic structure; very firm; many fine roots throughout; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--14 to 20 inches, (35 to 51 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules; 1 percent fine faint; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--20 to 26 inches, (51 to 65 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 2 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--26 to 36 inches, (65 to 92 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 1 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bg1--36 to 66 inches, (92 to 168 cm);, silty clay loam, grayish brown (10YR 5/2) broken face, moist; 32 percent clay; moderate fine subangular blocky structure; friable; few fine roots between peds; common fine irregular pores; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine faint gray (10YR 5/1), moist, masses of reduced iron and 20 percent fine prominent strong brown (7.5YR 5/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bg2--66 to 80 inches, (168 to 203 cm);, silty clay loam, brown (10YR 5/3) broken face, moist; 36 percent clay; moderate fine subangular blocky structure; friable; common fine irregular pores; 5 percent fine faint gray (10YR 5/1), moist, masses of reduced iron and 20 percent fine prominent strong brown (7.5YR 5/6), moist, masses of oxidized iron;

noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btss1--80 to 88 inches, (203 to 224 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 50 percent clay; moderate medium angular blocky structure; very firm; few fine irregular pores; 20 percent discontinuous very dark grayish brown (10YR 3/2), moist, clay films; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btss2--88 to 104 inches, (224 to 264 cm);, silty clay, 50 percent brown (7.5YR 4/3) broken face and 50 percent dark brown (7.5YR 3/3) broken face, moist; 50 percent clay; moderate medium angular blocky structure; very firm; few fine irregular pores; 20 percent discontinuous grayish brown (10YR 5/2), moist, clay films; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
Describer: DeAnn Presley

Site ID: 06KS017001 Pedon ID: 06KS017001

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SE 1/4 of SE 1/4 of Section 22, Township 18S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 727194 meters, UTM Northing: 4260586 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: 225 (deg)
Elevation: 1253 feet, 382.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
non-calcareous residuum weathered from shale over
residuum weathered from calcareous shale
Bedrock Depth: 78.7 inches (200.0 cm)

Particle Size Control Section: 7.5 to 27.2 in. (19 to 69 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	26.0	0	66
Redox concentrations	7.5	78.7	19	200
Argillic horizon	7.5	74.4	19	189
Gypsum accumulations	26.0	74.4	66	189
Secondary carbonates	26.0	37.4	66	95
Lithologic discontinuity	37.4	52.8	95	134
Lithologic discontinuity	52.8	74.4	134	189
Lithologic discontinuity	74.4	78.7	189	200
Paralithic contact	78.7		200	
Lithologic discontinuity	78.7		200	

Pedon Notes:

A1--0 to 4 inches, (0 to 10 cm); dark grayish brown (10YR 4/2) broken face, silt loam, black (10YR 2/1) rubbed, moist; 20 percent clay; weak fine subangular blocky structure; friable; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

A2--4 to 7 inches, (10 to 19 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 36 percent clay; weak fine subangular blocky structure; firm; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--7 to 19 inches, (19 to 49 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--19 to 26 inches, (49 to 66 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 46 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btky--26 to 37 inches, (66 to 95 cm);, silty clay, brown (10YR 4/3) broken face, moist; 44 percent clay; moderate fine subangular blocky structure; firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct light gray (10YR 7/2), moist, gypsum masses and 10 percent medium distinct light gray (10YR 7/2), moist, carbonate masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bty1--37 to 53 inches, (95 to 134 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 32 percent clay; moderate fine subangular blocky structure; friable; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bty2--53 to 74 inches, (134 to 189 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 36 percent clay; moderate fine subangular blocky structure; friable; common fine irregular pores; 50 percent continuous faint dark brown (10YR 3/3), moist, clay

films; 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4BC--74 to 79 inches, (189 to 200 cm);, reddish brown (2.5YR 5/4) broken face, moist; weak fine angular blocky structure; firm; few fine irregular pores; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 10 percent shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

5Cr--79 to 86 inches, (200 to 219 cm);, reddish brown (2.5YR 5/4) broken face, moist; ; calcareous shale fragments; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Dwight
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017002 Pedon ID: 06KS017002

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:

County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:

Legal Description: SE 1/4 of SE 1/4 of Section 22, Township 18S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 727302 meters, UTM Northing: 4260378 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: concave
 Slope: 2.0 percent Aspect: 225 (deg)
 Elevation: 1253 feet, 382.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from calcareous shale
 Bedrock Depth: 70.9 inches (180.0 cm)

Particle Size Control Section: 8.7 to 28.3 in. (22 to 72 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	28.0	0	71
Redox concentrations	8.7	70.9	22	180

Argillic horizon	8.7	66.5	22	169
Secondary carbonates	35.0	56.3	89	143
Lithologic discontinuity	45.7	56.3	116	143
Lithologic discontinuity	56.3	66.5	143	169
Lithologic discontinuity	66.5		169	
Paralithic contact	70.9		180	

Pedon Notes:

A1--0 to 6 inches, (0 to 14 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 24 percent clay; weak fine subangular blocky structure; friable; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

A2--6 to 9 inches, (14 to 22 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 38 percent clay; moderate fine subangular blocky structure; firm; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--9 to 22 inches, (22 to 55 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt2--22 to 28 inches, (55 to 71 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--28 to 35 inches, (71 to 89 cm);, silty clay, brown (10YR 4/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--35 to 46 inches, (89 to 116 cm);, silty clay loam, brown (7.5YR 4/4) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 1 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btk2--46 to 56 inches, (116 to 143 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 36 percent clay; moderate fine subangular blocky structure; very firm; few fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt--56 to 67 inches, (143 to 169 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 42 percent clay; moderate fine subangular blocky structure; very firm; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate masses; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4BC--67 to 71 inches, (169 to 180 cm);, silty clay, yellowish brown (10YR 5/4) broken face, moist; 45 percent clay; weak fine subangular blocky structure; very firm; few fine irregular pores; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--71 to 79 inches, (180 to 200 cm); ; 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; calcareous shale fragments.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
Describer: DeAnn Presley

Site ID: 06KS017003 Pedon ID: 06KS017003

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SE 1/4 of SE 1/4 of Section 22, Township 18S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 727219 meters, UTM Northing: 4260717 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 2.0 percent Aspect: 203 (deg)
Elevation: 1257 feet, 383.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
colluvium over residuum weathered from shale over
residuum weathered from calcareous shale
Bedrock Depth: 105.5 inches (268.0 cm)

Particle Size Control Section: 10.2 to 29.9 in. (26 to 76 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	28.7	0	73
Redox concentrations	10.2	105.5	26	268
Argillic horizon	10.2	94.5	26	240
Secondary carbonates	28.7	53.1	73	135
Lithologic discontinuity	37.0	53.1	94	135
Gypsum accumulations	37.0	63.0	94	160
Lithologic discontinuity	53.1	63.0	135	160
Lithologic discontinuity	63.0	94.5	160	240
Lithologic discontinuity	94.5	105.5	240	268
Paralithic contact	105.5		268	
Lithologic discontinuity	105.5		268	

Pedon Notes:

A1--0 to 7 inches, (0 to 18 cm);, silt loam, black (10YR 2/1) rubbed, moist; 23 percent clay; moderate fine subangular blocky structure; friable; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

A2--7 to 10 inches, (18 to 26 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 38 percent clay; moderate fine subangular blocky structure; firm; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--10 to 17 inches, (26 to 44 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; common fine roots between pedis; few fine irregular pores; 5 percent discontinuous faint organoargillans; 1 percent black (N 2/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--17 to 29 inches, (44 to 73 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm; common very fine roots between pedis; few fine irregular pores; 5 percent discontinuous faint organoargillans; 1 percent black (N 2/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--29 to 37 inches, (73 to 94 cm);, silty clay, brown (10YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few very fine roots between pedis; few fine irregular pores; 2 percent discontinuous faint clay films; 2 percent black (N 2/0), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent medium faint carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btky--37 to 53 inches, (94 to 135 cm);, silty clay loam, (7.5YR 4/5) broken face, moist; 38 percent clay; moderate medium subangular blocky structure; firm; few fine irregular pores; 2 percent discontinuous faint clay films; 2 percent black (N 2/0), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent gypsum masses and 1 percent medium faint carbonate masses; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bty--53 to 63 inches, (135 to 160 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 38 percent clay; moderate medium subangular blocky structure; firm; few fine

irregular pores; 2 percent discontinuous faint clay films; 1 percent black (N 2/0), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 5 percent gypsum masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

4Bt--63 to 94 inches, (160 to 240 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm; common fine irregular pores; 20 percent continuous faint clay films; 2 percent black (N 2/0), moist, iron-manganese masses and 20 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

5CB--94 to 98 inches, (240 to 250 cm);, silty clay, light olive brown (2.5Y 5/3) broken face, moist; 42 percent clay; weak medium prismatic structure; very firm; 1 percent black (N 2/0), moist, iron-manganese masses and 20 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 50 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

5C--98 to 106 inches, (250 to 268 cm);, silty clay loam, olive (5Y 5/3) broken face, moist; 36 percent clay; medium angular blocky structure; firm; 20 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

6Cr--106 to 110 inches, (268 to 280 cm);, pale olive (5Y 6/3) broken face, moist; ; calcareous shale fragments.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
Describer: DeAnn Presley

Site ID: 06KS017004 Pedon ID: 06KS017004
Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SE 1/4 of NW 1/4 of Section 3, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 726709 meters, UTM Northing: 4256815 meters

Geomorphic Setting: on shoulder of None Assigned
Upslope Shape: linear Cross Slope Shape: concave
Slope: 1.0 percent Aspect: 270 (deg)
Elevation: 1204 feet, 367.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
noncalcareous residuum weathered from shale over
residuum weathered from cherty limestone
Bedrock Depth: 61.8 inches (157.0 cm)

Particle Size Control Section: 5.1 to 24.8 in. (13 to 63 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.8	0	63

Redox concentrations	5.1	61.8	13	157
Argillic horizon	5.1	57.9	13	147
Secondary carbonates	24.8	38.6	63	98
Lithologic discontinuity	31.9	38.6	81	98
Gypsum accumulations	31.9	57.9	81	147
Lithologic discontinuity	38.6	57.9	98	147
Lithologic discontinuity	57.9	61.8	147	157
Paralithic contact	61.8	65.0	157	165
Lithologic discontinuity	61.8	65.0	157	165
Lithic contact	65.0		165	

Pedon Notes:

A--0 to 5 inches, (0 to 13 cm);, silt loam, black (10YR 2/1) rubbed, moist; 24 percent clay; moderate fine subangular blocky structure; friable; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--5 to 18 inches, (13 to 45 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm; common fine roots between peds; few fine irregular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine distinct iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--18 to 25 inches, (45 to 63 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine distinct iron-manganese masses; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--25 to 32 inches, (63 to 81 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 36 percent clay; moderate fine subangular blocky and moderate fine prismatic structure; very firm; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 3 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btky--32 to 39 inches, (81 to 98 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 39 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct iron-manganese masses; 1 percent threadlike gypsum masses and 3 percent medium distinct carbonate nodules; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bty--39 to 58 inches, (98 to 147 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 46 percent clay; moderate medium prismatic structure; very firm; few fine irregular pores; 25 percent continuous distinct dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, manganese masses and 5 percent fine distinct iron-manganese nodules; 5 percent threadlike gypsum masses; 5 percent chert

fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

4BC--58 to 62 inches, (147 to 157 cm);, silty clay, 50 percent light olive brown (2.5Y 5/3) broken face and 50 percent dark brown (7.5YR 3/2) broken face, moist; 46 percent clay; weak medium prismatic structure; very firm; few fine irregular pores; 25 percent continuous distinct grayish brown (10YR 5/2), moist, clay films and 25 percent continuous distinct dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct iron-manganese nodules; 3 percent shale fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

5Cr--62 to 65 inches, (157 to 165 cm);, light gray (2.5Y 7/2) broken face, moist; ; limestone fragments; abrupt smooth boundary.

5R--65 inches, (165 to cm); .

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 01/05/2006
Describer: DeAnn Presley

Site ID: 06KS017005 Pedon ID: 06KS017005

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SE 1/4 of NW 1/4 of Section 3, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 726781 meters, UTM Northing: 4256759 meters

Geomorphic Setting: on shoulder of None Assigned
Upslope Shape: linear Cross Slope Shape: concave
Slope: 1.0 percent Aspect: 270 (deg)
Elevation: 1207 feet, 368.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over residuum
weathered from shale over residuum weathered from
calcareous shale

Bedrock Depth: 69.3 inches (176.0 cm)

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	19.7	0	50
Argillic horizon	5.5	69.3	14	176
Redox concentrations	19.7	73.2	50	186
Lithologic discontinuity	26.0	46.9	66	119
Secondary carbonates	26.0	34.3	66	87
Lithologic discontinuity	46.9	73.2	119	186
Paralithic contact	73.2		186	
Lithologic discontinuity	73.2		186	

Pedon Notes:

A--0 to 6 inches, (0 to 14 cm);, silty clay loam, very dark brown (10YR 2/2) rubbed, moist; 28 percent clay; weak medium granular structure; friable, slightly hard, moderately sticky, moderately plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 13 inches, (14 to 33 cm);, silty clay, black (10YR 2/1) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--13 to 20 inches, (33 to 50 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--20 to 26 inches, (50 to 66 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btk--26 to 34 inches, (66 to 87 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct black (N 2/0), moist, iron-manganese masses and 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine light gray (10YR 7/2), moist, carbonate nodules and 1 percent medium light gray (10YR 7/2), moist, carbonate nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bty--34 to 47 inches, (87 to 119 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron; 5 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses; 3 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Bt--47 to 69 inches, (119 to 176 cm);, silty clay loam, dark brown (7.5YR 3/2) broken

face, moist; 38 percent clay; moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 25 percent continuous distinct dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3BC--69 to 73 inches, (176 to 186 cm);, silty clay loam, 50 percent dark brown (7.5YR 3/2) broken face and 50 percent light olive brown (2.5Y 5/3) broken face, moist; 36 percent clay; weak medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron; 50 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4Cr--73 to 84 inches, (186 to 213 cm);, light yellowish brown (2.5Y 6/3) broken face, moist; ; calcareous shale fragments; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 01/05/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017006 Pedon ID: 06KS017006
 Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SE 1/4 of NW 1/4 of Section 3, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 726886 meters, UTM Northing: 4256435 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 4.0 percent Aspect: 270 (deg)
 Elevation: 1207 feet, 368.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over residuum
 weathered from shale over residuum weathered from
 calcareous shale

Bedrock Depth: 65.7 inches (167.0 cm)

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	20.5	0	52

Argillic horizon	7.9	58.3	20	148
Abrupt textural change	7.9	8.3	20	21
Redox concentrations	13.0	74.4	33	189
Secondary carbonates	27.2	42.5	69	108
Gypsum accumulations	27.2	42.5	69	108
Lithologic discontinuity	42.5	58.3	108	148
Lithologic discontinuity	58.3	74.4	148	189
Lithologic discontinuity	74.4		189	
Paralithic contact	74.4		189	

Pedon Notes:

A--0 to 8 inches, (0 to 20 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 23 percent clay; weak fine subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--8 to 13 inches, (20 to 33 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 5 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--13 to 20 inches, (33 to 52 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--20 to 27 inches, (52 to 69 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btky--27 to 43 inches, (69 to 108 cm);, silty clay, brown (10YR 4/3) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent fine distinct light brownish gray (10YR 6/2), moist, gypsum masses and 1 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Bt--43 to 58 inches, (108 to 148 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 42 percent clay; moderate medium subangular blocky structure; firm, very hard, very sticky, very plastic; few fine irregular pores; 25 percent patchy faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth

boundary.

3CB--58 to 66 inches, (148 to 167 cm);, silty clay, 25 percent dark brown (7.5YR 3/3) broken face and 75 percent light olive brown (2.5Y 5/3) broken face, moist; 44 percent clay; weak medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 5 percent chert fragments and 75 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3C--66 to 74 inches, (167 to 189 cm);, silty clay, olive gray (5Y 5/2) broken face, moist; 44 percent clay; medium angular blocky structure; very firm, very hard, very sticky, very plastic; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--74 to 81 inches, (189 to 207 cm);, olive gray (5Y 5/2) broken face, moist; ; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; calcareous shale fragments; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017007 Pedon ID: 06KS017007

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SW 1/4 of NE 1/4 of Section 3, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 726906 meters, UTM Northing: 4256562 meters
 Geomorphic Setting: on shoulder of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: 270 (deg)
 Elevation: 1207 feet, 368.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from shale over residuum
 weathered from calcareous shale
 Bedrock Depth: 87.4 inches (222.0 cm)

Particle Size Control Section: 7.5 to 27.2 in. (19 to 69 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	22.4	0	57
Argillic horizon	7.5	87.4	19	222

Redox concentrations	11.8	93.3	30	237
Secondary carbonates	28.3	49.6	72	126
Lithologic discontinuity	36.2	49.6	92	126
Gypsum accumulations	36.2	49.6	92	126
Lithologic discontinuity	49.6	87.4	126	222
Lithologic discontinuity	87.4	93.3	222	237
Paralithic contact	93.3		237	
Lithologic discontinuity	93.3		237	

Pedon Notes:

A--0 to 7 inches, (0 to 19 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 23 percent clay; weak fine subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--7 to 12 inches, (19 to 30 cm);, silty clay, black (10YR 2/1) broken face, moist; 42 percent clay; moderate fine subangular blocky structure; firm, hard, very sticky, very plastic; common fine roots throughout; common fine dendritic tubular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt2--12 to 22 inches, (30 to 57 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--22 to 28 inches, (57 to 72 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--28 to 36 inches, (72 to 92 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct (10YR 4/8), moist, masses of oxidized iron; 2 percent medium very pale brown (10YR 7/3), moist, carbonate nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btky--36 to 50 inches, (92 to 126 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 39 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct (10YR 4/8), moist, masses of oxidized iron; 1 percent fine light gray (10YR 7/2), moist, carbonate nodules and 5 percent fine brown (10YR 5/3), moist, gypsum masses; 5 percent chert fragments; noneffervescent, by HCl, 1

normal; clear smooth boundary.

3Bt1--50 to 69 inches, (126 to 175 cm);, silty clay, dark brown (7.5YR 3/2) broken face, moist; 42 percent clay; moderate fine subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct (10YR 4/8), moist, masses of oxidized iron; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt2--69 to 87 inches, (175 to 222 cm);, silty clay loam, brown (7.5YR 5/2) broken face, moist; 39 percent clay; moderate fine subangular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 50 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4C--87 to 93 inches, (222 to 237 cm);, clay, olive gray (5Y 5/2) broken face, moist; 60 percent clay; medium angular blocky structure; very firm, very hard, very sticky, very plastic; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

5Cr--93 to 98 inches, (237 to 250 cm);, yellowish brown (10YR 5/6) broken face, moist; ; limestone fragments; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 01/05/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017008 Pedon ID: 06KS017008

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Saffordville, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SW 1/4 of NE 1/4 of Section 3, Township 19S, Range 9E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 726970 meters, UTM Northing: 4256470 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 3.0 percent Aspect: 225 (deg)
 Elevation: 1207 feet, 368.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	20.5	0	52
Argillic horizon	5.9		15	
Redox concentrations	11.8		30	

Secondary carbonates	20.5	35.4	52	90
Lithologic discontinuity	35.4	47.2	90	120
Lithologic discontinuity	47.2		120	

Pedon Notes:

Ap--0 to 6 inches, (0 to 15 cm);, silty clay loam, very dark grayish brown (10YR 3/2) rubbed, moist; 30 percent clay; moderate fine subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--6 to 12 inches, (15 to 30 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; common fine dendritic tubular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--12 to 20 inches, (30 to 52 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Btk--20 to 35 inches, (52 to 90 cm);, silty clay, brown (10YR 4/3) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent fine very pale brown (10YR 7/3), moist, carbonate nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt1--35 to 47 inches, (90 to 120 cm);, silty clay, dark brown (7.5YR 3/4) broken face, moist; 42 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt2--47 to 73 inches, (120 to 186 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 50 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Udertic Argiustolls

Description Date: 02/07/2006
Describer: DeAnn Presley

Site ID: 06KS017009 Pedon ID: 06KS017009

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: NE 1/4 of NE 1/4 of Section 5, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 724275 meters, UTM Northing: 4256757 meters

Geomorphic Setting: on summit of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: 315 (deg)
Elevation: 1263 feet, 385.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
hard cherty limestone
Bedrock Depth: 31.9 inches (81.0 cm)

Particle Size Control Section: 3.5 to 23.2 in. (9 to 59 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	20.5	0	52

Argillic horizon	3.5	31.9	9	81
Redox concentrations	8.3	31.9	21	81
Lithologic discontinuity	20.5	27.6	52	70
Slickensides	20.5	27.6	52	70
Lithologic discontinuity	27.6	31.9	70	81
Lithic contact	31.9		81	
Lithologic discontinuity	31.9		81	

Pedon Notes:

A--0 to 4 inches, (0 to 9 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 24 percent clay; moderate fine granular structure; friable, slightly sticky, slightly plastic; many fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--4 to 8 inches, (9 to 21 cm);, silty clay loam, very dark grayish brown (10YR 3/2) broken face, moist; 32 percent clay; weak fine subangular blocky parting to weak fine granular structure; friable, moderately sticky, moderately plastic; many fine roots throughout; common fine dendritic tubular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--8 to 20 inches, (21 to 52 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; many fine roots throughout; common fine dendritic tubular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btss--20 to 28 inches, (52 to 70 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots between peds; few fine irregular pores; 10 percent; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt--28 to 32 inches, (70 to 81 cm);, silty clay, dark brown (7.5YR 3/4) broken face, moist; 42 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; common fine roots between peds; few fine irregular pores; 25 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4R--32 inches, (81 to cm); ; limestone fragments.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 02/07/2006
Describer: DeAnn Presley

Site ID: 06KS017010 Pedon ID: 06KS017010

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: NE 1/4 of SW 1/4 of NE 1/4 of Section 5, Township 19S,
Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 723959 meters, UTM Northing: 4256710 meters

Geomorphic Setting: on summit of None Assigned
Upslope Shape: concave Cross Slope Shape: linear
Slope: 1.0 percent Aspect: (deg)
Elevation: 1250 feet, 381.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
soft residuum weathered from cherty limestone over
hard cherty limestone
Bedrock Depth: 34.3 inches (87.0 cm)

Particle Size Control Section: 6.3 to 26.0 in. (16 to 66 cm)

Diagnostic Features:
| Top Bottom Top Bottom |

Kind	Depth (in)	Depth (in)	Depth (cm)	Depth (cm)
Mollic epipedon	0.0	18.5	0	47
Abrupt textural change	2.8	3.1	7	8
Argillic horizon	6.3	34.3	16	87
Redox concentrations	11.4	22.8	29	58
Secondary carbonates	11.4	22.8	29	58
Lithologic discontinuity	18.5	22.8	47	58
Lithologic discontinuity	22.8	34.3	58	87
Paralithic contact	34.3	34.6	87	88
Lithologic discontinuity	34.3	34.6	87	88
Lithic contact	34.6		88	
Lithologic discontinuity	34.6		88	

Pedon Notes:

A--0 to 3 inches, (0 to 7 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 18 percent clay; weak fine subangular blocky structure; friable, moderately hard, slightly sticky, slightly plastic; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--3 to 6 inches, (7 to 16 cm);, silty clay, black (10YR 2/1) broken face, moist; 40 percent clay; moderate fine subangular blocky structure; very firm, very sticky, very plastic; common fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--6 to 11 inches, (16 to 29 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots throughout; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--11 to 19 inches, (29 to 47 cm);, silty clay loam, dark brown (10YR 3/3) broken face, moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between pedis; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk2--19 to 23 inches, (47 to 58 cm);, silty clay loam, dark brown (7.5YR 3/4) broken face, moist; 36 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine roots between pedis; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt--23 to 34 inches, (58 to 87 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between pedis; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules and 2 percent medium distinct very pale brown (10YR 7/3), moist,

carbonate nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4C--34 to 35 inches, (87 to 88 cm);, dark yellowish brown (10YR 4/4) broken face, moist; ; few fine irregular pores; limestone fragments; slight effervescence, by HCl, 1 normal; abrupt smooth boundary.

5Rr--35 inches, (88 to cm); ; limestone fragments.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 02/07/2006
Describer: DeAnn Presley

Site ID: 06KS017011 Pedon ID: 06KS017011

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SW 1/4 of NE 1/4 of Section 5, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 723907 meters, UTM Northing: 4256398 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 2.0 percent Aspect: 180 (deg)
Elevation: 1234 feet, 376.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
non-calcareous residuum weathered from shale
Bedrock Depth: 54.3 inches (138.0 cm)

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	20.1	0	51

Abrupt textural change	2.8	3.1	7	8
Argillic horizon	5.5	54.3	14	138
Redox concentrations	13.8	54.3	35	138
Secondary carbonates	20.1	28.7	51	73
Lithologic discontinuity	32.7	39.0	83	99
Lithologic discontinuity	39.0	54.3	99	138
Paralithic contact	54.3		138	
Lithologic discontinuity	54.3		138	

Pedon Notes:

A--0 to 3 inches, (0 to 7 cm);, silt loam, black (10YR 2/1) rubbed, moist; 20 percent clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; many fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--3 to 6 inches, (7 to 14 cm);, silty clay loam, black (10YR 2/1) broken face, moist; 38 percent clay; moderate fine subangular blocky structure; firm, moderately sticky, moderately plastic; many fine roots throughout; common fine irregular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--6 to 14 inches, (14 to 35 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots throughout; few fine irregular pores; 5 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--14 to 20 inches, (35 to 51 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots between peds; few fine irregular pores; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, organoargillans; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--20 to 29 inches, (51 to 73 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent fine light gray (10YR 7/2), moist, carbonate nodules and medium light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--29 to 33 inches, (73 to 83 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 38 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, organoargillans; 2 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--33 to 39 inches, (83 to 99 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 40 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 25 percent continuous faint dark brown (10YR 3/3), moist, clay films; 10 percent fine distinct black (N 2.5/0),

moist, iron-manganese masses and 15 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt3--39 to 54 inches, (99 to 138 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 35 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 50 percent continuous faint dark brown (7.5YR 3/2), moist, clay films; 10 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 25 percent fine prominent (7.5YR 4/8), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--54 to 56 inches, (138 to 143 cm);, yellowish brown (10YR 5/4) broken face, moist; ; shale fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 02/07/2006
Describer: DeAnn Presley

Site ID: 06KS017012 Pedon ID: 06KS017012

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:
Location Information:
County: Chase Quad Sheet Name: Saffordville, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SE 1/4 of NE 1/4 of Section 5, Township 19S, Range 9E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 724157 meters, UTM Northing: 4256467 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: 180 (deg)
Elevation: 1234 feet, 376.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
non-calcareous residuum weathered from shale over
residuum weathered from calcareous shale
Bedrock Depth: 58.7 inches (149.0 cm)

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	22.4	0	57

Redox concentrations	5.5	68.1	14	173
Argillic horizon	5.5	58.7	14	149
Abrupt textural change	5.5	5.9	14	15
Secondary carbonates	22.4	36.6	57	93
Lithologic discontinuity	29.1	36.6	74	93
Lithologic discontinuity	36.6	58.7	93	149
Gypsum accumulations	36.6	52.8	93	134
Lithologic discontinuity	58.7	68.1	149	173
Paralithic contact	68.1		173	
Lithologic discontinuity	68.1		173	

Pedon Notes:

A--0 to 6 inches, (0 to 14 cm);, silt loam, black (10YR 2/1) rubbed, moist; 20 percent clay; moderate fine subangular blocky structure; friable, slightly sticky, slightly plastic; many fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 8 inches, (14 to 21 cm);, silty clay, black (10YR 2/1) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; many fine roots between peds; common fine dendritic tubular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt2--8 to 14 inches, (21 to 36 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots between peds; few fine dendritic tubular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--14 to 22 inches, (36 to 57 cm);, silty clay loam, very dark grayish brown (10YR 3/2) broken face, moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots between peds; few fine dendritic tubular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--22 to 29 inches, (57 to 74 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine dendritic tubular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk2--29 to 37 inches, (74 to 93 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine dendritic tubular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black

(N 2.5/0), moist, iron-manganese nodules; 5 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules and 2 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bty--37 to 53 inches, (93 to 134 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 43 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine dendritic tubular pores; 20 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 2 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 5 percent fine distinct brown (10YR 5/3), moist, gypsum masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3BC--53 to 59 inches, (134 to 149 cm);, silty clay loam, 25 percent dark brown (7.5YR 3/3) broken face and 75 percent light olive brown (2.5Y 5/3) broken face, moist; 38 percent clay; moderate fine subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 25 percent shale fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

4C--59 to 68 inches, (149 to 173 cm);, silty clay loam, olive (5Y 5/3) broken face, moist; 38 percent clay; medium angular blocky structure; very firm, very sticky, very plastic; 20 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

5Cr--68 to 69 inches, (173 to 176 cm);, light olive gray (5Y 6/2) broken face, moist; ; calcareous shale fragments; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 06/27/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017013 Pedon ID: 06KS017013

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Wilsey Se, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: 9 miles south of Council Grove
 Legal Description: NW 1/4 of NE 1/4 of Section 3, Township 185, Range 8E
 Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 717336 meters, UTM Northing: 4266238 meters

Geomorphic Setting: on shoulder of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 3.0 percent Aspect: 0 (deg)
 Elevation: 1489 feet, 454.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.0	0	61
Argillic horizon	5.9	24.0	15	61
Abrupt textural change	5.9	6.3	15	16
Redox concentrations	16.5		42	
Secondary carbonates	24.0	33.5	61	85

Argillic horizon	32.3		82	
Lithologic discontinuity	32.3	43.3	82	110
Slickensides	43.3		110	
Redox depletions with chroma 2 or less	43.3		110	
Lithologic discontinuity	43.3		110	

Pedon Notes:

A--0 to 6 inches, (0 to 15 cm);, silt loam, very dark brown (10YR 2/2), moist; 22 percent clay; moderate fine subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt1--6 to 17 inches, (15 to 42 cm);, silty clay, very dark brown (10YR 2/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear boundary.

Bt2--17 to 24 inches, (42 to 61 cm);, silty clay loam, dark brown (10YR 3/3), moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

BcK--24 to 32 inches, (61 to 82 cm);, silt loam, brown (10YR 5/3), moist; 24 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; slight effervescence, by HCl, 1 normal; clear boundary.

2Bt--32 to 43 inches, (82 to 110 cm);, silt loam, brown (7.5YR 5/3), moist; 24 percent clay; moderate medium subangular blocky structure; friable, moderately sticky, moderately plastic; common fine irregular pores; 5 percent patchy faint brown (10YR 4/3), moist, clay films on all faces of peds; 10 percent fine prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt boundary.

3Btss--43 to 93 inches, (110 to 237 cm);, silty clay, dark brown (7.5YR 3/3), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 10 percent slickensides (pedogenic) and 50 percent continuous faint brown (7.5YR 4/2), moist, clay films on all faces of peds; 5 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 06/27/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017014 Pedon ID: 06KS017014

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Wilsey Se, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: 9 miles south of Council Grove
 Legal Description: NW 1/4 of NE 1/4 of Section 3, Township 185, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 717209 meters, UTM Northing: 4266230 meters

Geomorphic Setting: on summit of None Assigned
 Upslope Shape: concave Cross Slope Shape: linear
 Slope: 0.0 percent Aspect: 225 (deg)
 Elevation: 1489 feet, 454.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland
 Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from cherty limestone
 Bedrock Depth: 90.9 inches (231.0 cm)

Particle Size Control Section: 3.1 to 22.8 in. (8 to 58 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	18.9	0	48
Argillic horizon	3.1	18.9	8	48

Abrupt textural change	3.1	3.5	8	9
Redox concentrations	11.8	90.9	30	231
Secondary carbonates	31.5	37.0	80	94
Argillic horizon	37.0	90.9	94	231
Lithologic discontinuity	37.0	44.1	94	112
Redox depletions with chroma 2 or less	44.1	90.9	112	231
Slickensides	44.1	90.9	112	231
Lithologic discontinuity	44.1	90.9	112	231
Paralithic contact	90.9		231	
Lithologic discontinuity	90.9		231	

Pedon Notes:

A--0 to 3 inches, (0 to 8 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 28 percent clay; moderate fine subangular blocky structure; friable, moderately sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt1--3 to 12 inches, (8 to 30 cm);, silty clay, very dark brown (10YR 2/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear boundary.

Bt2--12 to 19 inches, (30 to 48 cm);, silty clay loam, dark brown (10YR 3/3), moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, organoargillans on all faces of peds; 1 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

Bw--19 to 31 inches, (48 to 80 cm);, silt loam, brown (10YR 5/3), moist; 24 percent clay; weak fine subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

BCK--31 to 37 inches, (80 to 94 cm);, silt loam, brown (7.5YR 5/3), moist; 24 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; common fine irregular pores; 10 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; slight effervescence, by HCl, 1 normal; clear boundary.

2Bt--37 to 44 inches, (94 to 112 cm);, silt loam, light brown (7.5YR 6/3), moist; 24 percent clay; moderate medium subangular blocky structure; friable, moderately sticky, moderately plastic; common fine irregular pores; 10 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt boundary.

3Btss--44 to 91 inches, (112 to 231 cm);, silty clay, dark brown (7.5YR 3/4), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 10 percent slickensides (pedogenic) and 50 percent continuous faint brown (7.5YR 4/2),

moist, clay films on all faces of peds; 5 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

4Cr--91 to 97 inches, (231 to 246 cm);, very pale brown (10YR 7/3), moist; ; limestone fragments; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 06/27/2006
 Descriptor: DeAnn Presley

Site ID: 06KS017015 Pedon ID: 06KS017015

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Chase Quad Sheet Name: Wilsey Se, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: 9 miles south of Council Grove
 Legal Description: NW 1/4 of NE 1/4 of Section 3, Township 185, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 717234 meters, UTM Northing: 4266372 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 4.0 percent Aspect: 225 (deg)
 Elevation: 1489 feet, 454.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 4.7 to 24.4 in. (12 to 62 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.0	0	61
Argillic horizon	4.7	24.0	12	61
Abrupt textural change	4.7	5.1	12	13

Redox concentrations	16.5		42	
Redox depletions with chroma 2 or less	53.1		135	
Slickensides	53.1		135	
Argillic horizon	53.1		135	
Lithologic discontinuity	53.1		135	

Pedon Notes:

A--0 to 5 inches, (0 to 12 cm);, silt loam, very dark brown (10YR 2/2), moist; 22 percent clay; moderate fine subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--5 to 17 inches, (12 to 42 cm);, silty clay, very dark brown (10YR 2/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--17 to 24 inches, (42 to 61 cm);, silty clay loam, dark brown (10YR 3/3), moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

BC--24 to 53 inches, (61 to 135 cm);, silt loam, brown (10YR 5/3), moist; 24 percent clay; weak fine subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 10 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btss--53 to 96 inches, (135 to 245 cm);, silty clay, dark brown (7.5YR 3/3), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 10 percent slickensides (pedogenic) and 50 percent continuous faint dark grayish brown (10YR 4/2), moist, clay films on all faces of peds; 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct dark grayish brown (10YR 4/2), moist, iron depletions and 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 1 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Dwight
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 02/21/2006
Describer: DeAnn Presley

Site ID: 06KS015001 Pedon ID: 06KS015001

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Pontiac, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Site is one mile south and two miles west of Rosalia,
Kansas.
Legal Description: of Section 23, Township 26S, Range 7E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 708322 meters, UTM Northing: 4183761 meters

Geomorphic Setting: None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 2.0 percent Aspect: (deg)
Elevation: 1496 feet, 456.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over residuum
weathered from cherty limestone

Particle Size Control Section: 8.3 to 28.0 in. (21 to 71 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	16.5	0	42

Redox concentrations	8.3	38.6	21	98
Argillic horizon	8.3	34.6	21	88
Abrupt textural change	8.3	8.7	21	22
Lithologic discontinuity	16.5	38.6	42	98
Secondary carbonates	16.5	34.6	42	88
Slickensides	16.5	34.6	42	88
Lithologic discontinuity	38.6		98	
Paralithic contact	38.6		98	

Pedon Notes:

A--0 to 8 inches, (0 to 21 cm);, silt loam, very dark brown (10YR 2/2) rubbed and grayish brown (10YR 5/2) broken face, moist; 20 percent clay; moderate fine granular and moderate medium subangular blocky structure; , moderately hard, moderately sticky, moderately plastic; common fine roots throughout; common fine dendritic tubular pores; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--8 to 17 inches, (21 to 42 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate fine subangular blocky structure; extremely firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint organoargillans; 2 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; 1 percent limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btkss1--17 to 25 inches, (42 to 63 cm);, silty clay, dark brown (7.5YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; extremely firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent dark brown (10YR 3/3), moist, and 25 percent continuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/0), moist, iron-manganese masses; 2 percent fine light gray (10YR 7/2), moist, carbonate nodules; 3 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btkss2--25 to 35 inches, (63 to 88 cm);, silty clay, dark brown (7.5YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; extremely firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent dark brown (10YR 3/3), moist, and 25 percent continuous faint dark brown (10YR 3/3), moist, clay films; 1 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/0), moist, iron-manganese masses; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2BC--35 to 39 inches, (88 to 98 cm);, silty clay, dark reddish brown (5YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; extremely firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine faint black (N 2.5/0), moist, iron-manganese masses and 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--39 to 42 inches, (98 to 107 cm);, 25 percent dark reddish brown (5YR 3/3) broken face and 75 percent white (10YR 8/1) broken face, moist; ; limestone fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 02/21/2006
 Descriptor: DeAnn Presley

Site ID: 06KS015002 Pedon ID: 06KS015002

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Butler Quad Sheet Name: Pontiac, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Site is one mile south and two miles west of Rosalia,
 Kansas.

Legal Description: of Section 23, Township 26S, Range 7E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 708106 meters, UTM Northing: 4183838 meters

Geomorphic Setting: None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: (deg)
 Elevation: 1506 feet, 459.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 12.2 to 31.9 in. (31 to 81 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	30.3	0	77
Argillic horizon	12.2		31	
Redox concentrations	12.2		31	

Lithologic discontinuity	38.2	53.1	97	135
Slickensides	38.2		97	
Secondary carbonates	38.2	45.3	97	115
Redox depletions with chroma 2 or less	45.3	82.7	115	210
Lithologic discontinuity	53.1		135	

Pedon Notes:

A--0 to 12 inches, (0 to 31 cm);, silty clay loam, grayish brown (10YR 5/2) broken face and very dark grayish brown (10YR 3/2) rubbed, moist; 28 percent clay; moderate coarse granular structure; friable, moderately sticky, moderately plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--12 to 30 inches, (31 to 77 cm);, silty clay loam, very dark grayish brown (10YR 3/2) broken face, moist; 38 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt2--30 to 38 inches, (77 to 97 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; friable, very sticky, very plastic; few fine roots between pedes; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Btkss--38 to 45 inches, (97 to 115 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between pedes; few fine irregular pores; 5 percent slickensides (pedogenic) and 20 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 10 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 15 percent fine prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; 5 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; 4 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btss1--45 to 53 inches, (115 to 135 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) and 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 10 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 10 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron and 15 percent fine prominent yellowish red (5YR 5/6), moist, masses of oxidized iron; 5 percent gypsum masses; 4 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btss2--53 to 66 inches, (135 to 168 cm);, clay, brown (7.5YR 4/3) broken face, moist; 50 percent clay; moderate coarse prismatic and moderate medium angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; dark brown (10YR 3/3), moist, clay films and slickensides (pedogenic); 10 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 20 percent fine prominent yellowish red (5YR 4/6), moist, masses

of oxidized iron and 25 percent fine distinct grayish brown (2.5Y 5/2), moist, masses of reduced iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btss3--66 to 83 inches, (168 to 210 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 38 percent clay; moderate medium angular blocky and moderate coarse prismatic structure; friable, very sticky, very plastic; few fine irregular pores; 15 percent slickensides (pedogenic) and 25 percent dark brown (10YR 3/3), moist, clay films; 10 percent fine prominent grayish brown (2.5Y 5/2), moist, masses of reduced iron and 10 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 20 percent fine prominent (7.5YR 4/8), moist, masses of oxidized iron; 2 percent limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Btss4--83 to 94 inches, (210 to 240 cm);, silty clay, 20 percent white (10YR 8/1) broken face and 80 percent brown (7.5YR 4/4) broken face, moist; 44 percent clay; moderate coarse prismatic and moderate medium angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 10 percent slickensides (pedogenic) and 20 percent dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 5 percent fine prominent black (N 2.5/0), moist, iron-manganese nodules and 25 percent fine prominent black (N 2.5/0), moist, iron-manganese masses; 20 percent limestone fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 02/21/2006
Describer: DeAnn Presley

Site ID: 06KS015003 Pedon ID: 06KS015003

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Pontiac, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Site is one mile south and two miles west of Rosalia,
Kansas.
Legal Description: of Section 23, Township 26S, Range 7E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 707844 meters, UTM Northing: 4183949 meters

Geomorphic Setting: None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: (deg)
Elevation: 1503 feet, 458.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 10.2 to 29.9 in. (26 to 76 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	19.3	0	49
Argillic horizon	10.2	84.3	26	214

Abrupt textural change	10.2	10.6	26	27
Redox concentrations	10.2		26	
Slickensides	28.0	84.3	71	214
Secondary carbonates	32.3	41.7	82	106
Lithologic discontinuity	41.7		106	
Redox depletions with chroma 2 or less	41.7	84.3	106	214

Pedon Notes:

A--0 to 10 inches, (0 to 26 cm); dark gray (10YR 4/1) broken face, silt loam, very dark brown (10YR 2/2) rubbed, moist; 22 percent clay; moderate fine subangular blocky and moderate medium granular structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--10 to 19 inches, (26 to 49 cm);, silty clay loam, dark brown (10YR 3/3) broken face, moist; 38 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--19 to 28 inches, (49 to 71 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Btss--28 to 32 inches, (71 to 82 cm);, silty clay, brown (7.5YR 4/4) broken face, moist; 44 percent clay; moderate medium prismatic and moderate fine angular blocky structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent slickensides (pedogenic) and 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 4 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Btkss--32 to 42 inches, (82 to 106 cm);, silty clay, brown (7.5YR 4/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; few fine roots between peds; few fine irregular pores; 5 percent slickensides (pedogenic) and 5 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btss1--42 to 65 inches, (106 to 165 cm);, silty clay, brown (7.5YR 4/4) broken face, moist; 48 percent clay; moderate medium prismatic and moderate fine angular blocky structure; few fine roots between peds; few fine irregular pores; 5 percent slickensides (pedogenic) and 20 percent continuous faint dark brown (7.5YR 3/3), moist, clay films; 5

percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btss2--65 to 84 inches, (165 to 214 cm);, silty clay, brown (7.5YR 4/4) broken face, moist; 48 percent clay; moderate medium prismatic and moderate fine angular blocky structure; few fine irregular pores; 5 percent slickensides (pedogenic) and 30 percent continuous faint dark brown (7.5YR 3/3), moist, clay films; 2 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 15 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2CB--84 to 88 inches, (214 to 223 cm);, silty clay loam, strong brown (7.5YR 4/6) broken face, moist; 36 percent clay; weak fine subangular blocky structure; common fine irregular pores; 2 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Labette
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 02/21/2006
 Descriptor: DeAnn Presley

Site ID: 06KS015004 Pedon ID: 06KS015004

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Butler Quad Sheet Name: Pontiac, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Site is one mile south and two miles west of Rosalia,
 Kansas.
 Legal Description: of Section 23, Township 26S, Range 7E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds
 Datum: NAD83
 UTM Zone: 14, UTM Easting: 707612 meters, UTM Northing: 4183572 meters

Geomorphic Setting: None Assigned
 Upslope Shape: concave Cross Slope Shape: concave
 Slope: 6.0 percent Aspect: (deg)
 Elevation: 1486 feet, 453.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over residuum
 weathered from cherty limestone

Particle Size Control Section: 4.7 to 24.4 in. (12 to 62 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	26.0	0	66
Argillic horizon	4.7	29.5	12	75

Abrupt textural change	4.7	5.1	12	13
Lithologic discontinuity	15.0	29.5	38	75
Redox concentrations	15.0	29.5	38	75
Slickensides	15.0	29.5	38	75
Lithologic discontinuity	29.5		75	
Lithic contact	29.5		75	

Pedon Notes:

A--0 to 5 inches, (0 to 12 cm); grayish brown (10YR 5/2) broken face, silt loam, very dark gray (10YR 3/1) rubbed, moist; 16 percent clay; moderate medium granular and weak fine subangular blocky structure; friable, slightly hard; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--5 to 10 inches, (12 to 26 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate fine prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots throughout; common fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--10 to 15 inches, (26 to 38 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btss1--15 to 26 inches, (38 to 66 cm);, silty clay, dark reddish brown (5YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 25 percent continuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 5 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btss2--26 to 30 inches, (66 to 75 cm);, silty clay, dark reddish brown (5YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 10 percent continuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 25 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3R--30 inches, (75 to cm);, white (10YR 8/1) broken face, moist; ; limestone fragments.

Soil Name as Described/Sampled: Labette
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 02/21/2006
 Descriptor: DeAnn Presley

Site ID: 06KS015005 Pedon ID: 06KS015005

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Butler Quad Sheet Name: Pontiac, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Site is one mile south and two miles west of Rosalia,
 Kansas.
 Legal Description: of Section 23, Township 26S, Range 7E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 707602 meters, UTM Northing: 4183454 meters

Geomorphic Setting: None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: percent Aspect: (deg)
 Elevation: 1486 feet, 453.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from cherty limestone

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	17.3	0	44
Argillic horizon	7.9	57.5	20	146

Abrupt textural change	7.9	8.3	20	21
Redox concentrations	7.9	57.5	20	146
Lithologic discontinuity	23.6	29.5	60	75
Lithologic discontinuity	29.5	57.5	75	146
Lithic contact	29.5		75	
Slickensides	29.5	40.6	75	103
Lithologic discontinuity	29.5		75	
Redox depletions with chroma 2 or less	40.6	57.5	103	146

A--0 to 8 inches, (0 to 20 cm); grayish brown (10YR 5/2) broken face, silt loam, very dark brown (10YR 2/2) rubbed, moist; 21 percent clay; weak coarse granular structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--8 to 17 inches, (20 to 44 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; common fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 2 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; 2 percent 5 to 20 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--17 to 24 inches, (44 to 60 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt3--24 to 30 inches, (60 to 75 cm);, silty clay, dark brown (7.5YR 3/4) broken face, moist; 42 percent clay; moderate medium prismatic structure; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 5 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btss--30 to 41 inches, (75 to 103 cm);, silty clay loam, reddish brown (5YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic structure; few fine roots between peds; few fine irregular pores; 25 percent continuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 5 percent 5 chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt--41 to 57 inches, (103 to 146 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 42 percent clay; moderate medium prismatic structure; few fine roots between peds; few fine irregular pores; 25 percent continuous faint grayish brown (10YR 5/2), moist, and dark yellowish brown (10YR 3/4), moist, clay films; 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 5 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4Cr--57 inches, (146 to cm);, light gray (10YR 7/2) broken face, moist; ; limestone fragments.

Soil Name as Described/Sampled: Dwight
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 02/25/2006
 Descriptor: DeAnn Presley

Site ID: 06KS015006 Pedon ID: 06KS015006

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Butler Quad Sheet Name: Rosalia Ne, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: of Section 1, Township 25S, Range 7E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 709653 meters, UTM Northing: 4197703 meters

Geomorphic Setting: None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: (deg)
 Elevation: 1480 feet, 451.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over residuum
 weathered from cherty limestone

Particle Size Control Section: 5.1 to 24.8 in. (13 to 63 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	30.3	0	77
Argillic horizon	5.1	51.2	13	130
Abrupt textural change	5.1	5.5	13	14
Redox concentrations	5.1	51.2	13	130
Lithologic discontinuity	20.9	51.2	53	130
Secondary carbonates	20.9	38.2	53	97

Slickensides	20.9	38.2	53	97
Gypsum accumulations	38.2	51.2	97	130
Lithologic discontinuity	51.2		130	
Lithic contact	51.2		130	

A--0 to 5 inches, (0 to 13 cm); very dark grayish brown (10YR 3/2) broken face, silt loam, very dark grayish brown (10YR 3/2) rubbed, moist; 22 percent clay; moderate fine subangular blocky structure; friable, hard; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--5 to 12 inches, (13 to 31 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm; few fine roots between peds; few fine irregular pores; 20 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--12 to 21 inches, (31 to 53 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 20 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btkss1--21 to 30 inches, (53 to 77 cm);, silty clay loam, dark brown (7.5YR 3/3) broken face, moist; 38 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm; few fine roots between peds; few fine irregular pores; 2 percent slickensides (pedogenic) and 25 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btkss2--30 to 38 inches, (77 to 97 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm; few fine roots between peds; few fine irregular pores; 5 percent slickensides (pedogenic) and 25 percent continuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 10 percent fine distinct (5YR 4/8), moist, masses of oxidized iron; 1 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bty--38 to 51 inches, (97 to 130 cm);, silty clay, dark reddish brown (5YR 3/4) broken face, moist; 44 percent clay; weak coarse prismatic structure; very firm; few fine irregular pores; 10 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 20 percent fine distinct (5YR 4/8), moist, masses of oxidized iron; 5 percent fine distinct brown (7.5YR 5/3), moist, gypsum masses; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3R--51 inches, (130 to cm); .

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Paleustolls

Description Date: 02/25/2006
Describer: DeAnn Presley

Site ID: 06KS015007 Pedon ID: 06KS015007

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Rosalia Ne, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: of Section 1, Township 25S, Range 7E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 709625 meters, UTM Northing: 4197595 meters

Geomorphic Setting: None Assigned
Upslope Shape: linear Cross Slope Shape: concave
Slope: 4.0 percent Aspect: (deg)
Elevation: 1483 feet, 452.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
colluvium

Particle Size Control Section: 6.7 to 26.4 in. (17 to 67 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	19.3	0	49
Argillic horizon	6.7		17	

Redox concentrations	6.7		17	
Secondary carbonates	24.0	37.8	61	96
Lithologic discontinuity	31.5	37.8	80	96
Lithologic discontinuity	37.8	46.9	96	119
Gypsum accumulations	37.8		96	
Lithologic discontinuity	46.9		119	
Slickensides	46.9		119	

Pedon Notes:

A--0 to 2 inches, (0 to 6 cm); grayish brown (10YR 5/2) broken face, silt loam, very dark brown (10YR 2/2) rubbed, moist; 20 percent clay; moderate fine subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

BA--2 to 7 inches, (6 to 17 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 39 percent clay; moderate medium subangular blocky structure; firm, moderately hard, moderately sticky, moderately plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--7 to 12 inches, (17 to 31 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; common fine dendritic tubular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 4 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--12 to 19 inches, (31 to 49 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, organoargillans; 5 percent fine faint black (N 2.5/0), moist, iron-manganese nodules and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--19 to 24 inches, (49 to 61 cm);, silty clay, 25 percent brown (10YR 4/3) broken face and 75 percent dark brown (10YR 3/3) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films; 5 percent fine faint black (N 2.5/0), moist, iron-manganese nodules and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--24 to 31 inches, (61 to 80 cm);, silty clay, brown (10YR 4/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films; 5 percent fine faint black (N 2.5/0), moist, iron-manganese nodules and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent medium distinct light brownish gray (10YR 6/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk2--31 to 38 inches, (80 to 96 cm);, silty clay, brown (7.5YR 4/3) broken face, moist;

44 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films; 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; 2 percent medium distinct light brownish gray (10YR 6/2), moist, carbonate nodules; 1 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bty--38 to 47 inches, (96 to 119 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent patchy faint dark brown (7.5YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron; 5 percent medium distinct grayish brown (10YR 5/2), moist, gypsum masses; 3 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4Btssy--47 to 70 inches, (119 to 177 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 50 percent clay; moderate very fine wedge structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent and 50 percent continuous distinct dark brown (7.5YR 3/3), moist, clay films; 10 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 20 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 5 percent medium distinct grayish brown (10YR 5/2), moist, gypsum masses; 5 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 02/25/2006
Describer: DeAnn Presley

Site ID: 06KS015008 Pedon ID: 06KS015008

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Rosalia Ne, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: of Section 1, Township 25S, Range 7E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 709494 meters, UTM Northing: 4197556 meters

Geomorphic Setting: None Assigned
Upslope Shape: Cross Slope Shape:
Slope: percent Aspect: (deg)
Elevation: 1483 feet, 452.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over residuum
weathered from cherty limestone

Particle Size Control Section: 6.7 to 26.4 in. (17 to 67 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	23.6	0	60
Argillic horizon	6.7	83.9	17	213

Redox concentrations	6.7	94.1	17	239
Secondary carbonates	23.6	33.5	60	85
Lithologic discontinuity	33.5	94.1	85	239
Slickensides	53.5	83.9	136	213
Lithologic discontinuity	94.1		239	
Paralithic contact	94.1		239	

Pedon Notes:

A--0 to 2 inches, (0 to 6 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 22 percent clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--2 to 7 inches, (6 to 17 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 32 percent clay; moderate medium subangular blocky structure; firm, moderately sticky, moderately plastic; few fine roots between peds; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--7 to 16 inches, (17 to 41 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--16 to 24 inches, (41 to 60 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 46 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--24 to 33 inches, (60 to 85 cm);, silty clay, brown (10YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine light gray (10YR 7/2), moist, carbonate nodules and 1 percent medium light gray (10YR 7/2), moist, carbonate nodules; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt--33 to 54 inches, (85 to 136 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 25 percent continuous distinct dark brown (7.5YR 3/3), moist, clay films; 10 percent medium distinct brown (10YR 5/3), moist, masses of reduced iron and 10 percent medium distinct black (N 2.5/0), moist, iron-manganese nodules and 20 percent medium distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btss--54 to 84 inches, (136 to 213 cm);, silty clay, reddish brown (5YR 4/3) broken face, moist; 50 percent clay; moderate medium prismatic and moderate very fine wedge structure; very firm, very sticky, very plastic; few fine irregular pores; 50 percent continuous distinct brown (7.5YR 4/3), moist, clay films; 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 20 percent medium distinct black (N 2.5/0), moist, iron-manganese masses; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2BC--84 to 94 inches, (213 to 239 cm);, silty clay, brown (7.5YR 4/4) broken face, moist; 44 percent clay; weak medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 30 percent continuous distinct brown (7.5YR 4/3), moist, clay films; 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 20 percent medium distinct black (N 2.5/0), moist, iron-manganese masses; 2 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--94 inches, (239 to cm); white (10YR 8/1) broken face, very pale brown (10YR 7/3) broken face, moist; ; limestone fragments.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 02/25/2006
Describer: DeAnn Presley

Site ID: 06KS015009 Pedon ID: 06KS015009

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Rosalia Ne, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: of Section 1, Township 25S, Range 7E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 709517 meters, UTM Northing: 4197389 meters

Geomorphic Setting: None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 0.5 percent Aspect: (deg)
Elevation: 1486 feet, 453.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from cherty limestone

Particle Size Control Section: 6.3 to 26.0 in. (16 to 66 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	19.7	0	50
Argillic horizon	6.3	97.6	16	248

Abrupt textural change	6.3	6.7	16	17
Redox concentrations	6.3	97.6	16	248
Secondary carbonates	26.8	51.6	68	131
Lithologic discontinuity	40.2	51.6	102	131
Lithologic discontinuity	51.6	97.6	131	248
Slickensides	51.6	97.6	131	248
Redox depletions with chroma 2 or less	51.6	97.6	131	248
Paralithic contact	97.6		248	
Lithologic discontinuity	97.6		248	

Pedon Notes:

A--0 to 2 inches, (0 to 6 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 20 percent clay; weak fine subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--2 to 6 inches, (6 to 16 cm);, silt loam, very dark brown (10YR 2/2) broken face, moist; 26 percent clay; moderate fine subangular blocky structure; friable, moderately hard, moderately sticky, moderately plastic; common fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 14 inches, (16 to 35 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 43 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between pedis; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 1 percent fine faint black (N 2.5/0), moist, iron-manganese nodules and 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--14 to 20 inches, (35 to 50 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between pedis; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; 2 percent fine faint black (N 2.5/0), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--20 to 27 inches, (50 to 68 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between pedis; few fine irregular pores; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Btk1--27 to 40 inches, (68 to 102 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 38 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine roots between pedis; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 10 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 15 percent fine distinct reddish brown (5YR 4/4), moist, masses of oxidized iron; 1 percent very fine

distinct light gray (10YR 7/2), moist, carbonate nodules; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk2--40 to 52 inches, (102 to 131 cm);, silty clay, brown (7.5YR 4/4) broken face, moist; 42 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 10 percent fine distinct brown (7.5YR 5/3), moist, masses of reduced iron and 15 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; 2 percent 5 to 10 millimeter cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btss--52 to 98 inches, (131 to 248 cm);, silty clay, reddish brown (5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic and moderate very fine wedge structure; very firm, very sticky, very plastic; few fine irregular pores; 10 percent slickensides (pedogenic) and 50 percent continuous distinct brown (10YR 5/3), moist, clay films; 10 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 20 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 30 percent medium prominent grayish brown (10YR 5/2), moist, masses of reduced iron; 4 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4Cr--98 inches, (248 to cm); white (10YR 8/1) broken face, very pale brown (10YR 8/2) broken face, moist; ; , very sticky, very plastic; limestone fragments; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 02/25/2006
 Descriptor: DeAnn Presley

Site ID: 06KS015010 Pedon ID: 06KS015010
 Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Butler Quad Sheet Name: Rosalia Ne, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: of Section 1, Township 25S, Range 7E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 709574 meters, UTM Northing: 4197274 meters

Geomorphic Setting: None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 0.5 percent Aspect: (deg)
 Elevation: 1489 feet, 454.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 8.3 to 28.0 in. (21 to 71 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	22.4	0	57
Redox concentrations	3.1		8	
Argillic horizon	8.3		21	
Lithologic discontinuity	32.7	44.5	83	113
Lithologic discontinuity	44.5		113	

Slickensides	44.5		113	
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Pedon Notes:

A--0 to 3 inches, (0 to 8 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 20 percent clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

BA--3 to 8 inches, (8 to 21 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 30 percent clay; moderate fine subangular blocky structure; firm, moderately sticky, moderately plastic; common fine roots throughout; few fine dendritic tubular pores; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--8 to 22 inches, (21 to 57 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent continuous faint very dark brown (10YR 2/2), moist, organoargillans; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--22 to 28 inches, (57 to 72 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--28 to 33 inches, (72 to 83 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 2 percent discontinuous faint dark brown (10YR 3/3), moist, clay films; 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/0), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt4--33 to 44 inches, (83 to 113 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btss1--44 to 62 inches, (113 to 158 cm);, silty clay, reddish brown (5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 25 percent continuous faint brown (7.5YR 4/3), moist, clay films; 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 25 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron; 2 percent

chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btss2--62 to 85 inches, (158 to 217 cm);, silty clay, reddish brown (5YR 4/3) broken face, moist; 44 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 50 percent continuous faint brown (7.5YR 4/3), moist, clay films; 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 25 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btss3--85 to 99 inches, (217 to 251 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 44 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 50 percent continuous faint brown (7.5YR 4/3), moist, clay films; 5 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/0), moist, iron-manganese masses; 2 percent chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 02/25/2006
Describer: DeAnn Presley

Site ID: 06KS015011 Pedon ID: 06KS015011

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Rosalia Ne, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: of Section 1, Township 25S, Range 7E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 709585 meters, UTM Northing: 4197194 meters

Geomorphic Setting: None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: (deg)
Elevation: 1493 feet, 455.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 3.9 to 23.6 in. (10 to 60 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.4	0	62
Abrupt textural change	3.9	4.3	10	11
Argillic horizon	3.9		10	

Redox concentrations	10.2		26	
Lithologic discontinuity	35.4	48.4	90	123
Lithologic discontinuity	48.4		123	
Redox depletions with chroma 2 or less	48.4		123	
Slickensides	61.8		157	

Pedon Notes:

Ap--0 to 4 inches, (0 to 10 cm);, silt loam, very dark brown (10YR 2/2) rubbed, moist; 22 percent clay; moderate fine subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--4 to 10 inches, (10 to 26 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 38 percent clay; moderate medium subangular blocky structure; firm, moderately hard, moderately sticky, moderately plastic; common fine roots throughout; few fine dendritic tubular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt2--10 to 18 inches, (26 to 45 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 4 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt3--18 to 24 inches, (45 to 62 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; common fine roots between peds; few fine irregular pores; 10 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 4 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt4--24 to 35 inches, (62 to 90 cm);, silty clay, brown (10YR 4/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent patchy faint dark brown (10YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese nodules and 5 percent fine distinct brown (10YR 5/3), moist, masses of reduced iron and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt5--35 to 48 inches, (90 to 123 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent patchy faint dark brown (7.5YR 3/3), moist, clay films; 2 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 10 percent medium distinct brown (10YR 5/3), moist, masses of reduced iron and 20 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt6--48 to 62 inches, (123 to 157 cm);, silty clay, reddish brown (5YR 4/3) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 25 percent continuous distinct brown (7.5YR 4/3), moist, clay films; 2 percent black (N 2.5/0), moist, iron-manganese masses and 10 percent medium distinct grayish brown (10YR 5/2), moist, masses of reduced iron and 10 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btss--62 to 92 inches, (157 to 234 cm);, silty clay, brown (7.5YR 5/4) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 50 percent continuous distinct brown (7.5YR 4/3), moist, clay films; 1 percent black (N 2.5/0), moist, iron-manganese masses and 5 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, masses of reduced iron; 2 percent chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 02/25/2006
 Descriptor: DeAnn Presley

Site ID: 06KS015012 Pedon ID: 06KS015012
 Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Butler Quad Sheet Name: Rosalia, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Two miles east and one mile north of Rosalia, KS.
 Legal Description: NE 1/4 of Section 30, Township 25S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 713123 meters, UTM Northing: 4192068 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 2.0 percent Aspect: 270 (deg)
 Elevation: 1552 feet, 473.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from cherty limestone
 Bedrock Depth: 85.4 inches (217.0 cm)

Particle Size Control Section: 7.5 to 27.2 in. (19 to 69 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.0	0	61
Argillic horizon	7.5	85.4	19	217

Abrupt textural change	7.5	7.9	19	20
Secondary carbonates	24.0	37.4	61	95
Lithologic discontinuity	37.4	50.4	95	128
Redox depletions with chroma 2 or less	37.4	85.4	95	217
Slickensides	50.4	85.4	128	217
Lithologic discontinuity	50.4	85.4	128	217
Paralithic contact	85.4		217	
Lithologic discontinuity	85.4		217	

Pedon Notes:

A--0 to 7 inches, (0 to 19 cm); grayish brown (10YR 5/2) broken face, silt loam, very dark brown (10YR 2/2) rubbed, moist; 3 percent sand; 23 percent clay; moderate fine subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear boundary.

Bt1--7 to 14 inches, (19 to 35 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 3 percent sand; 40 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; firm, hard, very sticky, very plastic; common fine roots throughout; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; clear boundary.

Bt2--14 to 24 inches, (35 to 61 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 3 percent sand; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese masses; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; gradual boundary.

Btk--24 to 37 inches, (61 to 95 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 3 percent sand; 42 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; 1 percent cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

2Bt--37 to 50 inches, (95 to 128 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 3 percent sand; 48 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 20 percent discontinuous faint brown (10YR 4/3), moist, clay films on vertical faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 20 percent fine prominent dark red (2.5YR 3/6), moist, masses of oxidized iron; 2 percent 5 to 10 millimeter cherty limestone fragments; noneffervescent, by HCl, 1 normal; Appears to be a stone line at the top of this horizon at 95 cm.; gradual boundary.

3Btss--50 to 85 inches, (128 to 217 cm);, silty clay, brown (7.5YR 4/4) broken face,

moist; 3 percent sand; 50 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) and 35 percent continuous faint brown (7.5YR 4/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine prominent yellowish red (5YR 4/6), moist, masses of oxidized iron and 30 percent fine prominent gray (10YR 6/1), moist, iron depletions; 2 percent 5 to 10 millimeter cherty limestone fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

4Cr--85 to 87 inches, (217 to 222 cm); white (10YR 8/1) broken face, very pale brown (10YR 8/2) broken face, moist; ; 25 percent chert fragments; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 02/25/2006
 Descriptor: DeAnn Presley

Site ID: 06KS015013 Pedon ID: 06KS015013

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Butler Quad Sheet Name: Rosalia, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Two miles east and one mile north of Rosalia, KS.
 Legal Description: NE 1/4 of Section 30, Township 25S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 713273 meters, UTM Northing: 4192058 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 3.0 percent Aspect: 270 (deg)
 Elevation: 1555 feet, 474.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 7.5 to 27.2 in. (19 to 69 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.8	0	63
Argillic horizon	7.5		19	
Redox concentrations	7.5		19	

Lithologic discontinuity	24.8	33.9	63	86
Secondary carbonates	28.3	43.7	72	111
Lithologic discontinuity	33.9		86	
Redox depletions with chroma 2 or less	33.9		86	
Slickensides	43.7		111	

Pedon Notes:

A--0 to 7 inches, (0 to 19 cm); dark grayish brown (10YR 4/2) broken face, silt loam, very dark brown (10YR 2/2) rubbed, moist; 25 percent clay; moderate fine subangular blocky structure; friable, slightly hard, moderately sticky, slightly plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt1--7 to 16 inches, (19 to 40 cm);, silty clay loam, very dark brown (10YR 2/2) broken face, moist; 37 percent clay; moderate medium prismatic structure; firm, hard, moderately sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt2--16 to 25 inches, (40 to 63 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, organoargillans on all faces of peds; 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

2Bt3--25 to 28 inches, (63 to 72 cm);, silty clay, brown (10YR 4/3) broken face, moist; 40 percent clay; moderate fine prismatic structure; firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 4 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; Stone line at 63 cm.; clear boundary.

2Btk1--28 to 34 inches, (72 to 86 cm);, silty clay, brown (10YR 4/3) broken face, moist; 40 percent clay; moderate medium subangular blocky structure; firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 4 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; 3 percent chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

3Btk2--34 to 44 inches, (86 to 111 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 45 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 4 percent fine distinct strong brown

(7.5YR 4/6), moist, masses of oxidized iron; 1 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; 1 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

3Btss1--44 to 61 inches, (111 to 156 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 47 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 2 percent slickensides (pedogenic) and 10 percent patchy faint clay films on all faces of peds; 10 percent fine prominent (7.5YR 4/8), moist, masses of oxidized iron and 25 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 25 percent medium prominent grayish brown (10YR 5/2), moist, iron depletions; 2 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal; gradual boundary.

3Btss2--61 to 98 inches, (156 to 248 cm);, silty clay, 25 percent brown (7.5YR 5/3) broken face and 75 percent brown (7.5YR 4/3) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; 5 percent slickensides (pedogenic) and 20 percent continuous faint brown (7.5YR 4/3), moist, clay films on all faces of peds; 10 percent fine distinct (7.5YR 4/8), moist, masses of oxidized iron and 10 percent medium prominent grayish brown (10YR 5/2), moist, iron depletions and 20 percent fine prominent black (N 2.5/), moist, iron-manganese masses; 5 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 02/25/2006
 Descriptor: DeAnn Presley

Site ID: 06KS015014 Pedon ID: 06KS015014

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Butler Quad Sheet Name: Rosalia, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Two miles east and one mile north of Rosalia, KS.
 Legal Description: NE 1/4 of Section 30, Township 25S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 713514 meters, UTM Northing: 4192095 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 2.0 percent Aspect: 270 (deg)
 Elevation: 1565 feet, 477.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 5.1 to 24.8 in. (13 to 63 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	23.2	0	59
Argillic horizon	5.1		13	
Redox concentrations	13.4		34	

Secondary carbonates	23.2	31.5	59	80
Redox depletions with chroma 2 or less	23.2		59	
Slickensides	55.1		140	
Lithologic discontinuity	55.1		140	

Pedon Notes:

A--0 to 5 inches, (0 to 13 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 23 percent clay; weak medium subangular blocky structure; friable, moderately sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

Bt1--5 to 13 inches, (13 to 34 cm);, silty clay, black (10YR 2/1) broken face, moist; 40 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; common fine roots throughout; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

Bt2--13 to 23 inches, (34 to 59 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear boundary.

Btk--23 to 31 inches, (59 to 80 cm);, silty clay loam, brown (10YR 5/3) broken face, moist; 29 percent clay; weak fine subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent medium distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 20 percent medium distinct grayish brown (10YR 5/2), moist, iron depletions; 1 percent fine distinct pale brown (10YR 6/3), moist, carbonate masses; noneffervescent, by HCl, 1 normal; clear boundary.

BC--31 to 55 inches, (80 to 140 cm);, silty clay loam, brown (10YR 5/3) broken face, moist; 33 percent clay; weak fine subangular blocky structure; friable, moderately sticky, moderately plastic; common fine irregular pores; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 20 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron and 20 percent medium distinct grayish brown (10YR 5/2), moist, iron depletions; noneffervescent, by HCl, 1 normal; abrupt boundary.

2Btss1--55 to 67 inches, (140 to 171 cm);, silty clay, dark brown (7.5YR 3/3) broken face, moist; 40 percent clay; moderate medium prismatic parting to moderate fine angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent continuous slickensides (pedogenic) and 30 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct reddish brown (5YR 4/4), moist, masses of oxidized iron and 20 percent medium distinct grayish brown (2.5Y 5/2), moist, iron depletions; noneffervescent, by HCl, 1 normal; clear boundary.

2Btss2--67 to 92 inches, (171 to 234 cm);, silty clay, brown (7.5YR 4/4) broken face, moist; 40 percent clay; moderate medium prismatic parting to moderate fine angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 2 percent slickensides (pedogenic) and 25 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/0), moist, iron-manganese masses and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions; 2 percent chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 02/25/2006
 Descriptor: DeAnn Presley

Site ID: 06KS015015 Pedon ID: 06KS015015

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Butler Quad Sheet Name: Rosalia, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Two miles east and one mile north of Rosalia, KS.
 Legal Description: NE 1/4 of Section 30, Township 25S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 713626 meters, UTM Northing: 4192100 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: 270 (deg)
 Elevation: 1572 feet, 479.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.0	0	61
Argillic horizon	7.9	27.2	20	69
Redox concentrations	16.1		41	

Secondary carbonates	24.0	27.2	61	69
Redox depletions with chroma 2 or less	27.2		69	
Slickensides	43.3		110	
Lithologic discontinuity	43.3		110	

Pedon Notes:

A--0 to 4 inches, (0 to 11 cm); dark gray (10YR 4/1) broken face, silt loam, black (10YR 2/1) rubbed, moist; 22 percent clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear boundary.

BA--4 to 8 inches, (11 to 20 cm);, silty clay loam, black (10YR 2/1) broken face, moist; 28 percent clay; moderate medium subangular blocky structure; friable, moderately sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear boundary.

Bt1--8 to 16 inches, (20 to 41 cm);, silty clay, black (10YR 2/1) broken face, moist; 40 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear boundary.

Bt2--16 to 24 inches, (41 to 61 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 40 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine faint black (N 2.5/), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear boundary.

Btk--24 to 27 inches, (61 to 69 cm);, silty clay loam, brown (10YR 4/3) broken face, moist; 34 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint brown (10YR 5/3), moist, iron depletions and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate masses; noneffervescent, by HCl, 1 normal; clear boundary.

BC--27 to 43 inches, (69 to 110 cm);, silty clay loam, brown (10YR 5/3) broken face, moist; 35 percent clay; weak medium subangular blocky structure; firm, very sticky, very plastic; common fine irregular pores; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent medium distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 20 percent medium distinct grayish brown (10YR 5/2), moist, iron depletions; noneffervescent, by HCl, 1 normal; clear boundary.

2Btss1--43 to 64 inches, (110 to 162 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 46 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) and 30 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct reddish brown (5YR 5/4), moist, masses

of oxidized iron and 20 percent medium distinct grayish brown (2.5Y 5/2), moist, iron depletions; 2 percent chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

2Btss2--64 to 101 inches, (162 to 256 cm);, silty clay, brown (7.5YR 4/4) broken face, moist; 50 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) and 25 percent continuous faint brown (7.5YR 4/3), moist, clay films on all faces of peds; 5 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 20 percent fine prominent black (N 2.5/), moist, iron-manganese masses; 5 percent chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 02/25/2006
 Descriptor: DeAnn Presley

Site ID: 06KS015016 Pedon ID: 06KS015016

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Butler Quad Sheet Name: Rosalia, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Two miles east and one mile north of Rosalia, KS.
 Legal Description: NE 1/4 of Section 30, Township 25S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 713608 meters, UTM Northing: 4191820 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: linear Cross Slope Shape: concave
 Slope: 0.0 percent Aspect: 315 (deg)
 Elevation: 1562 feet, 476.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 6.7 to 26.4 in. (17 to 67 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	28.3	0	72
Argillic horizon	6.7		17	
Redox concentrations	6.7		17	

Lithologic discontinuity	36.2		92	
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Pedon Notes:

A--0 to 7 inches, (0 to 17 cm); dark grayish brown (10YR 4/2) broken face, silty clay, very dark grayish brown (10YR 3/2) rubbed, moist; 23 percent clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots throughout; few fine dendritic tubular pores; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt1--7 to 17 inches, (17 to 43 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual boundary.

Bt2--17 to 22 inches, (43 to 57 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 2 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

Bt3--22 to 28 inches, (57 to 72 cm);, silty clay, dark brown (10YR 3/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

Bt4--28 to 36 inches, (72 to 92 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

2Bt5--36 to 38 inches, (92 to 97 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 25 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 50 percent chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 05/23/2006
Describer: DeAnn Presley

Site ID: 06KS015017 Pedon ID: 06KS015017

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Rosalia Ne, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Seven miles south and three miles east of Cassoday,
Kansas.
Legal Description: NE 1/4 of NW 1/4 of Section 19, Township 24S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 712556 meters, UTM Northing: 4203500 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 0.5 percent Aspect: 45 (deg)
Elevation: 1532 feet, 467.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from cherty limestone
Bedrock Depth: 98.0 inches (249.0 cm)

Particle Size Control Section: 4.3 to 24.0 in. (11 to 61 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	20.9	0	53
Argillic horizon	4.3	98.0	11	249
Redox concentrations	12.2	98.0	31	249
Secondary carbonates	24.4	29.9	62	76
Lithologic discontinuity	24.4	42.5	62	108
Redox depletions with chroma 2 or less	42.5	98.0	108	249
Lithologic discontinuity	42.5	98.0	108	249
Lithologic discontinuity	98.0		249	
Paralithic contact	98.0		249	

Pedon Notes:

A--0 to 4 inches, (0 to 11 cm); dark grayish brown (10YR 4/2) broken face, silty clay loam, very dark brown (10YR 2/2) rubbed, moist; 28 percent clay; weak medium subangular blocky structure; firm, hard, slightly sticky, slightly plastic; few fine roots throughout; many fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt1--4 to 12 inches, (11 to 31 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; gradual boundary.

Bt2--12 to 21 inches, (31 to 53 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear boundary.

Bt3--21 to 24 inches, (53 to 62 cm);, silty clay, dark grayish brown (10YR 4/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear boundary.

2Btk--24 to 30 inches, (62 to 76 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 32 percent clay; moderate fine subangular blocky structure; firm, hard, very sticky, moderately plastic; few fine roots between peds; common fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct brown (10YR 5/3), moist, iron depletions and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct pale brown (10YR 6/3), moist, carbonate masses; noneffervescent, by HCl, 1 normal; gradual boundary.

2Bt1--30 to 43 inches, (76 to 108 cm);, silty clay loam, brown (7.5YR 4/4) broken face, moist; 36 percent clay; moderate fine subangular blocky structure; firm, hard, very sticky, moderately plastic; common fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/),

moist, iron-manganese masses and 5 percent fine distinct brown (10YR 5/3), moist, iron depletions; noneffervescent, by HCl, 1 normal; clear boundary.

3Bt2--43 to 55 inches, (108 to 139 cm);, silty clay loam, brown (7.5YR 4/4) broken face, moist; 36 percent clay; moderate fine subangular blocky structure; firm, hard, very sticky, moderately plastic; common fine irregular pores; 10 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual boundary.

3Btss1--55 to 71 inches, (139 to 181 cm);, silty clay, dark reddish brown (5YR 3/3) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) and 30 percent continuous faint brown (7.5YR 4/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct brown (7.5YR 5/2), moist, iron depletions and 15 percent fine distinct reddish brown (5YR 4/4), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; gradual boundary.

3Btss2--71 to 98 inches, (181 to 249 cm);, silty clay, reddish brown (5YR 4/3) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) and 50 percent continuous faint brown (7.5YR 4/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine faint reddish brown (5YR 4/4), moist, masses of oxidized iron and 10 percent fine distinct brown (7.5YR 5/2), moist, iron depletions; noneffervescent, by HCl, 1 normal; abrupt boundary.

4Cr--98 to 102 inches, (249 to 260 cm); white (10YR 8/1) crushed, light gray (10YR 7/2) crushed, moist; ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 05/23/2006
Describer: DeAnn Presley

Site ID: 06KS015018 Pedon ID: 06KS015018

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Rosalia Ne, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Seven miles south and three miles east of Cassoday,
Kansas.
Legal Description: NE 1/4 of NW 1/4 of Section 19, Township 24S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 712336 meters, UTM Northing: 4203194 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: 0 (deg)
Elevation: 1529 feet, 466.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 7.1 to 26.8 in. (18 to 68 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	23.2	0	59
Argillic horizon	7.1		18	

Abrupt textural change	7.1	7.5	18	19
Redox concentrations	7.1		18	
Lithologic discontinuity	33.5	49.2	85	125
Secondary carbonates	33.5	64.6	85	164
Redox depletions with chroma 2 or less	33.5	49.2	85	125
Lithologic discontinuity	49.2		125	
Slickensides	49.2		125	
Gypsum accumulations	49.2	64.6	125	164

Pedon Notes:

A--0 to 7 inches, (0 to 18 cm); grayish brown (10YR 5/2) broken face, silt loam, very dark brown (10YR 2/2) rubbed, moist; 20 percent clay; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear boundary.

Bt1--7 to 17 inches, (18 to 42 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few fine roots throughout; few fine dendritic tubular pores; 5 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual boundary.

Bt2--17 to 23 inches, (42 to 59 cm);, silty clay, very dark grayish brown (10YR 3/2) broken face, moist; 42 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual boundary.

Bt3--23 to 33 inches, (59 to 85 cm);, silty clay loam, 25 percent brown (10YR 4/3) broken face and 75 percent dark brown (10YR 3/3) broken face, moist; 36 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; firm, very sticky, very plastic; few very fine roots between peds; common fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, organoargillans on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent medium distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

2Btk--33 to 49 inches, (85 to 125 cm);, silty clay loam, brown (7.5YR 4/3) broken face, moist; 36 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; few very fine roots throughout; common fine irregular pores; 10 percent patchy faint clay films on all faces of peds; 5 percent fine distinct (10YR2), moist, iron depletions and 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 20 percent medium distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct carbonate masses; 1 percent 2 to 4 millimeter chert fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

3Btkssy--49 to 65 inches, (125 to 164 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) and 50 percent

continuous faint reddish brown (5YR 4/3), moist, clay films on all faces of peds; 5 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent fine distinct carbonate nodules; 2 percent 2 to 4 millimeter chert fragments; noneffervescent, by HCl, 1 normal; Possible gypsum threads observed, approximately 2%.; gradual boundary.

3Btss--65 to 102 inches, (164 to 260 cm);, silty clay, reddish brown (5YR 4/4) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) and 50 percent continuous faint reddish brown (5YR 4/3), moist, clay films on all faces of peds; 5 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 3 percent 4 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 05/23/2006
Describer: DeAnn Presley

Site ID: 06KS015019 Pedon ID: 06KS015019

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Rosalia Ne, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Seven miles south and three miles east of Cassoday,
Kansas.
Legal Description: NE 1/4 of NW 1/4 of Section 19, Township 24S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 712136 meters, UTM Northing: 4203019 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 0.5 percent Aspect: 45 (deg)
Elevation: 1529 feet, 466.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	24.8	0	63
Argillic horizon	5.9		15	

Redox concentrations	5.9		15	
Abrupt textural change	5.9	14.2	15	36
Lithologic discontinuity	31.5	38.2	80	97
Secondary carbonates	31.5	52.0	80	132
Lithologic discontinuity	38.2		97	
Slickensides	38.2	97.2	97	247

Pedon Notes:

A--0 to 6 inches, (0 to 15 cm); dark grayish brown (10YR 4/2) broken face, silt loam, very dark brown (10YR 2/2) rubbed, moist; 22 percent clay; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots throughout; common fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt1--6 to 14 inches, (15 to 36 cm);, silty clay, very dark brown (10YR 2/2) broken face, moist; 40 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few fine roots throughout; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear boundary.

Bt2--14 to 25 inches, (36 to 63 cm);, silty clay, 50 percent very dark grayish brown (10YR 3/2) broken face and 50 percent very dark brown (10YR 2/2) broken face, moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear boundary.

Bt3--25 to 31 inches, (63 to 80 cm);, silty clay, dark yellowish brown (10YR 3/4) broken face, moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

2Btk--31 to 38 inches, (80 to 97 cm);, silty clay, brown (7.5YR 4/3) broken face, moist; 44 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct reddish brown (5YR 4/4), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 2 percent fine distinct carbonate nodules; 2 percent 2 to 4 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

3Btkss--38 to 52 inches, (97 to 132 cm);, silty clay, reddish brown (5YR 4/3) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 25 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct brown (7.5YR 5/3), moist, iron depletions and 5 percent fine faint reddish brown (5YR 4/4), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 2

percent medium distinct carbonate nodules; 4 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal; gradual boundary.

3Btss--52 to 97 inches, (132 to 247 cm); silty clay, reddish brown (5YR 4/3) broken face, moist; 50 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 50 percent continuous faint dark reddish brown (5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct brown (7.5YR 5/3), moist, iron depletions and 5 percent fine faint reddish brown (5YR 4/4), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 5 percent 2 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 05/23/2006
Describer: DeAnn Presley

Site ID: 06KS015020 Pedon ID: 06KS015020

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Rosalia Ne, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: Seven miles south and three miles east of Cassoday,
Kansas.
Legal Description: NE 1/4 of SW 1/4 of Section 19, Township 24S, Range 8E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 711921 meters, UTM Northing: 4202738 meters

Geomorphic Setting: on summit of interfluvium of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: 315 (deg)
Elevation: 1526 feet, 465.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from cherty limestone
Bedrock Depth: 81.5 inches (207.0 cm)

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)

Mollic epipedon	0.0	20.1	0	51
Argillic horizon	5.5	81.5	14	207
Abrupt textural change	5.5	5.9	14	15
Redox concentrations	11.8	81.5	30	207
Lithologic discontinuity	27.2	37.4	69	95
Secondary carbonates	27.2	50.8	69	129
Lithologic discontinuity	37.4	81.5	95	207
Slickensides	50.8	81.5	129	207
Paralithic contact	81.5		207	
Lithologic discontinuity	81.5		207	

Pedon Notes:

A--0 to 6 inches, (0 to 14 cm); dark grayish brown (10YR 4/2), silt loam, very dark grayish brown (10YR 3/2), moist; 23 percent clay; moderate fine subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt--6 to 12 inches, (14 to 30 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 10 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few fine roots throughout; few fine dendritic tubular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear boundary.

Bt2--12 to 20 inches, (30 to 51 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 42 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few fine roots throughout; few fine dendritic tubular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual boundary.

Bt3--20 to 27 inches, (51 to 69 cm);, silty clay, brown (10YR 4/3), moist; 44 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

2Btk--27 to 37 inches, (69 to 95 cm);, silty clay, brown (7.5YR 4/3), moist; 44 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent medium distinct light gray (10YR 7/2), moist, carbonate nodules; 5 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

3Btk2--37 to 51 inches, (95 to 129 cm);, silty clay, brown (7.5YR 4/4), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint brown

(7.5YR 5/3), moist, iron depletions and 5 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate nodules; 2 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

3Btss--51 to 81 inches, (129 to 207 cm);, silty clay, reddish brown (5YR 4/3), moist; 50 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) and 25 percent continuous faint dark reddish brown (5YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint brown (7.5YR 5/3), moist, iron depletions and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron; 2 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal; abrupt boundary.

4Cr--81 to 90 inches, (207 to 229 cm); white (10YR 8/1), very pale brown (10YR 8/2), moist; ; violent effervescence, by HCl, 1 normal

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 05/23/2006
 Descriptor: DeAnn Presley

Site ID: 06KS015021 Pedon ID: 06KS015021

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Butler Quad Sheet Name: Rosalia Ne, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: Seven miles south and three miles east of Cassoday,
 Kansas.
 Legal Description: NE 1/4 of SW 1/4 of Section 19, Township 24S, Range 8E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 711842 meters, UTM Northing: 4202648 meters

Geomorphic Setting: on backslope of interfluvium of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 3.0 percent Aspect: 225 (deg)
 Elevation: 1522 feet, 464.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Grassland rangeland

Parent Material: clayey loess over colluvium

Particle Size Control Section: 20.5 to 40.2 in. (52 to 102 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	10.6	0	27
Redox concentrations	0.0		0	

Argillic horizon	20.5	51.2	52	130
Abrupt textural change	20.5	22.4	52	57
Lithologic discontinuity	59.4		151	
Argillic horizon	59.4		151	
Redox depletions with chroma 2 or less	59.4		151	

Pedon Notes:

A--0 to 11 inches, (0 to 27 cm); dark grayish brown (10YR 4/2), silt loam, very dark grayish brown (10YR 3/2), moist; 20 percent clay; moderate fine subangular blocky parting to moderate medium granular structure; very friable, soft, slightly sticky, slightly plastic; few fine roots throughout; few fine dendritic tubular pores; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

BE--11 to 20 inches, (27 to 52 cm);, silt loam, dark grayish brown (10YR 4/2), moist; 17 percent clay; moderate fine subangular blocky parting to moderate medium granular structure; very friable, soft, slightly sticky, slightly plastic; few fine roots throughout; few fine dendritic tubular pores; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

Bt--20 to 51 inches, (52 to 130 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent continuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct (7.5Y 4/6), moist, masses of oxidized iron; 2 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear boundary.

BC--51 to 59 inches, (130 to 151 cm);, silty clay loam, brown (10YR 4/3), moist; 36 percent clay; moderate fine subangular blocky structure; firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent fine faint grayish brown (10YR 5/2), moist, iron depletions and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 20 percent medium prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

2Bt--59 to 62 inches, (151 to 158 cm);, silty clay, brown (7.5YR 4/3), moist; 40 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; few fine irregular pores; 25 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 08/12/2006
Describer: DeAnn Presley

Site ID: 06KS015022 Pedon ID: 06KS015022

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Butler Quad Sheet Name: Elbing, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: NW1/4 of Section 19, Township 235, Range 3E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 662693 meters, UTM Northing: 4212256 meters

Geomorphic Setting: on shoulder of None Assigned
Upslope Shape: Cross Slope Shape:
Slope: 1.0 percent Aspect: 338 (deg)
Elevation: 1450 feet, 442.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over residuum
weathered from limestone and shale

Particle Size Control Section: 12.2 to 31.9 in. (31 to 81 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	66.1	0	168
Redox concentrations	6.7		17	

Argillic horizon	12.2	81.9	31	208
Abrupt textural change	12.2	12.6	31	32
Secondary carbonates	29.1	42.5	74	108
Lithologic discontinuity	42.5	66.1	108	168
Lithologic discontinuity	66.1		168	
Redox depletions with chroma 2 or less	66.1		168	

Ap--0 to 7 inches, (0 to 17 cm); dark grayish brown (10YR 4/2), silt loam, very dark grayish brown (10YR 3/2), moist; 20 percent clay; weak fine granular structure; friable, slightly sticky, slightly plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; abrupt boundary.

A--7 to 12 inches, (17 to 31 cm);, silt loam, very dark brown (10YR 2/2), moist; 25 percent clay; moderate medium prismatic structure; friable, moderately sticky, moderately plastic; few fine roots between peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt--12 to 29 inches, (31 to 74 cm);, silty clay, very dark brown (10YR 2/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; 25 percent continuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt boundary.

Bt--29 to 43 inches, (74 to 108 cm);, silty clay, dark brown (10YR 3/3), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; 20 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; abrupt boundary.

2Bt--43 to 66 inches, (108 to 168 cm);, silty clay, dark brown (7.5YR 3/3), moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual boundary.

3Bt2--66 to 82 inches, (168 to 208 cm);, silty clay, yellowish brown (10YR 5/4), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent patchy faint brown (10YR 4/3), moist, clay films on all faces of peds; 5 percent fine distinct grayish brown (10YR 5/2), moist, iron-manganese masses and 5 percent fine distinct black (N 2.5/), moist, iron depletions and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 5 percent shale fragments; noneffervescent, by HCl, 1 normal; gradual boundary.

3BC--82 to 102 inches, (208 to 258 cm);, silty clay loam, light olive brown (2.5Y 5/3), moist; 38 percent clay; weak medium subangular blocky structure; very firm, very sticky, very plastic; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct grayish brown (2.5Y 5/2), moist, iron depletions and 10 percent fine prominent strong brown (7.5YR 5/6), moist, masses of oxidized iron; 10 percent limestone fragments and 20 percent shale fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 06/15/2006
 Descriptor: DeAnn Presley

Site ID: 06KS115001 Pedon ID: 06KS115001

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Marion Quad Sheet Name: Hillsboro, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: Six miles south of Hillsboro, KS.
 Legal Description: SE 1/4 of of Section 32, Township 20S, Range 2E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 655297 meters, UTM Northing: 4237006 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 0.0 percent Aspect: 0 (deg)
 Elevation: 1457 feet, 444.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over shale derived
 from calcareous shale

Particle Size Control Section: 8.7 to 28.3 in. (22 to 72 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	38.2	0	97
Argillic horizon	8.7	96.5	22	245

Redox concentrations	8.7		22	
Secondary carbonates	24.4	38.2	62	97
Lithologic discontinuity	38.2	72.0	97	183
Redox depletions with chroma 2 or less	38.2	96.5	97	245
Lithologic discontinuity	72.0		183	

Pedon Notes:

A--0 to 9 inches, (0 to 22 cm); dark grayish brown (10YR 4/2), silty clay, very dark gray (10YR 3/1), moist; 40 percent clay; moderate medium angular blocky structure; very firm, moderately sticky, very plastic; common fine roots between peds; few fine irregular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--9 to 17 inches, (22 to 43 cm);, silty clay, very dark brown (10YR 2/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt2--17 to 24 inches, (43 to 62 cm);, silty clay, very dark brown (10YR 2/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--24 to 38 inches, (62 to 97 cm);, silty clay loam, very dark grayish brown (10YR 3/2), moist; 39 percent clay; moderate medium prismatic and moderate medium subangular blocky structure; very firm, very sticky, moderately plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 5 percent coarse distinct light brownish gray (10YR 6/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt1--38 to 54 inches, (97 to 137 cm);, silty clay loam, dark grayish brown (10YR 4/2), moist; 36 percent clay; moderate medium subangular blocky structure; friable, very sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine faint dark grayish brown (10YR 4/2), moist, iron depletions and 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--54 to 72 inches, (137 to 183 cm);, silty clay, dark brown (10YR 3/3), moist; 40 percent clay; moderate medium subangular blocky structure; friable, very sticky, very plastic; few very fine roots between peds; common fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine faint dark grayish brown (10YR 4/2), moist, iron depletions and 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1

normal; gradual smooth boundary.

3Bt3--72 to 96 inches, (183 to 245 cm);, silty clay, brown (10YR 4/3), moist; 50 percent clay; weak medium subangular blocky structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine faint dark grayish brown (10YR 4/2), moist, iron depletions and 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 5 percent shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3C--96 to 103 inches, (245 to 262 cm);, silty clay loam, light olive brown (2.5Y 5/3), moist; 35 percent clay; structureless massive; friable, moderately sticky, moderately plastic; common fine irregular pores; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 20 percent calcareous shale fragments; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 06/15/2006
Describer: DeAnn Presley

Site ID: 06KS115002 Pedon ID: 06KS115002

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Marion Quad Sheet Name: Hillsboro, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Six miles south of Hillsboro, KS.
Legal Description: SE 1/4 of of Section 32, Township 20S, Range 2E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 655251 meters, UTM Northing: 4236855 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 0.0 percent Aspect: 0 (deg)
Elevation: 1463 feet, 446.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 6.7 to 26.4 in. (17 to 67 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	14.2	0	36
Argillic horizon	6.7		17	
Redox concentrations	14.2		36	

Secondary carbonates	14.2	28.0	36	71
Lithologic discontinuity	22.8	28.0	58	71
Redox depletions with chroma 2 or less	22.8		58	
Lithologic discontinuity	28.0		71	

Pedon Notes:

A--0 to 7 inches, (0 to 17 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 42 percent clay; moderate medium angular blocky structure; very firm, very sticky, very plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--7 to 14 inches, (17 to 36 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 44 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--14 to 23 inches, (36 to 58 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 1 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk2--23 to 28 inches, (58 to 71 cm);, silty clay loam, brown (7.5YR 4/3), moist; 36 percent clay; moderate medium prismatic structure; firm, very sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 10 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct light gray (10YR 7/2), moist, carbonate masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt--28 to 49 inches, (71 to 124 cm);, silty clay loam, brown (7.5YR 4/3), moist; 36 percent clay; moderate medium prismatic structure; firm, very sticky, moderately plastic; few very fine roots between peds; common fine irregular pores; 25 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 20 percent medium prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 06/15/2006
Describer: DeAnn Presley

Site ID: 06KS115003 Pedon ID: 06KS115003

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Marion Quad Sheet Name: Hillsboro, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Six miles south of Hillsboro, KS.
Legal Description: SE 1/4 of of Section 32, Township 20S, Range 2E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 655223 meters, UTM Northing: 4236734 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: 203 (deg)
Elevation: 1463 feet, 446.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over residuum
weathered from shale over residuum weathered from
calcareous shale

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	25.6	0	65

Argillic horizon	5.5	57.1	14	145
Redox concentrations	5.5	87.4	14	222
Secondary carbonates	25.6	45.7	65	116
Lithologic discontinuity	45.7	57.1	116	145
Slickensides	45.7	57.1	116	145
Lithologic discontinuity	57.1	73.6	145	187
Lithologic discontinuity	73.6		187	
Paralithic contact	87.4		222	

Pedon Notes:

A--0 to 6 inches, (0 to 14 cm); dark grayish brown (10YR 4/2), silty clay loam, very dark grayish brown (10YR 3/2), moist; 32 percent clay; weak medium subangular blocky structure; firm, hard, moderately sticky, moderately plastic; few very fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 19 inches, (14 to 48 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt2--19 to 26 inches, (48 to 65 cm);, silty clay, dark brown (10YR 3/3), moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Btk--26 to 46 inches, (65 to 116 cm);, silty clay, brown (7.5YR 4/3), moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules and 2 percent medium distinct very pale brown (10YR 7/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btss--46 to 57 inches, (116 to 145 cm);, silty clay loam, brown (7.5YR 4/3), moist; 36 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 20 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3C1--57 to 74 inches, (145 to 187 cm);, silty clay loam, olive (5Y 5/3), moist; 36 percent clay; structureless massive; firm, hard, very sticky, very plastic; 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 20 percent shale fragments;

noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4C2--74 to 87 inches, (187 to 222 cm);, silty clay loam, olive gray (5Y 5/2), moist; 32 percent clay; structureless massive; friable, slightly hard, slightly sticky, moderately plastic; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 40 percent calcareous shale fragments; slight effervescence, by HCl, 1 normal; clear smooth boundary.

4Cr--87 to 94 inches, (222 to 240 cm);, pale olive (5Y 6/4), moist; ; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 06/15/2006
Describer: DeAnn Presley

Site ID: 06KS115004 Pedon ID: 06KS115004

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Marion Quad Sheet Name: Hillsboro, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Six miles south of Hillsboro, KS.
Legal Description: SE 1/4 of of Section 32, Township 20S, Range 2E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 655113 meters, UTM Northing: 4236496 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 2.0 percent Aspect: 203 (deg)
Elevation: 1460 feet, 445.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	33.1	0	84
Argillic horizon	5.9		15	
Redox concentrations	5.9		15	

Secondary carbonates	19.7		50	
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Pedon Notes:

A--0 to 6 inches, (0 to 15 cm); dark grayish brown (10YR 4/2), silty clay loam, very dark brown (10YR 2/2), moist; 35 percent clay; weak medium subangular blocky structure; firm, hard, very sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--6 to 20 inches, (15 to 50 cm);, silty clay, very dark brown (10YR 2/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk1--20 to 33 inches, (50 to 84 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules; 2 percent medium distinct light brownish gray (10YR 6/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Btk2--33 to 43 inches, (84 to 110 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 44 percent clay; moderate medium subangular blocky structure; very firm, very hard, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 10 percent medium distinct light brownish gray (10YR 6/2), moist, carbonate nodules; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 06/15/2006
Describer: DeAnn Presley

Site ID: 06KS115005 Pedon ID: 06KS115005

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Marion Quad Sheet Name: Hillsboro, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: Six miles south of Hillsboro, KS.
Legal Description: SE 1/4 of of Section 32, Township 20S, Range 2E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 654954 meters, UTM Northing: 4236406 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 3.0 percent Aspect: 203 (deg)
Elevation: 1463 feet, 446.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Hayland

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	26.8	0	68
Argillic horizon	5.5		14	
Abrupt textural change	5.5	5.9	14	15

Redox concentrations	5.5		14	
Lithologic discontinuity	26.8	59.1	68	150
Secondary carbonates	31.9	59.1	81	150
Lithologic discontinuity	59.1		150	

Pedon Notes:

Ap--0 to 6 inches, (0 to 14 cm); dark grayish brown (10YR 4/2), silt loam, very dark grayish brown (10YR 3/2), moist; 20 percent clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few very fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--6 to 20 inches, (14 to 50 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few very fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt2--20 to 27 inches, (50 to 68 cm);, silty clay loam, dark brown (10YR 3/3), moist; 36 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few very fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, organoargillans on all faces of peds; 1 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt3--27 to 32 inches, (68 to 81 cm);, silty clay, brown (7.5YR 4/3), moist; 46 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few very fine irregular pores; 30 percent continuous distinct dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct (10YR 4/5), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btk--32 to 44 inches, (81 to 111 cm);, silty clay, brown (7.5YR 4/4), moist; 46 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few very fine irregular pores; 30 percent discontinuous distinct dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint brown (10YR 5/3), moist, iron depletions and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine carbonate nodules and 2 percent medium carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk2--44 to 59 inches, (111 to 150 cm);, silty clay, reddish brown (5YR 4/4), moist; 40 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few very fine irregular pores; 10 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint brown (7.5YR 5/3), moist, iron depletions and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron; 1 percent fine carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt--59 to 74 inches, (150 to 187 cm);, silty clay loam, dark brown (7.5YR 3/3), moist; 36 percent clay; -- Error in Exists On -- structure; very firm, very sticky, very plastic; few very fine irregular pores; 25 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint brown (7.5YR 5/3), moist, iron depletions and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt2--74 to 83 inches, (187 to 212 cm);, silty clay loam, brown (7.5YR 4/4), moist; 36 percent clay; -- Error in Exists On -- structure; firm, very sticky, very plastic; few very fine irregular pores; 10 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 2 percent fine faint brown (7.5YR 5/3), moist, iron depletions and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 06/18/2006
 Descriptor: DeAnn Presley

Site ID: 06KS115006 Pedon ID: 06KS115006

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Marion Quad Sheet Name: Florence, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: 8 miles east of Peabody, KS
 Legal Description: SE 1/4 of of Section 2, Township 22S, Range 4E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 679176 meters, UTM Northing: 4225424 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 2.0 percent Aspect: (deg)
 Elevation: 1421 feet, 433.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Other grass/herbaceous cover

Parent Material: clayey loess over colluvium over residuum
 weathered from shale over residuum weathered from
 calcareous shale

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	53.9	0	137

Argillic horizon	7.9	63.8	20	162
Redox concentrations	7.9	78.7	20	200
Secondary carbonates	17.3	53.9	44	137
Lithologic discontinuity	28.0	53.9	71	137
Slickensides	28.0	63.8	71	162
Lithologic discontinuity	53.9	63.8	137	162
Lithologic discontinuity	73.2		186	
Paralithic contact	78.7		200	

Pedon Notes:

Ap--0 to 8 inches, (0 to 20 cm);, silty clay loam, very dark grayish brown (10YR 3/2), moist; 28 percent clay; weak medium subangular blocky structure; friable, very sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--8 to 17 inches, (20 to 44 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 40 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--17 to 28 inches, (44 to 71 cm);, silty clay, dark brown (10YR 3/3), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, organoargillans on all faces of peds; 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btkss--28 to 54 inches, (71 to 137 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 45 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very sticky, very plastic; common fine roots between peds; few fine irregular pores; 5 percent slickensides (pedogenic) and 20 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 1 percent fine distinct carbonate nodules; 1 percent shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btss--54 to 64 inches, (137 to 162 cm);, silty clay, grayish brown (2.5Y 5/2), moist; 50 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) and 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 20 percent shale fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3C1--64 to 73 inches, (162 to 186 cm);, silty clay, olive gray (5Y 5/2), moist; 55 percent clay; structureless massive; extremely firm, very sticky, very plastic; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct dark

yellowish brown (10YR 4/6), moist, masses of oxidized iron; 25 percent shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4C2--73 to 79 inches, (186 to 200 cm); silty clay, olive (5Y 5/3), moist; 36 percent clay; structureless massive; very firm, very sticky, very plastic; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 50 percent calcareous shale fragments; slight effervescence, by HCl, 1 normal; clear smooth boundary.

4Cr--79 to 84 inches, (200 to 214 cm); white (10YR 8/1), light gray (10YR 7/2), moist; ; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 06/18/2006
Describer: DeAnn Presley

Site ID: 06KS115007 Pedon ID: 06KS115007

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Marion Quad Sheet Name: Florence, Kansas
State: Kansas
MLRA: 76 -- Bluestem Hills
Soil Survey Area:
Map Unit: --

Location Description: 8 miles east of Peabody, KS
Legal Description: SE 1/4 of of Section 2, Township 22S, Range 4E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 679179 meters, UTM Northing: 4225606 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 2.0 percent Aspect: (deg)
Elevation: 1421 feet, 433.0 meters
Drainage class:

Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Other grass/herbaceous cover

Parent Material: clayey loess over colluvium over colluvium over
residuum weathered from shale over residuum
weathered from calcareous shale

Particle Size Control Section: 7.9 to 27.6 in. (20 to 70 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	44.5	0	113

Argillic horizon	7.9	84.6	20	215
Redox concentrations	7.9	93.3	20	237
Lithologic discontinuity	24.0	44.5	61	113
Secondary carbonates	24.0	44.5	61	113
Lithologic discontinuity	44.5	84.6	113	215
Slickensides	44.5	84.6	113	215
Lithologic discontinuity	84.6	93.3	215	237
Lithologic discontinuity	93.3		237	
Paralithic contact	93.3		237	

Pedon Notes:

Ap1--0 to 4 inches, (0 to 10 cm);, silt loam, very dark grayish brown (10YR 3/2), moist; 26 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Ap2--4 to 8 inches, (10 to 20 cm);, silty clay loam, very dark grayish brown (10YR 3/2), moist; 35 percent clay; weak medium subangular blocky structure; firm, very sticky, very plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--8 to 24 inches, (20 to 61 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 1 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk--24 to 44 inches, (61 to 113 cm);, silty clay, dark brown (10YR 3/3), moist; 46 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct pale brown (10YR 6/3), moist, carbonate nodules and 1 percent medium distinct pale brown (10YR 6/3), moist, carbonate nodules; 2 percent 2 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btss1--44 to 61 inches, (113 to 155 cm);, silty clay, brown (7.5YR 4/3), moist; 48 percent clay; -- Error in Exists On -- structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent slickensides (pedogenic) on all faces of peds and 10 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct reddish brown (5YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btss2--61 to 85 inches, (155 to 215 cm);, silty clay, brown (7.5YR 4/4), moist; 48 percent clay; moderate medium prismatic parting to moderate medium angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 10 percent slickensides (pedogenic) and 50 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine faint reddish brown (5YR 4/4), moist, masses of oxidized iron and 30 percent medium prominent black (N 2.5/), moist, iron-manganese masses; 1 percent 2 to 5 millimeter shale fragments and 1 percent 2 to 5 millimeter limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4C1--85 to 89 inches, (215 to 226 cm);, silty clay, olive (5Y 5/3), moist; 45 percent clay; structureless massive; very firm, very sticky, very plastic; 10 percent medium prominent black (N 2.5/), moist, iron-manganese masses; 40 percent shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4C2--89 to 93 inches, (226 to 237 cm);, silty clay, 25 percent light gray (10YR 7/2) and 75 percent olive (5Y 5/3), moist; 45 percent clay; structureless massive; very firm, very sticky, very plastic; 20 percent medium prominent black (N 2.5/), moist, iron-manganese masses; 40 percent calcareous shale fragments; strong effervescence, by HCl, 1 normal; abrupt smooth boundary.

5Cr--93 to 95 inches, (237 to 242 cm); white (10YR 8/1), light gray (10YR 7/2), moist; ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 06/18/2006
 Descriptor: DeAnn Presley

Site ID: 06KS115008 Pedon ID: 06KS115008

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Marion Quad Sheet Name: Florence, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --
 Location Description: 8 miles east of Peabody, KS
 Legal Description: SW 1/4 of of Section 2, Township 22S, Range 4E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 678366 meters, UTM Northing: 4225405 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 2.0 percent Aspect: (deg)
 Elevation: 1411 feet, 430.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Other grass/herbaceous cover

Parent Material: clayey loess over colluvium over colluvium over
 residuum weathered from calcareous shale over
 residuum weathered from calcareous shale

Particle Size Control Section: 17.3 to 37.0 in. (44 to 94 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	41.3	0	105
Argillic horizon	17.3	78.7	44	200

Abrupt textural change	17.3	17.7	44	45
Redox concentrations	17.3	78.7	44	200
Lithologic discontinuity	28.7	41.3	73	105
Lithologic discontinuity	41.3	78.7	105	200
Secondary carbonates	41.3	78.7	105	200
Slickensides	50.0	78.7	127	200
Paralithic contact	78.7	86.6	200	220
Lithologic discontinuity	78.7	86.6	200	220
Paralithic contact	86.6		220	
Lithologic discontinuity	86.6		220	

Pedon Notes:

Ap--0 to 4 inches, (0 to 11 cm);, silt loam, very dark grayish brown (10YR 3/2), moist; 24 percent clay; weak fine subangular blocky parting to weak fine granular structure; friable, moderately sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

A--4 to 17 inches, (11 to 44 cm);, silt loam, very dark brown (10YR 2/2), moist; 22 percent clay; weak medium subangular blocky parting to weak medium prismatic structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--17 to 29 inches, (44 to 73 cm);, silty clay, very dark brown (10YR 2/2), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 20 percent faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent medium faint black (N 2.5/), moist, iron-manganese nodules; 1 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--29 to 41 inches, (73 to 105 cm);, silty clay, dark brown (10YR 3/3), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 30 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent medium distinct black (N 2.5/), moist, iron-manganese nodules; 1 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btk--41 to 50 inches, (105 to 127 cm);, silty clay, brown (7.5YR 4/3), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 25 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 2 percent fine distinct very pale brown (10YR 7/3), moist, carbonate nodules and 1 percent medium distinct very pale brown (10YR 7/3), moist, carbonate nodules; 1 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btkss1--50 to 66 inches, (127 to 167 cm);, silty clay, brown (7.5YR 4/3), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 30 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on faces of peds; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N

2.5/), moist, iron-manganese nodules; 1 percent medium distinct very pale brown (10YR 7/3), moist, carbonate nodules and 1 percent coarse distinct very pale brown (10YR 7/3), moist, carbonate nodules; 1 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btkss2--66 to 79 inches, (167 to 200 cm);, silty clay, brown (7.5YR 4/3), moist; 45 percent clay; -- Error in Exists On -- structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 25 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on faces of peds; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 2 percent medium distinct very pale brown (10YR 7/3), moist, carbonate nodules; 1 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4Cr1--79 to 87 inches, (200 to 220 cm);, light olive brown (2.5Y 5/3), moist; ; few very fine roots between peds; strong effervescence, by HCl, 1 normal; clear smooth boundary.

5Cr2--87 to 92 inches, (220 to 234 cm); white (2.5Y 8/1), light gray (2.5Y 7/1), moist; ; few very fine roots between peds; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 06/18/2006
 Descriptor: DeAnn Presley

Site ID: 06KS115009 Pedon ID: 06KS115009

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Marion Quad Sheet Name: Florence, Kansas
 State: Kansas
 MLRA: 76 -- Bluestem Hills
 Soil Survey Area:
 Map Unit: --

Location Description: 8 miles east of Peabody, KS
 Legal Description: SW 1/4 of of Section 2, Township 22S, Range 4E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 678369 meters, UTM Northing: 4225624 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: (deg)
 Elevation: 1407 feet, 429.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Other grass/herbaceous cover

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 13.0 to 32.7 in. (33 to 83 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	28.7	0	73
Redox concentrations	7.9		20	
Argillic horizon	13.0		33	
Lithologic discontinuity	19.7	43.3	50	110
Lithologic discontinuity	43.3		110	
Slickensides	43.3		110	

Ap--0 to 8 inches, (0 to 20 cm); very dark gray (10YR 3/1), silty clay loam, black (10YR 2/1), moist; 34 percent clay; moderate fine subangular blocky structure; friable, moderately sticky, moderately plastic; many very fine roots throughout; few fine dendritic tubular pores; 1 percent 2 to 5 millimeter limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

BA--8 to 13 inches, (20 to 33 cm);, silty clay loam, black (10YR 2/1), moist; 35 percent clay; moderate medium subangular blocky parting to moderate medium granular structure; friable, moderately sticky, moderately plastic; common very fine roots throughout; few fine dendritic tubular pores; 1 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--13 to 20 inches, (33 to 50 cm);, silty clay, dark brown (10YR 3/3), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent medium distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine faint dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; 1 percent 5 to 10 millimeter shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bt2--20 to 29 inches, (50 to 73 cm);, silty clay, dark brown (7.5YR 3/3), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, organoargillans on all faces of peds; 5 percent medium distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron; 5 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt3--29 to 43 inches, (73 to 110 cm);, silty clay, brown (7.5YR 4/4), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 20 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent medium distinct black (N 2.5/), moist, iron-manganese nodules; 5 percent 5 to 10 millimeter chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btss1--43 to 55 inches, (110 to 140 cm);, silty clay, brown (7.5YR 4/3), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent slickensides (pedogenic) on all faces of peds and 30 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent medium distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btss2--55 to 60 inches, (140 to 152 cm);, brown (7.5YR 4/3), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent slickensides (pedogenic) on all faces of peds and 30 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent medium distinct black (N 2.5/), moist, iron-manganese nodules; 10 percent 2 to 10 millimeter limestone fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 06/18/2006
Describer: DeAnn Presley

Site ID: 06KS115010 Pedon ID: 06KS115010

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Marion Quad Sheet Name: Peabody Nw, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: SW 1/4 of SE 1/4 of Section 25, Township 21S, Range 2E

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 660978 meters, UTM Northing: 4228536 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: 180 (deg)
Elevation: 1483 feet, 452.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over alluvium over
residuum weathered from shale over residuum
weathered from calcareous shale

Particle Size Control Section: 14.2 to 33.9 in. (36 to 86 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	33.9	0	86

Redox concentrations	4.7	120.1	12	305
Argillic horizon	14.2	92.9	36	236
Lithologic discontinuity	33.9	45.3	86	115
Lithologic discontinuity	45.3	115.7	115	294
Secondary carbonates	60.6	92.9	154	236
Lithologic discontinuity	115.7	120.1	294	305
Paralithic contact	120.1		305	
Lithologic discontinuity	120.1		305	

Pedon Notes:

Ap--0 to 5 inches, (0 to 12 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 32 percent clay; moderate fine subangular blocky parting to moderate medium granular structure; friable, moderately sticky, moderately plastic; common fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

A--5 to 14 inches, (12 to 36 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 35 percent clay; moderate medium subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; few fine irregular pores; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt1--14 to 34 inches, (36 to 86 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 34 percent clay; moderate medium subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; 1 percent 2 to 5 millimeter; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Bt2--34 to 45 inches, (86 to 115 cm);, silty clay, brown (10YR 4/3), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint clay films on all faces of peds; 10 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent 2 to 5 millimeter shale fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt3--45 to 61 inches, (115 to 154 cm);, silty clay, brown (7.5YR 4/3), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 5 percent mixed rock fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btk--61 to 93 inches, (154 to 236 cm);, clay, brown (7.5YR 4/4), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 5 percent fine prominent black (N 2.5/), moist, iron-manganese masses; 2 percent coarse distinct pale brown (10YR 6/3), moist, carbonate nodules; 5 percent mixed rock fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3BC--93 to 116 inches, (236 to 294 cm);, clay, strong brown (7.5YR 4/6), moist; 42 percent

clay; weak medium subangular blocky structure; very firm, very sticky, very plastic; common fine irregular pores; 5 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 20 percent fine prominent black (N 2.5/), moist, iron-manganese masses; 5 percent 2 to 5 millimeter mixed rock fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4C--116 to 120 inches, (294 to 305 cm);, silty clay, light olive brown (2.5Y 5/3), moist; 45 percent clay; structureless massive; very firm, very sticky, very plastic; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 40 percent 2 to 5 millimeter shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

5Cr--120 inches, (305 to cm);, very pale brown (10YR 8/2), moist; ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 06/18/2006
 Descriptor: DeAnn Presley

Site ID: 06KS115011 Pedon ID: 06KS115011

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Marion Quad Sheet Name: Peabody Nw, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SW 1/4 of SE 1/4 of Section 25, Township 21S, Range 2E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 661003 meters, UTM Northing: 4228662 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: 180 (deg)
 Elevation: 1483 feet, 452.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Row crop

Parent Material: clayey loess over alluvium over colluvium

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Redox concentrations	0.0		0	
Mollic epipedon	0.0	42.9	0	109
Argillic horizon	5.9		15	

Lithologic discontinuity	42.9	56.7	109	144
Secondary carbonates	51.2	69.3	130	176
Lithologic discontinuity	56.7		144	
Redox depletions with chroma 2 or less	69.3		176	

Pedon Notes:

Ap--0 to 6 inches, (0 to 15 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 30 percent clay; weak fine subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--6 to 30 inches, (15 to 76 cm);, silty clay, very dark brown (10YR 2/2), moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between pedes; 5 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans on all faces of pedes; 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--30 to 43 inches, (76 to 109 cm);, silty clay, dark brown (10YR 3/3), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between pedes; 5 percent patchy faint dark brown (10YR 3/3), moist, organoargillans on all faces of pedes; 10 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt3--43 to 51 inches, (109 to 130 cm);, silty clay, brown (10YR 4/3), moist; 46 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between pedes; 5 percent patchy faint brown (10YR 4/3), moist, clay films on all faces of pedes; 10 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent 2 quartz fragments and 1 percent 5 chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk1--51 to 57 inches, (130 to 144 cm);, silty clay, brown (10YR 4/3), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between pedes; 5 percent patchy faint brown (10YR 4/3), moist, clay films on all faces of pedes; 10 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct pale brown (10YR 6/3), moist, carbonate nodules; 2 percent 2 to 5 millimeter chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Btk2--57 to 69 inches, (144 to 176 cm);, silty clay, brown (7.5YR 4/3), moist; 42 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; 5 percent patchy faint brown (7.5YR 4/3), moist, clay films on all faces of pedes; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 1 percent medium distinct pale brown (10YR 6/3), moist, carbonate nodules; 1 percent 2 chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt1--69 to 81 inches, (176 to 206 cm);, silty clay loam, brown (7.5YR 4/4), moist; 39 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; 5 percent patchy faint brown (7.5YR 4/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 1 percent 2 chert fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt2--81 to 93 inches, (206 to 236 cm);, silty clay, brown (7.5YR 4/4), moist; 44 percent clay; weak fine subangular blocky structure; very firm, very sticky, very plastic; 10 percent patchy faint brown (7.5YR 4/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 2 percent 2 to 5 millimeter limestone fragments and 2 percent shale fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 06/18/2006
 Descriptor: DeAnn Presley

Site ID: 06KS115012 Pedon ID: 06KS115012

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Marion Quad Sheet Name: Peabody Nw, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SW 1/4 of SE 1/4 of Section 25, Township 21S, Range 2E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 661033 meters, UTM Northing: 4228787 meters

Geomorphic Setting: on summit of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 0.0 percent Aspect: 180 (deg)
 Elevation: 1480 feet, 451.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Row crop

Parent Material: clayey loess over alluvium over residuum weathered
 from calcareous shale

Particle Size Control Section: 10.6 to 30.3 in. (27 to 77 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	36.2	0	92
Redox concentrations	3.1	94.1	8	239

Argillic horizon	10.6	89.4	27	227
Lithologic discontinuity	56.7	94.1	144	239
Secondary carbonates	56.7	89.4	144	227
Lithologic discontinuity	94.1		239	
Paralithic contact	94.1		239	

Pedon Notes:

Ap--0 to 3 inches, (0 to 8 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 34 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; 1 percent 2 quartz fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

BA--3 to 11 inches, (8 to 27 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 38 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots throughout; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules; 1 percent 2 quartz fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--11 to 36 inches, (27 to 92 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent 2 to 5 millimeter shale fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bt2--36 to 57 inches, (92 to 144 cm);, silty clay, dark yellowish brown (10YR 3/4), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent 2 to 5 millimeter shale fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk1--57 to 75 inches, (144 to 190 cm);, silty clay, dark brown (7.5YR 3/3), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules; 2 percent 2 to 5 millimeter shale fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk2--75 to 89 inches, (190 to 227 cm);, silty clay, brown (7.5YR 4/4), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 10 percent discontinuous faint brown (7.5YR 4/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules; 2 percent 2 to 5 millimeter shale fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2BC--89 to 94 inches, (227 to 239 cm);, silty clay, strong brown (7.5YR 4/6), moist; 40

percent clay; weak coarse subangular blocky structure; very firm, very sticky, very plastic; 10 percent discontinuous faint brown (7.5YR 4/3), moist, clay films on all faces of peds; 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 5 percent 2 to 10 millimeter shale fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--94 to 104 inches, (239 to 264 cm);, 50 percent very pale brown (10YR 8/3) and 50 percent yellowish brown (10YR 5/6), moist; ; 10 percent 5 to 10 millimeter calcareous shale fragments; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/20/2006
 Descriptor: DeAnn Presley

Site ID: 06KS113001 Pedon ID: 06KS113001

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Mcpherson Quad Sheet Name: Galva, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: 4 miles North and 2 miles East of McPherson, KS
 Legal Description: NW 1/4 of Section 6, Township 19S, Range 2W

Latitude: 38 degrees 25 minutes 41.00 seconds north
 Longitude: 97 degrees 35 minutes 16.53 seconds west

Datum: NAD83
 UTM Zone: 14, UTM Easting: 623255 meters, UTM Northing: 4254255 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 0.5 percent Aspect: (deg)
 Elevation: 1545 feet, 471.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: loess over loess over loess

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	31.5	0	80
Argillic horizon	5.5	79.5	14	202
Redox concentrations	5.5		14	

Secondary carbonates	31.5		80	
Lithologic discontinuity	63.4	79.5	161	202
Lithologic discontinuity	79.5		202	

Ap--0 to 6 inches, (0 to 14 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 37 percent clay; moderate fine subangular blocky structure; very firm, very sticky, very plastic; common very fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 17 inches, (14 to 44 cm);, silty clay, black (10YR 2/1), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint black (10YR 2/1), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--17 to 31 inches, (44 to 80 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 46 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent patchy faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 5 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--31 to 63 inches, (80 to 161 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules; slight effervescence, by HCl, 1 normal; gradual smooth boundary.

2Btk2--63 to 80 inches, (161 to 202 cm);, silty clay loam, brown (10YR 4/3), moist; 37 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 2 percent medium distinct carbonate nodules; slight effervescence, by HCl, 1 normal; clear smooth boundary.

3Bk--80 to 90 inches, (202 to 229 cm);, silty clay loam, brown (7.5YR 4/4), moist; 32 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; common fine irregular pores; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 15 percent medium distinct carbonate nodules; strong effervescence, by HCl, 1 normal; clear smooth boundary.

3Btk--90 to 100 inches, (229 to 253 cm);, silty clay loam, brown (7.5YR 4/4), moist; 36 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; common fine irregular pores; 5 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 20 percent medium distinct carbonate nodules; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 07/20/2006
 Descriptor: DeAnn Presley

Site ID: 06KS113002 Pedon ID: 06KS113002

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Mcpherson Quad Sheet Name: Galva, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: 4 miles north and 2 miles east of McPherson, KS
 Legal Description: NW 1/4 of Section 6, Township 19S, Range 2W

Latitude: 38 degrees 25 minutes 44.57 seconds north
 Longitude: 97 degrees 35 minutes 23.17 seconds west

Datum: NAD83
 UTM Zone: 14, UTM Easting: 623092 meters, UTM Northing: 4254362 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 0.0 percent Aspect: (deg)
 Elevation: 1542 feet, 470.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: loess over loess over loess

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	55.5	0	141
Redox concentrations	5.5		14	
Argillic horizon	5.5		14	
Secondary carbonates	27.2		69	
Lithologic discontinuity	55.5	65.7	141	167
Lithologic discontinuity	65.7		167	

Ap--0 to 6 inches, (0 to 14 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 39 percent clay; weak medium subangular blocky structure; very firm, very sticky, very plastic; few very fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt1--6 to 15 inches, (14 to 37 cm);, silty clay loam, 50 percent black (10YR 2/1) and 50 percent very dark brown (10YR 2/2), moist; 36 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--15 to 27 inches, (37 to 69 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk1--27 to 56 inches, (69 to 141 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 46 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk2--56 to 66 inches, (141 to 167 cm);, silty clay, brown (10YR 4/3), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, organoargillans on all faces of peds; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 2 percent medium distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Btk3--66 to 80 inches, (167 to 204 cm);, silty clay, brown (7.5YR 4/4), moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine irregular pores; 5 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 5 percent medium distinct carbonate nodules; slight effervescence, by HCl, 1 normal.

3Btk4--80 to 96 inches, (204 to 245 cm);, silty clay loam, brown (7.5YR 4/4), moist; 36 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine irregular pores; 5 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 20 percent medium distinct carbonate nodules; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 07/20/2006
 Descriptor: DeAnn Presley

Site ID: 06KS113003 Pedon ID: 06KS113003

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Mcpherson Quad Sheet Name: Galva, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: 4 miles north and 2 miles east of McPherson, KS
 Legal Description: NW 1/4 of Section 6, Township 19S, Range 2W

Latitude: 38 degrees 25 minutes 48.16 seconds north
 Longitude: 97 degrees 35 minutes 29.67 seconds west

Datum: NAD83
 UTM Zone: 14, UTM Easting: 622933 meters, UTM Northing: 4254470 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 0.0 percent Aspect: (deg)
 Elevation: 1539 feet, 469.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: loess over loess over loess

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	32.7	0	83
Argillic horizon	5.5	32.7	14	83
Redox concentrations	5.5		14	

Secondary carbonates	23.6	47.2	60	120
Reduced matrix	32.7	91.3	83	232
Lithologic discontinuity	47.2	91.3	120	232
Secondary carbonates	66.9		170	
Lithologic discontinuity	91.3		232	

Pedon Notes:

Ap--0 to 6 inches, (0 to 14 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 36 percent clay; moderate thick subangular blocky structure; firm, moderately sticky, moderately plastic; common fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--6 to 24 inches, (14 to 60 cm);, silty clay loam, black (10YR 2/1), moist; 36 percent clay; moderate medium prismatic structure; firm, moderately sticky, moderately plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint black (10YR 2/1), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--24 to 33 inches, (60 to 83 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese masses; 4 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bkg--33 to 47 inches, (83 to 120 cm);, silty clay, olive gray (5Y 5/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine irregular pores; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent medium distinct carbonate nodules; slight effervescence, by HCl, 1 normal; clear smooth boundary.

2Bg--47 to 67 inches, (120 to 170 cm);, silty clay loam, dark grayish brown (10YR 4/2), moist; 35 percent clay; moderate medium subangular blocky structure; firm, moderately sticky, moderately plastic; common fine irregular pores; 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Bkg--67 to 91 inches, (170 to 232 cm);, silty clay loam, dark grayish brown (10YR 4/2), moist; 35 percent clay; moderate medium subangular blocky structure; firm, moderately sticky, moderately plastic; common fine irregular pores; 20 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 5 percent fine distinct carbonate nodules; strong effervescence, by HCl, 1 normal; clear smooth boundary.

3Btk--91 to 99 inches, (232 to 251 cm);, silty clay, brown (10YR 4/3), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 5 percent fine distinct carbonate nodules; strong effervescence, by HCl, 1 normal.

PEDON DESCRIPTION

Soil Name as Described/Sampled: Irwin
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 07/21/2006
Describer: DeAnn Presley

Site ID: 06KS113004 Pedon ID: 06KS113004

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Mcpherson Quad Sheet Name: Galva, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: 4 miles north and 2 miles east of McPherson,KS
Legal Description: NE 1/4 of Section 35, Township 18S, Range 2W

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 630631 meters, UTM Northing: 4256024 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 2.0 percent Aspect: 180 (deg)
Elevation: 1565 feet, 477.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Close-grown crop

Parent Material: loess over colluvium over residuum weathered from limestone
Bedrock Depth: 84.6 inches (215.0 cm)

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	15.7	0	40
Argillic horizon	5.9	30.7	15	78
Redox concentrations	15.7	84.6	40	215

Secondary carbonates	15.7	30.7	40	78
Reduced matrix	30.7	58.3	78	148
Lithologic discontinuity	58.3	84.6	148	215
Lithologic discontinuity	84.6		215	
Paralithic contact	84.6		215	

Pedon Notes:

Ap--0 to 6 inches, (0 to 15 cm);, silty clay loam, very dark grayish brown (10YR 3/2), moist; 34 percent clay; weak medium subangular blocky structure; firm, moderately sticky, moderately plastic; few very fine roots throughout; few fine dendritic tubular pores; 1 percent 10 chert fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--6 to 16 inches, (15 to 40 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots throughout; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--16 to 31 inches, (40 to 78 cm);, silty clay loam, dark grayish brown (10YR 4/2), moist; 37 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots throughout; few fine irregular pores; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 5 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

BCg--31 to 58 inches, (78 to 148 cm);, silty clay loam, grayish brown (10YR 5/2), moist; 34 percent clay; weak fine platy parting to weak fine angular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; few fine irregular pores; 5 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt1--58 to 78 inches, (148 to 198 cm);, sandy clay loam, pale brown (10YR 6/3), moist; 25 percent clay; weak fine subangular blocky structure; friable, moderately sticky, moderately plastic; few fine irregular pores; 5 percent clay bridges on all faces of peds; 5 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--78 to 85 inches, (198 to 215 cm);, sandy clay loam, brown (7.5YR 4/4), moist; 30 percent clay; moderate medium subangular blocky structure; friable, moderately sticky, moderately plastic; few fine irregular pores; 10 percent discontinuous faint brown (7.5YR 4/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 15 percent medium distinct yellowish red (5YR 5/6), moist, masses of oxidized iron; 20 percent limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--85 to 85 inches, (215 to 216 cm); white (10YR 8/1), white (10YR 8/1), moist; ; noneffervescent, by HCl, 1 normal.

USDA - NATURAL RESOURCES CONSERVATION SERVICE Print Date: 12/01/2006
PEDON DESCRIPTION

Soil Name as Described/Sampled: Irwin

Soil Name as Correlated:
Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 07/21/2006
Describer: DeAnn Presley

Site ID: 06KS113005 Pedon ID: 06KS113005

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Mcpherson Quad Sheet Name: Galva, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: 4 miles north and 2 miles east of McPherson, KS
Legal Description: NE 1/4 of Section 35, Township 18S, Range 2W

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 630497 meters, UTM Northing: 4256137 meters

Geomorphic Setting: on summit of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 1.0 percent Aspect: 90 (deg)
Elevation: 1568 feet, 478.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Close-grown crop

Parent Material: loess over loess

Particle Size Control Section: 4.3 to 24.0 in. (11 to 61 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	17.7	0	45
Argillic horizon	4.3		11	
Redox concentrations	4.3		11	
Secondary carbonates	17.7	37.0	45	94
Lithologic discontinuity	37.0		94	
Slickensides	37.0	52.0	94	132

Pedon Notes:

Ap--0 to 4 inches, (0 to 11 cm);, silt loam, very dark brown (10YR 2/2), moist; 26 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; few fine irregular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--4 to 18 inches, (11 to 45 cm);, silty clay, very dark brown (10YR 2/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--18 to 37 inches, (45 to 94 cm);, silty clay loam, dark grayish brown (10YR 4/2), moist; 38 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 4 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

2Btss--37 to 52 inches, (94 to 132 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) on all faces of peds and 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt1--52 to 70 inches, (132 to 177 cm);, clay, very dark grayish brown (10YR 3/2), moist; 42 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 20 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--70 to 90 inches, (177 to 228 cm);, clay loam, very dark grayish brown (10YR 3/2), moist; 35 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent medium distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/21/2006
 Descriptor: DeAnn Presley

Site ID: 06KS113006 Pedon ID: 06KS113006

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Mcpherson Quad Sheet Name: Canton, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: 4 miles north and 2 miles east of McPherson, KS
 Legal Description: NW 1/4 of Section 36, Township 18S, Range 2W

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 631054 meters, UTM Northing: 4256164 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 3.0 percent Aspect: 0 (deg)
 Elevation: 1572 feet, 479.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Hayland

Parent Material: loess over loess

Particle Size Control Section: 3.5 to 23.2 in. (9 to 59 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	28.3	0	72
Argillic horizon	3.5	39.0	9	99
Redox concentrations	3.5		9	
Secondary carbonates	28.3	51.6	72	131
Reduced matrix	39.0	51.6	99	131
Lithologic discontinuity	51.6		131	

Ap--0 to 4 inches, (0 to 9 cm); dark gray (10YR 4/1), silty clay loam, very dark brown (10YR 2/2), moist; 29 percent clay; weak fine subangular blocky structure; firm, moderately sticky, moderately plastic; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt1--4 to 17 inches, (9 to 43 cm);, silty clay, very dark brown (10YR 2/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; common fine roots throughout; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--17 to 28 inches, (43 to 72 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--28 to 39 inches, (72 to 99 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent medium distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

Bkg--39 to 52 inches, (99 to 131 cm);, silty clay loam, grayish brown (10YR 5/2), moist; 36 percent clay; weak coarse subangular blocky structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 25 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 21 percent carbonate, finely disseminated; slight effervescence, by HCl, 1 normal; gradual smooth boundary.

2Bt1--52 to 68 inches, (131 to 172 cm);, silty clay, dark brown (10YR 3/3), moist; 42 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on vertical faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct dark grayish brown (10YR 4/2), moist, iron depletions and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--68 to 99 inches, (172 to 252 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 44 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, clay films on vertical faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct dark grayish brown (10YR 4/2), moist, iron depletions; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Argiustolls

Description Date: 07/21/2006
 Descriptor: DeAnn Presley

Site ID: 06KS113007 Pedon ID: 06KS113007

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Mcpherson Quad Sheet Name: Canton, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: 4 miles north and 2 miles east of McPherson, KS
 Legal Description: NW 1/4 of Section 36, Township 18S, Range 2W

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 631202 meters, UTM Northing: 4256111 meters

Geomorphic Setting: on summit of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: 315 (deg)
 Elevation: 1572 feet, 479.0 meters
 Drainage class:

Primary Earth Cover: Grass/herbaceous cover
 Secondary Earth Cover: Hayland

Parent Material: loess over loess

Particle Size Control Section: 8.7 to 28.3 in. (22 to 72 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	16.1	0	41
Argillic horizon	8.7		22	
Redox concentrations	8.7		22	

Lithologic discontinuity	31.1		79	
Redox depletions with chroma 2 or less	31.1		79	
Secondary carbonates	31.1	65.0	79	165
Slickensides	31.1	65.0	79	165

Ap--0 to 9 inches, (0 to 22 cm); dark grayish brown (10YR 4/2), silty clay loam, very dark grayish brown (10YR 3/2), moist; 34 percent clay; weak medium subangular blocky structure; firm, moderately sticky, moderately plastic; common fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--9 to 16 inches, (22 to 41 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--16 to 31 inches, (41 to 79 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine roots between peds; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct iron-manganese nodules; 1 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btkss1--31 to 51 inches, (79 to 130 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent slickensides (pedogenic) on all faces of peds and 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 4 percent medium distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btkss2--51 to 65 inches, (130 to 165 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 50 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent slickensides (pedogenic) on all faces of peds and 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 2 percent medium distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt--65 to 96 inches, (165 to 244 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 44 percent clay; -- Error in Exists On -- structure; very firm, very sticky, very plastic; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 20 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 07/21/2006
 Descriptor: DeAnn Presley

Site ID: 06KS113008 Pedon ID: 06KS113008

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Mcpherson Quad Sheet Name: Canton, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: 4 miles north and 2 miles east of McPherson KS
 Legal Description: SW 1/4 of Section 36, Township 18S, Range 2W

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 630953 meters, UTM Northing: 4255291 meters

Geomorphic Setting: on summit of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 0.0 percent Aspect: 180 (deg)
 Elevation: 1555 feet, 474.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: loess over loess over colluvium

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	36.2	0	92
Argillic horizon	5.9	36.2	15	92
Redox concentrations	5.9		15	
Secondary carbonates	29.1	51.2	74	130
Reduced matrix	36.2	51.2	92	130

Lithologic discontinuity	51.2	68.5	130	174
Redox depletions with chroma 2 or less	51.2	68.5	130	174
Lithologic discontinuity	68.5		174	

Pedon Notes:

Ap--0 to 6 inches, (0 to 15 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 28 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--6 to 29 inches, (15 to 74 cm);, silty clay, very dark brown (10YR 2/2), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--29 to 36 inches, (74 to 92 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; 1 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bkg--36 to 51 inches, (92 to 130 cm);, silty clay loam, grayish brown (10YR 5/2), moist; 36 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent medium distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2Bt--51 to 69 inches, (130 to 174 cm);, silty clay loam, very dark grayish brown (2.5Y 3/2), moist; 38 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 20 percent discontinuous faint dusky red (2.5YR 3/2), moist, organoargillans on all faces of peds; 15 percent medium prominent dark grayish brown (10YR 4/2), moist, iron depletions and 25 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3BC--69 to 98 inches, (174 to 250 cm);, clay, light brownish gray (2.5Y 6/2), moist; 48 percent clay; weak coarse subangular blocky structure; very firm, very sticky, very plastic; 5 percent fine prominent black (N 2.5/), moist, iron-manganese masses and 5 percent fine prominent yellowish red (5YR 5/8), moist, masses of oxidized iron and 20 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/21/2006
Describer: DeAnn Presley

Site ID: 06KS113009 Pedon ID: 06KS113009

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Mcpherson Quad Sheet Name: Canton, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description: 4 miles north and 2 miles east of McPherson KS
Legal Description: SW 1/4 of Section 36, Township 18S, Range 2W

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 631144 meters, UTM Northing: 4255291 meters

Geomorphic Setting: None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 0.0 percent Aspect: 180 (deg)
Elevation: 1555 feet, 474.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Close-grown crop

Parent Material: loess over colluvium over colluvium over residuum
weathered from shale over residuum weathered from
calcareous shale

Bedrock Depth: 98.0 inches (249.0 cm)

Particle Size Control Section: 6.7 to 26.4 in. (17 to 67 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	54.3	0	138
Argillic horizon	6.7	62.2	17	158

Redox concentrations	6.7	98.0	17	249
Abrupt textural change	6.7	7.1	17	18
Redox depletions with chroma 2 or less	23.6	54.3	60	138
Secondary carbonates	23.6	54.3	60	138
Lithologic discontinuity	32.3	54.3	82	138
Slickensides	32.3	54.3	82	138
Lithologic discontinuity	54.3	62.2	138	158
Lithologic discontinuity	62.2	98.0	158	249
Lithologic discontinuity	98.0		249	
Paralithic contact	98.0		249	

Ap--0 to 7 inches, (0 to 17 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 28 percent clay; weak medium subangular blocky structure; firm, moderately sticky, moderately plastic; few fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--7 to 24 inches, (17 to 60 cm);, silty clay, very dark brown (10YR 2/2), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint (10YR 2/4), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--24 to 32 inches, (60 to 82 cm);, silty clay, dark brown (10YR 3/3), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btkss--32 to 54 inches, (82 to 138 cm);, clay, very dark grayish brown (10YR 3/2), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 5 percent slickensides (pedogenic) on all faces of peds and 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 10 percent medium distinct grayish brown (10YR 5/2), moist, iron depletions and 15 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt--54 to 62 inches, (138 to 158 cm);, silty clay loam, grayish brown (2.5Y 5/2), moist; 38 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few fine irregular pores; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

4BC1--62 to 76 inches, (158 to 193 cm);, clay loam, gray (2.5Y 5/1), moist; 35 percent clay; moderate coarse subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 10 percent fine distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 25 percent limestone fragments; noneffervescent, by HCl, 1 normal; clear smooth boundary.

4BC2--76 to 98 inches, (193 to 249 cm);, clay, light brownish gray (2.5Y 6/2), moist; 42

percent clay; weak coarse subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 10 percent fine prominent black (N 2.5/), moist, iron-manganese masses and 25 percent fine prominent yellowish red (5YR 5/8), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

5Cr--98 to 100 inches, (249 to 255 cm);, white (10YR 8/1), moist; ; very firm, very sticky, very plastic; few fine irregular pores; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladsmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/26/2006
 Descriptor: DeAnn Presley

Site ID: 06KS113010 Pedon ID: 06KS113010

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Mcpherson Quad Sheet Name: Galva, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: 4 miles north and 2 miles east of McPherson, KS
 Legal Description: SW 1/4 of Section 9, Township 19S, Range 2W

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 626205 meters, UTM Northing: 4252205 meters

Geomorphic Setting: on summit of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: 90 (deg)
 Elevation: 1552 feet, 473.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: loess over loess over colluvium

Particle Size Control Section: 7.1 to 26.8 in. (18 to 68 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	23.6	0	60
Argillic horizon	7.1	42.9	18	109
Redox concentrations	7.1		18	

Secondary carbonates	23.6	42.9	60	109
Lithologic discontinuity	42.9	79.5	109	202
Gypsum accumulations	51.6	79.5	131	202
Lithologic discontinuity	79.5		202	

Pedon Notes:

Ap--0 to 7 inches, (0 to 18 cm);, silty clay loam, very dark grayish brown (10YR 3/2), moist; 32 percent clay; weak medium subangular blocky structure; firm, moderately sticky, moderately plastic; few very fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--7 to 24 inches, (18 to 60 cm);, silty clay, very dark brown (10YR 2/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--24 to 43 inches, (60 to 109 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct carbonate nodules and 1 percent medium distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2BA--43 to 52 inches, (109 to 131 cm);, silty clay loam, dark brown (10YR 3/3), moist; 35 percent clay; weak fine subangular blocky structure; friable, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bty--52 to 80 inches, (131 to 202 cm);, silty clay, dark brown (10YR 3/3), moist; 42 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 10 percent medium distinct brown (10YR 5/3), moist, gypsum masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

3Bt--80 to 98 inches, (202 to 250 cm);, silty clay, reddish brown (5YR 4/3), moist; 46 percent clay; moderate medium prismatic parting to moderate fine angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 20 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine faint yellowish red (5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent 2 to 5 millimeter limestone fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 07/26/2006
 Descriptor: DeAnn Presley

Site ID: 06KS113011 Pedon ID: 06KS113011

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Mcpherson Quad Sheet Name: Galva, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description: 4 miles north and 2 miles east McPherson, KS
 Legal Description: SW 1/4 of Section 9, Township 19S, Range 2W

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 626439 meters, UTM Northing: 4252319 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: concave Cross Slope Shape: linear
 Slope: 2.0 percent Aspect: 90 (deg)
 Elevation: 1552 feet, 473.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: loess over loess over colluvium

Particle Size Control Section: 7.1 to 26.8 in. (18 to 68 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	23.6	0	60
Argillic horizon	7.1	35.8	18	91
Redox concentrations	7.1		18	
Secondary carbonates	23.6	35.8	60	91
Lithologic discontinuity	35.8	63.4	91	161

Gypsum accumulations	45.7	63.4	116	161
Lithologic discontinuity	63.4		161	

Pedon Notes:

Ap--0 to 7 inches, (0 to 18 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 30 percent clay; weak medium subangular blocky structure; firm, moderately sticky, moderately plastic; few very fine roots throughout; few fine dendritic tubular pores; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--7 to 24 inches, (18 to 60 cm);, silty clay, 25 percent very dark grayish brown (10YR 3/2) and 75 percent very dark brown (10YR 2/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Btk--24 to 36 inches, (60 to 91 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules and 2 percent medium distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2BA--36 to 46 inches, (91 to 116 cm);, silty clay loam, dark brown (10YR 3/3), moist; 35 percent clay; weak fine subangular blocky structure; friable, very sticky, very plastic; few very fine roots between peds; few fine irregular pores; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bty--46 to 63 inches, (116 to 161 cm);, silty clay, dark brown (10YR 3/3), moist; 42 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 5 percent patchy faint dark brown (10YR 3/3), moist, organoargillans on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 25 percent medium distinct threadlike gypsum masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

3Bt--63 to 77 inches, (161 to 195 cm);, silty clay, reddish brown (5YR 4/3), moist; 50 percent clay; moderate medium prismatic parting to moderate fine angular blocky structure; very firm, very sticky, very plastic; few fine irregular pores; 20 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 25 percent medium distinct yellowish red (5YR 4/6), moist, masses of oxidized iron; 1 percent 5 to 10 millimeter limestone fragments; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
Soil Name as Correlated:
Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 07/26/2006
Describer: DeAnn Presley

Site ID: 06KS079001 Pedon ID: 06KS079001

Site Note:

Pedon Type:
Pedon Purpose: research site
Taxon Kind:

Location Information:
County: Harvey Quad Sheet Name: Hesston, Kansas
State: Kansas
MLRA: 75 -- Central Loess Plains
Soil Survey Area:
Map Unit: --

Location Description:
Legal Description: S 1/2 SW 1/4 of Section 16, Township 22S, Range 1W

Latitude: degrees minutes seconds
Longitude: degrees minutes seconds

Datum: NAD83
UTM Zone: 14, UTM Easting: 636559 meters, UTM Northing: 4221507 meters

Geomorphic Setting: on backslope of None Assigned
Upslope Shape: linear Cross Slope Shape: linear
Slope: 0.5 percent Aspect: 180 (deg)
Elevation: 1473 feet, 449.0 meters
Drainage class:

Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over residuum
weathered from limestone
Bedrock Depth: 87.4 inches (222.0 cm)

Particle Size Control Section: 5.9 to 25.6 in. (15 to 65 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	34.6	0	88

Argillic horizon	5.9	87.4	15	222
Redox concentrations	5.9		15	
Secondary carbonates	15.0	34.6	38	88
Lithologic discontinuity	34.6	87.4	88	222
Lithologic discontinuity	87.4		222	
Paralithic contact	87.4		222	

Pedon Notes:

Ap--0 to 6 inches, (0 to 15 cm); dark grayish brown (10YR 4/2), silty clay loam, very dark grayish brown (10YR 3/2), moist; 38 percent clay; weak medium subangular blocky structure; friable; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--6 to 15 inches, (15 to 38 cm);, silty clay, very dark brown (10YR 2/2), moist; 45 percent clay; moderate medium prismatic structure; very firm; few very fine roots throughout; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--15 to 35 inches, (38 to 88 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 45 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 1 percent fine distinct pale brown (10YR 6/3), moist, carbonate masses; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt--35 to 66 inches, (88 to 167 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 45 percent clay; moderate medium prismatic structure; firm; few very fine roots between peds; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; 1 percent mixed rock fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Bt2--66 to 87 inches, (167 to 222 cm);, clay, brown (7.5YR 4/3), moist; 45 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; firm; 2 percent patchy faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 30 percent medium prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--87 to 108 inches, (222 to 275 cm);, very pale brown (10YR 8/2), moist; weak massive; 20 percent medium prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Typic Haplustalfs

Description Date: 07/26/2006
 Descriptor: DeAnn Presley

Site ID: 06KS079002 Pedon ID: 06KS079002

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Harvey Quad Sheet Name: Hesston, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: S 1/2 SW 1/4 of Section 16, Township 22S, Range 1W
 Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 636483 meters, UTM Northing: 4221664 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 0.5 percent Aspect: 180 (deg)
 Elevation: 1476 feet, 450.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Row crop

Parent Material: clayey loess

Particle Size Control Section: 6.3 to 26.0 in. (16 to 66 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	6.3	0	16
Argillic horizon	6.3	50.8	16	129
Redox concentrations	6.3		16	
Secondary carbonates	33.1	50.8	84	129

Pedon Notes:

A--0 to 6 inches, (0 to 16 cm); dark grayish brown (10YR 4/2), silty clay loam, very dark grayish brown (10YR 3/2), moist; 35 percent clay; weak fine subangular blocky structure; few fine roots throughout; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--6 to 19 inches, (16 to 49 cm);, silty clay, dark yellowish brown (10YR 3/4), moist; 45 percent clay; moderate medium prismatic structure; few fine roots between peds; 25 percent continuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--19 to 33 inches, (49 to 84 cm);, silty clay, dark brown (7.5YR 3/4), moist; 45 percent clay; moderate medium prismatic structure; few fine roots between peds; 25 percent continuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 2 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--33 to 51 inches, (84 to 129 cm);, silty clay, brown (7.5YR 4/4), moist; 45 percent clay; moderate medium prismatic structure; 25 percent continuous faint brown (10YR 4/3), moist, clay films on all faces of peds; 5 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses; 1 percent fine distinct pale brown (10YR 6/3), moist, carbonate nodules and 1 percent medium distinct pale brown (10YR 6/3), moist, carbonate nodules; noneffervescent, by HCl, 1 normal; clear smooth boundary.

BC--51 to 80 inches, (129 to 203 cm);, silty clay loam, brown (7.5YR 4/4), moist; 35 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; 2 percent fine faint dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese masses; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 07/26/2006
 Descriptor: DeAnn Presley

Site ID: 06KS079003 Pedon ID: 06KS079003

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Harvey Quad Sheet Name: Hesston, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: S 1/2 SW 1/4 of Section 16, Township 22S, Range 1W

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 636703 meters, UTM Northing: 4221670 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: 90 (deg)
 Elevation: 1470 feet, 448.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Row crop

Parent Material: clayey loess over colluvium over residuum
 weathered from limestone
 Bedrock Depth: 91.3 inches (232.0 cm)

Particle Size Control Section: 4.3 to 24.0 in. (11 to 61 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	25.2	0	64
Argillic horizon	4.3	91.3	11	232
Redox concentrations	4.3	91.3	11	232
Secondary carbonates	25.2	91.3	64	232
Lithologic discontinuity	36.2	91.3	92	232

Slickensides	61.8	91.3	157	232
Lithologic discontinuity	91.3		232	
Paralithic contact	91.3		232	

Ap--0 to 4 inches, (0 to 11 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 38 percent clay; weak medium subangular blocky structure; very firm, very sticky, very plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt--4 to 17 inches, (11 to 42 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--17 to 25 inches, (42 to 64 cm);, silty clay, dark brown (10YR 3/3), moist; 43 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Btk--25 to 36 inches, (64 to 92 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 1 percent fine distinct carbonate nodules; 1 percent 2 to 5 millimeter limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk2--36 to 62 inches, (92 to 157 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 50 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 5 percent patchy faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, iron depletions and 10 percent fine prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; 1 percent medium distinct carbonate nodules; 1 percent 2 to 5 millimeter limestone fragments; noneffervescent, by HCl, 1 normal; gradual smooth boundary.

2Btk3--62 to 91 inches, (157 to 232 cm);, silty clay, brown (10YR 4/3), moist; 48 percent clay; moderate medium subangular blocky structure; very firm, very sticky, very plastic; 2 percent patchy faint dark grayish brown (10YR 4/2), moist, clay films on all faces of peds; 5 percent fine distinct pale brown (10YR 6/3), moist, iron depletions and 10 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 25 percent medium prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; 1 percent medium distinct carbonate nodules; 1 percent 2 to 5 millimeter limestone fragments; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

3Cr--91 to 94 inches, (232 to 239 cm); white (10YR 8/1), white (10YR 8/1), moist; ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 08/09/2006
 Descriptor: DeAnn Presley

Site ID: 06KS079004 Pedon ID: 06KS079004

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:

County: Harvey Quad Sheet Name: Sedgwick Ne, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:

Legal Description: S 1/2 N E1/4 of Section 5, Township 24S, Range 1E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 645672 meters, UTM Northing: 4206354 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 2.0 percent Aspect: 225 (deg)
 Elevation: 1460 feet, 445.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over residuum
 weathered from limestone
 Bedrock Depth: 66.9 inches (170.0 cm)

Particle Size Control Section: 5.1 to 24.8 in. (13 to 63 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	25.2	0	64
Argillic horizon	5.1	49.2	13	125
Redox concentrations	5.1	66.9	13	170
Redox depletions with chroma 2 or less	16.5	49.2	42	125

Lithologic discontinuity	35.8	49.2	91	125
Secondary carbonates	35.8	49.2	91	125
Lithologic discontinuity	49.2		125	
Paralithic contact	66.9		170	

Ap--0 to 5 inches, (0 to 13 cm);, silty clay loam, black (10YR 2/1), moist; 34 percent clay; weak medium subangular blocky structure; friable, very sticky, very plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear boundary.

Bt--5 to 17 inches, (13 to 42 cm);, silty clay loam, black (10YR 2/1), moist; 39 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few very fine roots between peds; 5 percent patchy faint black (10YR 2/1), moist, organoargillans on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear boundary.

Bt2--17 to 25 inches, (42 to 64 cm);, silty clay loam, very dark grayish brown (10YR 3/2), moist; 39 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few very fine roots between peds; 20 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent medium distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine faint grayish brown (10YR 5/2), moist, iron depletions; noneffervescent, by HCl, 1 normal; clear boundary.

Bt3--25 to 36 inches, (64 to 91 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine faint grayish brown (10YR 5/2), moist, iron depletions and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent medium distinct black (N 2.5/), moist, iron-manganese nodules; 1 percent 2 to 5 millimeter limestone fragments; noneffervescent, by HCl, 1 normal; clear boundary.

2Btk--36 to 49 inches, (91 to 125 cm);, silty clay, dark grayish brown (10YR 4/2), moist; 46 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine faint grayish brown (10YR 5/2), moist, iron depletions and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent medium distinct black (N 2.5/), moist, iron-manganese nodules; 1 percent medium distinct carbonate nodules; 2 percent 2 to 5 millimeter limestone fragments; noneffervescent, by HCl, 1 normal; clear boundary.

3C--49 to 67 inches, (125 to 170 cm);, silty clay loam, olive gray (5Y 5/2), moist; 35 percent clay; structureless massive; friable, moderately sticky, moderately plastic; 5 percent fine distinct black (N 2.5/), moist, iron-manganese masses and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 50 percent 5 to 10 millimeter limestone fragments; strong effervescence, by HCl, 1 normal; abrupt boundary.

3Cr--67 to 87 inches, (170 to 220 cm);, 20 percent white (5Y 8/1) and 80 percent light olive gray (5Y 6/2), moist; ; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine-loamy, mixed, mesic Pachic Argiustolls

Description Date: 08/09/2006
 Descriptor: DeAnn Presley

Site ID: 06KS079005 Pedon ID: 06KS079005

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Harvey Quad Sheet Name: Sedgwick Ne, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: S1/2 NE 1/4 of Section 5, Township 24S, Range 1E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 645358 meters, UTM Northing: 4206386 meters
 Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 2.0 percent Aspect: 270 (deg)
 Elevation: 1453 feet, 443.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over alluvium

Particle Size Control Section: 5.1 to 24.8 in. (13 to 63 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	33.1	0	84
Argillic horizon	5.1	66.9	13	170
Redox concentrations	5.1		13	
Lithologic discontinuity	33.1		84	

Pedon Notes:

Ap--0 to 5 inches, (0 to 13 cm);, silty clay loam, black (10YR 2/1), moist; 29 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear boundary.

Bt--5 to 17 inches, (13 to 42 cm);, silty clay loam, very dark grayish brown (10YR 3/2), moist; 34 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few very fine roots throughout; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual boundary.

Bt2--17 to 33 inches, (42 to 84 cm);, clay loam, dark brown (10YR 3/3), moist; 34 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few very fine roots throughout; 10 percent patchy faint dark brown (10YR 3/3), moist, organoargillans on all faces of peds; 5 percent fine distinct dark brown (10YR 3/3), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear boundary.

2Bt3--33 to 55 inches, (84 to 140 cm);, sandy clay loam, brown (7.5YR 4/3), moist; 28 percent clay; moderate medium subangular blocky structure; firm, moderately sticky, moderately plastic; 10 percent faint dark brown (7.5YR 3/4), moist, clay bridges on all faces of peds; 10 percent fine distinct brown (10YR 5/3), moist, iron depletions and 15 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual boundary.

2Bt4--55 to 67 inches, (140 to 170 cm);, sandy clay loam, brown (7.5YR 4/4), moist; 28 percent clay; moderate medium subangular blocky structure; friable, moderately sticky, moderately plastic; 10 percent faint dark brown (7.5YR 3/4), moist, clay bridges on all faces of peds; 10 percent medium distinct brown (10YR 5/3), moist, iron depletions and 25 percent medium prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

2C--67 to 106 inches, (170 to 270 cm);, sandy clay loam, 25 percent brown (7.5YR 5/4) and 75 percent brown (7.5YR 4/4), moist; 26 percent clay; structureless single grain; loose, nonsticky, nonplastic; 20 percent medium prominent yellowish red (5YR 4/6), moist, masses of oxidized iron; 1 percent fine carbonate, finely disseminated; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 08/09/2006
 Descriptor: DeAnn Presley

Site ID: 06KS079006 Pedon ID: 06KS079006

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Harvey Quad Sheet Name: Sedgwick Ne, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: NW1/4 of Section 7, Township 24S, Range 1E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 643105 meters, UTM Northing: 4204629 meters

Geomorphic Setting: on summit of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 1.0 percent Aspect: 225 (deg)
 Elevation: 1453 feet, 443.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop
 Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 5.5 to 25.2 in. (14 to 64 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	48.0	0	122
Argillic horizon	5.5	86.2	14	219
Redox concentrations	5.5		14	
Lithologic discontinuity	23.2	66.5	59	169
Secondary carbonates	23.2	66.5	59	169

Redox depletions with chroma 2 or less	48.0		122	
Lithologic discontinuity	66.5		169	

Pedon Notes:

Ap--0 to 6 inches, (0 to 14 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 28 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear boundary.

Bt--6 to 23 inches, (14 to 59 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear boundary.

2Btk--23 to 48 inches, (59 to 122 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 25 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine faint black (N 2.5/), moist, iron-manganese nodules; 5 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual boundary.

2Btk2--48 to 67 inches, (122 to 169 cm);, clay, dark grayish brown (10YR 4/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent medium distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent medium faint grayish brown (10YR 5/2), moist, iron depletions and 10 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine faint carbonate nodules; noneffervescent, by HCl, 1 normal; gradual boundary.

3Bt--67 to 86 inches, (169 to 219 cm);, clay, brown (10YR 4/3), moist; 42 percent clay; moderate medium subangular blocky structure; very firm, very sticky, moderately plastic; few very fine roots between peds; 5 percent patchy faint dark grayish brown (10YR 4/2), moist, clay films on all faces of peds; 5 percent medium faint grayish brown (10YR 5/2), moist, iron depletions and 5 percent medium distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual boundary.

3BC--86 to 97 inches, (219 to 247 cm);, sandy clay, dark yellowish brown (10YR 4/4), moist; 36 percent clay; moderate medium subangular blocky structure; very firm, very sticky, moderately plastic; 5 percent medium faint grayish brown (10YR 5/2), moist, iron depletions and 5 percent medium distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent medium prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 08/09/2006
 Descriptor: DeAnn Presley

Site ID: 06KS079007 Pedon ID: 06KS079007

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Harvey Quad Sheet Name: Sedgwick Ne, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: NW1/4 of Section 7, Township 24S, Range 1E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 643333 meters, UTM Northing: 4204931 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: concave
 Slope: 3.0 percent Aspect: 225 (deg)
 Elevation: 1404 feet, 428.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 6.3 to 26.0 in. (16 to 66 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	69.3	0	176
Argillic horizon	6.3		16	
Redox concentrations	6.3		16	

Lithologic discontinuity	20.9	69.3	53	176
Lithologic discontinuity	69.3		176	
Redox depletions with chroma 2 or less	69.3		176	

Pedon Notes:

Ap--0 to 6 inches, (0 to 16 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 28 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear boundary.

Bt--6 to 21 inches, (16 to 53 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 5 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

2Bt2--21 to 37 inches, (53 to 93 cm);, silty clay, very dark brown (10YR 2/2), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual boundary.

2Bt3--37 to 69 inches, (93 to 176 cm);, clay, dark brown (10YR 3/3), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 25 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual boundary.

3Bt4--69 to 97 inches, (176 to 247 cm);, sandy clay, 40 percent brown (10YR 4/3) and 80 percent dark yellowish brown (10YR 4/4), moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, moderately plastic; 5 percent patchy faint brown (10YR 4/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron and 10 percent fine distinct grayish brown (10YR 5/2), moist, iron depletions; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 08/09/2006
 Descriptor: DeAnn Presley

Site ID: 06KS079008 Pedon ID: 06KS079008

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Harvey Quad Sheet Name: Sedgwick Ne, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: NW1/4 of Section 7, Township 24S, Range 1E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 643601 meters, UTM Northing: 4205195 meters

Geomorphic Setting: on backslope of None Assigned
 Upslope Shape: linear Cross Slope Shape: linear
 Slope: 2.0 percent Aspect: 225 (deg)
 Elevation: 1427 feet, 435.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over colluvium

Particle Size Control Section: 10.6 to 30.3 in. (27 to 77 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	47.6	0	121
Argillic horizon	10.6		27	
Redox concentrations	10.6		27	

Lithologic discontinuity	16.5	47.6	42	121
Lithologic discontinuity	47.6		121	
Redox depletions with chroma 2 or less	58.7		149	

Pedon Notes:

Ap--0 to 11 inches, (0 to 27 cm);, silty clay loam, very dark grayish brown (10YR 3/2), moist; 28 percent clay; weak medium subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear boundary.

Bt--11 to 17 inches, (27 to 42 cm);, silty clay loam, dark brown (10YR 3/3), moist; 35 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few very fine roots between peds; 1 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 1 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

2Bt2--17 to 29 inches, (42 to 74 cm);, silty clay, dark brown (7.5YR 3/3), moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual boundary.

2Bt3--29 to 48 inches, (74 to 121 cm);, clay, dark brown (7.5YR 3/2), moist; 50 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual boundary.

3Bt4--48 to 59 inches, (121 to 149 cm);, clay, dark brown (7.5YR 3/4), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual boundary.

3Bt5--59 to 113 inches, (149 to 286 cm);, sandy clay, reddish brown (5YR 4/3), moist; 36 percent clay; moderate medium prismatic structure; very firm, moderately sticky, moderately plastic; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark brown (7.5YR 3/2), moist, iron depletions; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 08/12/2006
 Descriptor: DeAnn Presley

Site ID: 06KS079009 Pedon ID: 06KS079009

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Harvey Quad Sheet Name: Elbing, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SE1/4 of SE1/4 of Section 25, Township 23S, Range 2E
 Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 662002 meters, UTM Northing: 4209942 meters

Geomorphic Setting: on summit of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 0.5 percent Aspect: 203 (deg)
 Elevation: 1407 feet, 429.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over residuum weathered from
 calcareous shale

Particle Size Control Section: 12.6 to 32.3 in. (32 to 82 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	38.2	0	97
Argillic horizon	12.6	44.9	32	114
Redox concentrations	12.6		32	

Lithologic discontinuity	44.9		114	
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Pedon Notes:

Ap--0 to 4 inches, (0 to 9 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 28 percent clay; weak fine subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Ap2--4 to 13 inches, (9 to 32 cm);, silty clay loam, black (10YR 2/1), moist; 34 percent clay; moderate medium prismatic structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

Bt--13 to 38 inches, (32 to 97 cm);, silty clay, very dark brown (10YR 2/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear smooth boundary.

Bt2--38 to 45 inches, (97 to 114 cm);, silty clay, 40 percent very dark grayish brown (10YR 3/2) and 60 percent dark grayish brown (10YR 4/2), moist; 11 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 5 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; abrupt smooth boundary.

2C--45 to 54 inches, (114 to 136 cm);, silty clay loam, reddish brown (2.5YR 5/3), moist; 32 percent clay; structureless massive; friable, moderately sticky, moderately plastic; 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; slight effervescence, by HCl, 1 normal; abrupt smooth boundary.

2C2--54 to 77 inches, (136 to 196 cm);, silty clay loam, light olive brown (2.5Y 5/3), moist; 34 percent clay; structureless massive; friable, moderately sticky, moderately plastic; 10 percent fine distinct strong brown (7.5YR 4/6), moist, masses of oxidized iron; strong effervescence, by HCl, 1 normal; clear smooth boundary.

2C3--76 to 94 inches, (192 to 240 cm);, silty clay loam, light yellowish brown (2.5Y 6/3), moist; 34 percent clay; structureless massive; friable, moderately sticky, moderately plastic; 10 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; strong effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, mesic Typic Paleustolls

Description Date: 08/12/2006
 Descriptor: DeAnn Presley

Site ID: 06KS079010 Pedon ID: 06KS079010

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Harvey Quad Sheet Name: Elbing, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SW1/4 of Section 25, Township 23S, Range 2E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 660889 meters, UTM Northing: 4209098 meters

Geomorphic Setting: on shoulder of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 2.0 percent Aspect: 90 (deg)
 Elevation: 1384 feet, 422.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium over residuum
 weathered from calcareous shale
 Bedrock Depth: 98.4 inches (250.0 cm)

Particle Size Control Section: 10.6 to 30.3 in. (27 to 77 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	10.6	0	27
Argillic horizon	10.6	81.5	27	207

Redox concentrations	10.6	98.4	27	250
Secondary carbonates	15.7	55.5	40	141
Lithologic discontinuity	43.3	98.4	110	250
Redox depletions with chroma 2 or less	55.5	98.4	141	250
Lithologic discontinuity	98.4		250	
Paralithic contact	98.4		250	

Pedon Notes:

Ap--0 to 3 inches, (0 to 7 cm);, silt loam, very dark brown (10YR 2/2), moist; 24 percent clay; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear boundary.

At2--3 to 11 inches, (7 to 27 cm);, silty clay loam, 40 percent black (10YR 2/1) and 60 percent dark brown (10YR 3/3), moist; 38 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few very fine roots between peds; noneffervescent, by HCl, 1 normal; clear boundary.

Bt--11 to 16 inches, (27 to 40 cm);, silty clay, brown (10YR 4/3), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual boundary.

Btk--16 to 43 inches, (40 to 110 cm);, silty clay, brown (7.5YR 4/3), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint dark brown (10YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; 10 percent medium distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual boundary.

2Btk2--43 to 56 inches, (110 to 141 cm);, silty clay, brown (7.5YR 4/4), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 10 percent discontinuous faint dark brown (7.5YR 3/3), moist, clay films on all faces of peds; 5 percent medium distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; gradual boundary.

2Bt--56 to 81 inches, (141 to 207 cm);, silty clay loam, brown (7.5YR 4/4), moist; 39 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 5 percent patchy faint dark reddish brown (5YR 3/3), moist, clay films on all faces of peds; 5 percent medium distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct brown (7.5YR 5/2), moist, iron depletions and 20 percent fine faint strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual boundary.

2BC--81 to 98 inches, (207 to 250 cm);, silty clay, brown (7.5YR 4/3), moist; 45 percent clay; weak medium prismatic structure; very firm, very sticky, very plastic; 5 percent patchy faint dark reddish brown (5YR 3/3), moist, clay films on all faces of peds; 5 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 10 percent fine distinct brown (7.5YR 5/2), moist, iron depletions and 10 percent fine faint (7.5YR 4/),

moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

3Cr--98 to 100 inches, (250 to 254 cm);, silty clay, brown (7.5YR 5/3), moist; 45 percent clay; structureless massive; very firm, very sticky, very plastic; 5 percent limestone fragments; slight effervescence, by HCl, 1 normal.

Soil Name as Described/Sampled: Ladysmith
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Argiustolls

Description Date: 08/12/2006
 Descriptor: DeAnn Presley

Site ID: 06KS079011 Pedon ID: 06KS079011

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Harvey Quad Sheet Name: Elbing, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SE1/4 of Section 13, Township 23S, Range 2E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 662002 meters, UTM Northing: 4212750 meters

Geomorphic Setting: on summit of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 0.0 percent Aspect: 338 (deg)
 Elevation: 1444 feet, 440.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium

Particle Size Control Section: 13.0 to 32.7 in. (33 to 83 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0	38.2	0	97
Redox concentrations	5.1		13	
Argillic horizon	13.0	47.2	33	120
Secondary carbonates	38.2	47.2	97	120
Reduced matrix	47.2	64.6	120	164
Redox depletions with chroma 2 or less	47.2	74.8	120	190

Lithologic discontinuity	64.6		164	
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Ap--0 to 5 inches, (0 to 13 cm);, silty clay loam, black (10YR 2/1), moist; 29 percent clay; weak fine subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear boundary.

A--5 to 13 inches, (13 to 33 cm);, silty clay loam, black (10YR 2/1), moist; 28 percent clay; moderate medium prismatic structure; friable, moderately sticky, moderately plastic; few very fine roots between peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of reduced iron; noneffervescent, by HCl, 1 normal; clear boundary.

Bt--13 to 30 inches, (33 to 76 cm);, silty clay, black (10YR 2/1), moist; 40 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 20 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; gradual boundary.

Bt2--30 to 38 inches, (76 to 97 cm);, silty clay, very dark gray (10YR 3/1), moist; 42 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 20 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear boundary.

Btk--38 to 47 inches, (97 to 120 cm);, silty clay, dark gray (10YR 4/1), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 10 percent discontinuous faint very dark gray (10YR 3/1), moist, clay films on all faces of peds; 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron; 2 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear boundary.

Bg--47 to 65 inches, (120 to 164 cm);, silty clay loam, gray (10YR 6/1), moist; 32 percent clay; moderate fine subangular blocky structure; friable, moderately sticky, moderately plastic; 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; slight effervescence, by HCl, 1 normal; gradual boundary.

2Bt--65 to 75 inches, (164 to 190 cm);, silty clay loam, dark grayish brown (10YR 4/2), moist; 38 percent clay; moderate medium subangular blocky structure; firm, very sticky, very plastic; 20 percent discontinuous faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 2 percent fine faint grayish brown (10YR 5/2), moist, iron depletions and 2 percent fine distinct dark yellowish brown (10YR 4/6), moist, masses of oxidized iron and 2 percent fine distinct black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; gradual boundary.

2Bt2--75 to 101 inches, (190 to 256 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 45 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 5 percent patchy faint very dark grayish brown (10YR 3/2), moist, clay films on all faces of peds; 5 percent fine faint iron depletions and 20 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal.

Soil Name as Described/Sampled: Irwin
 Soil Name as Correlated:
 Classification: Fine, smectitic, mesic Pachic Paleustolls

Description Date: 08/12/2006
 Descriptor: DeAnn Presley

Site ID: 06KS079012 Pedon ID: 06KS079012

Site Note:

Pedon Type:
 Pedon Purpose: research site
 Taxon Kind:

Location Information:
 County: Harvey Quad Sheet Name: Elbing, Kansas
 State: Kansas
 MLRA: 75 -- Central Loess Plains
 Soil Survey Area:
 Map Unit: --

Location Description:
 Legal Description: SW1/4 of SE1/4 of Section 13, Township 23S, Range 2E

Latitude: degrees minutes seconds
 Longitude: degrees minutes seconds

Datum: NAD83
 UTM Zone: 14, UTM Easting: 661267 meters, UTM Northing: 4212401 meters

Geomorphic Setting: on shoulder of None Assigned
 Upslope Shape: Cross Slope Shape:
 Slope: 0.5 percent Aspect: 225 (deg)
 Elevation: 1424 feet, 434.0 meters
 Drainage class:

Primary Earth Cover: Crop cover
 Secondary Earth Cover: Close-grown crop

Parent Material: clayey loess over colluvium

Particle Size Control Section: 18.9 to 38.6 in. (48 to 98 cm)

Diagnostic Features:

Kind	Top Depth (in)	Bottom Depth (in)	Top Depth (cm)	Bottom Depth (cm)
Mollic epipedon	0.0		0	
Argillic horizon	18.9		48	
Redox concentrations	18.9		48	

Slickensides	37.0	66.9	94	170
Secondary carbonates	50.0	78.0	127	198
Lithologic discontinuity	78.0		198	

Ap--0 to 6 inches, (0 to 16 cm);, silt loam, very dark grayish brown (10YR 3/2), moist; 20 percent clay; weak fine granular structure; friable, slightly sticky, slightly plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear boundary.

A--6 to 19 inches, (16 to 48 cm);, silt loam, very dark grayish brown (10YR 3/2), moist; 26 percent clay; weak fine subangular blocky structure; friable, moderately sticky, moderately plastic; few very fine roots throughout; noneffervescent, by HCl, 1 normal; clear boundary.

Bt--19 to 25 inches, (48 to 63 cm);, silty clay loam, very dark brown (10YR 2/2), moist; 36 percent clay; moderate medium prismatic structure; firm, very sticky, very plastic; few very fine roots between peds; 20 percent discontinuous faint very dark brown (10YR 2/2), moist, organoargillans on all faces of peds; 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules and 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal; clear boundary.

Bt2--25 to 37 inches, (63 to 94 cm);, silty clay, black (10YR 2/1), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 25 percent discontinuous faint black (10YR 2/1), moist, organoargillans on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear boundary.

Btss--37 to 50 inches, (94 to 127 cm);, silty clay, very dark gray (10YR 3/1), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; few very fine roots between peds; 5 percent slickensides (pedogenic) and 25 percent continuous faint very dark gray (10YR 3/1), moist, clay films on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules; noneffervescent, by HCl, 1 normal; clear boundary.

Btkss--50 to 67 inches, (127 to 170 cm);, silty clay, very dark gray (10YR 3/1), moist; 48 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 5 percent slickensides (pedogenic) and 25 percent continuous faint very dark gray (10YR 3/1), moist, clay films on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules; 1 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear boundary.

Btk--67 to 78 inches, (170 to 198 cm);, silty clay, very dark gray (10YR 3/1), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 25 percent continuous faint very dark gray (10YR 3/1), moist, clay films on all faces of peds; 2 percent fine distinct dark yellowish brown (10YR 4/4), moist, masses of oxidized iron and 2 percent fine faint black (N 2.5/), moist, iron-manganese nodules; 1 percent fine distinct carbonate nodules; noneffervescent, by HCl, 1 normal; clear boundary.

2Bt--78 to 100 inches, (198 to 254 cm);, silty clay, very dark grayish brown (10YR 3/2), moist; 44 percent clay; moderate medium prismatic structure; very firm, very sticky, very plastic; 5 percent patchy faint very dark brown (10YR 2/2), moist, clay films on all faces of peds; 5 percent fine prominent strong brown (7.5YR 4/6), moist, masses of oxidized iron; noneffervescent, by HCl, 1 normal.

Appendix B - Laboratory Characterization Data

Table B.1. Particle size analysis results for all characterized pedons.

#	Sample Pedon ID	Depth	Horizon	TS (mm)					CC (um)	FC (um)	TC (um)	Textural Class	
				†	CSI (um)	MSI (um)	FSI (um)	TSI (um)					
908	05KS161005	0-22	Ap	3.2	33.1	24.0	4.6	61.7	11.6	23.5	35.1	sicl	
909		22-41	Bt1	2.0	29.4	19.9	5.5	54.8	14.3	28.9	43.2	sic	
910		41-80	Bt2	2.3	31.5	21.2	4.8	57.5	14.6	25.6	40.2	sic	
911		80-116	Btk	3.6	33.4	22.6	5.3	61.3	14.0	21.1	35.1	sicl	
912		116-175	2Bt3	3.8	32.3	21.4	5.1	58.8	13.7	23.7	37.4	sicl	
913		175-207	2Bt4	4.5	34.3	17.2	5.0	56.5	12.8	26.1	38.9	sicl	
914		207-234	3Bt5	4.6	35.0	17.6	4.4	57.0	13.8	24.6	38.4	sicl	
915		234-246	3Bt6	3.5	26.8	25.4	8.0	60.2	16.8	19.5	36.3	sicl	
916		246-255	4Cr										
944	05KS161010	0-25	Ap	2.9	38.4	12.9	4.7	56.0	17.3	23.8	41.1	sic	
945		25-48	Bt1	2.6	34.9	14.7	5.3	54.9	15.1	27.4	42.5	sic	
946		48-76	Bt2	2.7	37.5	15.8	5.4	58.7	15.5	23.1	38.6	sicl	
947		76-114	Btk	4.4	40.6	14.6	4.8	60.0	13.6	22.0	35.6	sicl	
948		114-140	2Bt3	5.0	41.4	11.2	4.0	56.6	12.3	26.1	38.4	sicl	
949		140-177	2Bt3	6.1	42.8	9.3	3.9	56.0	12.1	25.8	37.9	sicl	
950		177-216	3Bt4	5.7	42.1	9.3	4.1	55.5	12.4	26.4	38.8	sicl	
951		216-242	3Bt5	3.0	33.2	18.2	7.7	59.1	19.7	18.2	37.9	sicl	
952		242-245	4Cr										
969	05KS127001	0-10	Ap	2.5	32.3	20.6	5.0	57.9	14.5	25.1	39.6	sicl	
970		10--29	BA	1.8	27.5	20.5	5.9	53.9	15.1	29.2	44.3	sic	
971		29-48	Bt1	1.9	28.4	21.6	5.8	55.8	15.6	26.7	42.3	sicl	
972		48-89	Btk	2.9	31.5	21.8	5.9	59.2	14.7	23.2	37.9	sicl	
973		89-122	Bt2	2.4	31.7	23.7	5.3	60.7	13.7	23.2	36.9	sicl	
974		122-156	2Bt3	2.5	28.5	22.8	6.4	57.7	15.9	23.9	39.8	sicl	
975		156-215	2Bt4	2.6	26.8	24.0	7.3	58.1	12.9	26.4	39.3	sicl	
976		215-230	3Cr										
1018		05KS127008	0-12	Ap	3.9	30.8	24.2	5.0	60.0	9.3	26.8	36.1	sicl
1019	12--40		Bt1	1.8	25.1	21.0	6.4	52.5	15.9	29.8	45.7	sic	
1020	40-64		Bt2	1.4	25.7	23.1	7.6	56.4	18.1	24.1	42.2	sic	

#	Sample Pedon ID	Depth	Horizon	TS (mm)	CSI (um)	MSI (um)	FSI (um)	TSI (um)	CC (um)	FC (um)	TC (um)	Textural Class
				†								
				2.00-0.05	50.0-20.0	20.0-5.0	5.0-2.0	50.0-2.0	2.0-0.2	<0.2	<2.0	
1021		64-99	Btk	4.7	35.1	16.8	5.4	57.3	14.3	23.7	38.0	sicl
1022		99-132	2Bty1	3.1	29.8	23.8	7.1	60.7	16.7	19.5	36.2	sicl
1023		132-161	2Bty2	3.8	32.2	17.2	2.7	52.1	14.1	30.0	44.1	sic
1024		161-198	3Btl	3.0	26.8	12.0	3.8	42.6	14.8	39.6	54.4	sic
1025		198-228	3Bt2	3.5	26.7	12.0	3.2	41.9	16.7	37.9	54.6	sic
1026		228-260	3Bt3	1.4	19.9	10.0	2.8	32.7	17.1	48.8	65.9	c
1078	05KS127017	0-14	Ap	3.9	31.8	21.1	4.6	57.5	9.8	28.8	38.6	sicl
1079		14-39	Bt1	2.7	27.8	20.3	6.4	54.5	14.6	28.2	42.8	sic
1080		39-60	Bt2	2.6	27.2	21.7	6.6	55.5	15.8	26.1	41.9	sic
1081		60-92	Btk	4.7	26.1	22.9	6.8	55.8	15.6	23.9	39.5	sicl
1082		92-124	2Bt2	4.9	25.5	19.5	6.2	51.2	14.8	29.1	43.9	sic
1083		124-164	"	4.6	24.7	19.2	4.3	48.2	16.1	31.1	47.2	sic
1084		164-199	"	4.8	23.1	16.5	6.7	46.3	17.3	31.6	48.9	sic
1085		199-225	2Bt2	5.4	22.1	15.8	6.5	44.4	19.4	30.8	50.2	sic
1086		225-252	"	5.6	21.6	15.9	6.5	44.0	22.5	27.9	50.4	sic
1143	05KS127025	0-5	Ap	2.9	35.6	17.8	4.9	58.3	15.3	23.5	38.8	sicl
1144		5--39	Bt1	1.7	26.6	18.5	5.2	50.3	16.5	31.5	48.0	sic
1145		39-55	Bt2	1.7	26.7	19.6	5.3	51.6	17.3	29.4	46.7	sic
1146		55-91	2Btk	2.8	27.3	22.1	5.1	54.5	17.8	24.9	42.7	sic
1147		91-124	3Bt1	2.3	30.5	19.8	5.0	55.3	16.4	26.0	42.4	sic
1148		124-166	3Bt2	2.5	28.4	14.9	3.7	47.0	17.0	33.5	50.5	sic
1149		166-191	3Bt3	2.1	27.2	15.1	5.7	48.0	19.0	30.9	49.9	sic
1150		191-220	3BC	1.9	25.0	21.0	7.5	53.5	15.0	29.6	44.6	sic
1151		220-297	4C									
1311	05KS017003	0-7	A	5.5	39.3	21.8	7.2	68.3	13.0	13.2	26.2	sil
1312		7--26	BA	4.7	33.7	20.3	6.9	60.9	12.7	21.7	34.4	sicl
1313		26--41	Bt1	3.6	29.9	19.7	4.9	55.2	13.0	28.9	41.9	sicl
1314		41-55	Bt2	4.8	30.3	19.4	6.0	55.7	11.4	28.1	39.5	sicl
1315		55-77	Bt3	5.3	33.4	18.7	6.3	58.4	10.7	25.6	36.3	sicl
1316		77-100	Bt4	5.7	32.2	18.5	4.2	54.9	11.1	28.3	39.4	sicl
1317		100-130	2Btg1	3.5	25.5	10.9	3.0	39.4	10.0	47.1	57.1	c

#	Sample Pedon ID	Depth	Horizon	TS (mm)		MSI (um)	FSI (um)	TSI (um)	CC (um)	FC (um)	TC (um)	Textural Class
				†	CSI (um)							
1318		130-165	"	4.6	29.1	14.1	2.2	45.4	10.0	40.0	50.0	c
1319		165-200	2Btg2	6.4	29.4	17.2	3.4	50.0	10.3	33.3	43.6	c
1320		200-206	2Btg3	7.8	30.7	17.8	3.8	52.3	9.9	30.0	39.9	sicl
1369	06KS017002	0-14	A1	3.5	40.9	25.0	5.2	71.1	9.7	15.7	25.4	sil
1370		14-22	A2	3.1	30.0	21.3	7.4	58.7	13.4	24.8	38.2	sicl
1371		22-40	Bt1	1.7	23.5	19.5	6.4	49.4	15.5	33.4	48.9	sic
1372		40-55	Bt1	1.2	25.8	20.3	7.2	53.3	16.1	29.4	45.5	sic
1373		55-71	Bt2	1.5	25.0	20.9	7.5	53.4	15.1	30.0	45.1	sic
1374		71-89	Bt3	2.4	26.6	22.4	7.7	56.7	15.5	25.4	40.9	sic
1375		89-116	Btk1	3.4	26.9	21.4	8.4	56.7	16.6	23.3	39.9	sicl
1376		116-143	2Btk2	4.2	23.6	20.7	8.3	52.6	17.1	26.1	43.2	sic
1377		143-169	3Bt	4.5	18.1	14.3	5.1	37.5	16.3	41.7	58.0	c
1378		169-180	4BC	2.1	13.6	21.4	9.8	44.8	21.5	31.6	53.1	sic
1379		180-200	4Cr									
1419	06KS017006	0-20	A	3.0	41.4	25.8	6.4	73.6	10.2	13.2	23.4	sil
1420		20-33	Bt1	3.1	24.6	21.8	7.3	53.7	14.5	28.7	43.2	sic
1421		33-52	Bt2	2.8	25.3	20.1	6.7	52.1	17.0	28.1	45.1	sic
1422		52-69	Bt3	2.7	25.7	21.1	6.2	53.0	17.1	27.2	44.3	sic
1423		69-90	Btky	3.8	27.3	20.9	5.8	54.0	15.7	26.5	42.2	sic
1424		90-108	Btky	3.5	25.5	19.4	5.3	50.2	15.7	30.6	46.3	sic
1425		108-130	2Bt	3.4	23.4	18.2	4.6	46.2	16.3	34.1	50.4	sic
1426		130-148	2Bt	2.6	24.9	17.7	4.4	47.0	17.7	32.7	50.4	sic
1427		148-167	3CB	0.9	21.8	30.9	6.0	58.7	18.1	22.3	40.4	sic
1428		167-189	3C	0.3	17.8	28.9	10.9	57.6	23.2	18.9	42.1	sic
1429		189-207	4Cr									
1464	06KS017011	0-7	A	2.8	39.1	22.8	5.3	67.2	10.0	20.0	30.0	sicl
1465		7--14	BA	2.3	36.0	17.9	5.0	58.9	10.3	28.5	38.8	sicl
1466		14-35	Bt1	1.8	28.1	19.6	5.5	53.2	14.5	30.5	45.0	sic
1467		35-51	Bt2	2.2	9.5	19.1	5.9	54.5	14.6	28.7	43.3	sic
1468		51-73	Btk	3.3	27.3	20.1	5.9	53.3	14.2	29.2	43.4	sic
1469		73-83	Bt1'	2.8	25.1	20.1	6.5	51.7	14.2	31.3	45.5	sic

#	Sample Pedon ID	Depth	Horizon	TS (mm)		MSI (um)	FSI (um)	TSI (um)	CC (um)	FC (um)	TC (um)	Textural Class
				†	CSI (um)							
1470		83-99	2Bt2	2.2	25.5	18.9	5.8	50.2	15.6	32.0	47.6	sic
1471		99-138	3Bt3	2.0	25.3	18.2	5.9	49.4	13.6	35.0	48.6	sic
ns		138-143	4Cr									
1525		0-13	A	6.4	36.7	23.3	5.0	65.0	8.6	20.0	28.6	sicl
1526	06KS015006	13-31	Bt1	3.2	30.8	18.5	5.1	54.4	13.2	29.2	42.4	sic
1527		31-53	Bt2	3.6	30.2	19.3	4.6	54.1	13.8	28.5	42.3	sic
1528		53-77	2Btkss1	4.8	31.7	18.0	3.8	53.5	12.2	29.5	41.7	sic
1529		77-97	2Btkss2	4.8	31.1	18.2	4.1	53.4	10.2	31.6	41.8	sic
1530		97-130	2Bty	4.9	33.9	14.9	3.8	52.6	11.2	31.3	42.5	sic
1531	06KS015007	0-6	A	5.4	38.1	27.5	5.2	70.8	9.3	14.5	23.8	sicl
1532		6-17	BA	3.4	30.6	21.0	6.6	58.2	14.5	23.9	38.4	sicl
1533		17-31	Bt1	3.5	27.5	20.3	5.6	53.4	14.2	28.9	43.2	sic
1534		31-49	Bt2	3.5	29.2	19.4	6.7	55.3	13.0	28.2	41.2	sic
1535		49-61	Bt3	2.8	26.0	23.3	5.8	55.1	13.5	28.6	42.1	sic
1536		61-80	Btk1	4.0	27.7	21.7	5.3	54.7	12.9	28.4	41.3	sic
1537		80-96	2Btk2	6.0	29.5	18.0	4.3	51.8	11.8	30.4	42.2	sic
1538		96-119	3Bty	4.3	29.1	16.4	4.2	49.7	11.0	35.0	46.0	sic
1539		119-141	4Btyss	4.3	29.1	16.2	3.9	49.2	9.8	36.7	46.5	sic
1540		141-160	4Btyss	4.1	32.2	14.7	3.0	49.9	11.3	34.7	46.0	sic
1541		160-177	4Btyss	4.2	32.7	14.8	3.0	50.5	11.3	34.0	45.3	sic
1566	06KS015010	0-8	A	4.6	33.9	28.1	4.5	66.5	9.4	19.5	28.9	sicl
1567		8-21	BA	2.4	30.7	19.5	5.7	55.9	12.6	29.1	41.7	sic
1568		21-57	Bt1	1.8	29.0	21.0	8.4	58.4	13.4	26.4	39.8	sicl
1569		57-72	Bt2	4.9	35.8	16.9	4.7	57.4	10.7	27.0	37.7	sicl
1570		72-83	Bt3	4.2	35.8	15.1	4.0	54.9	9.9	31.0	40.9	sic
1571		83-113	2Bt4	4.2	33.8	14.0	3.1	50.9	8.7	36.2	44.9	sic
1572		113-158	3Btss1	3.2	31.5	14.0	4.4	49.9	8.6	38.3	46.9	sic
1574		158-190	3Btss2	3.1	31.7	16.9	3.8	52.4	10.2	34.3	44.6	sic
1575		190-217	3Btss2	3.0	31.7	18.0	4.0	53.7	12.8	30.5	43.3	sic
1576		217-251	3Btss3	3.0	28.7	18.8	5.0	52.5	14.7	29.8	44.5	sic
1692	06KS115003	0-14	A	6.0	37.2	19.7	5.0	61.9	13.9	18.2	32.1	sicl

#	Sample Pedon ID	Depth	Horizon	TS (mm)		CSI (um)	MSI (um)	FSI (um)	TSI (um)	CC (um)	FC (um)	TC (um)	Textural Class
				†									
1693		14-32	Bt1	2.8	28.4	16.6	5.5	50.5	15.0	31.7	46.7	sic	
1694		32-48	Bt1	2.7	29.4	17.9	5.8	53.1	14.7	29.5	44.2	sic	
1695		48-65	Bt2	2.4	26.5	22.0	7.0	55.5	15.6	26.5	42.1	sic	
1696		65-98	Btk	3.6	21.5	21.2	7.1	49.8	17.2	29.4	46.6	sic	
1697		98-116	Btk	2.5	18.0	22.0	7.2	47.2	18.2	32.1	50.3	sic	
1698		116-145	2Btss	1.9	14.6	26.2	7.2	48.0	22.3	27.8	50.1	sic	
1699		145-187	3C1	0.7	12.9	32.9	15.0	60.8	26.5	13.0	38.5	sicl	
1700		187-222	4C2	2.6	16.6	45.3	12.3	74.2	16.8	6.4	23.2	sil	
1701		222-240	4Cr										
1708	06KS115005	0-14	Ap	11.1	40.4	15.7	4.0	60.1	9.3	19.5	28.8	sicl	
1709		14-35	Bt1	5.8	18.9	27.2	4.4	50.5	17.5	26.2	43.7	sic	
1710		35-50	Bt1	6.0	18.1	28.5	5.8	52.4	14.2	27.4	41.6	sic	
1711		50-68	Bt2	16.6	17.9	23.5	5.7	47.1	13.5	22.8	36.3	sicl	
1712		68-81	2Bt3	21.6	31.5	7.7	3.8	43.0	13.7	21.7	35.4	l	
1713		81-111	2Btk1	23.7	23.5	11.7	4.1	39.3	11.4	25.6	37.0	l	
1714		111-150	2Btk2	22.0	24.1	12.8	2.5	39.4	11.9	26.7	38.6	l	
1715		150-187	3Bt1	19.2	28.0	11.1	5.0	44.1	11.5	25.2	36.7	sicl	
1716		187-212	3Bt2	12.5	33.2	13.2	4.6	51.0	12.9	23.6	36.5	sicl	
1730	06KS115007	0-10	Ap1	4.5	40.4	20.3	5.4	66.1	14.3	15.1	29.4	sicl	
1731		10-20	Ap2	4.4	33.2	20.4	6.6	60.2	13.6	21.8	35.4	sicl	
1732		20-41	Bt1	3.0	28.8	19.9	6.8	55.5	13.2	28.3	41.5	sic	
1733		41-61	Bt1	3.4	28.2	21.8	5.5	55.5	13.5	27.6	41.1	sic	
1734		61-93	2Btk	4.2	34.1	15.3	2.8	52.2	14.2	29.4	43.6	sic	
1735		93-113	2Btk	4.5	29.5	15.7	4.1	49.3	11.2	35.0	46.2	sic	
1736		113-136	3Btss1	4.1	31.4	15.8	3.8	51.0	11.1	33.8	44.9	sic	
1737		136-155	3Btss1	4.3	30.7	16.4	4.5	51.6	12.2	31.9	44.1	sic	
1738		155-173	3Btss2	3.4	30.8	17.8	5.1	53.7	12.2	30.7	42.9	sic	
1739		173-194	3Btss2	4.3	26.4	20.2	5.4	52.0	14.7	29.0	43.7	sic	
1740		197-215	3Btss2	3.1	24.8	21.2	5.0	51.0	17.2	28.7	45.9	sic	
1741		215-226	4C1	1.0	3.7	14.9	26.0	44.6	15.6	38.7	54.3	sic	
1742		226-237	4C2	13.0	13.0	9.6	8.0	30.6	16.8	39.6	56.4	c	

#	Sample Pedon ID	Depth	Horizon	TS (mm)		MSI (um) 20.0-5.0	FSI (um) 5.0-2.0	TSI (um) 50.0-2.0	CC (um) 2.0-0.2	FC (um) <0.2	TC (um) <2.0	Textural Class
				†	CSI (um) 50.0-20.0							
1743		237-242	5Cr									
1766	06KS115010	0-12	Ap	17.1	33.6	12.0	5.5	51.1	10.2	21.6	31.8	sicl
1767		12-36	A	14.5	20.4	22.9	6.2	49.5	15.6	20.4	36.0	sicl
1768		36-68	Bt1	13.9	15.1	30.5	5.3	50.9	12.9	22.3	35.2	sicl
1769		68-86	Bt1	13.5	31.2	16.9	5.4	53.5	10.5	22.5	33.0	sicl
1770		86-115	2Bt2	12.6	27.8	14.7	4.9	47.4	10.1	29.9	40.0	sic
1771		115-154	3Bt3	14.6	30.3	13.6	5.1	49.0	10.7	25.7	36.4	sicl
1772		154-199	3Btk	15.6	29.2	13.4	4.6	47.2	8.9	28.3	37.2	sicl
1773		199-236	3Btk	20.7	27.7	13.6	3.3	44.6	9.3	25.4	34.7	l
1774		236-294	3BC	29.6	22.2	12.1	3.6	37.9	10.0	22.5	32.5	l
1775		294-305	4C	1.2	19.3	30.1	12.1	61.5	22.3	15.0	37.3	sicl
1776		305-305	5Cr									
1822	06KS161001	0-13	A	5.0	44.3	17.7	3.1	65.1	11.0	18.9	29.9	sicl
1823		13-20	BA	4.2	41.7	15.4	3.9	61.0	10.6	24.2	34.8	sicl
1824		20-36	Bt	3.0	32.8	17.8	5.9	56.5	14.6	25.9	40.5	sic
1825		36-53	Btss1	3.0	32.2	18.7	5.6	56.5	14.9	25.6	40.5	sic
1826		53-66	Btss2	3.3	32.3	20.3	4.6	57.2	14.1	25.4	39.5	sicl
1827		66-79	2Btkss	3.3	34.1	20.1	5.2	59.4	13.6	24.2	37.3	sicl
1828		79-104	2Bt1	5.0	34.8	18.0	5.1	57.9	13.8	23.3	37.1	sicl
1829		104-132	3Bt2	6.6	33.8	15.9	5.0	54.7	13.5	25.2	38.7	sicl
1830		132-178	3Bt3	7.9	34.6	11.0	5.1	50.7	12.1	29.3	41.4	sic
ns		178-185	4Cr									
1838		0-14	Ap	2.6	30.2	21.9	6.3	58.4	14.7	24.3	39.0	sicl
1839		14-37	Bt1	2.4	28.7	20.5	5.6	54.8	13.7	29.1	42.8	sic
1840		37-69	Bt2	2.4	23.8	23.1	6.9	53.8	14.3	29.5	43.8	sic
1841		69-141	Btk1	7.4	29.4	21.1	4.4	54.9	12.3	25.4	37.7	sicl
1842		141-167	2Btk2	10.5	28.8	18.6	3.7	51.1	12.1	26.3	38.4	sicl
1843		167-204	3Btk3	10.7	28.4	17.2	4.0	49.6	14.3	25.4	39.7	sicl
1844		204-245	3Btk4	11.1	25.6	14.5	7.2	47.3	18.0	23.6	41.6	sic
1872	06KS113007	0-22	Ap	9.9	27.8	18.0	5.0	50.8	10.3	29.0	39.3	sicl
1873		22-41	Bt	5.4	29.0	20.1	5.2	54.3	16.8	23.5	40.3	sic

#	Sample Pedon ID	Depth	Horizon	TS (mm)		MSI (um)	FSI (um)	TSI (um)	CC (um)	FC (um)	TC (um)	Textural Class
				†	CSI (um)							
1874		41-79	Btk1	8.5	24.2	24.3	6.6	55.1	15.4	21.0	36.4	sicl
1875		79-130	2Btkss1	25.8	21.1	6.4	7.8	35.3	11.6	27.3	38.9	cl
1876		130-165	2Btkss2	20.0	18.6	6.9	5.1	30.6	15.0	34.4	49.4	sic
1877		165-244	2Bt	20.6	18.7	5.8	6.2	30.7	16.4	32.3	48.7	c
1878	06KS113008	0-15	Ap	25.7	30.1	14.1	4.0	48.2	10.2	15.9	26.1	cl
1879		15-50	Bt	16.1	24.5	13.9	4.6	43.0	12.4	28.5	40.9	sic
1880		50-74	Bt	6.5	25.7	16.4	4.1	46.2	13.3	34.0	47.3	sic
1881		74-92	Btk	6.4	24.7	18.2	5.4	48.3	16.3	29.0	45.3	sic
1882		92-130	Bkg	2.6	30.4	26.0	5.0	61.4	19.4	16.6	36.0	sicl
1883		130-174	2Bt	18.4	24.0	9.5	4.6	38.1	19.4	24.1	43.5	sic
1884		174-210	3BC	32.3	16.0	5.4	4.2	25.6	18.2	23.9	42.1	c
1885		204-250	3BC	41.1	17.8	5.1	1.7	24.6	16.1	18.2	34.3	cl
1895	06KS113010	0-18	Ap	5.6	36.9	20.8	1.5	59.2	15.3	19.9	35.2	sicl
1896a		18-39	Bt	3.9	26.9	18.5	5.5	50.9	15.7	29.5	45.2	sic
1896b		39-60	Bt	3.4	24.5	24.0	5.7	54.2	15.5	26.9	42.4	sic
1897		60-109	Btk	3.3	30.1	22.3	6.4	58.8	17.4	20.5	37.9	sicl
1898		109-131	2BA	7.0	32.8	21.5	6.3	60.6	15.1	17.3	32.4	sicl
1899		131-202	2Bty	10.8	35.0	16.1	4.6	55.7	11.2	22.3	33.5	sicl
1900		202-250	3Bt	9.7	35.2	13.6	4.0	52.8	11.8	25.7	37.5	sicl
1907	06KS127001	0-13	A	2.0	35.5	20.2	4.6	60.3	9.3	28.4	37.7	sicl
1908		13-26	Bt1	1.7	31.9	17.8	5.2	54.9	16.0	27.4	43.4	sic
1909		26-42	Bt2	1.3	27.8	17.9	6.0	51.7	16.8	30.0	46.8	sic
1910		42-51	Bt3	1.3	27.8	18.5	7.0	53.3	15.7	29.7	45.4	sic
1911		51-75	Btk	2.1	28.3	21.3	6.7	56.3	14.7	26.9	41.6	sic
1912		75-87	2Bt	2.1	28.0	19.4	5.4	52.8	14.8	30.3	45.1	sic
1925	06KS079003	0-11	Ap	4.3	27.8	19.8	5.5	53.1	15.4	27.2	42.6	sic
1926		11-29	Bt1	3.6	26.5	19.8	6.6	52.9	14.4	29.1	43.5	sic
1927		29-42	Bt1	4.0	24.7	24.1	5.9	54.7	13.2	28.1	41.3	sic
1928		42-64	Bt2	6.0	23.4	27.0	5.9	56.3	11.7	26.0	37.7	sicl
1929		64-92	Btk1	9.5	22.0	27.7	4.2	53.9	10.5	26.1	36.6	sicl
1930		92-130	2Btk2	9.2	23.0	25.0	3.0	51.0	12.4	27.4	39.8	sicl

#	Sample Pedon ID	Depth	Horizon	TS (mm)		CSI (um)	MSI (um)	FSI (um)	TSI (um)	CC (um)	FC (um)	TC (um)	Textural Class
				†									
1931		130-157	2Btk2	2.00-0.05	50.0-20.0	20.0-5.0	5.0-2.0	50.0-2.0	2.0-0.2	<0.2	<2.0		sic
1932		157-197	2Btk3	9.7	30.2	14.6	4.2	49.0	12.5	28.8	41.3		sic
1933		197-232	2Btk3	11.0	29.5	14.9	4.6	49.0	12.6	27.4	40.0		sic
1934		232-239	3Cr	17.5	29.4	13.3	3.9	46.6	12.0	23.9	35.9		sicl
1935	06KS079004	0-13	Ap	8.1	30.6	21.5	5.4	57.5	14.7	19.7	34.4		sicl
1936		13-42	Bt1	6.4	25.5	21.9	6.7	54.1	15.3	24.2	39.5		sicl
1937		42-64	Bt2	10.0	25.8	16.2	4.4	46.4	14.0	29.6	43.6		sic
1938		64-91	Bt3	11.8	22.8	16.5	4.0	43.3	14.9	30.0	44.9		sic
1939		91-125	2Btk	13.2	22.4	14.5	4.7	41.6	16.4	28.8	45.2		sic
1940		125-170	3C	32.3	16.7	8.8	3.5	29.0	17.7	21.0	38.7		cl
1993	06KS015022	0-17	Ap	12.2	37.3	24.8	4.0	66.1	11.4	10.3	21.7		sil
1994		17-31	A	7.1	36.8	20.3	5.9	63.0	13.4	16.5	29.9		sicl
1995		31-56	Bt	4.9	26.7	20.0	5.5	52.2	13.0	30.0	43.0		sic
1996		56-74	Bt	5.4	27.5	19.6	6.0	53.1	13.0	28.5	41.5		sic
1997		74-108	Btk	7.4	26.4	16.4	5.0	47.8	14.6	30.2	44.8		sic
1998		108-143	2Bt1	6.0	27.1	14.2	5.2	46.5	13.7	33.8	47.5		sic
1999		143-168	2Bt1	5.6	27.0	14.4	4.4	45.8	13.6	35.0	48.6		sic
2000		168-208	3Bt2	3.5	21.3	14.2	8.0	43.5	20.1	32.9	53.0		sic
2001		208-258	3BC	7.7	14.8	20.6	10.5	45.9	26.8	19.6	46.4		sic
2011	06KS079012	0-16	Ap	33.1	24.1	12.4	3.4	39.9	10.7	16.3	27.0		l/cl
2012		16-48	A	25.7	27.6	15.1	2.6	45.3	12.6	16.4	29.0		cl
2013		48-63	Bt1	9.7	37.0	20.8	5.1	62.9	12.3	15.1	27.4		sil/sicl
2014		63-94	Bt2	4.6	28.2	23.4	5.1	56.7	12.3	26.4	38.7		sicl
2015		64-127	Btss	2.9	28.0	23.4	5.0	56.4	14.9	25.8	40.7		sic
2016		127-170	Btkss	4.8	31.8	21.5	5.1	58.4	16.2	20.6	36.8		sicl
2017		170-198	Btkss	7.5	27.0	19.7	4.4	51.1	17.4	24.0	41.4		sic
2018		198-252	2Bt	9.2	25.8	16.4	3.9	46.1	23.7	21.0	44.7		sic

† TS = total sand, and size range is in millimeters. CSI = coarse silt, MSI = medium silt, FSI = fine silt, and TSI = total silt, CC = coarse clay, FC = fine clay, and TC = total clay. All silt and clay size ranges are in micrometers.

Table B.2. Other physical properties for all characterized samples.

Sample	Pedon ID	Depth	Horizon	FC:TC†	O.D.B.D g cm ⁻³ ‡	O.D.B.D g cm ⁻³	Mean p.s. um§	Median p.s. um¶	
908	05KS161005	0-22	Ap	0.67			17.4	12.1	
909		22-41	Bt1	0.67			16.3	13.4	
910		41-80	Bt2	0.64			17.0	13.6	
911		80-116	Btk	0.60			24.8	13.3	
912		116-175	2Bt3	0.63			17.8	13.1	
913		175-207	2Bt4	0.67			18.1	12.7	
914		207-234	3Bt5	0.64			18.5	13.2	
915		234-246	3Bt6	0.54			19.2	14.7	
916		246-255	4Cr						
944		05KS161010	0-25	Ap	0.58			18.9	12.7
945			25-48	Bt1	0.64	1.48		18.1	13.6
946			48-76	Bt2	0.60	1.52		18.0	14.0
947			76-114	Btk	0.62	1.36		23.0	13.1
948			114-140	2Bt3 up	0.68	1.42		22.3	11.8
949			140-177	2Bt3 low	0.68			23.6	10.7
950			177-216	3Bt4	0.68	1.29		23.0	10.9
951	216-242		3Bt5	0.48			20.2	15.4	
952	242-245		4Cr						
969	05KS127001		0-10	Ap	0.63			17.6	13.5
970		10--29	BA	0.66			16.5	13.8	
971		29-48	Bt1	0.63			15.7	14.1	
972		48-89	Btk	0.61	1.6		25.3	13.6	
973		89-122	Bt2	0.63	2.02		16.4	13.1	
974		122-156	2Bt3	0.60			15.3	14.2	
975		156-215	2Bt4	0.67	1.69		15.0	12.7	
976		215-230	3Cr						
1018	05KS127008	0-12	Ap	0.74			19.3	10.9	
1019		12--40	Bt1	0.65	1.84		16.2	14.2	

Sample	Pedon ID	Depth	Horizon	FC:TC†	O.D.B.D g cm ⁻³ ‡	O.D.B.D g cm ⁻³	Mean p.s. um§	Median p.s. um¶
1020		40-64	Bt2	0.57	1.63		14.6	15.3
1021		64-99	Btk	0.62	1.58		23.7	13.4
1022		99-132	2Bty1	0.54	1.99	1.81	26.2	14.6
1023		132-161	2Bty2	0.68	1.46		19.2	13.3
1024		161-198	3Btl	0.73	1.34	1.54	14.7	12.3
1025		198-228	3Bt2	0.69			15.2	12.3
1026		228-260	3Bt3	0.74	1.38	1.66	10.0	11.3
1078	05KS127017	0-14	Ap	0.75			18.0	11.2
1079		14-39	Bt1	0.66			17.1	13.6
1080		39-60	Bt2	0.62	1.53		16.3	14.2
1081		60-92	Btk	0.61	1.48		32.8	14.1
1082		92-124	2Bt2	0.66	1.87		18.4	13.7
1083		124-164	"	0.66	1.8	1.46	17.6	14.3
1084		164-199	"	0.65			17.0	14.5
1085		199-225	2Bt2	0.61			18.6	14.2
1086		225-252	"	0.55			18.9	14.2
1143	05KS127025	0-5	Ap	0.61			18.9	13.9
1144		5--39	Bt1	0.66	1.37	1.37	14.5	14.5
1145		39-55	Bt2	0.63			16.0	14.9
1146		55-91	2Btk	0.58	1.61		25.8	15.2
1147		91-124	3Bt1	0.61	1.46		16.5	14.5
1148		124-166	3Bt2	0.66	1.45	1.51	15.2	13.7
1149		166-191	3Bt3	0.62	1.6		13.6	13.8
1150		191-220	3BC	0.66	1.29		15.2	13.8
1151		220-297	4C					
1311	05KS017003	0-7	A	0.50			31.0	12.8
1312		7--26	BA	0.63			25.0	12.6
1313		26--41	Bt1	0.69			23.8	12.8
1314		41-55	Bt2	0.71			24.8	12.0
1315		55-77	Bt3	0.71			26.5	11.6
1316		77-100	Bt4	0.72			31.2	11.8
1317		100-130	2Btg1	0.82			21.2	10.5

Sample	Pedon ID	Depth	Horizon	FC:TC†	O.D.B.D g cm ⁻³ ‡	O.D.B.D g cm ⁻³	Mean p.s. um§	Median p.s. um¶
1318		130-165	"	0.80			24.0	11.3
1319		165-200	2Btg2	0.76			29.0	11.4
1320		200-206	2Btg3	0.75			45.0	11.2
1369	06KS017002	0-14	A1	0.62			28.3	11.1
1370		14-22	A2	0.65			25.1	13.0
1371		22-40	Bt1	0.68			16.1	14.0
1372		40-55	Bt1	0.65			15.9	14.3
1373		55-71	Bt2	0.67			16.6	13.8
1374		71-89	Bt3	0.62			23.8	14.0
1375		89-116	Btk1	0.58			32.5	14.6
1376		116-143	2Btk2	0.60			26.9	14.8
1377		143-169	3Bt	0.72			41.9	13.4
1378		169-180	4BC	0.60			23.2	13.1
1379		180-200	4Cr					
1419	06KS017006	0-20	A	0.56	1.32		26.5	11.4
1420		20-33	Bt1	0.66	1.52		22.8	13.5
1421		33-52	Bt2	0.62	1.55		18.8	14.8
1422		52-69	Bt3	0.61	1.59		20.3	14.8
1423		69-90	Btky	0.63			27.0	14.1
1424		90-108	Btky	0.66	1.47		20.6	14.1
1425		108-130	2Bt	0.68			23.6	14.4
1426		130-148	2Bt	0.65	1.42		19.1	15.1
1427		148-167	3CB	0.55	1.48		13.1	15.3
1428		167-189	3C	0.45	1.41		10.8	15.2
1429		189-207	4Cr					
1464	06KS017011	0-7	A	0.67			22.1	11.3
1465		7--14	BA	0.73	1.27		18.6	11.4
1466		14-35	Bt1	0.68	1.48		16.3	13.5
1467		35-51	Bt2	0.66			13.2	11.0
1468		51-73	Btk	0.67	1.49		36.6	13.4
1469		73-83	Bt1'	0.69	1.49		26.3	13.4
1470		83-99	2Bt2	0.67			19.8	14.1

Sample	Pedon ID	Depth	Horizon	FC:TC†	O.D.B.D g cm ⁻³ ‡	O.D.B.D g cm ⁻³	Mean p.s. um§	Median p.s. um¶
1471		99-138	3Bt3	0.72	1.46	1.31	17.8	13.1
ns		138-143	4Cr					
1525		0-13	A	0.70	0.97		25.4	10.6
1526	06KS015006	13-31	Bt1	0.69	1.37		19.6	12.9
1527		31-53	Bt2	0.67			22.0	13.2
1528		53-77	2Btkss1	0.71	1.33		26.6	12.4
1529		77-97	2Btkss2	0.76	1.54		27.5	11.4
1530		97-130	2Bty	0.74			20.7	11.9
1531	06KS015007	0-6	A	0.61	1.14		25.4	10.9
1532		6-17	BA	0.62			21.2	13.5
1533		17-31	Bt1	0.67	1.28		19.4	13.4
1534		31-49	Bt2	0.68			18.8	12.8
1535		49-61	Bt3	0.68			17.1	13.0
1536		61-80	Btk1	0.69			21.7	12.7
1537		80-96	2Btk2	0.72	1.41		41.3	12.2
1538		96-119	3Bty	0.76	1.5		22.3	11.8
1539		119-141	4Btyss	0.79			19.4	11.2
1540		141-160	4Btyss	0.75	1.54		19.1	11.9
1541		160-177	4Btyss	0.75			19.7	11.9
1566	06KS015010	0-8	A	0.67	0.87		22.2	11.0
1567		8-21	BA	0.70			18.4	12.6
1568		21-57	Bt1	0.66	1.17	1.34	15.8	13.0
1569		57-72	Bt2	0.72	1.3		23.0	11.6
1570		72-83	Bt3	0.76	1.3		20.9	11.2
1571		83-113	2Bt4	0.81			19.6	10.6
1572		113-158	3Btss1	0.82			18.0	10.6
1574		158-190	3Btss2	0.77	1.46		18.3	11.4
1575		190-217	3Btss2	0.70			18.4	12.7
1576		217-251	3Btss3	0.67			16.1	13.6
1692	06KS115003	0-14	A	0.57	1.12		26.7	13.2
1693		14-32	Bt1	0.68	1.21		17.2	13.8
1694		32-48	Bt1	0.67			19.7	13.6

Sample	Pedon ID	Depth	Horizon	FC:TC†	O.D.B.D g cm ⁻³ ‡	O.D.B.D g cm ⁻³	Mean p.s. um§	Median p.s. um¶
1695		48-65	Bt2	0.63		1.46	18.0	14.1
1696		65-98	Btk	0.63		1.33	28.4	14.9
1697		98-116	Btk	0.64			16.9	15.3
1698		116-145	2Btss	0.55		1.13	15.5	13.6
1699		145-187	3C1	0.34		1.16	11.2	13.0
1700		187-222	4C2	0.28		1.5	23.1	12.4
1701		222-240	4Cr					
1708	06KS115005	0-14	Ap	0.68		1.42	55.1	10.9
1709		14-35	Bt1	0.60		1.14	29.5	15.0
1710		35-50	Bt1	0.66			32.7	13.4
1711		50-68	Bt2	0.63		1.55	77.8	13.0
1712		68-81	2Bt3	0.61		1.54	106.4	10.1
1713		81-111	2Btk1	0.69		1.44	123.5	11.6
1714		111-150	2Btk2	0.69			108.6	12.2
1715		150-187	3Bt1	0.69			89.1	11.3
1716		187-212	3Bt2	0.65			51.1	12.7
1730	06KS115007	0-10	Ap1	0.51		1.2	23.1	13.4
1731		10-20	Ap2	0.62			21.0	13.1
1732		20-41	Bt1	0.68		1.32	16.9	12.9
1733		41-61	Bt1	0.67			17.2	13.0
1734		61-93	2Btk	0.67		1.58	22.4	13.4
1735		93-113	2Btk	0.76		1.46	23.5	11.9
1736		113-136	3Btss1	0.75		1.54	21.1	11.8
1737		136-155	3Btss1	0.72			17.9	12.4
1738		155-173	3Btss2	0.72			17.1	12.4
1739		173-194	3Btss2	0.66		1.55	21.9	13.6
1740		197-215	3Btss2	0.63			17.8	14.9
1741		215-226	4C1	0.71		1.21	4.3	26.0
1742		226-237	4C2	0.70			75.5	11.1
1743		237-242	5Cr					
1766	06KS115010	0-12	Ap	0.68		0.74	74.4	11.1
1767		12-36	A	0.57		1.55	59.6	14.1

Sample	Pedon ID	Depth	Horizon	FC:TC†	O.D.B.D g cm ⁻³ ‡	O.D.B.D g cm ⁻³	Mean p.s. um§	Median p.s. um¶
1768		36-68	Bt1	0.63	1.34		62.8	12.7
1769		68-86	Bt1	0.68			71.2	11.5
1770		86-115	2Bt2	0.75	1.63		77.4	11.3
1771		115-154	3Bt3	0.71			84.7	11.6
1772		154-199	3Btk	0.76	1.56		105.1	10.7
1773		199-236	3Btk	0.73			146.8	10.9
1774		236-294	3BC	0.69	1.35		188.5	11.7
1775		294-305	4C	0.40			14.9	13.8
1776		305-305	5Cr					
1822	06KS161001	0-13	A	0.63			28.9	11.8
1823		13-20	BA	0.70			20.4	11.6
1824		20-36	Bt	0.64			16.9	13.6
1825		36-53	Btss1	0.63			16.8	13.7
1826		53-66	Btss2	0.64			17.2	13.3
1827		66-79	2Btkss	0.65			17.8	13.1
1828		79-104	2Bt1	0.63			19.1	13.2
1829		104-132	3Bt2	0.65			20.4	13.0
1830		132-178	3Bt3	0.71			24.6	11.6
ns		178-185	4Cr					
1838		0-14	Ap		1.02		16.8	13.6
1839		14-37	Bt1	0.68	1.34		15.8	13.1
1840		37-69	Bt2	0.67	1.92		14.6	13.4
1841		69-141	Btk1	0.67	1.56		36.1	12.4
1842		141-167	2Btk2	0.68			35.2	12.3
1843		167-204	3Btk3	0.64	1.33		35.9	13.4
1844		204-245	3Btk4	0.57			40.1	13.5
1872	06KS113007	0-22	Ap	0.74	0.76		29.5	11.4
1873		22-41	Bt	0.58	1.48		22.4	14.7
1874		41-79	Btk1	0.58	1.39		36.6	14.0
1875		79-130	2Btkss1	0.70	1.4		63.1	11.2
1876		130-165	2Btkss2	0.70	1.42		39.5	11.6
1877		165-244	2Bt	0.66	1.46		36.2	12.5

Sample	Pedon ID	Depth	Horizon	FC:TC†	O.D.B.D g cm ⁻³ ‡	O.D.B.D g cm ⁻³	Mean p.s. um§	Median p.s. um¶	
1878	06KS113008	0-15	Ap		1.22		87.2	11.4	
1879		15-50	Bt		1.23		58.1	12.5	
1880		50-74	Bt				27.7	12.9	
1881		74-92	Btk				28.4	14.4	
1882		92-130	Bkg				19.9	14.6	
1883		130-174	2Bt		1.41		49.1	11.0	
1884		174-210	3BC		1.3		94.9	12.0	
1885		204-250	3BC		1.68		105.6	15.1	
1895		06KS113010	0-18	Ap		1.13		22.3	13.9
1896a	18-39		Bt		1.62		16.9	14.1	
1896b	39-60		Bt				17.6	14.0	
1897	60-109		Btk		1.71	1.53	20.6	15.0	
1898	109-131		2BA				24.6	13.8	
1899	131-202		2Bty		1.26		30.9	11.9	
1900	202-250		3Bt		1.39		30.0	12.2	
1907	06KS127001		0-13	A	0.75			17.3	10.9
1908			13-26	Bt1	0.63			16.3	14.3
1909		26-42	Bt2	0.64			13.8	14.7	
1910		42-51	Bt3	0.65			14.6	14.1	
1911		51-75	Btk	0.65			21.0	13.6	
1912		75-87	2Bt	0.67			19.2	13.7	
1925	06KS079003	0-11	Ap	0.64	1.49		20.2	14.0	
1926		11-29	Bt1	0.67			20.3	13.5	
1927		29-42	Bt1	0.68	1.41		20.6	12.9	
1928		42-64	Bt2	0.69	1.63		25.6	12.1	
1929		64-92	Btk1	0.71	1.56		33.3	11.5	
1930		92-130	2Btk2	0.69	1.52		33.6	12.5	
1931		130-157	2Btk2	0.70			36.8	12.5	
1932		157-197	2Btk3	0.69	1.51		38.2	12.6	
1933		197-232	2Btk3	0.67			70.1	12.3	
1934		232-239	3Cr						
1935		06KS079004	0-13	Ap		1.3		37.3	13.6

Sample	Pedon ID	Depth	Horizon	FC:TC†	O.D.B.D g cm ⁻³ ‡	O.D.B.D g cm ⁻³	Mean p.s. um§	Median p.s. um¶
1936		13-42	Bt1		1.23		30.2	13.9
1937		42-64	Bt2				54.3	13.3
1938		64-91	Bt3		1.4	1.43	55.7	13.7
1939		91-125	2Btk		1.68		80.2	13.5
1940		125-170	3C		1.27		158.7	11.6
1993	06KS015022	0-17	Ap		1.53		38.8	10.9
1994		17-31	A				29.7	13.0
1995		31-56	Bt		1.52		23.4	12.8
1996		56-74	Bt		1.55		24.3	12.8
1997		74-108	Btk				38.1	13.6
1998		108-143	2Bt1		1.4		27.5	13.1
1999		143-168	2Bt1				24.3	13.1
2000		168-208	3Bt2		1.33		18.5	13.4
2001		208-258	3BC		1.51		27.1	13.7
2011	06KS079012	0-16	Ap		1.08		128.1	12.4
2012		16-48	A		1.35		75.4	12.6
2013		48-63	Bt1				37.9	12.4
2014		63-94	Bt2		1.44		23.7	12.4
2015		64-127	Btss				18.8	13.7
2016		127-170	Btkss				23.2	14.4
2017		170-198	Btkss				31.5	15.0
2018		198-252	2Bt				34.1	14.5

† FC: TC = fine clay to total clay ratio.

‡ O.D. B.D. = oven dry bulk density.

§ Mean p.s. = mean particle size diameter.

¶ Median p.s. = median particle size diameter.

Table B.3. pH, Total Nitrogen, and Total Carbon for all characterized samples.

Sample	Pedon ID	Depth	Horizon	0.01M CaCl ₂		Total N %	Total C %	
				H ₂ O (1:1)	(2:1)			
908	05KS161005	0-22	Ap	6.15		0.298	3.51	
909		22-41	Bt1	6.44		0.102	0.96	
910		41-80	Bt2	6.20		0.077	0.66	
911		80-116	Btk	7.22		0.063	0.51	
912		116-175	2Bt3	7.26		0.065	0.57	
913		175-207	2Bt4	7.24		0.054	0.47	
914		207-234	3Bt5	7.64		0.037	0.23	
915		234-246	3Bt6	7.64		0.038	0.46	
916		246-255	4Cr	nd		nd	nd	
944		05KS161010	0-25	Ap	5.52		0.150	1.48
945			25-48	Bt1	6.37		0.092	0.82
946			48-76	Bt2	6.96		0.067	0.53
947			76-114	Btk	7.04		0.064	0.52
948			114-140	2Bt3 up	6.81		0.072	0.63
949			140-177	2Bt3 low	6.62		0.053	0.45
950			177-216	3Bt4	7.46		0.038	0.26
951	216-242		3Bt5	7.80		0.035	0.13	
952	242-245		4Cr	nd		nd	nd	
969	05KS127001		0-10	Ap	6.84	5.84	0.146	1.49
970		10--29	BA	7.24	6.54	0.111	1.00	
971		29-48	Bt1	7.68	7.21	0.079	0.69	
972		48-89	Btk	7.97	7.50	0.051	0.51	
973		89-122	Bt2	7.94	7.18	0.050	0.34	
974		122-156	2Bt3	7.44	6.82	0.053	0.39	
975		156-215	2Bt4	8.24	7.28	0.044	0.29	
976		215-230	3Cr	nd	nd	nd		
1018	05KS127008	0-12	Ap	nd	nd	0.142	1.80	

Sample	Pedon ID	Depth	Horizon	0.01M CaCl ₂		Total N %	Total C %
				H ₂ O (1:1)	(2:1)		
1019		12--40	Bt1	6.5	6.1	0.095	1.04
1020		40-64	Bt2	7.0	6.7	0.071	0.74
1021		64-99	Btk	6.5	6.4	0.029	0.16
1022		99-132	2Bty1	7.2	7.0	0.040	0.34
1023		132-161	2Bty2	6.8	6.5	0.032	0.23
1024		161-198	3Btl	7.2	6.8	0.034	0.26
1025		198-228	3Bt2	7.6	7.1	0.022	0.15
1026		228-260	3Bt3	7.6	7.3	0.027	0.40
1078	05KS127017	0-14	Ap	nd	nd	0.280	2.95
1079		14-39	Bt1	7.2	6.6	0.140	1.06
1080		39-60	Bt2	7.5	6.9	0.082	0.80
1081		60-92	Btk	7.7	7.4	0.061	0.84
1082		92-124	2Bt2	7.8	7.4	0.068	0.78
1083		124-164	"	7.4	7.1	0.069	0.81
1084		164-199	"	7.6	7.1	0.072	0.87
1085		199-225	2Bt2	7.7	7.1	0.060	0.76
1086		225-252	"	7.6	7.0	0.061	0.76
1143	05KS127025	0-5	Ap	nd	nd	0.138	1.42
1144		5--39	Bt1	6.9	6.6	0.106	1.03
1145		39-55	Bt2	6.9	6.6	0.086	0.80
1146		55-91	2Btk	8.0	7.4	0.056	0.59
1147		91-124	3Bt1	7.2	7.0	0.062	0.49
1148		124-166	3Bt2	8.0	7.3	0.052	0.40
1149		166-191	3Bt3	8.1	7.3	0.041	0.26
1150		191-220	3BC	7.7	7.3	0.034	0.25
1151		220-297	4C				
1311	05KS017003	0-7	A	5.9	5.1	0.18	2.50
1312		7--26	BA	ns	4.9	0.12	1.61
1313		26--41	Bt1	5.7	4.9	0.09	1.10
1314		41-55	Bt2	5.7	5.3	0.06	0.77
1315		55-77	Bt3	6.8	6.1	0.04	0.55
1316		77-100	Bt4	7.4	6.9	0.02	0.28

Sample	Pedon ID	Depth	Horizon	0.01M CaCl ₂		Total N %	Total C %
				H ₂ O (1:1)	(2:1)		
1317		100-130	2Btg1	7.6	7.2	0.02	0.23
1318		130-165	"	7.8	7.3	0.01	0.10
1319		165-200	2Btg2	7.7	7.3	0.00	0.06
1320		200-206	2Btg3	ns	ns	0.00	0.05
1369	06KS017002	0-14	A1	5.8	5.1	0.204	2.47
1370		14-22	A2	6.4	5.3	0.127	1.43
1371		22-40	Bt1	7.0	5.9	0.105	1.13
1372		40-55	Bt1	7.3	6.5	0.093	0.98
1373		55-71	Bt2	7.6	6.9	0.075	0.78
1374		71-89	Bt3	7.3	6.9	0.047	0.45
1375		89-116	Btk1	7.7	7.3	0.038	0.32
1376		116-143	2Btk2	6.8	6.7	0.044	0.37
1377		143-169	3Bt	7.4	7.1	0.058	0.43
1378		169-180	4BC				
1379		180-200	4Cr				
1419	06KS017006	0-20	A	6.4	5.5	0.163	2.05
1420		20-33	Bt1	6.7	5.5	0.119	1.35
1421		33-52	Bt2	7.2	6.1	0.106	1.15
1422		52-69	Bt3	ns	ns	0.075	0.81
1423		69-90	Btky	ns	ns	0.043	0.40
1424		90-108	Btky	7.7	6.6	0.034	0.28
1425		108-130	2Bt	7.5	7.1	0.030	0.28
1426		130-148	2Bt	7.4	7.1	0.025	0.18
1427		148-167	3CB	7.9	7.2	0.024	0.11
1428		167-189	3C	7.9	7.3	0.028	0.13
1429		189-207	4Cr				
1464	06KS017011	0-7	A	7.7	7.1	0.317	4.78
1465		7--14	BA	7.8	7.4	0.182	2.13
1466		14-35	Bt1	7.1	6.0	0.115	1.34
1467		35-51	Bt2	7.6	6.6	0.096	1.08
1468		51-73	Btk	7.8	7.3	0.057	0.86
1469		73-83	Bt1'	ns	ns	0.043	0.52

Sample	Pedon ID	Depth	Horizon	0.01M CaCl ₂		Total N %	Total C %
				H ₂ O (1:1)	(2:1)		
1470		83-99	2Bt2	7.4	7.2	0.042	0.39
1471		99-138	3Bt3	7.3	7.1	0.049	0.49
ns		138-143	4Cr				
1525		0-13	A	5.7	5.0	0.193	2.51
1526	06KS015006	13-31	Bt1	6.7	6.0	0.112	1.29
1527		31-53	Bt2	7.4	6.7	0.088	1.00
1528		53-77	2Btkss1	7.5	6.8	0.059	0.58
1529		77-97	2Btkss2	7.9	7.3	0.040	0.37
1530		97-130	2Bty	7.9	7.2	0.033	0.31
1531	06KS015007	0-6	A	5.6	5.1	0.211	2.60
1532		6-17	BA	6.3	5.2	0.144	1.68
1533		17-31	Bt1	7.1	5.8	0.102	1.24
1534		31-49	Bt2	7.6	6.5	0.080	0.89
1535		49-61	Bt3	7.1	6.7	0.071	0.75
1536		61-80	Btk1	7.5	7.1	0.051	0.53
1537		80-96	2Btk2	7.1	7.0	0.037	0.55
1538		96-119	3Bty	7.5	7.2	0.033	0.28
1539		119-141	4Btyss	8.0	7.2	0.027	0.27
1540		141-160	4Btyss	8.1	7.3	0.020	0.18
1541		160-177	4Btyss	8.0	7.4	0.020	0.17
1566	06KS015010	0-8	A	5.7	5.0	0.170	2.14
1567		8-21	BA	6.7	5.9	0.078	0.87
1568		21-57	Bt1	7.6	6.8	0.068	0.77
1569		57-72	Bt2	7.5	7.1	0.041	0.43
1570		72-83	Bt3	8.0	7.4	0.030	0.25
1571		83-113	2Bt4	7.4	7.0	0.024	0.19
1572		113-158	3Btss1	7.7	7.2	0.023	0.19
1574		158-190	3Btss2	7.6	7.1	0.014	0.10
1575		190-217	3Btss2	7.8	7.2	0.013	0.09
1576		217-251	3Btss3	7.8	7.3	0.007	0.07
1692	06KS115003	0-14	A	5.4	5.1	0.110	1.21
1693		14-32	Bt1	7.2	6.0	0.084	0.86

Sample	Pedon ID	Depth	Horizon	0.01M CaCl ₂		Total N %	Total C %
				H ₂ O (1:1)	(2:1)		
1694		32-48	Bt1	7.9	6.5	0.064	0.65
1695		48-65	Bt2	6.9	6.5	0.040	0.43
1696		65-98	Btk	7.8	7.3	0.037	0.43
1697		98-116	Btk	7.7	7.3	0.035	0.30
1698		116-145	2Btss	7.1	6.9	0.027	0.22
1699		145-187	3C1	7.5	7.2	0.026	0.21
1700		187-222	4C2	7.8	7.5	0.019	1.73
1701		222-240	4Cr				
1708	06KS115005	0-14	Ap	5.3	5.0	0.160	1.75
1709		14-35	Bt1	6.6	5.8	0.090	0.97
1710		35-50	Bt1	6.3	6.0	0.067	0.73
1711		50-68	Bt2	6.3	6.0	0.047	0.44
1712		68-81	2Bt3	7.2	6.8	0.033	0.26
1713		81-111	2Btk1	7.1	6.9	0.026	0.22
1714		111-150	2Btk2	8.0	7.4	0.038	0.40
1715		150-187	3Bt1	8.1	7.4	0.023	0.20
1716		187-212	3Bt2	8.2	7.4	0.017	0.14
1730	06KS115007	0-10	Ap1	5.6	5.3	0.152	1.68
1731		10-20	Ap2	5.5	4.9	0.106	1.18
1732		20-41	Bt1	6.3	5.7	0.081	0.82
1733		41-61	Bt1	6.4	6.1	0.068	0.73
1734		61-93	2Btk	7.5	7.0	0.041	0.42
1735		93-113	2Btk	7.7	7.3	0.031	0.31
1736		113-136	3Btss1	7.4	7.2	0.028	0.29
1737		136-155	3Btss1	7.6	7.3	0.017	0.16
1738		155-173	3Btss2	7.7	7.4	0.015	0.11
1739		173-194	3Btss2	7.7	7.5	0.015	0.11
1740		197-215	3Btss2	7.8	7.6	0.020	0.22
1741		215-226	4C1	7.6	7.4	0.037	0.18
1742		226-237	4C2	7.5	7.5	0.035	1.84
1743		237-242	5Cr				
1766	06KS115010	0-12	Ap	5.8	5.5	0.146	1.73

Sample	Pedon ID	Depth	Horizon	0.01M CaCl ₂		Total N %	Total C %
				H ₂ O (1:1)	(2:1)		
1767		12-36	A	5.6	5.2	0.117	1.35
1768		36-68	Bt1	6.3	5.8	0.080	0.96
1769		68-86	Bt1	6.6	5.9	0.067	0.85
1770		86-115	2Bt2	6.2	6.0	0.029	0.29
1771		115-154	3Bt3	6.4	6.4	0.033	0.30
1772		154-199	3Btk	7.2	7.0	0.026	0.23
1773		199-236	3Btk	7.2	7.0	0.022	0.18
1774		236-294	3BC	6.1	6.2	0.013	0.21
1775		294-305	4C	7.0	6.9	0.013	0.09
1776		305-305	5Cr			0.021	0.29
1822	06KS161001	0-13	A	7.3	6.9	0.305	4.00
1823		13-20	BA	6.6	5.9	0.158	1.84
1824		20-36	Bt	6.6	5.7	0.098	1.07
1825		36-53	Btss1	6.6	5.7	0.072	0.74
1826		53-66	Btss2	6.7	5.9	0.062	0.61
1827		66-79	2Btkss	7.1	6.1	0.058	0.52
1828		79-104	2Bt1	7.5	6.6	0.045	0.38
1829		104-132	3Bt2	7.9	7.0	0.041	0.34
1830		132-178	3Bt3	7.9	7.2	0.039	0.38
ns		178-185	4Cr				
1838		0-14	Ap	5.8	5.5	0.180	1.33
1839		14-37	Bt1	6.3	5.9	0.091	0.89
1840		37-69	Bt2	6.9	6.5	0.059	0.54
1841		69-141	Btk1	7.7	7.2	0.035	0.53
1842		141-167	2Btk2	7.6	7.2	0.022	0.24
1843		167-204	3Btk3	7.8	7.4	0.016	0.42
1844		204-245	3Btk4	7.9	7.6	0.012	1.69
1872	06KS113007	0-22	Ap	6.3	5.9	0.240	2.64
1873		22-41	Bt	6.7	6.1	0.088	0.87
1874		41-79	Btk1	7.3	7.0	0.048	0.48
1875		79-130	2Btkss1	7.7	7.4	0.028	0.29
1876		130-165	2Btkss2	7.7	7.4	0.027	0.21

Sample	Pedon ID	Depth	Horizon	0.01M CaCl ₂		Total N %	Total C %
				H ₂ O (1:1)	(2:1)		
1877		165-244	2Bt	7.4	6.8	0.032	0.29
1878	06KS113008	0-15	Ap	5.6	5.0	0.104	1.25
1879		15-50	Bt	6.4	5.5	0.091	1.01
1880		50-74	Bt	7.1	6.3	0.063	0.65
1881		74-92	Btk	7.2	6.9	0.050	0.87
1882		92-130	Bkg	7.0	7.0	0.034	0.40
1883		130-174	2Bt	7.6	7.1	0.026	0.24
1884		174-210	3BC	7.3	6.9	0.014	0.07
1885		204-250	3BC	7.3	6.9	0.006	0.03
1895	06KS113010	0-18	Ap	6.0	5.6	0.127	1.41
1896a		18-39	Bt	6.4	6.2	0.099	1.02
1896b		39-60	Bt	6.7	6.5	0.073	0.75
1897		60-109	Btk	7.4	7.2	0.044	0.40
1898		109-131	2BA	7.2	7.0	0.051	0.47
1899		131-202	2Bty	6.9	6.7	0.047	0.46
1900		202-250	3Bt	7.3	6.9	0.030	0.20
1907	06KS127001	0-13	A	6.7	6.1	0.196	2.06
1908		13-26	Bt1	6.7	6.5	0.119	1.31
1909		26-42	Bt2	7.1	7.0	0.104	1.07
1910		42-51	Bt3	7.3	7.2	0.084	0.82
1911		51-75	Btk	7.6	7.5	0.053	0.50
1912		75-87	2Bt	7.5	7.5	0.053	0.44
1925	06KS079003	0-11	Ap	6.8	6.2	0.093	1.20
1926		11-29	Bt1	7.3	6.4	0.073	0.92
1927		29-42	Bt1	7.5	6.7	0.059	0.65
1928		42-64	Bt2	7.4	7.0	0.046	0.50
1929		64-92	Btk1	7.8	7.3	0.034	0.55
1930		92-130	2Btk2	7.8	7.4	0.030	0.35
1931		130-157	2Btk2	7.7	7.3	0.026	0.30
1932		157-197	2Btk3	7.8	7.3	0.017	0.17
1933		197-232	2Btk3	7.9	7.4	0.011	0.23
1934		232-239	3Cr				

Sample	Pedon ID	Depth	Horizon	0.01M CaCl ₂		Total N %	Total C %	
				H ₂ O (1:1)	(2:1)			
1935	06KS079004	0-13	Ap	6.0	5.5	0.118	1.43	
1936		13-42	Bt1	6.4	5.9	0.105	1.27	
1937		42-64	Bt2	6.5	6.2	0.059	0.63	
1938		64-91	Bt3	6.6	6.4	0.042	0.41	
1939		91-125	2Btk	7.5	7.1	0.035	0.42	
1940		125-170	3C	7.5	7.3	0.020	4.80	
1993	06KS015022	0-17	Ap	4.8	4.6	0.132	1.51	
1994		17-31	A	5.8	5.1	0.109	1.31	
1995		31-56	Bt	6.5	6.1	0.081	0.86	
1996		56-74	Bt	7.1	6.6	0.060	0.61	
1997		74-108	Btk	7.7	7.2	0.046	0.73	
1998		108-143	2Bt1	8.1	7.4	0.035	0.33	
1999		143-168	2Bt1	8.0	7.4	0.031	0.28	
2000		168-208	3Bt2	8.0	7.4	0.028	0.14	
2001		208-258	3BC	8.1	7.6	0.025	1.35	
2011		06KS079012	0-16	Ap	5.8	4.8	0.106	1.22
2012			16-48	A	6.3	5.7	0.089	1.04
2013			48-63	Bt1	6.8	6.1	0.065	0.88
2014	63-94		Bt2	7.0	6.3	0.055	0.68	
2015	64-127		Btss	6.9	6.8	0.044	0.45	
2016	127-170		Btkss	7.6	7.3	0.042	0.35	
2017	170-198		Btkss	7.9	7.4	0.038	0.29	
2018	198-252		2Bt	7.8	7.2	0.042	0.31	

Table B.4. Cation Exchange Capacity, Base Saturation, and Exchangeable Sodium Percentage for all characterized samples.

Sample #	Pedon ID	Depth	Horizon	H	Extractable Cations (meq/100g soil)					Sum Bases	Sum Cations	Base Sat. %	ESP %
					Ca	K	Mg	Na					
908	05KS161005	0-22	Ap	3.77	19.83	1.06	5.79	0.04	26.72	30.49	87.8	0.13	
909		22-41	Bt1	5.88	26.70	0.87	9.75	0.15	37.47	43.35	86.5	0.35	
910		41-80	Bt2	6.10	26.30	0.52	8.47	0.40	35.69	41.79	85.4	0.96	
911		80-116	Btk	1.23	30.65	0.44	7.12	0.71	38.92	40.15	96.9	1.77	
912		116-175	2Bt3	3.36	24.25	0.42	6.72	0.69	32.08	35.44	90.6	1.95	
913		175-207	2Bt4	3.13	24.39	0.54	6.69	1.04	32.66	35.79	91.3	2.91	
914		207-234	3Bt5	2.56	23.07	0.56	6.05	0.91	30.59	33.15	92.3	2.75	
915		234-246	3Bt6	0.00	41.95	0.49	4.90	0.77	48.11	48.11	100.0	1.60	
916		246-255	4Cr										
944		05KS161010	0-25	Ap	9.16	27.35	0.48	7.18	0.08	35.09	44.25	79.3	0.18
945	25-48		Bt1	8.56	30.70	0.54	7.82	0.12	39.18	47.74	82.1	0.25	
946	48-76		Bt2	5.06	27.47	0.42	6.08	0.12	34.09	39.15	87.1	0.31	
947	76-114		Btk	4.01	30.02	0.38	5.25	0.27	35.92	39.93	90.0	0.68	
948	114-140		2Bt3	4.72	26.10	0.44	5.85	0.21	32.60	37.32	87.3	0.56	
949	140-177		2Bt3	6.46	26.88	0.52	7.36	0.07	34.83	41.29	84.4	0.17	
950	177-216		3Bt4	4.04	24.96	0.51	7.48	0.27	33.22	37.26	89.2	0.72	
951	216-242		3Bt5	3.38	20.54	0.43	5.77	0.39	27.13	30.51	88.9	1.28	
952	242-245		4Cr										
969	05KS127001		0-10	Ap	7.33	19.92	1.53	8.03	0.90	30.38	37.71	80.5	2.39
970		10--29	BA	4.73	24.78	0.74	10.52	2.25	38.29	43.02	89.1	5.23	
971		29-48	Bt1	4.11	24.65	0.44	10.90	3.29	39.28	43.39	90.5	7.58	
972		48-89	Btk	2.07	24.66	0.33	9.86	4.44	39.29	41.36	95.0	10.74	
973		89-122	Bt2	3.63	20.93	0.35	8.71	4.38	34.37	38.00	90.4	11.53	
974		122-156	2Bt3	4.01	20.03	0.31	7.63	3.67	31.64	35.65	88.7	10.29	
975		156-215	2Bt4	5.65	22.15	0.30	6.63	3.46	32.54	38.19	85.2	9.06	
976		215-230	3Cr										

Sample #	Pedon ID	Depth	Horizon	Extractable Cations (meq/100g soil)						Sum Bases	Sum Cations	Base	ESP %
				H	Ca	K	Mg	Na	Sat. %				
1018	05KS127008	0-12	Ap	4.04	19.95	0.45	5.90	0.80	27.10	31.14	87.1	2.57	
1019		12--40	Bt1	10.04	30.76	0.52	9.08	1.77	42.13	52.17	80.7	3.39	
1020		40-64	Bt2	3.58	33.34	0.49	9.30	2.86	45.99	49.57	92.8	5.77	
1021		64-99	Btk	4.60	22.11	0.41	5.31	1.72	29.55	34.15	86.5	5.04	
1022		99-132	2Bty1	6.27	30.62	0.41	7.17	2.57	40.77	47.04	86.8	5.46	
1023		132-161	2Bty2	5.15	27.84	0.53	6.27	2.28	36.92	42.07	87.7	5.42	
1024		161-198	3Btl	0.00	36.16	0.67	7.96	4.20	48.99	48.99	100.0	8.57	
1025		198-228	3Bt2	0.00	41.10	0.70	8.61	4.24	54.65	54.65	100.0	7.76	
1026		228-260	3Bt3	0.00	67.40	0.95	10.74	5.60	84.69	84.69	100.0	6.61	
1078		05KS127017	0-14	Ap	10.60	24.40	0.65	8.93	0.25	34.23	44.83	76.4	0.56
1079	14-39		Bt1	6.38	26.65	0.44	11.69	1.01	39.79	46.17	86.2	2.19	
1080	39-60		Bt2	7.19	27.75	0.46	12.02	2.36	42.59	49.78	85.6	4.74	
1081	60-92		Btk	6.46	29.38	0.41	10.60	3.17	43.56	50.02	87.1	6.34	
1082	92-124		2Bt2	3.55	26.53	0.50	10.13	3.61	40.77	44.32	92.0	8.15	
1083	124-164		"	5.02	26.18	0.57	9.62	3.73	40.10	45.12	88.9	8.27	
1084	164-199		"	3.23	28.67	0.67	9.98	3.75	43.07	46.30	93.0	8.10	
1085	199-225		2Bt2	2.89	29.21	0.57	9.79	3.40	42.97	45.86	93.7	7.41	
1086	225-252		"	4.76	28.19	0.60	9.23	3.19	41.21	45.97	89.7	6.94	
1143	05KS127025		0-5	Ap	6.22	18.94	0.54	7.81	0.13	27.42	33.64	81.6	0.39
1144		5--39	Bt1	6.12	23.93	0.55	11.18	0.70	36.36	42.48	85.6	1.65	
1145		39-55	Bt2	3.87	24.37	0.54	11.72	1.08	37.71	41.58	90.8	2.60	
1146		55-91	2Btk	8.95	24.77	0.42	10.51	1.70	37.40	46.35	80.8	3.67	
1147		91-124	3Bt1	6.22	19.93	0.53	9.54	2.50	32.50	38.72	84.0	6.46	
1148		124-166	3Bt2	2.37	20.96	0.48	9.89	2.33	33.66	36.03	93.5	6.47	
1149		166-191	3Bt3	4.94	20.88	0.69	9.94	2.82	34.32	39.26	87.6	7.18	
1150		191-220	3BC	3.62	28.75	0.56	9.02	2.66	41.00	44.61	92.0	5.97	
1151		220-297	4C										
1311		05KS017003	0-7	A	11.06	15.07	0.56	4.67	0.00	20.30	31.35	64.7	0.00
1312	7--26		BA	12.83	15.15	0.39	5.39	0.16	21.10	33.93	62.2	0.48	
1313	26--41		Bt1	9.57	18.18	0.45	6.87	0.54	26.04	35.61	73.2	1.51	
1314	41-55		Bt2	7.69	18.69	0.44	6.93	0.85	26.91	34.60	77.9	2.45	
1315	55-77		Bt3	5.27	17.51	0.34	6.13	1.26	25.24	30.51	82.8	4.13	

Sample #	Pedon ID	Depth	Horizon	Extractable Cations (meq/100g soil)						Sum Bases	Sum Cations	Base	ESP %
				H	Ca	K	Mg	Na	Sat. %				
1316		77-100	Bt4	3.38	21.12	0.34	7.04	2.48	30.99	34.37	90.3	7.22	
1317		100-130	2Btg1	3.58	30.36	0.56	11.53	4.97	47.41	50.99	93.0	9.74	
1318		130-165	"	2.59	26.66	0.52	10.14	5.04	42.35	44.94	94.2	11.21	
1319		165-200	2Btg2	1.77	23.60	0.48	8.82	4.65	37.55	39.32	95.6	11.84	
1320		200-206	2Btg3	3.50	21.21	0.47	7.70	3.88	33.25	36.75	90.5	10.56	
1369	06KS017002	0-14	A1	3.50	11.65	0.37	2.81	0.39	15.22	18.72	81.3	2.08	
1370		14-22	A2	1.85	16.06	0.28	4.90	1.40	22.64	24.49	92.9	5.72	
1371		22-40	Bt1	4.93	20.54	0.35	6.66	1.92	29.47	34.40	85.8	5.58	
1372		40-55	Bt1	2.54	20.67	0.31	6.60	2.33	29.91	32.45	92.2	7.18	
1373		55-71	Bt2	3.34	20.28	0.32	6.43	2.68	29.71	33.05	89.9	8.11	
1374		71-89	Bt3	2.40	18.26	0.31	5.79	2.34	26.70	29.10	92.0	8.04	
1375		89-116	Btk1	4.81	20.39	0.32	5.63	2.62	28.96	33.77	85.8	7.76	
1376		116-143	2Btk2	5.52	19.78	0.31	5.69	2.78	28.56	34.08	83.8	8.16	
1377		143-169	3Bt	5.57	25.35	0.53	7.19	3.52	36.59	42.16	86.8	8.35	
1378		169-180	4BC										
1379		180-200	4Cr										
1419	06KS017006	0-20	A	10.49	10.83	0.35	3.31	0.65	15.14	25.63	59.2	2.54	
1420		20-33	Bt1	12.04	16.12	0.28	6.41	1.54	24.35	36.39	67.2	4.23	
1421		33-52	Bt2	4.88	15.11	0.29	6.17	1.66	23.23	28.11	82.8	5.91	
1422		52-69	Bt3	4.60	17.35	0.33	6.90	2.29	26.87	31.47	86.1	7.28	
1423		69-90	Btky	1.66	16.85	0.29	6.24	2.31	25.69	27.35	93.9	8.45	
1424		90-108	Btky	8.86	17.36	0.37	6.49	2.48	26.70	35.56	75.5	6.97	
1425		108-130	2Bt	5.05	21.27	0.44	7.72	2.84	32.27	37.32	86.5	7.61	
1426		130-148	2Bt	8.95	21.14	0.44	7.97	2.76	32.31	41.26	78.4	6.69	
1427		148-167	3CB	10.23	17.02	0.27	6.01	2.14	25.44	35.67	71.2	6.00	
1428		167-189	3C	3.38	18.56	0.27	4.85	1.94	25.62	29.00	88.2	6.69	
1429		189-207	4Cr										
1464	06KS017011	0-7	A	7.92	12.34	0.79	3.71	0.22	17.06	24.98	68.1	0.88	
1465		7--14	BA	11.12	13.92	0.33	5.03	0.50	19.78	30.90	64.6	1.62	
1466		14-35	Bt1	5.55	17.98	0.27	6.87	1.26	26.38	31.93	82.6	3.95	
1467		35-51	Bt2	5.64	21.43	0.34	7.73	2.65	32.15	37.79	85.3	7.01	
1468		51-73	Btk	5.65	26.07	0.31	7.73	3.26	37.37	43.02	87.0	7.58	

Sample #	Pedon ID	Depth	Horizon	Extractable Cations (meq/100g soil)							Sum Bases	Sum Cations	Base Sat. %	ESP %
				H	Ca	K	Mg	Na						
1469		73-83	Bt1'	2.59	22.42	0.32	7.30	3.83	33.87	36.46	92.8	10.50		
1470		83-99	2Bt2	4.94	20.13	0.42	7.57	4.31	32.43	37.37	87.0	11.53		
1471		99-138	3Bt3	7.14	20.49	0.45	7.61	4.27	32.82	39.96	82.2	10.69		
ns		138-143	4Cr											
1525		0-13	A	9.89	12.33	0.44	4.40	1.32	18.49	28.38	65.1	4.65		
1526	06KS015006	13-31	Bt1	8.36	24.27	0.01	8.59	3.54	36.41	44.77	81.4	7.91		
1527		31-53	Bt2	6.18	25.29	1.26	8.53	3.73	38.81	44.99	86.3	8.29		
1528		53-77	2Btkss1	3.83	24.06	0.21	8.06	5.65	37.98	41.81	90.8	13.51		
1529		77-97	2Btkss2	4.68	22.51	0.05	7.62	6.11	36.29	40.97	88.6	14.91		
1530		97-130	2Bty	4.48	22.50	0.00	7.80	6.13	36.43	40.91	89.0	14.98		
1531	06KS015007	0-6	A	9.01	10.65	1.12	3.59	1.04	16.40	25.41	64.1	4.09		
1532		6-17	BA	8.59	22.07	0.14	7.57	2.55	32.33	40.92	79.0	6.23		
1533		17-31	Bt1	6.71	26.19	0.06	8.61	3.37	38.23	44.94	85.1	7.50		
1534		31-49	Bt2	4.21	26.26	0.17	8.32	3.51	38.26	42.47	90.1	8.26		
1535		49-61	Bt3	4.12	25.02	0.31	7.80	4.22	37.35	41.47	90.0	10.18		
1536		61-80	Btk1	3.95	26.46	0.00	7.88	4.66	39.00	42.95	90.8	10.85		
1537		80-96	2Btk2	3.74	27.25	0.00	7.68	4.87	39.80	43.54	91.4	11.19		
1538		96-119	3Bty	3.81	24.81	0.16	7.57	4.69	37.23	41.04	90.6	11.43		
1539		119-141	4Btyss	4.29	26.14	0.17	7.88	4.70	38.89	43.18	90.3	10.88		
1540		141-160	4Btyss	7.49	29.34	0.29	8.88	5.47	43.98	51.47	85.4	10.63		
1541		160-177	4Btyss	6.79	29.36	0.77	8.54	4.53	43.20	49.99	86.5	9.06		
1566	06KS015010	0-8	A	10.34	12.35	0.48	4.03	0.03	16.89	27.23	61.9	0.11		
1567		8-21	BA	6.46	24.48	0.05	7.54	1.43	33.50	39.96	83.9	3.58		
1568		21-57	Bt1	4.46	26.48	0.05	7.64	2.37	36.54	41.00	89.1	5.78		
1569		57-72	Bt2	4.08	20.74	0.03	5.79	2.51	29.07	33.15	87.6	7.57		
1570		72-83	Bt3	2.77	22.45	0.12	6.41	3.24	32.22	34.99	82.2	9.26		
1571		83-113	2Bt4	7.96	25.99	0.13	7.51	3.85	37.48	45.44	82.3	8.47		
1572		113-158	3Btss1	13.38	29.79	0.20	8.19	4.03	42.21	55.59	75.9	7.25		
1574		158-190	3Btss2	11.58	28.01	0.50	7.44	3.82	39.77	51.35	77.5	7.44		
1575		190-217	3Btss2	4.47	31.08	0.35	8.11	4.14	43.68	48.15	90.7	8.60		
1576		217-251	3Btss3	7.67	35.68	0.18	9.12	3.99	48.97	56.64	86.4	7.04		
1692	06KS115003	0-14	A	9.78	14.17	0.46	9.17	0.21	24.01	33.79	71.0	0.62		

Sample #	Pedon ID	Depth	Horizon	Extractable Cations (meq/100g soil)						Sum Bases	Sum Cations	Base	ESP
				H	Ca	K	Mg	Na	Sat. %			%	
1693		14-32	Bt1	7.23	22.13	0.38	18.84	0.88	42.23	49.46	85.4	1.78	
1694		32-48	Bt1	3.99	19.03	0.38	17.76	1.60	38.77	42.76	90.6	3.74	
1695		48-65	Bt2	5.09	19.99	0.41	20.03	2.33	42.76	47.85	89.4	4.87	
1696		65-98	Btk	5.26	24.89	0.40	19.34	2.99	47.62	52.88	90.2	5.65	
1697		98-116	Btk	4.73	18.30	0.90	17.51	3.88	40.59	45.32	89.5	8.56	
1698		116-145	2Btss	3.99	26.70	0.45	19.63	4.47	51.25	55.24	92.9	8.09	
1699		145-187	3C1	4.56	24.13	0.46	19.21	4.76	48.56	53.12	91.4	8.96	
1700		187-222	4C2	4.49	42.43	0.10	9.57	3.21	55.31	59.80	92.5	5.37	
1701		222-240	4Cr										
1708	06KS115005	0-14	Ap	10.45	12.43	0.29	6.10	0.24	19.06	29.51	64.4	0.81	
1709		14-35	Bt1	8.41	21.93	0.40	13.86	0.60	36.79	45.20	81.4	1.33	
1710		35-50	Bt1	8.13	21.40	0.37	14.53	0.53	36.83	44.96	81.9	1.18	
1711		50-68	Bt2	4.94	16.71	0.21	11.32	0.59	28.83	33.77	85.3	1.75	
1712		68-81	2Bt3	3.55	14.12	0.13	9.26	0.73	24.24	27.79	87.2	2.63	
1713		81-111	2Btk1	3.08	17.47	0.20	10.33	1.07	29.07	32.15	90.4	3.33	
1714		111-150	2Btk2	3.82	16.64	0.23	11.15	1.45	29.47	33.29	88.6	4.36	
1715		150-187	3Bt1	4.57	14.31	0.25	10.96	1.75	27.27	31.84	85.9	5.50	
1716		187-212	3Bt2	3.07	17.02	0.84	14.17	2.19	34.22	37.29	91.8	5.87	
1730	06KS115007	0-10	Ap1	8.29	18.63	1.08	6.63	0.22	26.56	34.85	76.3	0.63	
1731		10-20	Ap2	9.43	17.91	0.53	8.10	0.26	26.80	36.23	74.0	0.72	
1732		20-41	Bt1	6.94	26.41	0.67	13.09	1.23	41.40	48.34	85.6	2.54	
1733		41-61	Bt1	6.22	26.15	0.62	12.82	2.18	41.77	47.99	87.0	4.54	
1734		61-93	2Btk	2.49	26.73	0.57	12.55	3.43	43.28	45.77	94.6	7.49	
1735		93-113	2Btk	2.05	29.06	0.69	14.36	4.85	48.96	51.01	96.0	9.51	
1736		113-136	3Btss1	2.93	25.83	0.92	13.64	4.96	45.35	48.28	93.8	10.27	
1737		136-155	3Btss1	4.96	25.96	0.73	14.14	4.97	45.80	50.76	90.2	9.79	
1738		155-173	3Btss2	4.75	26.23	0.67	14.09	5.03	46.02	50.77	90.6	9.91	
1739		173-194	3Btss2	4.98	27.82	0.66	13.70	5.28	47.46	52.44	90.6	10.07	
1740		197-215	3Btss2	5.66	26.10	0.55	9.61	4.79	41.05	46.71	87.9	10.25	
1741		215-226	4C1	9.20	20.71	0.60	8.66	5.12	35.09	44.29	79.5	11.56	
1742		226-237	4C2	3.18	42.48	0.71	11.25	5.39	59.83	63.01	95.0	8.55	
1743		237-242	5Cr										

Sample #	Pedon ID	Depth	Horizon	Extractable Cations (meq/100g soil)							Sum Bases	Sum Cations	Base Sat. %	ESP %
				H	Ca	K	Mg	Na						
1766	06KS115010	0-12	Ap	9.53	15.87	0.84	4.10	0.09	20.90	30.43	68.7	0.30		
1767		12-36	A	9.85	14.27	0.47	6.30	0.00	21.04	30.89	68.1	0.00		
1768		36-68	Bt1	7.85	14.27	0.47	6.91	0.22	21.87	29.72	73.6	0.74		
1769		68-86	Bt1	5.97	13.10	0.53	6.07	0.35	20.05	26.02	77.1	1.35		
1770		86-115	2Bt2	6.71	16.62	0.56	7.59	0.81	25.58	32.29	79.2	2.51		
1771		115-154	3Bt3	4.38	16.58	0.48	7.03	0.84	24.93	29.31	85.1	2.87		
1772		154-199	3Btk	3.92	18.78	0.47	6.24	1.23	26.72	30.64	87.2	4.01		
1773		199-236	3Btk	2.65	21.24	0.48	6.43	1.64	29.79	32.44	91.8	5.06		
1774		236-294	3BC	3.10	18.34	0.43	6.37	1.75	26.89	29.99	89.7	5.84		
1775		294-305	4C	3.81	36.78	0.42	7.55	2.10	46.85	50.66	92.6	4.15		
1776		305-305	5Cr											
1822		06KS161001	0-13	A	4.08	26.52	0.97	5.16	0.78	33.43	37.51	89.1	2.08	
1823	13-20		BA	6.20	16.73	0.32	6.23	0.42	23.70	29.90	79.2	1.40		
1824	20-36		Bt	7.42	18.88	0.38	7.97	0.88	28.11	35.53	79.1	2.48		
1825	36-53		Btss1	6.36	18.67	0.27	7.91	0.69	27.54	33.90	81.2	2.04		
1826	53-66		Btss2	6.87	18.77	0.28	7.49	0.71	27.25	34.12	79.9	2.08		
1827	66-79		2Btkss	4.97	18.82	0.29	7.14	1.04	27.29	32.26	84.7	3.22		
1828	79-104		2Bt1	3.92	12.60	0.16	4.60	0.42	17.78	21.70	80.3	1.94		
1829	104-132		3Bt2	4.25	17.64	0.22	6.63	0.82	25.31	29.56	85.7	2.77		
1830	132-178		3Bt3	4.42	19.20	0.28	8.30	0.91	28.69	33.11	87.1	2.75		
ns	178-185		4Cr											
1838	0-14		Ap	9.25	20.22	0.74	6.45	0.59	28.00	37.25	75.2	1.58		
1839	14-37		Bt1	7.13	23.79	0.37	7.67	0.46	32.29	39.42	81.9	1.17		
1840	37-69	Bt2	7.19	24.07	0.59	7.53	0.87	33.06	40.25	82.1	2.16			
1841	69-141	Btk1	3.90	27.05	0.46	7.43	1.36	36.30	40.20	90.3	3.38			
1842	141-167	2Btk2	3.05	25.66	0.50	8.40	1.45	36.01	39.06	92.2	3.71			
1843	167-204	3Btk3	3.18	37.40	0.55	8.62	1.43	48.00	51.18	93.8	2.79			
1844	204-245	3Btk4	0.03	43.93	0.44	8.44	1.27	54.08	54.11	99.5	2.35			
1872	06KS113007	0-22	Ap	6.34	22.06	1.12	5.23	0.10	28.51	34.85	81.8	0.29		
1873		22-41	Bt	3.99	25.33	0.60	5.93	0.19	32.05	36.04	89.0	0.53		
1874		41-79	Btk1	2.40	28.90	0.47	5.56	0.44	35.37	37.77	93.6	1.16		
1875		79-130	2Btkss1	2.04	27.15	0.34	6.72	1.54	35.75	37.79	94.6	4.08		

Sample #	Pedon ID	Depth	Horizon	Extractable Cations (meq/100g soil)						Sum Bases	Sum Cations	Base	ESP %
				H	Ca	K	Mg	Na	Sat. %				
1876		130-165	2Btkss2	3.19	26.12	0.71	7.42	2.70	36.95	40.14	92.1	6.73	
1877		165-244	2Bt	2.53	21.43	0.66	5.45	2.67	30.21	32.74	92.3	8.16	
1878	06KS113008	0-15	Ap	4.93	9.25	0.59	2.16	0.35	12.35	17.28	73.1	2.03	
1879		15-50	Bt	3.98	17.73	0.61	4.23	0.51	23.08	27.06	85.4	1.88	
1880		50-74	Bt	4.81	24.78	0.80	5.57	0.54	31.69	36.50	86.8	1.48	
1881		74-92	Btk	2.13	26.63	0.60	4.66	0.82	32.71	34.84	94.1	2.35	
1882		92-130	Bkg	2.39	22.67	0.49	3.61	1.39	28.16	30.55	92.8	4.55	
1883		130-174	2Bt	3.36	21.43	0.53	3.85	1.54	27.35	30.71	88.8	5.01	
1884		174-210	3BC	3.01	22.45	0.58	4.08	1.81	28.92	31.93	90.2	5.67	
1885		204-250	3BC	2.41	20.52	0.60	3.44	1.69	26.25	28.66	91.9	5.90	
1895	06KS113010	0-18	Ap	8.12	11.03	0.51	3.55	0.39	15.48	23.60	65.2	1.65	
1896a		18-39	Bt	9.41	24.08	0.74	8.14	0.36	33.32	42.73	78.0	0.84	
1896b		39-60	Bt	5.90	23.84	0.69	7.95	0.90	33.38	39.28	85.2	2.29	
1897		60-109	Btk	5.58	26.83	0.58	7.42	1.19	36.02	41.60	86.7	2.86	
1898		109-131	2BA	3.89	19.10	0.44	5.49	1.51	26.54	30.43	87.4	4.96	
1899		131-202	2Bty	2.15	17.09	0.42	4.38	1.71	23.60	25.75	91.6	6.64	
1900		202-250	3Bt	2.62	20.27	0.60	4.92	2.13	27.92	30.54	91.6	6.97	
1907	06KS127001	0-13	A	8.17	12.70	1.30	3.84	2.13	19.97	28.14	70.8	7.57	
1908		13-26	Bt1	5.45	17.19	0.33	5.40	7.04	29.96	35.41	84.6	19.88	
1909		26-42	Bt2	5.25	18.68	0.33	6.33	10.29	35.63	40.88	87.1	25.17	
1910		42-51	Bt3	3.94	17.58	0.31	6.23	10.85	34.97	38.91	89.9	27.88	
1911		51-75	Btk	5.34	19.49	0.29	6.24	10.87	36.89	42.23	87.3	25.74	
1912		75-87	2Bt	6.43	26.94	0.18	9.61	13.82	50.55	56.98	88.7	24.25	
1925	06KS079003	0-11	Ap	5.93	29.28	0.29	7.58	0.32	37.47	43.40	86.4	0.74	
1926		11-29	Bt1	7.45	31.95	0.20	8.12	0.75	41.02	48.47	84.5	1.55	
1927		29-42	Bt1	3.40	28.27	0.16	6.97	1.13	36.53	39.93	91.5	2.83	
1928		42-64	Bt2	1.96	29.57	0.38	6.99	1.68	38.62	40.58	95.2	4.14	
1929		64-92	Btk1	0.46	28.09	0.25	6.32	2.15	36.81	37.27	98.8	5.77	
1930		92-130	2Btk2	3.41	33.61	0.21	7.59	2.80	44.21	47.62	92.9	5.88	
1931		130-157	2Btk2	3.08	34.42	0.25	8.16	3.34	46.17	49.25	93.8	6.78	
1932		157-197	2Btk3	2.47	32.07	0.38	7.63	3.07	43.15	45.62	94.6	6.73	
1933		197-232	2Btk3	5.05	30.50	0.23	7.00	3.04	40.77	45.82	89.0	6.63	

Sample #	Pedon ID	Depth	Horizon	Extractable Cations (meq/100g soil)						Sum Bases	Sum Cations	Base Sat. %	ESP %
				H	Ca	K	Mg	Na					
1934		232-239	3Cr										
1935	06KS079004	0-13	Ap	6.25	19.27	0.67	5.30	0.25	25.49	31.74	80.3	0.79	
1936		13-42	Bt1	6.67	22.32	0.60	6.65	0.39	29.96	36.63	81.8	1.06	
1937		42-64	Bt2	3.99	27.30	0.62	8.39	0.69	37.00	40.99	90.3	1.68	
1938		64-91	Bt3	4.45	27.42	0.60	8.35	0.91	37.28	41.73	89.4	2.18	
1939		91-125	2Btk	3.82	35.00	0.63	8.53	1.20	45.36	49.18	92.3	2.44	
1940		125-170	3C	2.33	41.20	0.53	5.80	1.15	48.68	51.01	95.4	2.25	
1993	06KS015022	0-17	Ap	12.64	8.66	0.52	2.61	0.00	11.79	24.43	48.4	0.00	
1994		17-31	A	9.95	13.87	0.56	4.36	0.34	19.13	29.08	66.2	1.17	
1995		31-56	Bt	7.52	21.29	0.67	7.43	0.55	29.94	37.46	80.0	1.47	
1996		56-74	Bt	5.34	20.45	0.60	7.08	0.62	28.75	34.09	84.3	1.82	
1997		74-108	Btk	5.07	26.16	0.66	7.67	1.35	35.84	40.91	87.6	3.30	
1998		108-143	2Bt1	6.80	23.63	0.65	7.97	2.16	34.41	41.21	83.5	5.24	
1999		143-168	2Bt1	4.33	22.36	0.63	7.67	2.60	33.26	37.59	88.5	6.92	
2000		168-208	3Bt2	7.10	25.31	0.68	8.31	3.06	37.36	44.46	84.0	6.88	
2001		208-258	3BC	1.94	38.20	0.48	5.93	2.45	47.06	49.00	95.9	5.00	
2011	06KS079012	0-16	Ap	8.61	10.21	0.51	3.48	0.19	14.39	23.00	62.6	0.83	
2012		16-48	A	8.04	13.30	0.41	4.54	0.38	18.63	26.67	70.0	1.42	
2013		48-63	Bt1	4.65	13.12	0.36	4.01	0.30	17.79	22.44	79.3	1.34	
2014		63-94	Bt2	6.00	19.86	0.49	6.26	0.55	27.16	33.16	82.0	1.66	
2015		64-127	Btss	3.99	21.64	0.50	6.61	0.75	29.50	33.49	88.1	2.24	
2016		127-170	Btkss	3.61	23.09	0.42	5.79	0.92	30.22	33.83	89.3	2.72	
2017		170-198	Btkss	3.35	26.49	0.46	6.25	1.26	34.46	37.81	91.1	3.33	
2018		198-252	2Bt	5.62	24.34	0.56	6.34	1.34	32.58	38.20	85.3	3.51	

Appendix C - X-ray Diffraction Patterns

Figure C.1. X-ray diffraction pattern for horizons of pedon 05KS161005, sampled in Riley County, Kansas. Mg-25°C treatment, scanned from 2 to 34° 2θ.

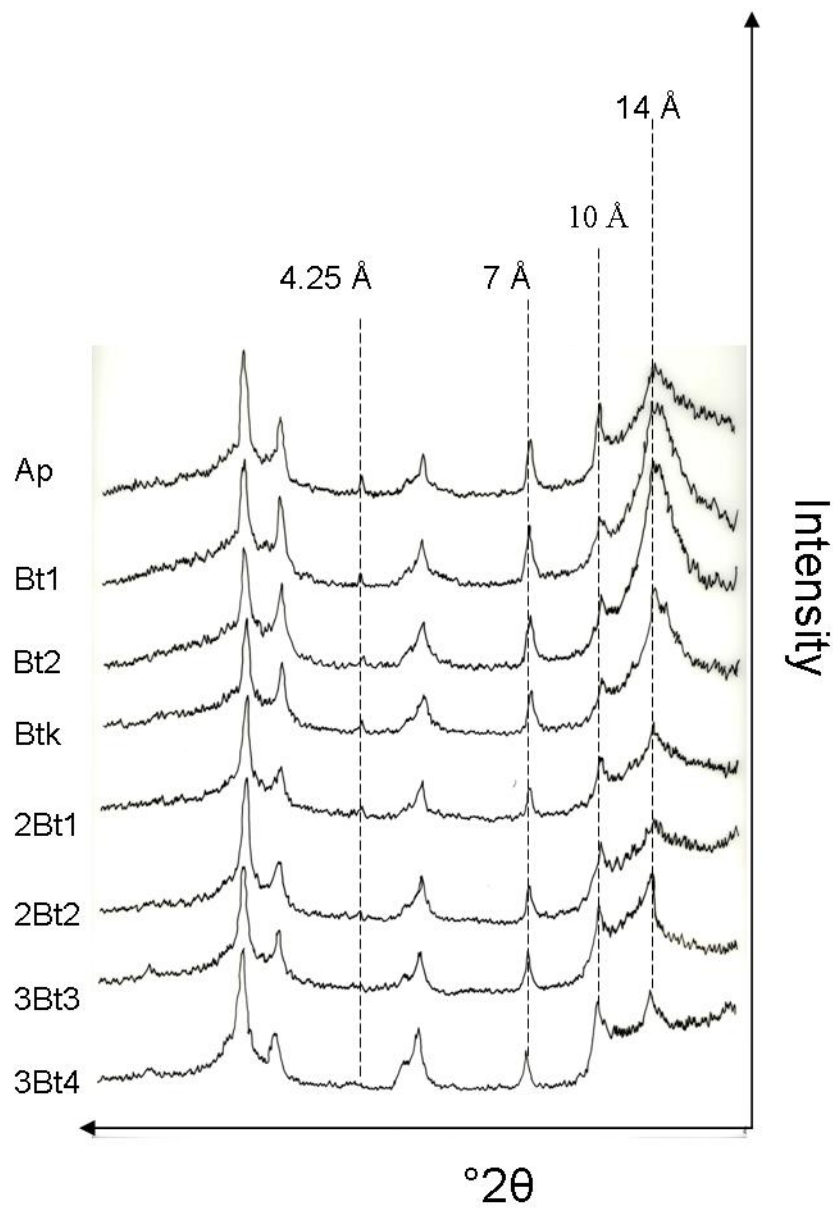


Figure C.2. X-ray diffraction pattern for horizons of pedon 05KS161005, sampled in Riley County, Kansas. Mg-Ethylene Glycol treatment, scanned from 2 to 15° 2θ.

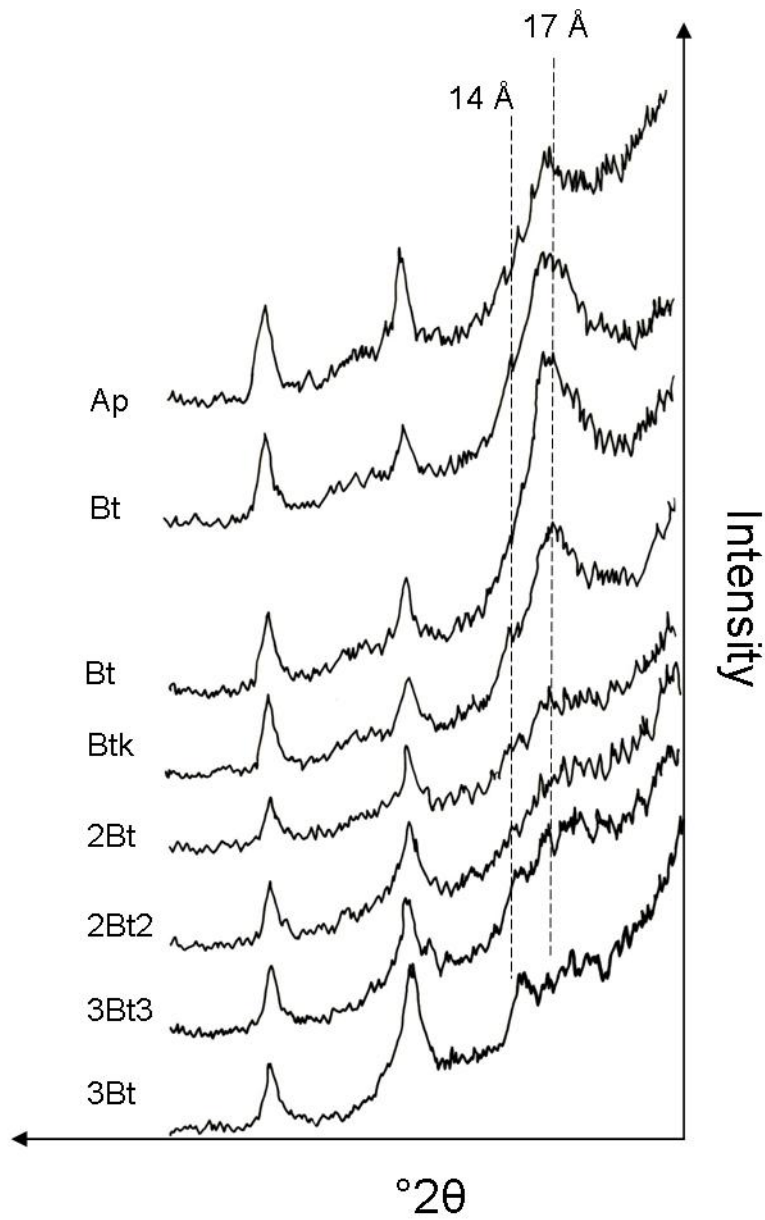


Figure C.3. X-ray diffraction pattern for horizons of pedon 06S017011, sampled in Chase County, Kansas. Mg-25°C treatment, scanned from 2 to 34° 2θ.

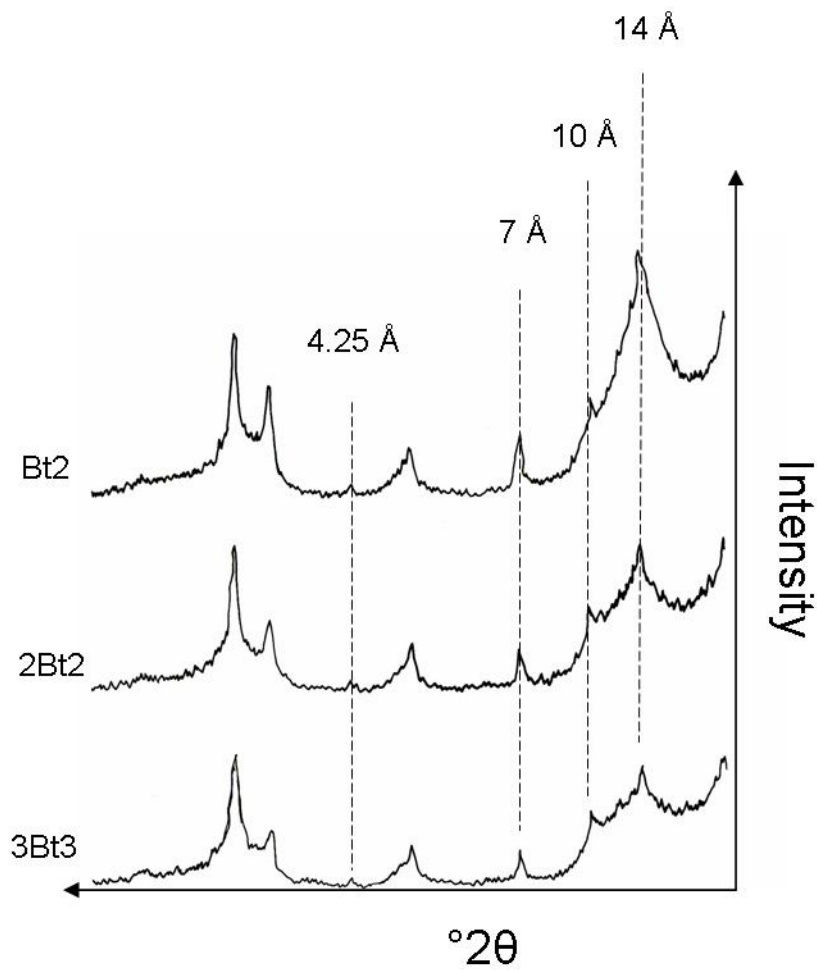


Figure C.4. X-ray diffraction pattern for horizons of pedon 06KS017011, sampled in Chase County, Kansas. Mg-Ethylene Glycol treatment, scanned from 2 to 15° 2θ.

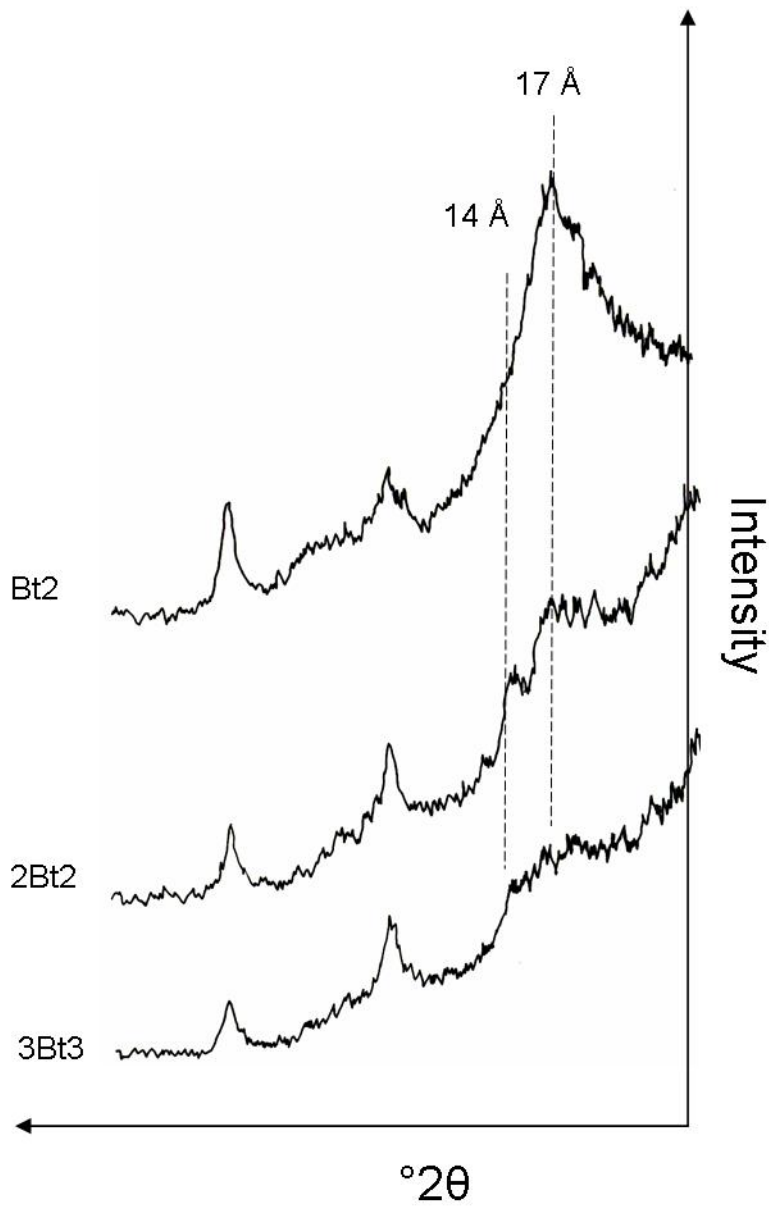


Figure C.5. X-ray diffraction pattern for horizons of pedon 06S0015010, sampled in Butler County, Kansas. Mg-25°C treatment, scanned from 2 to 34° 2θ.

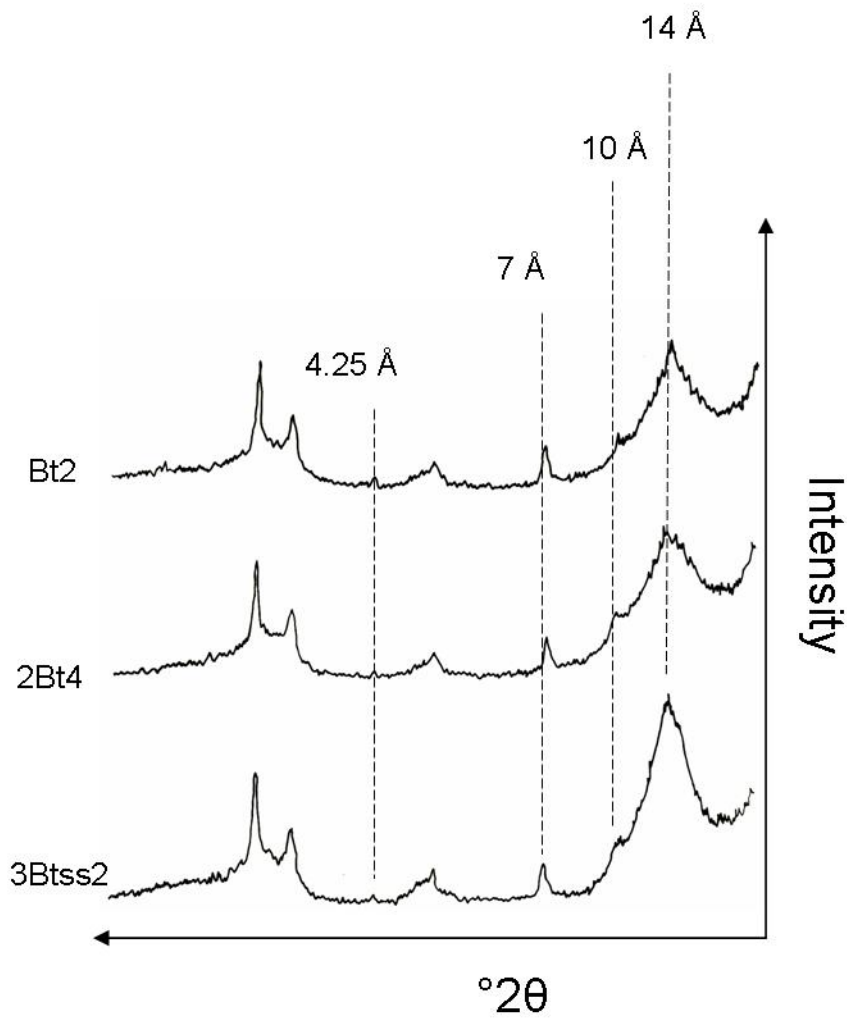


Figure C.6. X-ray diffraction pattern for horizons of pedon 06KS015010, sampled in Butler County, Kansas. Mg-Ethylene Glycol treatment, scanned from 2 to 15° 2 θ .

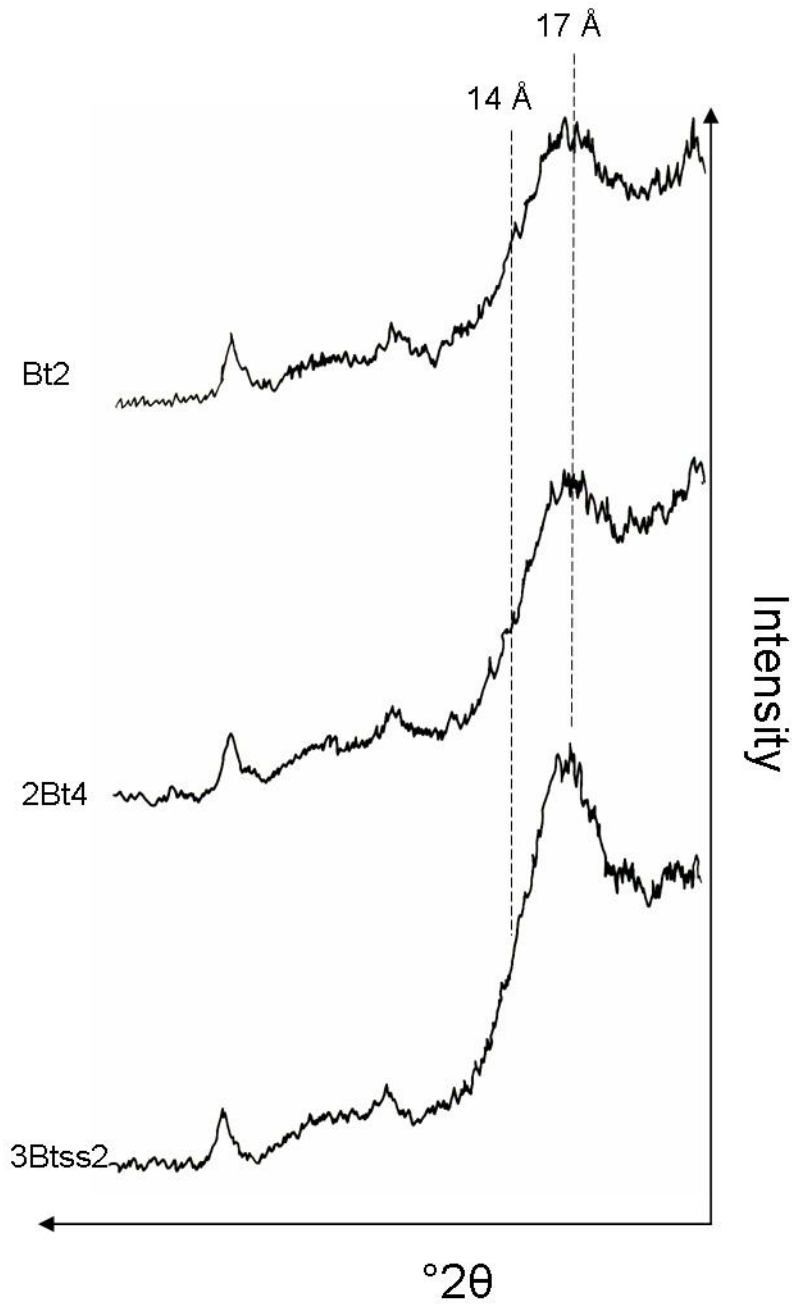


Figure C.7. X-ray diffraction pattern for horizons of pedon 06S0115010, sampled in Marion County, Kansas. Mg-25°C treatment, scanned from 2 to 34° 2θ.

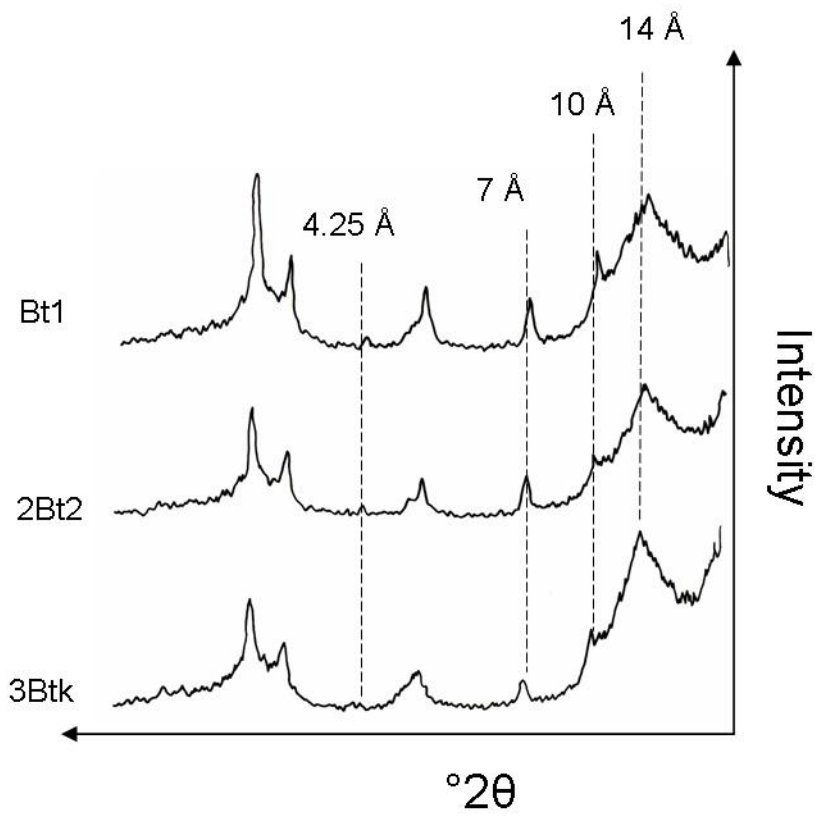


Figure C.8. X-ray diffraction pattern for horizons of pedon 06KS115010, sampled in Marion County, Kansas. Mg-Ethylene Glycol treatment, scanned from 2 to 15° 2 θ .

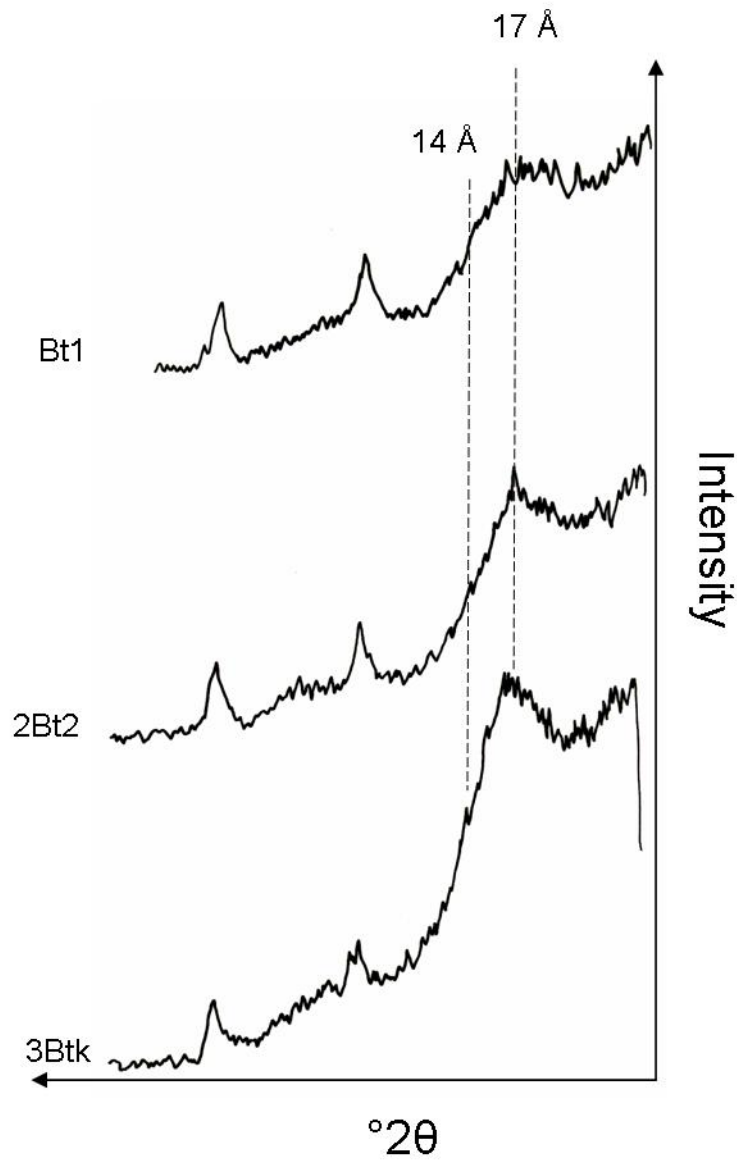


Figure C.9. X-ray diffraction pattern for horizons of pedon 06S0113002, sampled in McPherson County, Kansas. Mg-25°C treatment, scanned from 2 to 34° 2θ.

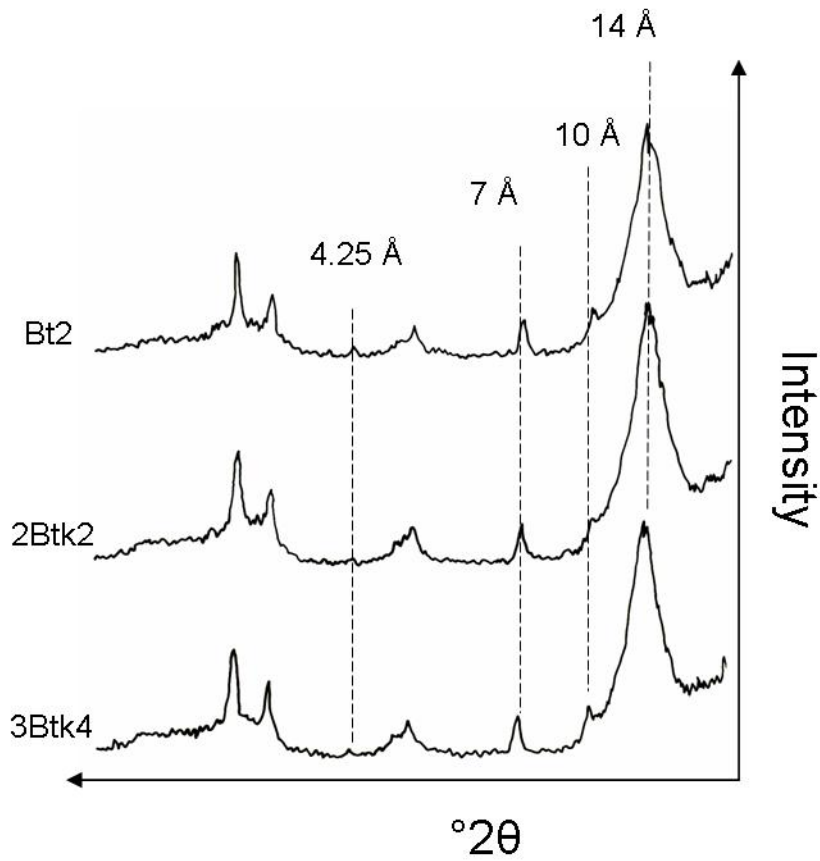


Figure C.10. X-ray diffraction pattern for horizons of pedon 06KS113002, sampled in McPherson County, Kansas. Mg-Ethylene Glycol treatment, scanned from 2 to 15° 2θ.

