A STRUCTURAL AND SEDIMENTATION STUDY OF THE SHAWNEE GROUP IN CENTRAL KANSAS AND THE POSSIBLE RELATIONSHIP TO OIL PRODUCING AREAS

by

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TABLE OF CONTENTS

INTRODUCTION

Purpose of Investigation

The purpose of this investigation is three fold: first, to make a structural and sedimentation study of the Shawnee group in central Kansas by constructing two structural maps and one clastic ratio map; second, to determine to what extent the pre-Cambrian structures in central Kansas have influenced the structure and sedimentation of the Shawnee group; third, to indicate some relationships of structure and sedimentation to oil accumulation in this area.

Area Covered by This Investigation

The area of this investigation covers 26 counties across central Kansas, and it extends from the Nebraska border on the north to the Oklahoma border on the south, Fig. 1. The area covered by the maps is somewhat larger than that from which the data were taken. This slight increase in area is due to the extension of the contour lines across areas from which no information was available.

Shawnee Group Defined

The Shawnee group as redefined by Moore (6) includes beds from the base of the Oread limestone to the top of the Topeka limestone. Included in this group are four thick limestone formations and three thinner shale formations. They are, named in

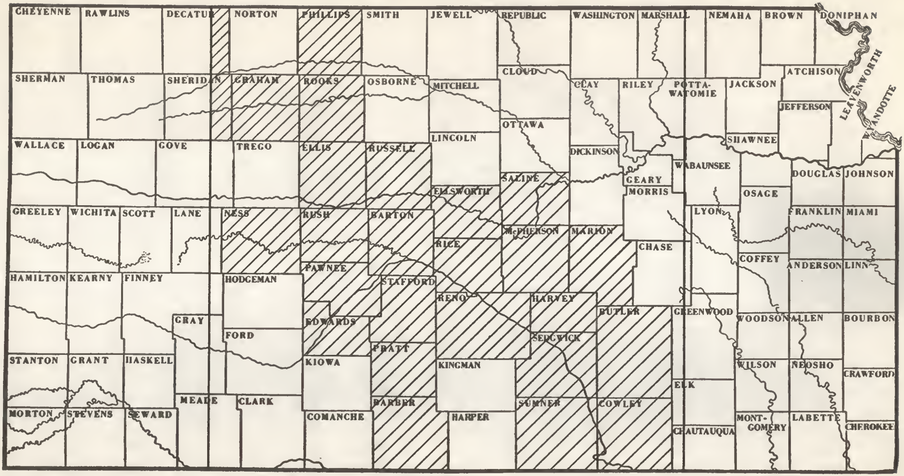


Fig. 1. Index map showing the area of this investigation.

upward order, Oread limestone, Kanwaka shale, Lecompton limestone, Tecumseh shale, Deer Creek limestone, Calhoun shale, and Topeka limestone.

Outcrops of the Shawnee group occur in a belt which trends south southwestward across Kansas from Doniphan county, on the north, to Chautauqua County, on the south. This stratigraphic interval is made up predominantly of thick limestone beds and thin intervening shale beds. In tracing the outcrop northward the limestones converge to form almost solid limestone, and to the south the clastic members become more predominant.

The total average thickness of the Shawnee group, along its outcrop, is about 350 feet (6). In tracing the group underground across central Kansas, one finds that the limestones become thicker and the shales thin out, and in some cases pinch out completely. While there is a wide variation in the thickness of the individual beds in the outcrop area as compared with the thickness in the subsurface in central Kansas, the total thickness remains surprisingly constant.

A generalized stratigraphic section penetrated by wells drilled in central Kansas is illustrated in Plate I. This plate compares favorably with the generalized stratigraphic section compiled from the outcrop area. There are, however, changes in thickness of some of the formations and members; and in two instances shale members pinch out entirely.

METHOD OF STUDY

The data for the construction of the two subsurface maps and the clastic ratio map used in this report were taken from 123 radioactive logs. The use of radioactive logs as a means of subsurface mapping is a relatively new one; therefore a brief discussion of the principles and methods of interpretation of radioactive logs will be given.

Radioactive Logs

A radioactive log consists of two logs, one a measure of the natural emanations of gamma rays from the rock units penetrated by the well and the other a measure of the effect of bombardment of the wall rocks by neutrons from an introduced source.

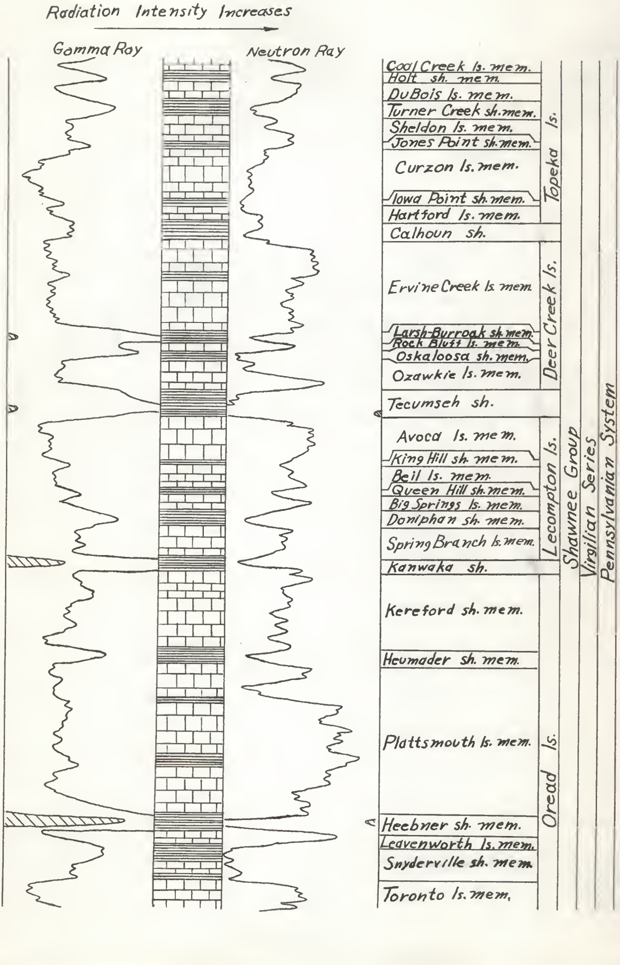
The gamma ray part of a radioactive log is produced by the disintegration of radioactive substances contained in the rocks. All types of rocks contain varying amounts of radioactive substances in varying degree of disintegration. As these radioactive substances disintegrate, gamma rays are given off. These rays are picked up by an ionization chamber which is lowered down the well and transmitted to a pen-and ink-type recorder, at the surface of the earth, by means of an electric cable.

The neutron curve is produced by bombarding the strata with a strong source of fast moving neutrons, and recording the secondary gamma rays produced. This curve might well be called a hydrogen content curve since hydrogen is the controlling factor of the intensity of the induced gamma ray radiation. Hydrogen in the

EXPLANATION OF PLATE I

Composite section of the Shawnee group, penetrated by wells drilled in central Kansas, showing the gamma ray and neutron ray reaction to each change in lithology.

PLATE I


Radiation Intensity Increases
Gamma Ray
Neutron Ray
Coal Creek ls. mem.
Holt sh. mem.
DuBois ls. mem.
Turner Creek sh. mem.
Sheldon ls. mem.
Jones Point sh. mem.
Curzon ls. mem.
Iowa Point sh. mem.
Hartford ls. mem.
Topeka ls.
Calhoun sh.
Ervine Creek ls. mem.
Larsh-Burroak sh. mem.
Rock Bluff ls. mem.
Oskaloosa sh. mem.
Ozawkie ls. mem.
Deer Creek ls.
Tecumseh sh.
Avoca ls. mem.
King Hill sh. mem.
Beil ls. mem.
Queen Hill sh. mem.
Big Springs ls. mem.
Doniphan sh. mem.
Spring Branch ls. mem.
Lecompton ls.
Kanwaka sh.
Kereford sh. mem.
Heumader sh. mem.
Plattsmouth ls. mem.
Heebner sh. mem.
Leavenworth ls. mem.
Snyderville sh. mem.
Toronto ls. mem.
Oread ls.
Shawnee Group
Virgilian Series
Pennsylvanian System

strata in any form (water, gas, oil) serves as a buffer to slow down or stop completely the neutron rays, thus reducing the amount of secondary gamma ray radiation.

On a radioactive log, radiation increases to the right; therefore beds containing the greater amount of radioactive material will be indicated as a throw to the right on the gamma ray curve, and beds containing a smaller amount of radioactive material will be indicated by a throw to the left.

On the neutron curve, beds containing a greater amount of interstitial liquid will be indicated on the log as a throw to the left. Beds containing little or no interstitial liquid will be indicated by a throw to the right.

Over a number of years, from laboratory measurements and the experience gained in logging thousands of wells, certain conclusions have been drawn concerning the relative intensity of radioactivity in different kinds of sedimentary rocks. As a general rule, shales are more radicactive and contain more liquid than the other common sedimentary rocks.

It is impossible, in this article, to give a complete description of the reaction of the gamma ray curve and the neutron curve to all the different types of sedimentary rocks. Therefore, only the two types encountered in the Shawnee group will be given.

According to S. W. McGaha (4):

> A shale is a sedimentary rock consisting of more or less consolidated fine mud. The fine muds may be predominantly of clay grade.

The common shales will usually have the maximum curve value (Gamma Ray) on most surveys. However, should a shale of marine origin or one containing bentonite or volcanic ash be traversed, the Gamma Ray Curve response will be much greater. Usually the darker the color of the shale the greater the radioactive value. The Neutron will record a minimum value because of high fluid content (connate water and waters of crystallization).

A limestone is a sedimentary rock consisting essentially of calcium carbonate ($CaCO_3$). Limestone varies greatly in texture depending on the impurities present. The color may vary from white to black. It occurs in cleavable crystals to compact mass, coarse to fine grains. It varies greatly in porosity, and with sufficient porosity it can contain good reservoirs for oil accumulation.

A limestone generally has less porosity than sandstone, therefore has less space for fluids, impurities and contamination. This may be one reason for the Neutron Curve being slightly higher in curve value than sandstone.

Gamma Ray--minimum value for clean limestone and will tend to increase toward the maximum with impurities. Neutron--high value, low fluid content or low curve value, high porosity and fluid content. The Neutron response for limestone is usually slightly more pronounced than the Neutron value for sandstone. This is probably due to the chemical crystalline structure.

Plate I shows the general stratigraphic section of the Shawnee group. It also shows the gamma ray and neutron ray curves' reaction to the various changes in lithology.

Construction of Structure Maps

From the discussion of radioactive logs, it is noted that the gamma ray curve is a lithology curve, and therefore it was used in determining the tops of different units. Each change in lithology is indicated by a characteristic "wiggle" on the log that may be traced from well to well across the state.

The characteristic wiggles for the units in the Shawnee group were identified by comparing one of the well logs from this area with a composite log of central Kansas prepared by the Lane-Wells Logging Company. After the different units had been identified and marked on one log, it was then used as a key in the identification of the units of the Shawnee group on the other 123 logs used in this study. The key log was prepared to give a log of the same scale to be used in the identification of the units.

The depths to the top of the Heebner and the Topeka were picked on all the logs, and these depth figures were reduced to elevations below sea level by subtracting the surface elevation of the various wells from the corresponding depth determinations, Table 1 (Appendix).

The elevations of the Heebner and the Topeka in the wells were plotted on overlays of a base map of central Kansas. The base map had been prepared by plotting the location of the wells on the base map from the legal description of the radioactive logs, Table 2 (Appendix).

Construction of Clastic Ratio Map

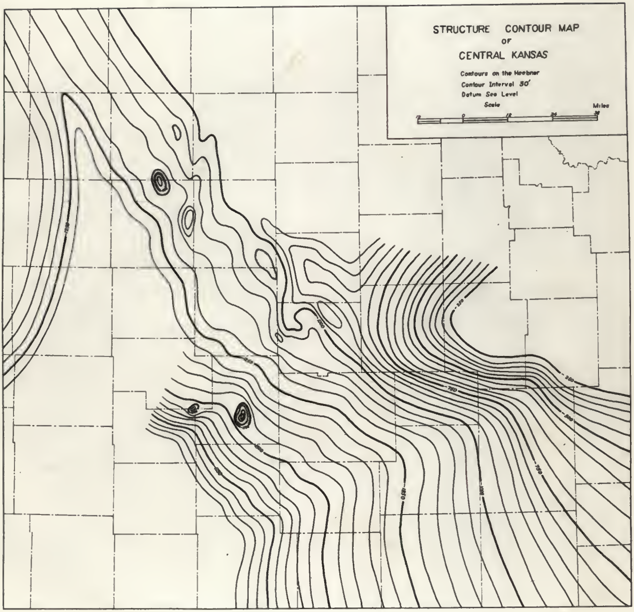
In making the clastic ratio map the thickness of the clastic in the Shawnee group was divided by the thickness of the non-clastic sediments. This ratio was then plotted on an overlay of the base map, and the map was then contoured in the same manner as any other contour map.

The data for the clastic ratio map were obtained from the radioactive logs by adding together the thickness of the limestones

EXPLANATION OF PLATE II

Structure contour map of central Kansas, contours on top of the Heebner shale member of Pennsylvanian age.

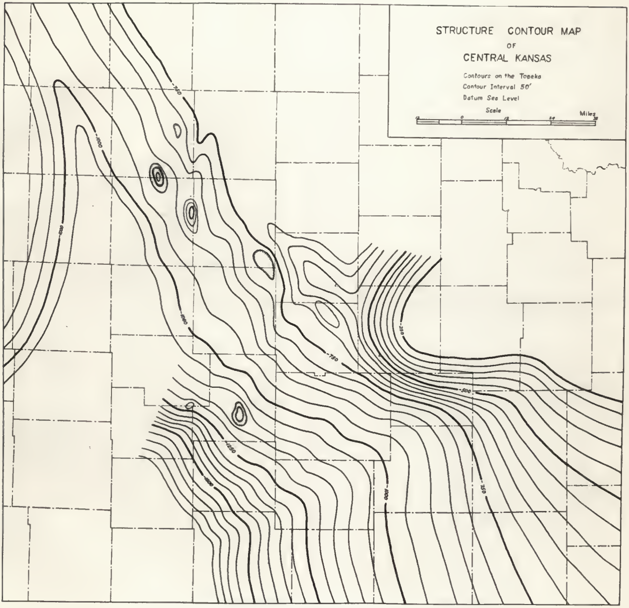
PLATE II


STRUCTURE CONTOUR MAP
OF
CENTRAL KANSAS
Contours on the Heebner
Contour Interval 30'
Datum Sea Level
Scale
Miles

EXPLANATION OF PLATE III

Structure contour map of central Kansas, contours on top of the Topeka limestone of Pennsylvanian age.

PLATE III


STRUCTURE CONTOUR MAP
OF
CENTRAL KANSAS
Contours on the Topeka
Contour Interval 50'
Datum Sea Level
Scale
Miles

of the Shawnee group, and then subtracting this figure from the total thickness of the Shawnee group on the logs. The difference in the total thickness and that of the limestones is the thickness of the clastic sediments in the group. The clastic ratio is the result obtained by dividing the clastic sediments by the nonclastic sediments.

REVIEW OF MAJOR STRUCTURE IN CENTRAL KANSAS

The two most striking tectonic features of the Kansas subsurface are the Nemaha uplift and the Central Kansas uplift. The Nemaha uplift lies along the eastern edge of the area described in this report, and the Central Kansas uplift lies along the western edge. Between these two areas lies the Salina basin, which in itself contains minor folds.

Central Kansas Uplift

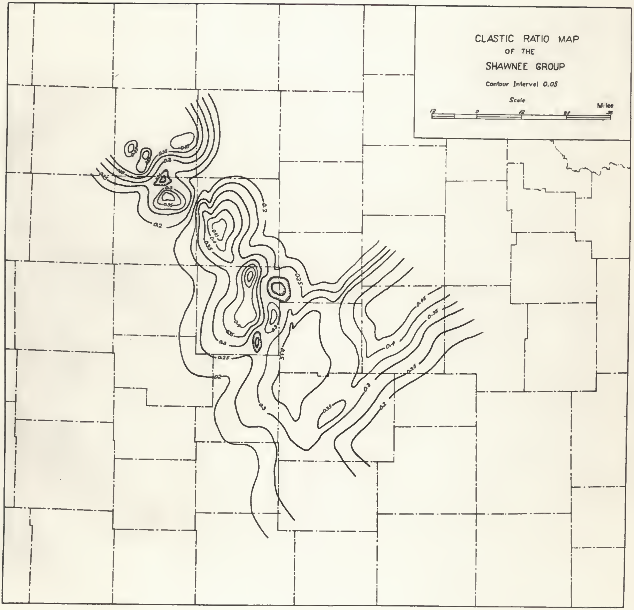
Koester states (2):

> The Central Kansas uplift is a buried, oft-rejuvenated structural feature trending northwest and southeast across west central Kansas which has been revealed by drilling for oil and gas within the past 10 years. It originated in pre-Cambrian time as a series of parallel batholiths and persisted as a positive element throughout much of Paleozoic time. Several periods of broad warping and erosion occurred during the Paleozoic and Mesozoic eras. Folding normal to the axis of the uplift has occurred principally in early Pennsylvanian and post-Cretaceous time and has been an important factor in the local accumulation of petroleum. The geologic history of the Central Kansas uplift is very similar to that of the Ozarks of Missouri.

EXPLANATION OF PLATE IV

Clastic ratio map of the Shawnee group. A numerical increase in contour value indicates an increase of clastic sediments.

PLATE IV


CLASTIC RATIO MAP
OF THE
SHAWNEE GROUP
Contour Interval 0.05
Scale
Miles

Nemaha Uplift

The Nemaha uplift is a north south trending granite ridge of pre-Cambrian crystalline rocks, which extends from Nebraska into Oklahoma. This granite ridge has had a history similar to that of the Central Kansas uplift in that both structures were pushed up and extensively eroded in early Pennsylvanian time. The long period of erosion that followed the uplift stripped off not only older Pennsylvanian sediments but also the Mississippian and Ordovician so that along the axis in the northern higher parts of the uplift later Pennsylvanian sediments rest directly upon pre-Cambrian crystalline rock. The structure of the Nemaha uplift is reflected in the overlying sediments; therefore it can be mapped by surface methods.

Salina Basin

The Salina basin was first defined by Barwick (1) as:

> The pre-Pennsylvanian syncline bounded on the east by the Nemaha granite ridge, on the southwest by the Barton arch, and on the south by the saddle between the Chautauqua arch and the Barton arch. The basin continues northward into Nebraska where its exact termination is not known.

The Barton arch, a name suggested by Barwick (1) is now known as the Central Kansas uplift.

The Salina basin was originally part of the North Kansas basin (Rich, 7). The North Kansas structural basin was separated into two basins by the uplift of the Nemaha granite ridge in post-Mississippian times, forming the Forest City basin on the east and the Salina basin on the west. During Pennsylvanian time these two basins were subsidence basins in which Pennsylvanian deposits accumulated to great thickness (3).

The major structures as well as some of the minor structures of the Kansas subsurface are shown in Plate IV.

INTERPRETATION OF STRUCTURE MAPS

Regional Dip

The major structures of central Kansas described previously are reflected in the Heebner and Topeka subsurface structure contour maps used in this study. These structures are indicated and labeled in Plate V.

Close examination of the two maps indicates they both reflect the same structure and the same local steepening and flattening of dip. There is, however, a slight difference in the regional dip of the two maps. The regional dip of the Heebner is steeper by about one foot per mile. This slight increase in dip is probably a reflection of sedimentation and not of tectonic forces.

The regional dip of the Shawnee group in central Kansas is approximately 18 feet per mile, although in places the dip increases to about 40 feet per mile. In McPherson and Harvey counties there is a general increase in dip in the direction of the Abilene arch and the Nemaha ridge. Another area of local steepening is in Pratt and Barton counties on the south flank of the Central Kansas uplift.

EXPLANATION OF PLATE V

Official Pool map. This map is a reproduction of the central part of the Official Pool Map prepared by Hugh McClellan consulting geologist, Wichita, Kansas.

Legend


.........................Huunton lime (H)


.........................Sylvan shale (Syl.)

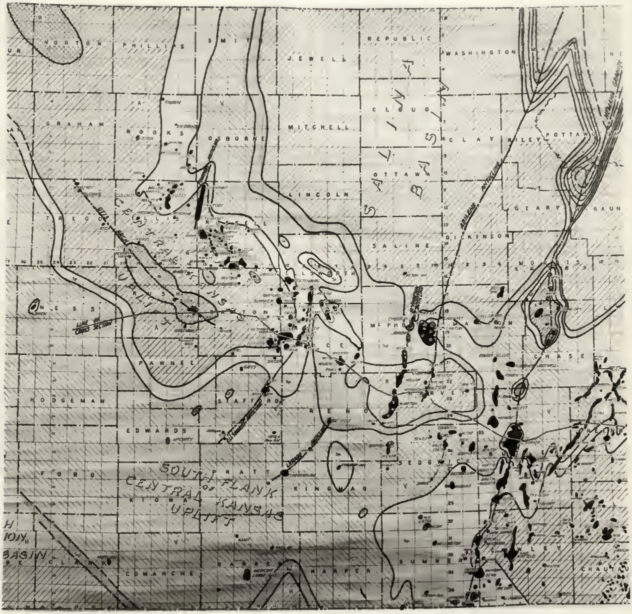

.........................Viola lime (V)


.........................Simpson shale and sand (Sp.) (including Wilcox sand)


.........................Arbuckle lime "Siliceous" (A)


.........................Basal sand and granite (G)

PLATE V


NORTON
PHILLIPS
REPUBLIC
WASHINGTON
JEWELL
GRAHAM
ROOKS
OSBORNE
MITCHELL
CLOUD
CLAY
RILEY
OTTAWA
LINCOLN
GEARY
DICKINSON
SALINE
TREGO
NESS
PAWNEE
HODGEMAN
EDWARDS
FORD
KIOWA
COMANCHE
PRATT
KINGMAN
HARPER
SEDGWICK
SUMNER
RENO
CHASE
SALINA BASIN
CENTRAL KANSAS UPLIFT
SOUTH FLANK CENTRAL KANSAS UPLIFT
ABILENE ANTICLINE
LINE OF CROSS SECTION

Across the Central Kansas uplift the regional dip is flattened to about 10 feet per mile on both the Topeka and the Heebner structure maps.

Local Steepening

In several places in central Kansas the local dip is steeper than can be explained by differential compaction over buried hills, Plates II and III. These areas of steep dip are probably the result of tectonic disturbances in the basement rocks in post-Pennsylvanian times.

Shift in Structure Axis

The structure axis, or the structure high, of the Central Kansas uplift in Devonian time passed through the northeast part of Rush county, Plate V. A comparison of the two structure maps of the Shawnee group indicates that the axis has shifted approximately 28 miles to the northeast. This shift in the structure high is greater than can be explained by the small amount of regional tilting that has taken place in this area. It is, therefore, felt by the author that this shift in structure high is due to a combination of regional tilting and broad warping of the Central Kansas uplift in post-Mississippian time.

INTERPRETATION OF THE CLASTIC RATIO MAP

The clastic ratio map indicates a lagoonal type of deposition for the Shawnee group over the Central Kansas uplift and over the Abilene arch. This lagoonal character is indicated by the five large high clastic ratio areas surrounded by low clastic ratio areas Plate IV. On the flanks of the Central Kansas uplift and the Abilene arch the clastic ratio diminishes in the direction of the Salina basin and the Dodge City basin, indicating an area of less clastic sediments.

The lagoonal character of the clastic ratio map is a direct reflection of the underlying buried hills. After the extensive warping and folding in post-Mississippian time, a long period of erosion ensued (2). Early in this period of erosion the sedimentary rocks were removed from the top of these hills, and a karst topography was produced in the relatively soluble dolomite surrounding the hills (8). Subsequent erosion tended to accentuate the relief of these pre-Cambrian hills due to the difference in the rate of erosion of the crystalline and sedimentary rocks exposed.

The first rocks deposited as the seas once again transgressed the land were non marine conglomerates derived from the residual material left in this area by erosion. As the seas became deeper, shale and limestone were deposited. By Virgilian times when the Shawnee group was deposited, the pre-Cambrian hills were completely covered to a considerable depth by earlier Pennsylvanian sediments.

The depth of water over Kansas was comparatively deep during the time of deposition of the Shawnee group as is indicated by the large amount of limestones in the group. The water over the buried hills was somewhat shallower, and large storm waves were able to rework the sediments and remove the finer fraction over the highest parts of the Central Kansas uplift. This agitation of sediments over the buried highs produced a slightly more clastic sediment than that deposited in the lagoonal areas and in the low lying areas of central Kansas, as indicated in Plate IV.

RELATIONSHIP OF STRUCTURE AND SEDIMENTATION TO OIL ACCUMULATION

The Shawnee group is not a prolific oil producing group in central Kansas. Therefore, certain assumptions must be made before the clastic ratio map can be used to show the relationship of structure and sedimentation to oil accumulation in this area.

The clastic ratio map of the Shawnee group in central Kansas reflects the structural highs and the buried hills of this area, as is shown on the Devonian erosional surface map, Plate V. Since the clastic ratio map reflects sedimentation controlled by the pre-Devonian structural highs and lows (high clastic ratio over buried hills--low clastic ratio in depressions and low areas surrounding the buried hills), it is believed, by the author, that clastic ratio maps of other groups and formations below the Shawnee group would reflect sedimentation controlled by these same high areas in a similar manner to that of the Shawnee group.

The more clastic sediments have a greater amount of porosity and permeability than the nonclastic sediments; therefore the clastic sediments make very good reservoir rocks in central Kansas. If these reservoir rocks are folded into structural traps, the possibility of encountering oil is much greater than in traps where the sediments are of a nonclastic nature or of a low clastic ratio.

The conditions just described are very well illustrated by the maps prepared for this study. In the southwest part and in the northwest part of Russell county the clastic ratio map shows an area of more clastic sediments. The structure maps indicate that this is a structural high area. The official oil pool map shows that in this area there are several big oil pools.

In the northwest corner of Barton county there is a buried hill similar to the others in central Kansas that have had an influence on the accumulation of oil. The location of the buried hill on the clastic ratio map shows that the clastic ratio is low over the hill. The oil pool map also shows there are no oil pools in this area.

SUMMARY

The results of this research have shown that the Shawnee group is continuously represented in the subsurface in central Kansas. This study indicates that the present structure is controlled to a large extent by the structural grain of the basement rocks established in pre-Cambrian time. The area has also been subjected to broad warping and tilting, but the main structures are the result of rejuvenation of structures established in pre-Cambrian time.

This investigation also indicates that the use of clastic

ratio maps in conjunction with structural maps would add valuable information about an area that could be used in oil exploratory studies of central Kansas.

ACKNOWLEDGMENT

The writer wishes to express his appreciation to Dr. J. R. Chelikowsky, Department of Geology, for his sincere interest and advice in directing this investigation. Acknowledgment is also extended to Mr. W. L. Pugh, Lane-Wells Company, for making available the radioactive logs used in this research.

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APPENDIX

Table 1. Data on oil wells derived from radioactive logs.

Well no.[1]	Surface elevation, feet	Depth to top of Topeka, feet	Depth to top of Heebner, feet	Elevation below sea level of Topeka, feet	Elevation below sea level of Heebner, feet	Clastic ratio
1	1,865	3,408	3,768	1,543	1,903	0.18
2	1,780	3,470	3,758	1,690	1,978	0.16
3	1,531	-	3,680	-	2,149	
4	1,829	-	3,752	-	1,923	
5	1,814	2,720	2,986	906	1,172	0.18
6	1,979	2,922	3,159	943	1,180	0.19
7	1,777	2,639	2,898	862	1,121	0.24
8	1,912	2,806	3,037	894	1,125	0.16
9	1,911	2,666	2,952	755	1,041	0.29
10	1,959	2,914	3,160	955	1,201	0.25
11	1,879	2,812	3,047	933	1,168	0.23
12	1,930	2,952	3,210	1,022	1,280	0.27
13	1,861	-	3,042	-	1,181	
14	1,841	2,770	3,010	929	1,169	0.35
15	1,939	2,872	3,110	933	1,171	0.33
16	1,775	2,666	2,930	891	1,155	0.23
17	1,846	2,795	3,022	949	1,176	
18	1,793	2,670	2,935	877	1,142	0.42
19	1,818	2,717	2,982	899	1,164	0.24
20	1,864	2,658	2,916	794	1,052	0.32
21	1,906	2,698	2,951	792	1,045	0.18
22	1,957	2,852	3,085	895	1,128	0.35
23	1,763	2,602	2,862	839	1,099	0.32
24	1,902	2,680	2,960	778	1,058	0.51
25	1,364	1,900	2,080	536	716	0.19

Table 1. (cont.)

Well no.[1]	Surface elevation, feet	Depth to top of Topeka, feet	Depth to top of Heebner feet	Elevation below sea level of Topeka, feet	Elevation below sea level of Heebner, feet	Clastic ratio
26	1,458	2,000	2,194	542	736	0.25
27	1,162	1,890	2,172	728	1,010	
28	1,279	1,900	2,204	621	925	
29	2,627	-	3,652	-	1,025	
30	2,056	3,184	3,458	1,128	1,402	0.19
31	2,075	3,052	3,250	977	1,175	0.26
32	1,903	2,690	2,964	787	1,061	0.18
33	2,019	2,978	3,235	959	1,216	0.22
34	1,955	2,810	3,030	855	1,075	0.2
35	1,862	2,800	3,023	938	1,161	0.25
36	2,162	3,092	3,360	930	1,198	0.31
37	2,086	-	3,266	-	1,180	
38	1,997	-	3,244	-	1,247	
39	1,999	2,938	3,200	939	1,201	0.24
40	1,950	3,032	3,258	1,082	1,308	0.17
41	2,046	3,025	3,245	979	1,199	0.24
42	2,093	3,060	3,286	967	1,193	0.4
43	1,797	2,542	2,795	745	998	0.28
44	2,250	-	3,463	-	1,213	
45	2,551	3,504	3,709	953	1,158	0.34
46	1,440	2,120	2,382	680	942	0.17
47	1,500	1,730	2,144	230	600	0.23
48	1,563	1,855	2,098	292	535	0.29
49	1,462	1,796	2,108	334	646	0.3
50	1,499	1,784	2,097	285	598	0.42

Table 1. (cont.)

Well no. [1]	Surface elevation, feet	Depth to top of Topeka, feet	Depth to top of Heebner, feet	Elevation below sea level of Topeka, feet	Elevation below sea level of Heebner, feet	Clastic ratio
51	1,394	-	1,648	-	254	
52	2,533	3,493	3,780	960	1,247	0.39
53	2,055	3,200	3,502	1,145	1,447	0.2
54	2,151	2,532	2,764	381	613	0.81
55	1,909	3,140	3,470	1,231	1,561	0.19
56	1,911	2,355	3,502	1,311	1,591	0.47
57	1,695	2,905	3,260	1,210	1,565	0.25
58	1,676	2,768	3,110	1,092	1,434	0.25
59	1,631	2,635	2,970	1,004	1,339	0.38
60	1,735	2,474	2,736	739	1,001	0.3
61	1,788	2,612	2,880	824	1,092	
62	1,750	2,360	2,630	610	880	
63	1,726	-	2,773	-	1,047	
64	1,779	2,427	2,701	648	922	0.33
65	1,721	-	2,746	-	1,025	
66	1,735	2,460	2,725	725	990	0.29
67	1,771	2,558	2,830	787	1,059	0.29
68	1,719	2,450	2,722	731	1,003	0.35
69	1,682	2,300	2,584	618	902	0.39
70	1,801	-	2,865	-	1,064	
71	1,805	2,643	2,916	838	1,111	0.33
72	1,752	2,527	2,795	775	1,043	0.34
73	1,679	2,422	2,722	743	1,043	
74	1,666	2,426	2,728	760	1,062	0.35
75	1,763	2,533	2,801	770	1,038	0.35

Table 1. (cont.)

Well no. [1]	Surface elevation, feet	Depth to top of Topeka, feet	Depth to top of Heebner, feet	Elevation below sea level of Topeka, feet	Elevation below sea level of Heebner, feet	Clastic ratio
76	1,726	2,460	2,739	734	1,013	0.33
77	1,744	2,462	2,729	718	985	0.32
78	1,697	-	2,592	-	895	
79	1,868	2,715	2,926	847	1,058	0.41
80	2,038	2,898	3,116	860	1,078	0.47
81	1,984	-	3,061	-	1,077	
82	1,965	2,813	3,032	848	1,067	0.47
83	2,198	3,138	3,348	940	1,150	0.53
84	1,959	2,858	3,072	899	1,113	0.43
85	2,229	3,222	3,430	993	1,201	
86	2,050	2,958	3,198	908	1,148	0.43
87	2,031	-	3,190	-	1,159	
88	2,021	2,896	3,112	875	1,091	0.4
89	2,235	3,270	3,465	1,035	1,230	
90	2,074	3,032	3,238	958	1,164	0.51
91	2,103	3,050	3,271	947	1,168	0.46
92	1,868	2,750	2,960	882	1,092	0.44
93	2,019	-	3,344	-	1,325	
94	2,072	-	3,413	-	1,341	
95	1,883	2,688	2,986	805	1,103	0.32
96	1,859	2,652	2,932	793	1,073	0.27
97	1,791	2,645	2,876	854	1,085	0.46
98	1,768	2,668	2,892	900	1,124	0.35
99	1,923	2,745	3,020	822	1,097	0.29
100	1,789	2,615	2,854	826	1,065	0.32

Table 1. (concl.)

Well no.[1]	Surface elevation, feet	Depth to top of Topeka, feet	Depth to top of Heebner, feet	Elevation below sea level of Topeka, feet	Elevation below sea level of Heebner, feet	Clastic ratio
101	1,841	2,652	2,878	811	1,037	0.26
102	1,865	-	2,982	-	1,117	
103	1,834	2,715	2,943	881	1,109	
104	1,863	2,728	2,975	865	1,112	0.34
105	1,834	-	2,895	-	1,061	
106	1,784	2,660	2,898	876	1,114	0.37
107	1,304	1,662	1,945	358	641	0.48
108	1,380	2,426	2,565	1,046	1,185	
109	2,639	-	3,572	-	933	
110	2,595	-	3,552	-	957	
111	1,875	2,863	3,118	988	1,243	0.27
112	1,823	-	3,133	-	1,310	
113	1,770	2,684	2,970	914	1,200	0.34
114	1,908	-	3,342	-	1,434	
115	1,964	3,310	3,527	1,346	1,563	0.23
116	1,855	-	3,256	-	1,401	
117	1,867	2,828	3,110	961	1,243	0.25
118	1,978	-	3,498	-	1,520	
119	1,878	2,810	3,180	932	1,302	
120	1,925	3,022	3,427	1,097	1,502	
121	1,878	2,855	3,134	977	1,256	0.22
122	1,818	-	3,200	-	1,382	
123	1,282	2,015	2,402	733	1,120	

[1] Well numbers in this table correspond to well numbers in Table 2.

Table 2. Legal description and location of wells.

Well no.[1]	Company	Well	Field	County	Location Sec. T. R.
1	J. M. Huber Corp.	Gant #4	North Skinner	Barber	32-30S-13W
2	J. M. Huber Corp.	Skinner "F" #1	Skinner-Simpson		20-31S-14W
3	Continental Oil Co.	G. R. Smity #5	Boggs		21-33S-12W
4	Natl. Co-op. Ref. Assn.	Massey #4	Sun City		27-30S-15W
5	N. C. R. A.	Stueckmann #1	North Hammer	Barton	23-19S-12W
6	Bridgeport Oil Co.	Hunt "A" #2	Boyd	Barton	32-17S-14W
7	Derby Oil Co.	Hamilton #1	NW Ames		9-18S-11W
8	Shell Oil Co.	Hoffman "C" #5	Trapp		1-16S-14W
9	N. C. R. A.	Redetzke #5	Kraft-Prusa		19-16S-11W
10	Harbar Drilling Co.	Rogers #1	Albert		4-19S-15W
11	Bridgeport Oil Co.	Murry "A" #3	Carroll		20-17S-14W
12	Harbar Drilling Co.	Brewer #1	Unruh		23-20S-14W
13	Hanlon-Boyle Inc.	Schartz #1	-		7-20S-12W
14	Republic Natural Gas Co.	W. O. Smith #2	Eveleigh		7-18S-13W
15	Continental Oil Co.	Monrow #5	Boyd		4-18S-14W
16	E. H. Adair	F. Roble #1	Hammeke		18-19S-11W
17	Hanlon-Boyle, Inc.	Schartz #4	Sunny Valley		7-20S-12W
18	Aladdin Petro. Corp.	Kultgen "A" #3	Cheyene		12-19S-12W
19	Brunson Drilling Co.	Feist #2	Feist		29-18S-11W
20	N. C. R. A.	Ney #3	Kraft-Prusa		17-16S-11W
21	Robert L. Williams	Kroutwurst #4	Kraft-Prusa		11-17S-11W
22	Musgrove Petro. Co.	Prusa #5	Trapp		20-16S-13W
23	Stanolind Oil & Gas Co.	W. M. Panning #8	Silica		2-20S-11W
24	Sunray Oil Corp.	Turgeon #5	Beaver		9-16S-12W
25	Cooperative Ref. Assn.	South Lathrop #19	Elbing Pool	Butler	17-23S-4E

Table 2. (cont.)

Well no.[1]	Company	Well	Field	County	Location Sec. T. R.
26	K. T. Wiedemann	Clearwater #1	North Havlett	Butler	31-23S-5E
27	Cooperative Ref. Assn.	Morton #1	Rock	Cowley	29-30S-4E
28	Biddle Drilling Co.	Biddle #1	Biddle	Cowley	7-32S-5E
29	Derby Oil Co.	Feeley #1	-	Decatur	26-5S-27W
30	Max Cohen	Bright #1	Mackville	Edwards	1-24S-16W
31	Midstates Oil Corp.	Wasinger "A" #4	Riverview	Ellis	21-11S-18W
32	Stanolind Oil & Gas Co.	L. L. Austin #6	S. Fairport		36-12S-16W
33	Darby & Bothwell	Karlin #1	Catherine		10-13S-17W
34	Anschutz Drilling Co.	Perschisnke #7	Fairport		11-13S-16W
35	C. L. Roberts	Oswald #3	Blue Hill		11-12S-16W
36	Doley Oil Co.	Koblitz #3	Koblitz		23-12S-18W
37	Westgate Greenland Co.	Windholz #2	Bemis Shutts		3-12S-17W
38	Alpine Oil & Royalty Co.	Leiker #6	Wildcat		18-15S-17W
39	Darby & Bothwell	Giebler "B" #6	Catherine		10-13S-17W
40	Midstates Oil Corp.	M. Cross #10	NW Burnett		2-11S-18W
41	N. C. R. A.	Warner #1	NW Burnett		3-11S-18W
42	Republic Natural Gas Co.	Hadley #1	Bemis		31-11S-17W
43	D. R. Lauck Oil Co.	Frevert #5	Stoltenberg	Ellsworth	11-17S-10W
44	Wilcox Oil Co.	Rush #1	Wildcat	Graham	9-6S-22W
45	Derby Oil Co.	Toll #1	Wildcat	Graham	15-7S-25W
46	N. C. R. A.	Schmidt #2	Burrton	Harvey	31-22S-3W
47	Continental Oil Co.	Boechner "A" #2	Graber	McPherson	28-21S-1W
48	Shell Oil Co.	Giffin "B" #3	Ritz-Canton		14-19S-2W
49	Shell Oil Co.	J. Stucky #2	Voshell		9-21S-3W
50	Casebeer Supply Co.	Johnson "B" #1	Doorstep		35-19S-3W

Table 2. (Cont.)

Well no.[1]	Company	Well	Field	County	Location Sec. T. R.
51	Branine-Goering-Jones	Ford #1	Wenger	Marion	10-21S-3E
52	Cooperative Ref. Assn.	Lythe #2	Aldrich	Ness	23-18S-26W
53	Stanolind Oil & Gas Co.	Smith-Schnack #1	Zook	Pawnee	16-23S-16W
54	Cooperative Ref. Assn.	Dusin #4	North Dayton	Phillips	13-2S-19W
55	Cooperative Ref. Assn.	Brown "B" #3	Carmi	Pratt	29-26S-12W
56	Shell Oil Co.	Honeman #1	Carmi		31-26S-12W
57	Skelly Oil Co.	Miller #6	Cunningham		36-27S-11W
58	J. M. Huber Corp.	Reese #5	Lerado	Reno	11-26S-9W
59	George Siegrist	Love #1	Abbyville	Reno	19-24S-7W
60	Skelly Oil Co.	Buehler #1	Kingwald	Rice	33-18S-10W
61	Stanolind Oil & Gas Co.	R. Specht #1	Silica		6-20S-10W
62	Shell Oil Co.	Zajic #3	Geneseo		13-18S-8W
63	Lindas Oil	Haxton #1	Chase		30-19S-9W
64	R. L. Williams	Janssen #2	Edwards		3-18S-8W
65	Anderson-Pritchard Oil	Volkland #6	Chase		32-18S-9W
66	Palmer Oil Corp.	Bredfeldt #2	Bredfeldt		7-18S-9W
67	D. R. Lauck Oil Co.	Probst #6	Chase		20-19S-10W
68	Shell Oil Co.	Gramm "A" #1	Chase		15-19S-9W
69	The Atlantic Ref. Co.	Green #1	Odessa		29-18S-6W
70	Jay Kornfeld	Proffitt #4	Chase		18-20S-9W
71	Branine & Holl	Specht #1	Raymond		16-20S-10W
72	Derby Drilling Co.	Bennke #2	Silica		15-19S-10W
73	Berry & Eelis	Walsten #2	Welch		8-21S-6W
74	Brunson Drilling Co.	Graham #1	Wildcat		28-20S-8W
75	Stanolind Oil & Gas	Manke #8	Silica		28-19S-10W

Table 2. (cont.)

Well no.[1]	Company	Well	Field	County	Location Sec. T. R.
76	Lindas Oil Co.	Patterson #1	Chase	Rice	23-19S-9W
77	Hinkle Oil Co.	Culbertson #1	Orth		26-18S-10W
78	Continental Oil Co.	Meyer #5	Geneseo		30-18S-7W
79	Cooperative Ref. Assn.	Clayton #3	Stockton	Rooks	35-7S-17W
80	Cooperative Ref. Assn.	McClay #4	Westhusin		12-9S-17W
81	Herndon Drilling Co.	Dorr #1	Dorr		17-9S-16W
82	Vickers Petroleum Co.	Gamble #4	Laton		3-9S-16W
83	Harbar Drilling Co.	Bumgartner #1	Wildcat		25-9S-19W
84	Harbar Drilling Co.	Dopita "A" #1	Dopita		31-8S-17W
85	Skelly Oil Co.	Lillian Scoggins #8	Berland		18-10S-19W
86	Derby Drilling Co.	Andreson #1	East Barry		31-8S-18W
87	Phillips Petro. Co.	Thytault #1	Chandler		11-8S-19W
88	C. W. Trickett	Daugherty #5	Westhusin		13-19S-17W
89	Heathman & Honiker Co.	Miller #1	Marcotte		5-10S-20W
90	Aylward Drilling Co.	Marcotte #1	Semi-Wildcat		18-9S-19W
91	J. A. Allison	Smith-Halderman #1	Zurich		26-10S-19W
92	Crown Drilling Co.	Chesney #1	Wildcat		18-8S-16W
93	Magnolis Petro. Co.	J. Tammen #2	Ryan	Rush	33-19S-16W
94	Great Lakes Carbon Co.	Dirks #2	Dirks	Rush	16-18S-18W
95	Cooperative Ref. Assn.	Sellens Estate #3	Trapp	Russell	29-15S-13W
96	W. H. Black	Janne #1	-		23-15S-12W
97	Jones-Shelborne Inc.	Opdycke #1	Hall-Gurney		20-14S-13W
98	Cooperative Ref. Assn.	Reinhardt #4 A East	Big Creek		36-14S-15W
99	Sohio Petro. Co.	Hines "B" #3	North Fairport		16-11S-15W
100	W. M. Steinle	Mahony #1	Mahony		8-14S-12W

Table 2. (concl.)

Well no.[1]	Company	Well	Field	County	Location Sec. T. R.
101	Stanolind Oil & Gas	Oswald #1	Fairport	Russell	8-12S-15W
102	Summit Oil Co.	Miller #1	Atherton		29-13S-14W
103	Francis M. Raymond	H. Reinhardt #7	Big Creek		19-14S-14W
104	Donald T. Ingling	Ney #1	North Beaver		31-15S-12W
105	B. H. & P. Oil Co.	Ptacke #3	Hall-Guerney		16-15S-12W
106	Cooperative Ref. Assn.	Lucinla Sellers #8	Trap		17-15S-13W
107	Currier & Keys	Johnson #1	Ollson	Saline	10-16S-3W
108	J. P. Gaty	Borg #1	Greenwich	Sedgwick	14-26S-2E
109	Continental Oil Co.	Bouts #1	Adell	Sheridan	2-6S-27W
110	Continental Oil Co.	Leonard #6	Adell	Sheridan	12-6S-27W
111	H. B. Armer	Andress "D" #1	East Rothgarn	Stafford	2-21S-13W
112	Herndon Drilling Co.	Riley #2	-		28-23S-11W
113	M. B. Armer	Amith #1	South Snyder		9-21S-11W
114	Crown Oil Co.	Glassock #1	St. John Town Site		4-24S-13W
115	Atlantic Ref. Co.	McCandless #4	McCandless		30-25S-13W
116	Ben F. Prack Oil Co.	Allen #1	Hildebrand		1-24S-12W
117	Midstates Oil Corp.	Clark #1	Mueller		18-21S-12W
118	Atlantic Ref. Co.	Nell #1	Richland		27-24S-14W
119	Atlantic Ref. Co.	Gates #12	Gates		12-21S-13W
120	Atlantic Ref. Co.	Wise #1	Rattlesnake		13-24S-14W
121	Midstates Oil Corp.	McCrary "A" #6	-		19-21S-12W
122	Sunray Oil Corp.	Banker "D" #1	Zenith		10-24S-11W
123	Cooperative Ref. Assn.	Beam #2	Wellington	Sumner	20-31S-1W

[1] Well numbers in this table correspond to well numbers in Table 1.

A STRUCTURAL AND SEDIMENTATION STUDY OF THE SHAWNEE GROUP IN CENTRAL KANSAS AND THE POSSIBLE RELATIONSHIP TO OIL PRODUCING AREAS

by

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ABSTRACT OF A THESIS

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The purpose of this investigation was to make a structural and sedimentation study of the Shawnee group in central Kansas, and to determine if any relationships existed between structure, sedimentation, and oil accumulation.

The data for the construction of the two structural maps and the clastic ratio map were taken from radioactive well logs of central Kansas. The location of the wells was plotted on a base map of the area and the information derived from the radioactive logs was placed on overlays of the base map. The maps were then contoured in the usual manner.

Close examination of the maps prepared for this study revealed that the structure of the Shawnee group is due primarily to a combination of three factors: regional tilting, sedimentation, and rejuvenation of structures developed in pre-Cambrian times.

A comparison of the structural maps, clastic ratio map, and official pool map indicates that there is a relationship between structure, sedimentation, and oil accumulation in central Kansas. The author believes that the use of clastic ratio maps in conjunction with structure maps would add valuable information about an area that could be used in oil exploratory studies of central Kansas.