FAULTING AS A POSSIBLE ORIGIN FOR THE FORMATION OF THE NEMAHA ANTICLINE

by

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INTRODUCTION

Location of the Problem Area

The area covered by this investigation comprises 16 counties of the 42 counties east of the sixth principle meridian in Kansas (Plate I). The problem area averages 130 miles in length, 100 miles in width, and has a land area of 13,000 square miles.

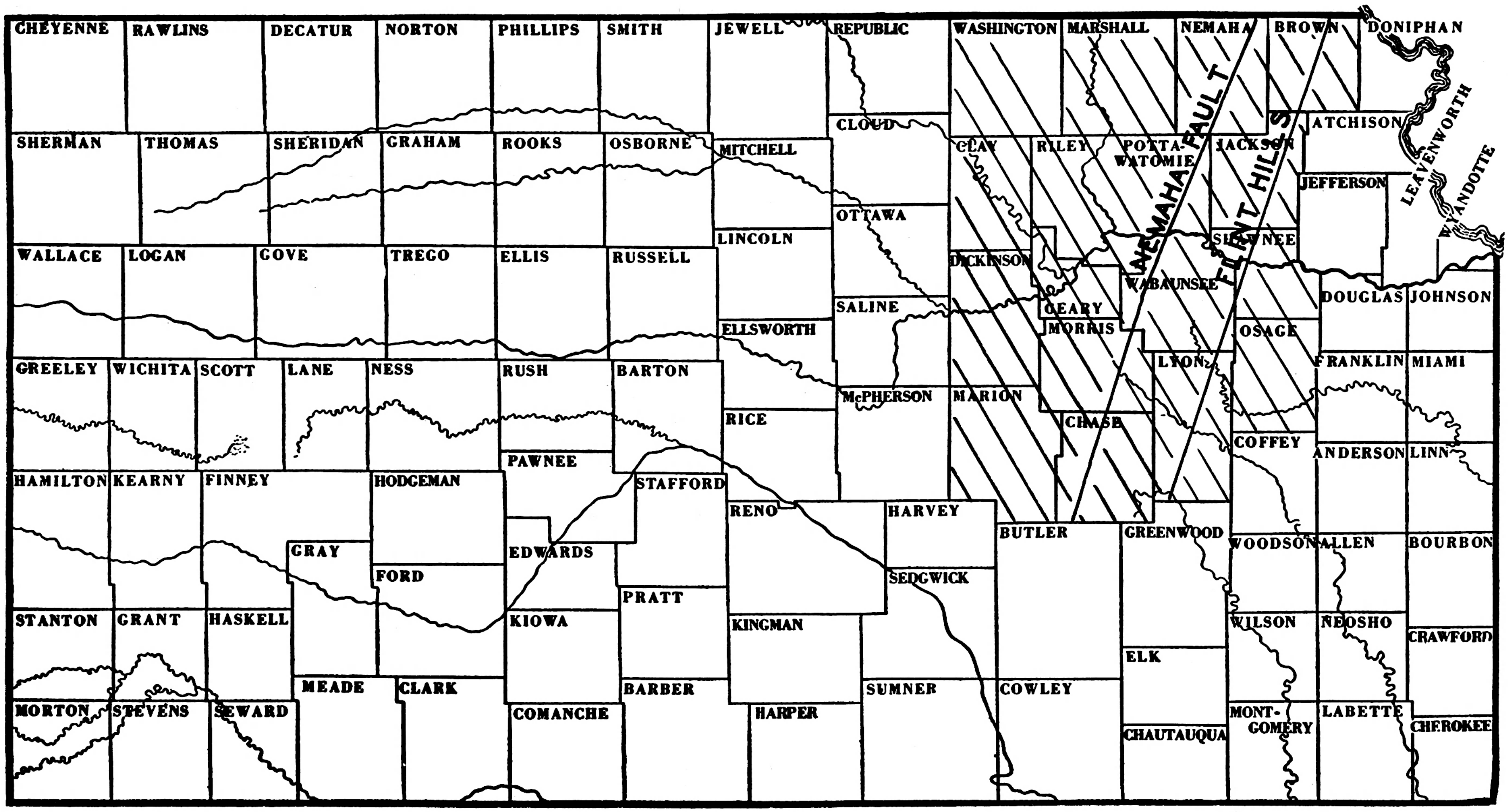
Geologic Setting

The problem area lies within the Western Interior Province, and is characterized by a gentle regional dip to the west; thus older rocks are encountered to the east. The topography has a relatively even low relief, except in the region of an east-facing scarp, referred to as the "Flint Hills" (Plate I). The "Flint Hills" extend across the entire state of Kansas with a strike of approximately north twenty degrees east (N20E). They cross the northern boundary in Brown county (range seventeen east), and the southern boundary in Cowley county (range eight east). They were formed by the differential erosion of a resistant series of Permian limestones to produce about 350 feet of relief. A cross section of the "Flint Hills" would show that they overlie an ancient subsurface structure referred to as "The Nemaha Buried Mountains", "The Nemaha Ridge", "The Table-rock Anticline", and many others; (Jewett 1951).

EXPLANATION OF PLATE I

Map of Kansas showing the 16 counties covered by this investigation, the approximate location of the Nemaha fault, and the "Flint Hills".

PLATE I


CHEYENNE
RAWLINS
DECATUR
NORTON
PHILLIPS
SMITH
JEWELL
REPUBLIC
WASHINGTON
MARSHALL
NEMAHA
BROWN
DONIPHAN
SHERMAN
THOMAS
SHERIDAN
GRAHAM
ROOKS
OSBORNE
MITCHELL
CLOUD
CLAY
RILEY
POTTA-WATOMIE
JACKSON
ATCHISON
JEFFERSON
LEAVENWORTH
WYANDOTTE
NEMAHA FAULT
FLINT HILLS
OTTAWA
LINCOLN
WALLACE
LOGAN
GOVE
TREGO
ELLIS
RUSSELL
DICKINSON
SHAWNEE
WABAUNSEE
GEARY
SALINE
DOUGLAS
JOHNSON
ELLSWORTH
MORRIS
OSAGE
GREELEY
WICHITA
SCOTT
LANE
NESS
RUSH
BARTON
LYON
FRANKLIN
MIAMI
McPHERSON
MARION
RICE
CHASE
COFFEY
ANDERSON
LINN
PAWNEE
HAMILTON
KEARNY
FINNEY
HODGEMAN
STAFFORD
RENO
HARVEY
BUTLER
GREENWOOD
WOODSON
ALLEN
BOURBON
GRAY
EDWARDS
FORD
SEDGWICK
PRATT
STANTON
GRANT
HASKELL
KIOWA
KINGMAN
WILSON
NEOSHO
CRAWFORD
ELK
MEADE
CLARK
BARBER
SUMNER
COWLEY
MORTON
STEVENS
SEWARD
COMANCHE
HARPER
MONT-GOMERY
LABETTE
CHAUTAUQUA
CHEROKEE

Statement of the Problem

In the discussion of the multi-named subsurface structure, little mention is found of the possibility of a fault origin. In the majority of all Kansas geologic literature, an anticlinal origin is favored. Thus, a problem for investigation appeared: "Could the subsurface structure which underlies, and parallels the 'Flint Hills' be the result of ancient faulting?". With the origin of the structure as the main topic, the nomenclature associated with faulting must be determined; i.e., movement, location, strike, displacement, and most important the date movement occurred.

SUBSURFACE DATA

Available Materials

The materials available for the preparation of a subsurface geologic problem are:

1. Geologic logs of oil wells that have been drilled in the problem area.

2. Prepared isopachus (thickness) maps of the general area.

3. Prepared cross sections of the general area.

4. Existing contour maps of the surfaces to be studied.

5. Theses that cover similar or identical structures that reflect different ideas, and approaches to the solution of the problem.

6. Geologic literature written on the general area.

Source of Data

The well log data (Table II, Appendix) was assembled in the office of the Well Log Library, Kansas State Geological Society, University of Kansas, Lawrence, Kansas. Additional logs were gathered from literature published by the Kansas State Geological Society. Isopachus maps, cross sections, and contour maps were taken from bulletins published by the Kansas State Geological Society.

Map Data

Since a regional aspect was desired to best portray the fault, a base map, scale 1:500,000, was obtained from the United States Geological Survey office, Lawrence, Kansas. With the map scale decided as 1:500,000, or one inch equal to approximately eight miles, a contour interval of 100 feet was decided on. The well logs obtained from the sources listed above were plotted on the base map of Kansas, accurate to the section. To aid in the plotting of the wells, a plastic template was made and the center of all the 36 sections within a range-township square were drilled out. A pen point was then used to mark the well location when the template was laid over the base map. Since many range-township squares are not perfect squares, due to inaccuracies in old land surveys, the template was not used in all locations. In over or under square range-townships the location of the well was plotted with a ruler.

CONSTRUCTION OF THE CONTOUR MAPS

Selection of the Contour Surface

The greatest surface for contention in the Historical geology of Kansas is the configuration of the Pre-Cambrian granite. This surface was chosen as the primary surface to be contoured, since it is the foundation for all the sedimentary rocks that have been laid down through the eras.

Location of the Fault

Locating the fault, if one was present, became a function of two thoughts: (1) a study of dips on both sides of the fault, and the abrupt increase in dips across the disrupted zone, and (2) the actual physical impossibility to contour across the disrupted zone if no fault was assumed.

A map was made of the dips on the Pre-Cambrian granite surface to study the area around and over the suspected fault. A portion of this map is included (Fig. 1) to illustrate the magnitude of the dips to the east and west of the suspected fault and the large increase in dip encountered crossing the suspected fault. It must be remembered that in this region of the great plains, the larger dips are those that range up to as much as twenty degrees. In the dip map, mentioned above, the dips on the east and west side range up to 75 feet per mile. This represents an angle of only zero degrees forty-nine minutes. The dips measured across the suspected fault range up to 980 feet per

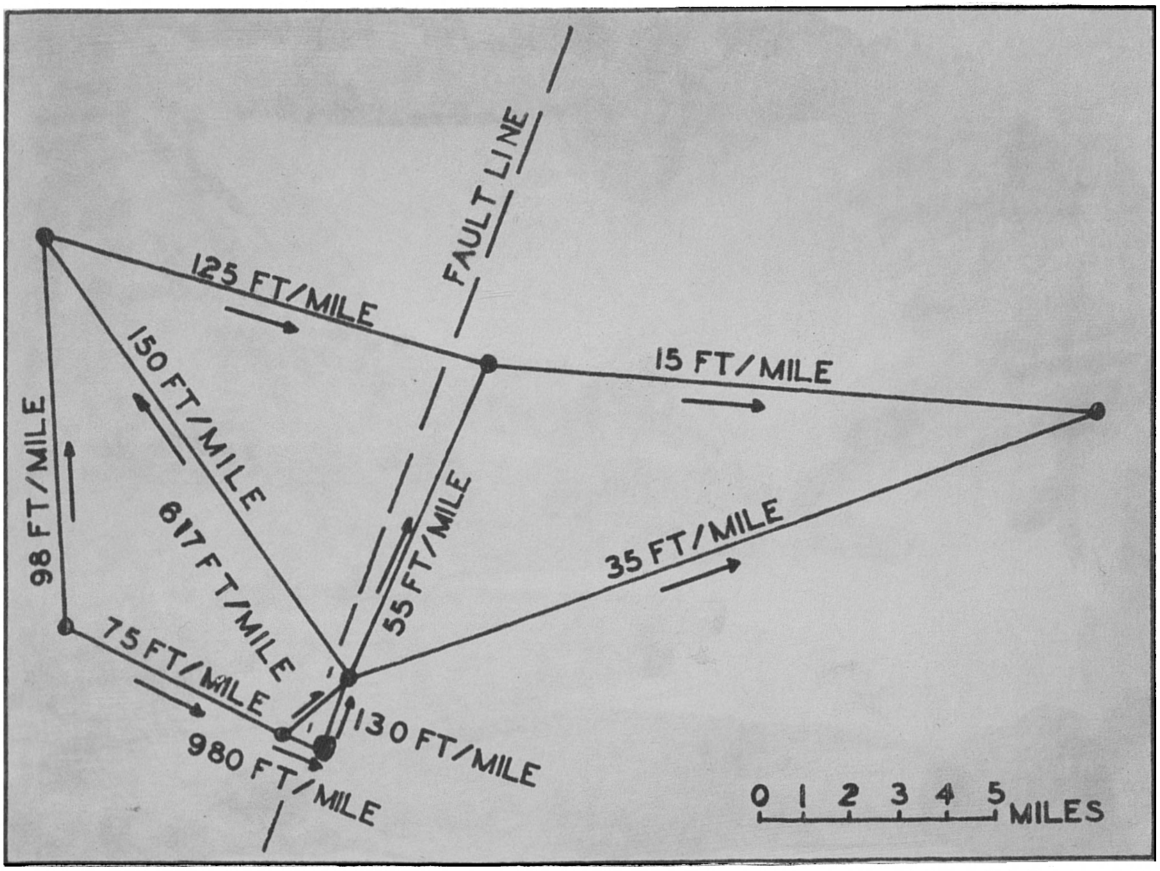


Fig. 1. Sample portion of the dip map constructed on the Pre-Cambrian surface.

mile. This represents an angle of ten degrees forty-two minutes, or 13 times as large as east and west side dips.

After a careful study of this map, the fault line was drawn in on the Pre-Cambrian contour map. Seven pairs of wells were used, one on each side of the fault, to locate the fault line. The wells are:

WEST SIDE	COUNTY	EAST SIDE
S34-T2S-R12E	Nemaha	S25-T3S-R13E
S16-T2S-R13E	Nemaha	S13-T2S-R14E
S1-T8S-R10E	Pottawotomie	S14-T8S-R11E
S32-T9S-R10E	Pottawotomie	S36-T9S-R10E
S32-T10S-R10E	Wabaunsee	S33-T10S-R10E
S5-T11S-R10E	Wabaunsee	S6-T11S-R10E
S1-T20S-R7E	Chase	S2-T20S-R7E

In all seven pairs of wells, the dips across the fault were many times greater than the dips on both sides of the fault. The accuracy of the location of the fault line varies with the distance between the paired wells. This distance varies from one mile apart to eight; thus the fault line is located accurately to one-half mile and inaccurately to four miles.

Errors in Contour Maps

In the construction of a contour map there are three physical errors that could occur: (1) misidentification of a particular formation by the well geologist, (2) mislocation of the well on the base map, and (3) mis-calculation of the elevation of the contoured surface. The misidentification of the Pre-Cambrian granite appears unlikely due to the definite lithographic difference between the granite and the overlying sedimentary rocks. The only chance for error is in driller's logs, where granite wash is recorded for granite.

If this error was not corrected, the granite wash, having a maximum thickness of about 20 feet, would change the contour only slightly. In all old logs, where granite wash was not noted, a 20 foot allowance was made. The mislocation and misidentification errors were eliminated or minimized by careful work and numerous checks of the work.

Contouring the Map

The physical act of contouring was started only after the following conditions were fulfilled:

1. Fault line located.

2. Wells located and elevation noted above or below sea level.

3. The dip map studied to give an understanding of the general topography.

Interpolation was made between adjoining wells and the 100 foot contours dashed in lightly. In the areas of little control, where data were meager, no attempt was made to suggest structures that did not actually appear. The contour lines were drawn in roughly to give an approximate picture of the topography. Several locations were noted where contour lines were un-natural in their appearance, contrary to the smooth, flowing effect elsewhere on the map. Referring to the dip map, it was noted that these un-natural contours appeared where larger than normal dips occurred. The possibility of faulting was indicated, just as in the Nemaha fault. The map was redrawn with the additional faults in place and a more natural appearance achieved.

THE PRE-CAMBRIAN MAP

Description of the Fault

The main fault, which appears on the contour map of the Pre-Cambrian surface (Fig. 5, Appendix) was drawn to relieve the un-realistic appearance that the contour lines would make if no fault was indicated. This fault will be referred to hereafter as the "Nemaha Fault". The Nemaha fault appears as a high angle, nearly vertical fault. No wells have reported penetrating the fault zone, so no definite descriptive geologic terminology can be given about the fault. The strike of the fault is approximately north twenty degrees east (N20E). In the area covered, the fault is about 144 miles long and extends from township one south, range fourteen east in Nemaha county to township twenty-two south, range seven east in Chase county. The fault appears to die out to the south, the largest displacement approximately 3,100 feet in Nemaha county to the north, and the smallest displacement approximately 850 feet in Chase county to the south. There has been no pronounced strike-slip movement, as highs on the east side (downthrow) appears to correspond to highs on the west side (upthrow).

Regional Dip

The regional dip on the east side of the fault is generally a gradual dip to the north, approximately 20 feet per mile. The west side of the fault, after much structural and erosional modification, varies from 50 to 75 feet per mile dipping to the west.

Similarity of Truncated Structures

A closer inspection of the similarity between truncated structural highs on both sides of the fault seem to indicate that an erosional anticline (an anticline unroofed by erosion) was present prior to the fault movement. The alignment of these similar truncated highs is parallel to the fault, suggesting that the fault is a continuation of the stress that produced the anticline. This similarity will be discussed later.

Previously Named Structures

Eight major structures previously mentioned in the geologic literature of Kansas (Jewett, 1951), were noted on the Pre-Cambrian contour map as supported by structural or topographic highs of the granite. The numbering system used here to delineate the structures, corresponds to the numbers found on the Pre-Cambrian contour map.

1. The Abiline Anticline appears on this map as a fault paralleling the Nemaha fault and dying out to the south. It has a maximum displacement in Marshall county of about 400 feet and disappears completely in Clay county. The granite dips gently northwest fifty feet per mile to the west of the fault and westward eighty-five feet per mile to the east of the fault. The surface expression of this fault, which is an anticline, probably results from supratenuous folding over the eroded fault scarp.

2. The Alma Anticline appears on this map as an elongated dome, sharply truncated by the Nemaha fault. Elongation in a north-south direction prior to faulting, now appears as an east-west elongation. The closure is approximately 700 feet and the flanks dip eighty-five feet per mile.

3. The Barneston Anticline is the surface expression of a large horst in the Pre-Cambrian granite. The displacement is as much as 1,300 feet in Marshall county and the strike is approximately north thirty degrees east. It was apparently formed by a cross fault that connects with the fault that formed the Abiline anticline.

4. The Brownville Syncline appears as an inverted nose plunging north twenty degrees east about seventeen feet per mile. The flanks dip in gently from the south-east at twelve feet per mile and from the south-west at twenty-five feet per mile.

5. The Burns-Elmdale Domes are two closely associated domes that appear on this map as a large and a small dome elongated parallel to the Nemaha fault. The Elmdale dome being the larger with a closure of about 600 feet, and the Burns dome with about 300 feet. Both domes have flanks that dip about eighty-five feet per mile. They are separated by a small syncline named the Cedar Creek syncline.

6. The Irving Syncline is the southern extension of the syncline that is the trough between the Barneston and Nemaha faults. In Pre-Cambrian rocks it is not a syncline, but appears as a terrace. The syncline in outcropping rocks is probably the result of thickening and thinning, and of changes in the regional dip in rocks above the Pre-Cambrian granite.

7. The Nemaha Anticline is the surface expression of the erosional remains of the Nemaha fault. Irregularities are caused by the buried topography.

8. The Zeandale Anticline appears as a north-west south-east elongated dome with a closure of about 600 feet. The dome was originally elongated parallel to the Nemaha fault, but a short fault cuts the northern half giving an appearance of elongation in northwest-southeast direction. The flanks dip gently forty feet per mile to the south and steepen to 200 feet

per mile to the west. Truncation on the north and east give the dome a "chopped" appearance.

This investigation will not touch on the numerous minor structures that may or may not have their support in the Pre-Cambrian granite.

THE VALUE OF ADDITIONAL CONTOUR MAPS

Surfaces Contoured

Additional contour maps were drawn on the Arbuckle, Viola, and Mississippian limestones (See Plate II for geologic column). It was assumed that the structures that were not clearly defined by the Pre-Cambrian contour map would be reflected in the overlying sedimentary rocks. The overlying sedimentary rocks, being closer to the surface of the earth, have been penetrated by more oil wells; hence better control could be exercised in the contour maps. The additional contour maps were drawn in an effort to find the structures missing, through lack of control, on the Pre-Cambrian contour map.

Topography not Structure

After a careful examination of the contour maps drawn on the Arbuckle, Viola, and Mississippian limestones, it was realized that the contours were drawn on erosional surfaces, and not true surfaces, giving an erroneous structural picture. For example (Fig. 2): well "A" shows the eroded surface of the Mississippian limestone, well "B" shows the true top of the Viola

EXPLANATION OF PLATE II

Simplified geologic column for the area covered by this investigation.

PLATE II

GEOLOGIC SYSTEM	SUBDIVISIONS USED IN THIS INVESTIGATION
PENNSYLVANIAN	TOPEKA LIMESTONE LANSING LIMESTONE KANSAS CITY LIMESTONE
MISSISSIPPIAN	"MISSISSIPPI LIME"
	CHATTANOOGA SHALE
DEVONIAN AND SILURIAN	HUNTON LIMESTONE
ORDOVICIAN	SYLVAN SHALE VIOLA LIMESTONE SIMPSON-ST. PETER SANDSTONE
	ARBUCKLE LIMESTONE
CAMBRIAN	LAMOTTE (REAGAN) SANDSTONE
PRE-CAMBRIAN	GRANITE & METAMORPHIC ROCKS

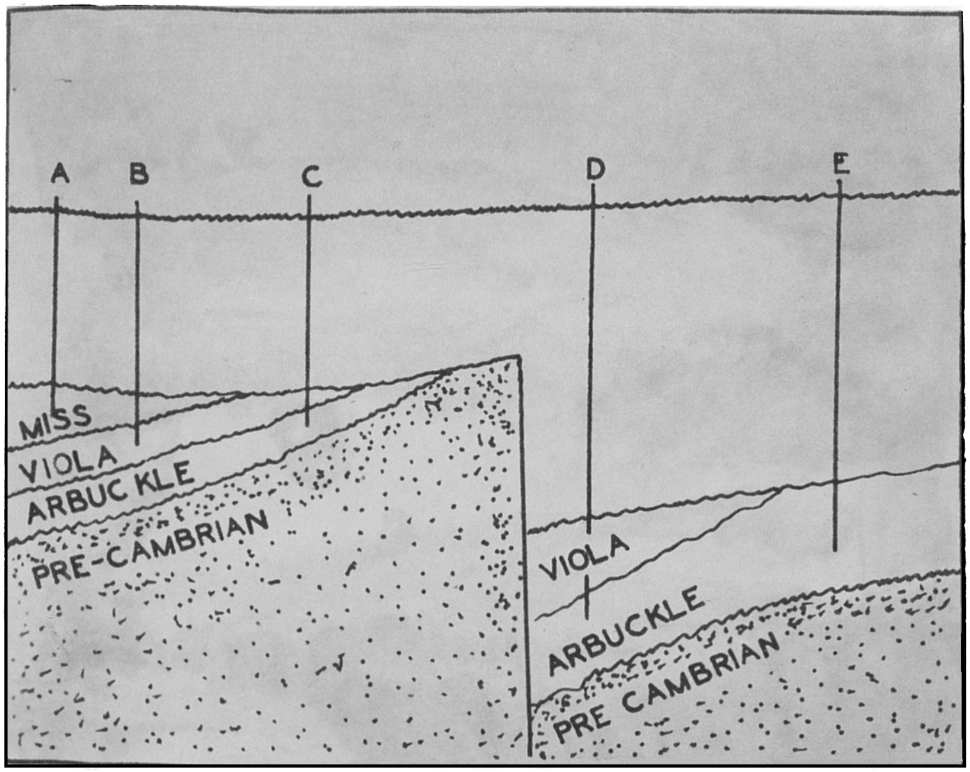


Fig. 2. Cross section showing erroneous value that would be obtained using the Arbuckle, Viola, and Mississippian limestones for contour horizons.

limestone, wells "C" and "D" show the eroded surface of the Viola limestone and the true top of the Arbuckle limestone, and well "E" shows the eroded surface of the Arbuckle limestone. Extensive study of cross sections, and restoration of eroded portions would have had to be made to give a complete picture of the structure of a particular formation. Since this would add nothing to the investigation of the fault, the contour maps drawn on the Arbuckle, Viola, and Mississippian limestones are not included.

DATING THE FAULT MOVEMENT

The Value of Isopachus Maps and Cross Sections

Subsurface structural movements are best revealed by

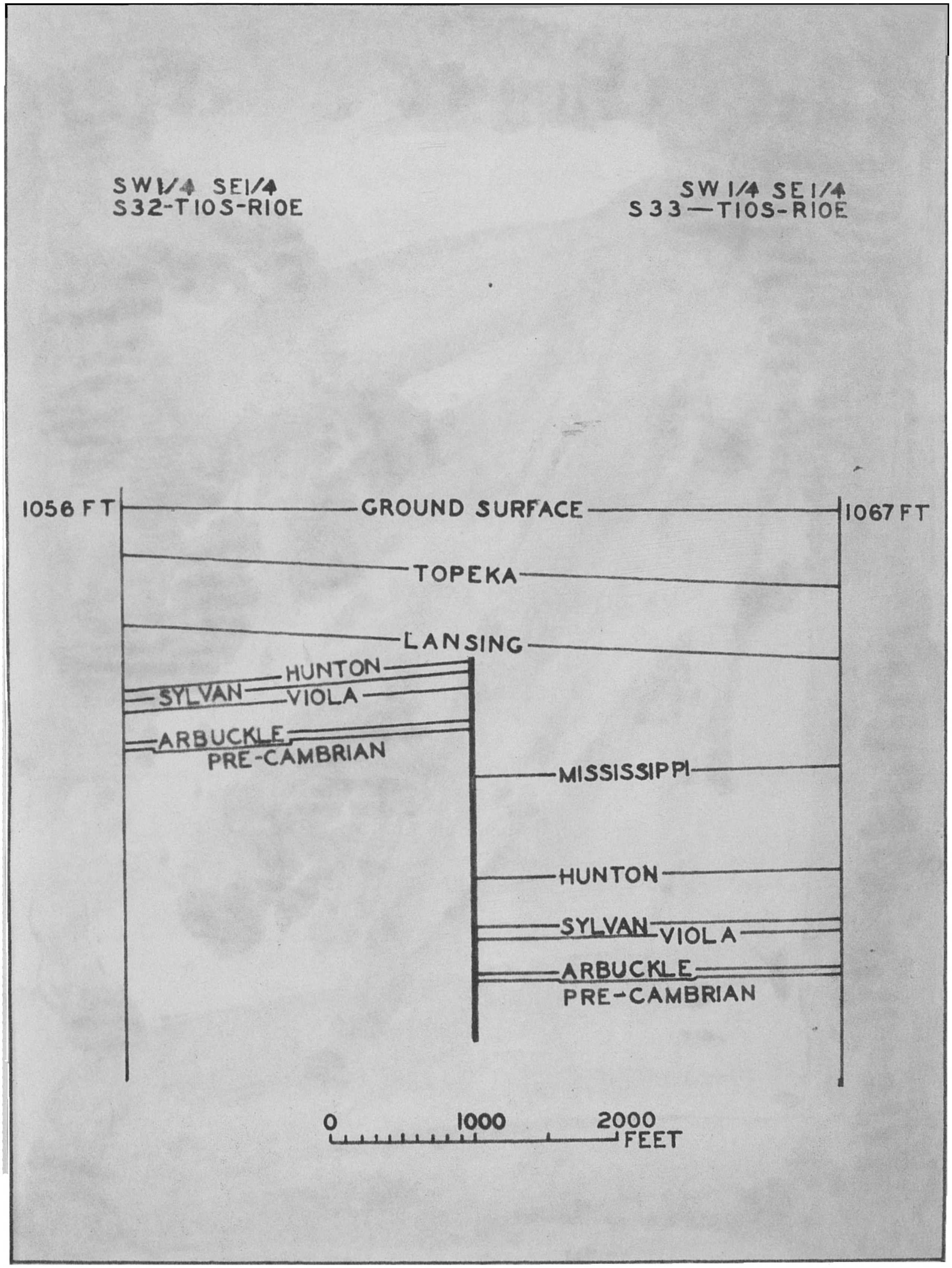
EXPLANATION OF PLATE III

Cross section of one pair of wells used in the location of the Nemaha fault. The vertical and horizontal scales are equal, giving an exact scale duplication of the structure.

The wells are located in Wabaunsee county.

1. SW1/4-SE1/4 S32-T10S-R10E
2. SW1/4-SE1/4 S33-T10E-R10E

PLATE III


SW1/4 SE1/4
S32-T10S-R10E
SW 1/4 SE 1/4
S33—T10S-R10E
1056 FT
GROUND SURFACE
1067 FT
TOPEKA
LANSING
HUNTON
SYLVAN
VIOLA
ARBUCKLE
PRE-CAMBRIAN
MISSISSIPPI
HUNTON
SYLVAN
VIOLA
ARBUCKLE
PRE-CAMBRIAN
0
1000
2000
FEET

isopachus maps used in conjunction with cross sections (Lee, 1954). Since the movement that concerns this investigation is a fault movement, isopachus maps and cross sections suit the purpose very well. Cross sections were made of the fault, (Plate III). In each case tables were prepared of the thickness between rock formations, (Table 1.).

Table 1. Sample of the thickness table showing the thickness of the formations shown in Plate III.

Formation Names	Thickness of Formation West	East
Topeka to Lansing	490	525
Lansing to Hunton	460	960
Hunton to Sylvan	70	345
Sylvan to Viola	95	74
Viola to Simpson	30	55
Simpson to Arbuckle	195	175
Arbuckle to Pre-Cambrian	28	29

Isopachus maps were consulted (Lee 1943; Lee, et al., 1948) that covered the problem area. Additional cross sections were studied, (Lee and Merriam, 1954) that covered the problem area.

Proof of Mississippian Movement

It is easy to see (Table 1.) that no movement occurred along the fault line from the beginning of Cambrian deposition to a time after Hunton deposition. This is shown by the similar thickness of rock intervals from the Pre-Cambrian granite to the Sylvan limestone. The first indication of movement occurs in the Hunton to Sylvan interval, and continues up to the top of the Lansing limestone. This indicates that movements occurred in post-Hunton and ended in pre-Lansing. Isopachus maps (Lee, 1943; Lee, et al., 1948) of the area were studied to further pinpoint the time movement began. The isopachus maps that were studied indicated that movement commenced in late Mississippian time, and continued until Lansing time.

Additional Proof of Mississippian Movement

A different approach was made to the problem to further prove the Mississippian date correct. The thought being to reconstruct the Mississippian surface as it appeared prior to movement, and see if the surface could be contoured without a fault. This would then prove that the fault movement occurred in late or post Mississippian time.

Reconstruction of the Mississippian surface becomes a problem of:

(1) Reconstruction of the Pre-Cambrian granite surface prior to faulting.

(2) Reconstruction of the Pre-Cambrian to Mississippian rock interval.

Reconstruction of the Pre-Cambrian Surface

In the reconstruction of the Pre-Cambrian granite surface, two basic assumptions had to be made: (1) no significant movement since the original faulting, and (2) all movement was on the upthrow side. With these assumptions made, it was possible to lower the upthrow side down until the highs and lows on both sides of the fault corresponded. The map (Fig. 6) could then be contoured without the fault as it appeared prior to Mississippi deposition.

A close examination of this map reveals the alignment of structural or topographic highs paralleling the Nemaha fault. This fact strongly suggests that an anticline was present before faulting occurred, and that the anticline was present prior to Mississippian time.

Reconstruction of the Pre-Cambrian to Mississippian Interval

The isopach of this rock interval was constructed by several different methods. An attempt was made to construct this isopach interval from the wells listed in Table II. Since the Mississippian limestones are missing from a large portion of the Nemaha ridge, this construction did not reveal the total thickness. A different approach was used with success. This method involved using the prepared isopachus maps (Lee, 1943; Lee, et al., 1948) of the interval from the Pre-Cambrian granite to the bottom of the Mississippian limestone; then adding to this a palinsplastic restoration (Fig. 3) of the thickness of the Mississippian limestone. The palinsplastic restoration was constructed by using Mississippian isopachus maps and cross sections of the problem area to restore the eroded portions. This palinsplastic map was then added to the isopach of the

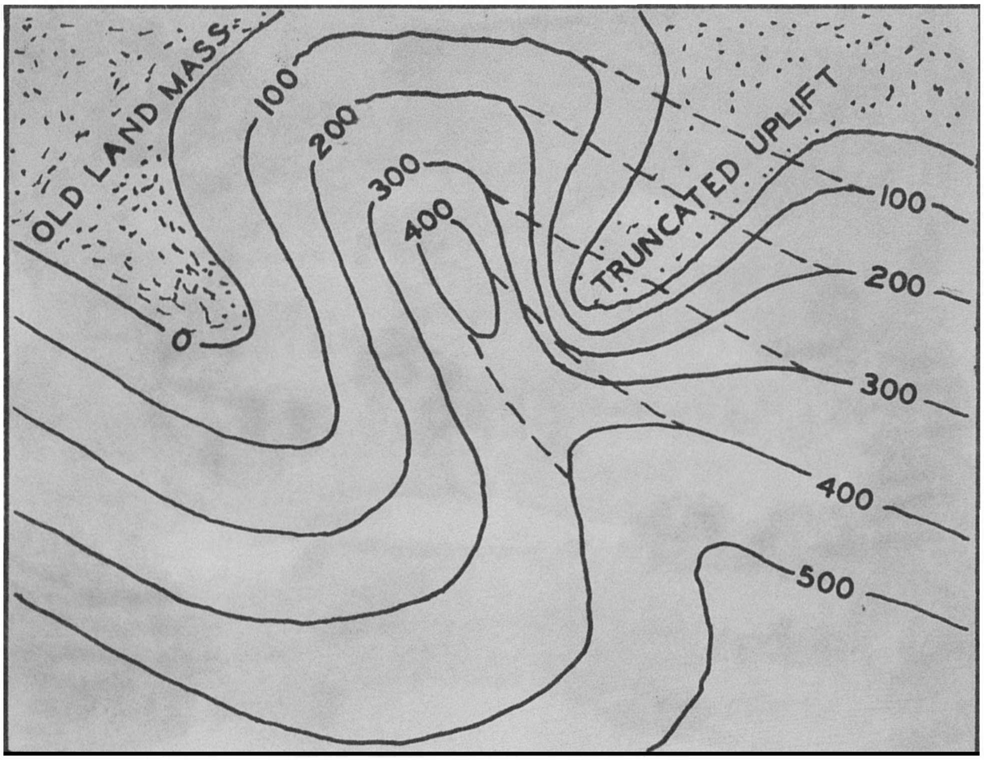


Fig. 3. Palinsplastic restoration showing how isopach contours are reconstructed to show the true thickness prior to truncation.

Pre-Cambrian to the bottom of the Mississippian limestones. This map (Fig. 4) would then show the true thickness of rocks from the Pre-Cambrian granite to the restored, uneroded top of the Mississippian limestones, prior to faulting and subsequent erosion.

Reconstruction of the Mississippian Surface

To reconstruct the surface of the Mississippian limestones as they appeared prior to faulting, the two maps (Fig. 4 and Fig. 6) were simply added together. This was a mechanical step involving superimposing the Mississippian limestone isopachus map (Fig. 4) over the reconstructed Pre-Cambrian contour map

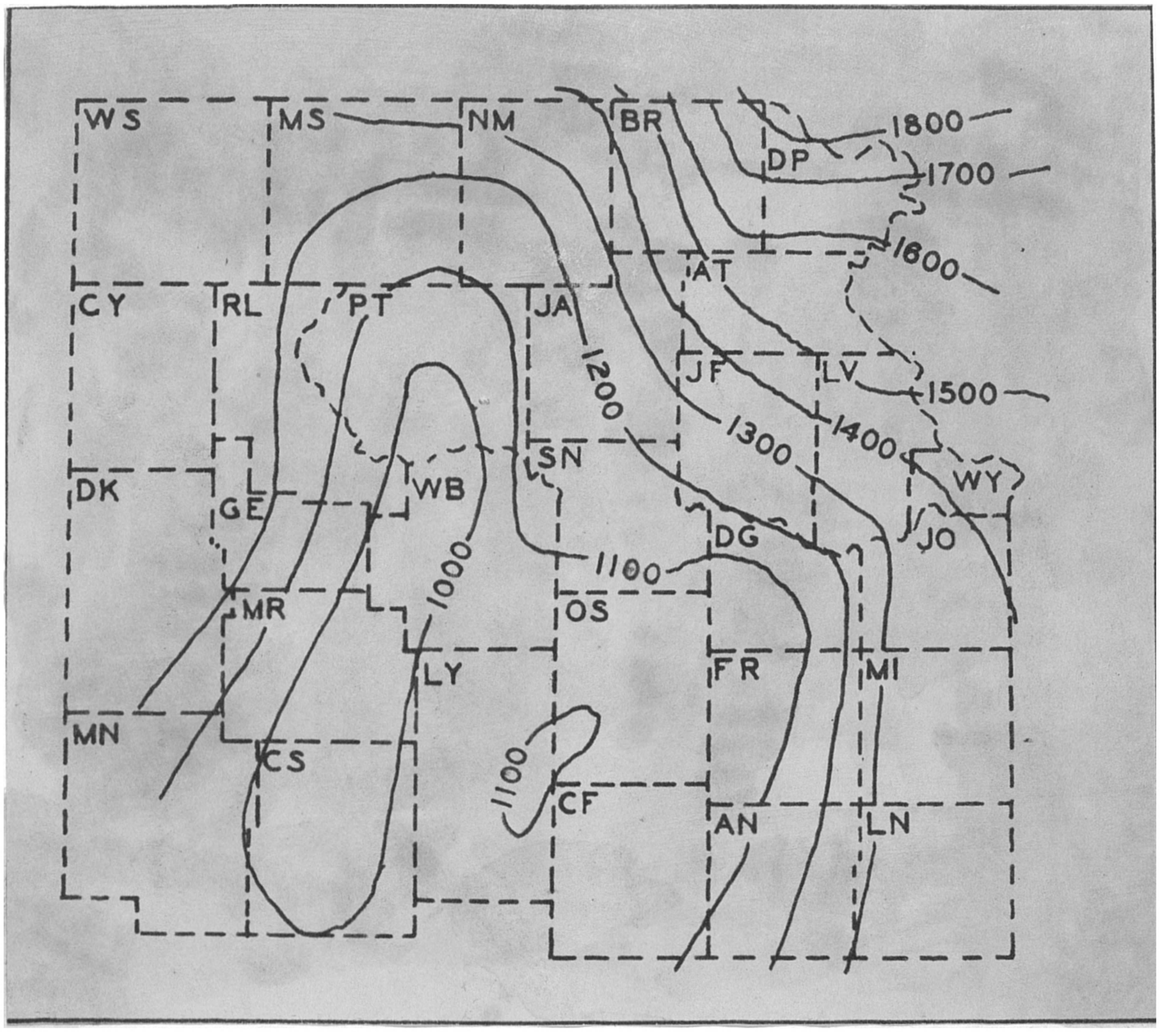


Fig. 4. Isopachus map of the interval between the Pre-Cambrian granite and the reconstructed top of the Mississippian limestones.

(Fig. 6) to give the contour map of the Mississippian limestones. This map (Fig. 7) could be contoured without a fault, further proving that faulting occurred in late or post Mississippian times.

CONCLUSION

This investigation has shown that the area studied could best be contoured with a fault present. No definite proof has been shown or offered to prove the existence of a fault; simply that a fault could be inferred from the material available.

Conclusive proof has been offered to date the structural movements as late as post Mississippian.

Additional information has indicated that an eroded anticline was present prior to the suspected fault movement.

Although this investigation only covered a portion of the Nemaha ridge, it is believed that the fault extends throughout its entire length.

The inferred fault has a strike of north twenty degrees east and has displacements ranging from 3,100 feet in Nemaha county to 850 feet in Chase county.

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APPENDIX

Table 2. Location and elevation of wells used in the preparation of this investigation.

County S-T-R	Elevation of Pre-Cambrian Granite Above or Below Sea Level
	Chase
5-18S-6E	-1022
19-18S-6E	- 964
25-18S-6E	- 609
27-18S-6E	- 825
32-18S-7E	- 914
36-18S-7E	- 881
7-19S-6E	-1299
21-19S-6E	-1033
34-19S-7E	- 782
35-19S-7E	- 598
25-20S-5E	-1690
2-20S-6E	-1117
1-20S-7E	-1385
2-20S-7E	- 464
7-20S-7E	- 734
15-20S-7E	- 846
16-20S-7E	- 503
	Clay
28-6S-4E	-1584
19-10S-4E	-1686
	Dickinson
12-14S-1E	-2227
	Geary
10-12S-7E	-1508
36-13S-5E	-1698
	Jackson
7-9S-13E	-2348
	Lyon
6-16S-10E	-1874
	Marion
22-19S-2E	-1663
28-19S-2E	-1713
26-21S-1E	-2460
19-21S-3E	-2167

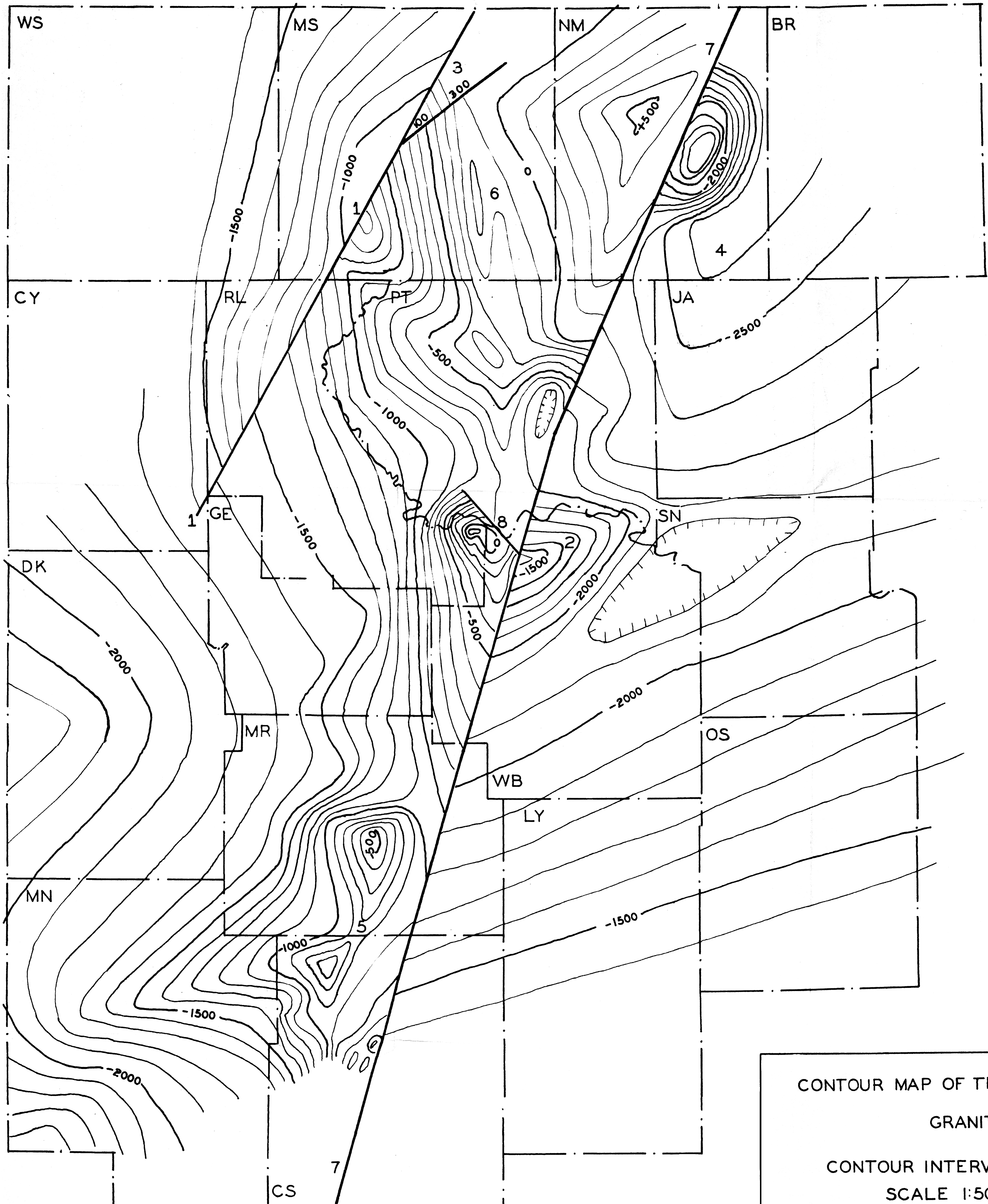
Table 2 (cont.).

County S-T-R		Elevation of Pre-Cambrian Granite Above or Below Sea Level
	Marshall	
20-1S-6E		-1485
34-2S-8E	SW1/4-NW1/4	- 937
34-2S-8E	center	- 387
20-2S-9E		28
29-2S-9E		- 127
22-3S-7E		- 984
4-4S-7E		- 937
10-4S-7E		- 994
21-4S-7E		- 869
22-4S-9E		- 83
24-4S-9E		- 198
27-5S-6E		-1188
3-5S-7E		-1301
30-5S-7E		-1088
	Morris	
5-14S-8E		-1130
6-15S-7E		-1557
24-15S-7E		-1121
24-16S-5E		-1594
34-17S-7E		- 987
11-16S-7E		- 412
	Nemaha	
34-2S-12E		531
16-2S-13E		456
3-2S-14E		-2612
13-2S-14E		-2675
25-3S-13E		-1670
34-4S-13E		-2620
23-5S-13E		-2631
	Osage	
4-15S-16E		-1664
	Pottawotomie	
25-6S-9E		- 252
33-6S-9E		- 427
34-6S-11E		196
8-7S-9E		- 364
12-7S-9E		- 400
1-7S-10E		- 84
4-7S-10E		- 240

Table 2 (concl.).

County S-T-R		Elevation of Pre-Cambrian Granite Above or Below Sea Level
		Pottawotomie (cont.)
29-7S-10E		- 312
32-8S-9E		- 874
1-8S-10E		- 878
7-8S-10E		- 455
14-8S-11E		-2194
22-8S-12E		-2326
29-8S-12E		-2329
20-9S-8E		-1095
16-9S-9E		- 824
24-9S-9E		- 739
32-9S-10E		- 634
36-9S-10E		-2011
7-9S-12E		-2348
		Riley
2-7S-5E		-2393
15-7S-5E		-1205
24-8S-4E		-1402
26-8S-5E		-1317
11-9S-4E		-1522
14-9S-4E		-1544
16-10S-8E		- 983
28-10S-9E	NW1/4-NW1/4	155
28-10S-9E	SW1/4-NW1/4	49
28-10S-9E	center	- 13
		Shawnee
6-10S-13E		-2206
14-11S-16E		-2059
		Wabaunsee
26-10S-9E		56
32-10S-10E		- 642
33-10S-10E		-1623
1-11S-9E		- 28
24-11S-9E		- 213
5-11S-10E	SE-SE-SE	-1396
5-11S-10E	NW-NW-NW	- 389
6-11S-10E		- 144
2-13S-10E		-2184

Fig. 5. Contour map of the Pre-Cambrian granite.



CONTOUR MAP OF THE PRE-CAMBRIAN GRANITE

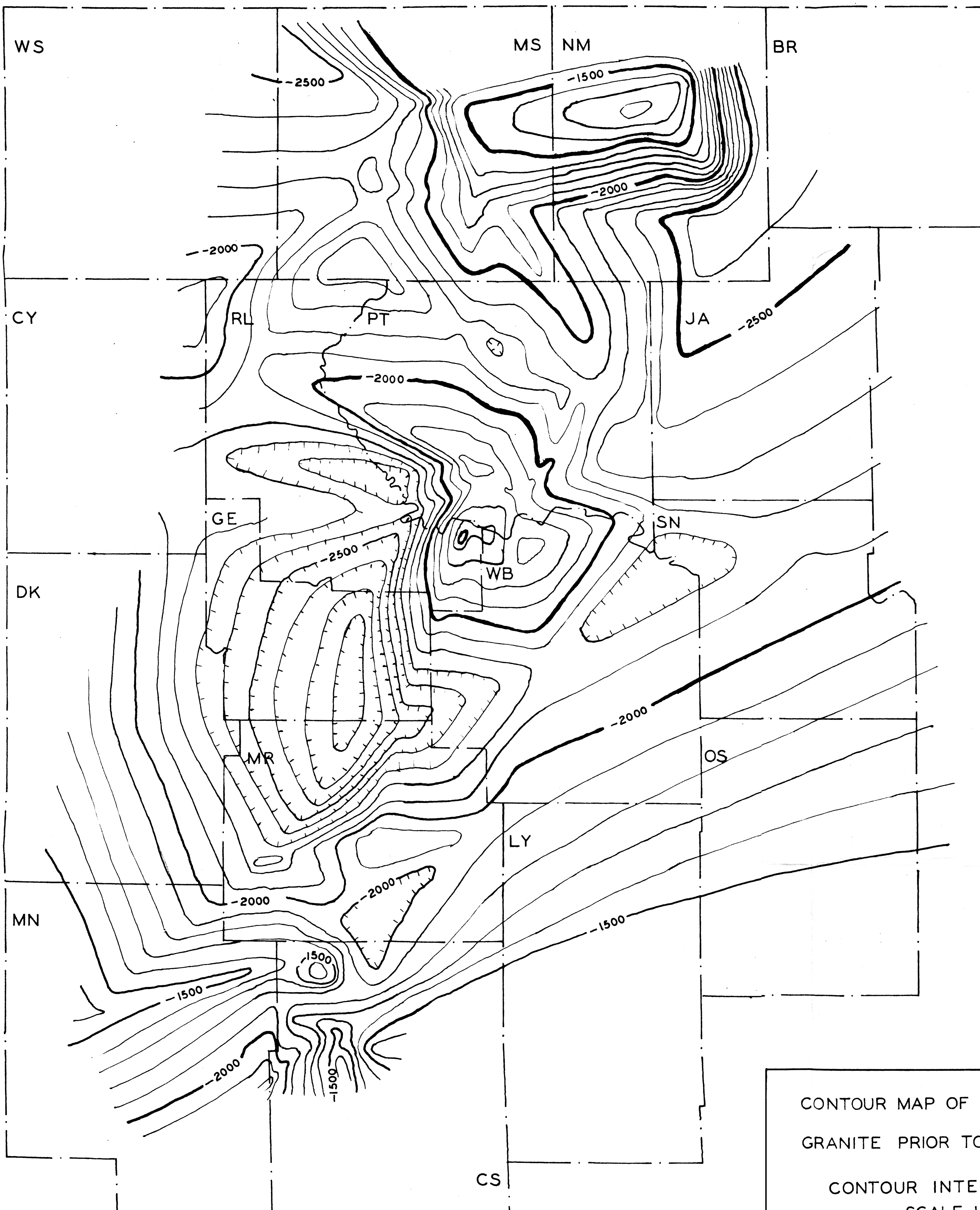
CONTOUR INTERVAL 100 FEET

SCALE 1:500,000

10 5 0 5 10 20 MILES

SEPTEMBER, 1955 D. L. KOONS

Fig. 6. Contour map of the Pre-Cambrian granite prior to Mississippian time.



CONTOUR MAP OF THE PRE-CAMBRIAN GRANITE PRIOR TO MISSISSIPPIAN TIME

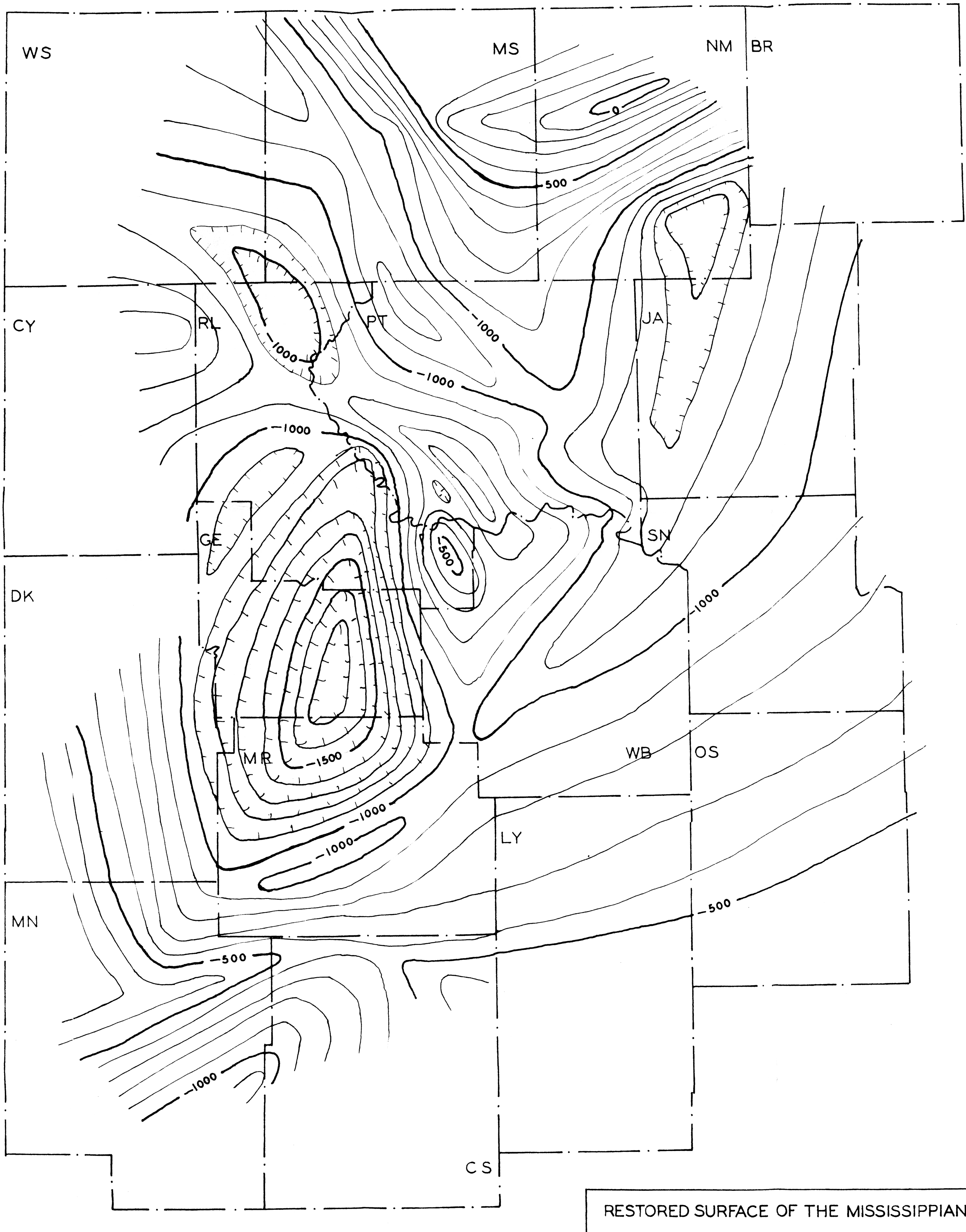
CONTOUR INTERVAL 100 FEET

SCALE 1:500,000

10 5 0 5 10 20 MILES

SEPTEMBER, 1955 D. L. KOONS

Fig. 7. Restored surface of the Mississippian limestones prior to post Mississippian structural deformation and erosion.



RESTORED SURFACE OF THE MISSISSIPPIAN LIMESTONES
PRIOR TO POST MISSISSIPPIAN STRUCTURAL
DEFORMATION AND EROSION

CONTOUR INTERVAL 100 FEET

SCALE 1:500,000

10 5 0 5 10 20 MILES

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FAULTING AS A POSSIBLE ORIGIN FOR THE FORMATION OF THE NEMAHA ANTICLINE

by

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B.S., Kansas State Teachers College, Emporia, Kansas, 1950

ABSTRACT OF A THESIS

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The area covered by this investigation comprises 16 counties in north-central Kansas. The area covers and roughly parallels the strike of the "Flint Hills" (N20E). Underlying the "Flint Hills" is a multi-named subsurface structure most commonly referred to as the "Nemaha anticline". This investigation will endeavour to show that this subsurface structure could be the result of ancient faulting.

The fault was indicated on the Pre-Cambrian contour map by the physical impossibility to contour across the disrupted zone and by the abnormally large dips encountered across the disrupted zone. The location of the fault was determined by seven pairs of well logs, one on each side of the fault. Since no wells actually penetrated the fault zone, no descriptive geologic terminology can be given about the fault. Dating the fault movement was accomplished in two manners: (1) thickness tables of the seven pairs of wells used to locate the fault, and (2) a palensplastic restoration of the Pre-Cambrian to Mississippian interval added to a pre-Mississippian version of the Pre-Cambrian granite.

This investigation has shown that a fault origin for the Nemaha anticline is logical. No definite proof has been shown or offered to prove the existence of a fault; simply that a fault could be inferred from the data available. The displacement along the fault varies from 3,100 feet in Nemaha county to 850 feet in Chase county. Proof has been offered to date the fault movement as late or post-Mississippian. Additional material has shown that an eroded anticline was present prior to the suspected fault movement. Eight structures previously mentioned in the geologic literature of Kansas were noted as having their support in the Pre-Cambrian granite.