KANSAS GEOLOGICAL SURVEY
OPEN-FILE REPORT 40-2

STRATIGRAPHY REPORT ON THE TOPEKA LIMESTONE

by

W. A. Bramlette

Disclaimer

The Kansas Geological Survey does not guarantee this document to be free from errors or inaccuracies and disclaims any responsibility or liability for interpretations based on data used in the production of this document or decisions based thereon. This report is intended to make results of research available at the earliest possible date, but is not intended to constitute final or formal publications.

Kansas Geological Survey
1930 Constant Avenue
University of Kansas
Lawrence, KS 66047-3726

3007 Dancy
Austin, Texas

Stratigraphy Report on the Topeka Limestone

W. A. Bramlette

June 5, 1940

Introduction

The University of Kansas stratigraphy class under the direction of R. C. Moore undertook in the spring of 1940 an investigation of the Topeka formation. Numerous sections were measured and the Topeka was traced along its outcrop across Kansas. The adjacent formations were examined and measured wherever possible. Due to lack of time detailed paleontological work was impossible but certain faunal zones were found to be traceable in limited areas and to be of stratigraphic value.

The purpose of this investigation was to determine the relationships between the various members of the Topeka formation throughout Kansas. Further work is required in certain areas, especially in Osage and Coffey Counties, where no really complete sections were obtained. However, both to the north and to the south of this central area sufficient data was obtained to reach a much clearer understanding of the stratigraphy of the Topeka formation.

General Stratigraphy

The Topeka formation was named by Bennett[1] from outcrops in the vicinity of Topeka, Kansas. It comprises the topmost formation of the Shawnee group as redefined by Moore[2]. The Topeka commonly forms a prominent east facing escarpment in the

---

1. Bennett, J., Kan. Univ. Geol. Surv., vol. 1, p. 116, 1898.
2. Moore, R. C., Stratigraphic classification of the Pennsylvanian rocks of Kansas, Univ. Kan. Bull., 22, 1935.

central and northern parts of the state; however, in southern Kansas it forms the long dip slope in back of the Deer Creek escarpment. This may be due to the thinning and disappearance of the intervening Calhoun shale to the south.

In the type area the Topeka consists of limestones separated by shales and is divided into five members; in ascending order, these are: Hartford limestone, Turner Creek shale, Du Bois limestone, Holt shale, and Coal Creek limestone. The most persistent of these appears to be the Hartford limestone which is the only one that can be definitely traced from northern to southern Kansas. The Topeka averages 40 to 45 feet in thickness through central and southern Kansas, but thins to the north to less than 10 feet in Nebraska.[1]

Calhoun Shale

T he Calhoun shale was named by Beede[2] from the "Calhoun Bluffs" of Kansas River northeast of Topeka (Section 9). It consists of a series of shales, sandy shales, and sandstones overlying the Deer Creek limestone and underlying the Topeka limestone. The Calhoun shows a marked variation in thickness. At the type locality 51 feet of Calhoun was measured but the formation thins both to the north and south. In Elk and Chautauqua counties the Calhoun appears to thin to only a few inches and may disappear entirely so that the Topeka rests directly on the Deer Creek limestone. This relationship can be observed

1. Moore, R. C., op. cit.
2. Beede, J. W., Kan. Acad. Sci. Trans., vol. 15, 1898, p. 79.

in Elk County, NE NW 3-30-11E.

Topeka Limestone

Northern Phase

In describing the Topeka it is convenient to divide the discussion between the northern and southern parts of the state. In the Northern Phase is included the facies developed in the type area in Shawnee County and thence northward to Nebraska. In general, limestones are more prominently developed in this area and certain distinctive members are, in fact, limited to it. In the vicinity of the type section the Topeka has a thickness of about 33 feet (see Section 7).

Hartford Limestone Member

The name Hartford limestone was introduced by Kirk[1] from an exposure below a highway bridge at the north edge of the town of Hartford, Kansas. It consists of one or more beds of massive limestone separated by shale intervals. The limestone is typically a blue-gray color on fresh exposure but weathers to a rusty brown. In Shawnee and Atchison Counties the Hartford consists of three distinct limestones separated by shales. The lower shale locally contains sandy seams and plant fossils. The middle limestone can be readily distinguished by the presence of dark chert in nodules or bands. The upper limestone is nodular and algal in appearance and contains Osagia. These limestones vary considerably in thickness. The Hartford limestones were

1. Kirk, M. Z., Kan. Univ. Geol. Surv., vol. 1, 1896, p. 80.

fossiliferous wherever observed and contained fusulines, Osagia, brachiopods, crinoid fragments, bryozoa, etc. This member has a thickness of 10 to 15 feet in northern Kansas but is reported to be absent in eastern Nebraska.

Turner Creek Shale Member

The Turner Creek Shale was named by Condra[1] after Turner Creek, southeast of Du Bois, Nebraska. It can be recognized only by its stratigraphic position between the Hartford limestone below and the Du Bois limestone above. It consists typically of bluish-gray, clayey shale but in many sections contained one or more limestones. Myalina, Derbya, etc. were collected from the Turner Creek shale but it is normally rather unfossiliferous. The thickness averages about 5 feet in northern Kansas.

Du Bois Limestone Member

The Du Bois limestone was named by Condra[1] after the town of Du Bois, Nebraska. It is readily distinguishable by persistent lithologic peculiarities. It consists of one or two beds of dark blue, dense limestone which shows vertical jointing. It is typical molluscan limestone containing pelecypods, Derbya, etc., which weather into relief. Fusulines are generally rare or absent. Its thickness is only a foot or two but its value as a stratigraphic marker calls for recognition as a member.

1. Condra, G. E., Neb., Geol. Surv., (2), Bull. 1, 1927, p. 52.

The Du Bois is not recognized in the southern development of the Topeka.

Holt Shale Member

The Holt shale was named by Condra[1] from a locality near Forest City, Holt County, Nebraska. It is a persistent and distinctive member of the Topeka occurring between the DuBois limestone below and the Coal Creek limestone above. In the lower part it consists of black fissile shale which grades upward into bluish, clayey shale. The thickness averages about 3 feet in northern Kansas and can not be identified in southern Kansas.

Coal Creek Limestone Member

The upper unit of the Topeka limestone was named the Coal Creek by Condra[1] from a type locality on Coal Creek one-half mile north of Union, Nebraska. This limestone is a typical "upper limestone" corresponding to the Ervine Creek member of the Deer Creek, etc. It consists of wavy, thin nodular beds with thin shale partings. Toward the north the limestone becomes more solid at the expense of the shale partings. The Coal Creek is a gray limestone which weathers white or buff. This member is highly fossiliferous and yields fusulines, brachiopods, bryozoa, etc. In Shawnee County the Du Bois had a thickness of 2 or 3 feet but thickens to the north into Nebraska. In the southern phase of the Topeka limestone the Du Bois can not be recognized with certainty.

---

1. Condra, G. E., Op. Cit., p. 52.

Topeka Limestone

Southern Phase

The Southern Phase of the Topeka comprises the area south of Coffey County, Kansas. Although limestones are still prominent, especially in the upper and lower parts, the Topeka would be more appropriately named under the more non-commital term, formation, than as a limestone. Much of the section is composed of shales with thin limestones seams, sandy shales, and sandstone. The Topeka shows a remarkable uniformity horizontally in its development in the Southern Phase. Sections can be matched bed for bed in Chautauqua, Elk, and Greenwood Counties. Only one member of the Northern Phase maintains its lithology sufficiently well to be definitely recognized in the southern area; this is the Hartford limestone member. For purposes of description the Southern Phase will be divided into the following five units: from the bottom up, Hartford limestone member, lower shale and limestone, middle sandstone, upper shale and limestone, and upper limestone.

Hartford Limestone Member

The base of the Hartford is represented throughout the area by a massive, gray, Ottonosia-bearing limestone, which may also contain fusulines, brachiopods, etc. In Greenwood County the Hartford consists of a single limestone unit about 10 feet thick. The lower part is a massive limestone while the upper 6 feet is a thin, wavy-bedded, algal limestone. In Elk County the

Hartford is divided by shale partings into three or four separate limestone beds, which total about 6 feet in thickness. Here again, however, the lower beds are massive and the upper part thin, wavy-bedded. In Chautauqua County a completely exposed Hartford section was not observed but the massive, Ottonosia-bearing limestone was clearly represented.

In summary, it may be said that the Hartford limestone member is a well-defined, recognizable unit along the outcrop section of the Topeka across Kansas. Its lithology, fauna, and stratigraphic position make it an extremely useful marker for field work. However, as would be expected, it does show variation in thickness and number of limestone units.

Lower Shale and Limestone Unit

Above the Hartford limestone in the Southern Phase occurs a persistent series of white nodular limestone and interbedded buff shale. These beds are fossiliferous, containing: fusulines, chonetids, bryozoa, Amblysiphonella, etc. The thickness is rather uniform averaging between 10 and 15 feet where observed.

At the top of this unit there occurs a sandy limestone which contains abundant Rhombopora. This zone was found to be present in all sections observed in the area, and to be extremely useful for correlation.

Middle Sandstone Unit

Overlying the Rhombopora zone previously mentioned there occurs a sandstone. This is a fine-grained, ferruginous sandstone weathering to a rusty brown. It is best developed in Elk and Chautaqua Counties,

but can still be recognized as a sandy shale in Greenwood County. This sandstone varies in thickness from less than one foot up to five feet.

Upper Shale and Limestone

Above the sandstone occurs a section of blue or gray shales with some thin limestone beds and nodular limestones. These beds average 20 to 25 feet in thickness in the southern Kansas. The lower part consists chiefly of shale with one or two limestone beds, which usually contain Osagia, Myalina, and other fossils. In the upper part the shales contain limestone beds only an inch or two in thickness. These are extremely fossiliferous, yielding abundant chonetids, Marginifera, Echinoconchus, bryozoa, etc.

Upper Limestone Unit

At the top of the Topeka in the Southern Phase is found a distinctive and persistent limestone. It is grey on fresh exposure, but weathers into a deep re-brown. A good exposure of this unit in contact with the overlying Severy shale may be had in Greenwood County, NE SW 32 - 26 - 11 (see Section 16). This contact is apparently a conformable one. At this locality the top bed of the Topeka is a gray, ripple-marked limestone containing Myalina and Osagia. The underlying limestone beds contain abundant fusulines and echinoid spines. These relationships show clearly the shallowing of the water during late Topeka time. However, this upper limestone unit may be developed as either a fusuline limestone or a wavy algal facies.

At the top of the Topeka in its Northern Phase also occurs a limestone member, the Coal Creek. However, this is a typical "upper limestone" and does not resemble the upper Topeka of the Southern Phase. Additional work is necessary in the intervening region of Osage and Coffey Counties to establish the relationship between these two limestones.

Conclusions

The correlation of the Northern and Southern Phases of the Topeka limestone can not be made on a sound basis without additional information in Osage and Coffey Counties. It is of interest to note that there appears to be a correspondence in the number of cyclothems developed in these two areas; while in other respects the sections are entirely dissimilar. Satisfactory correlation should result from a tracing of the well marked cyclothems of the Northern Phase southward through Coffey County.

Sections within each of the Phases, when examined in detail, show remarkable uniformity and permit very exact correlation. The relationships as determined from this study are shown on Plate 1. For each county the most complete sections were selected for comparison and plotted with the top of the Ervine Creek as a datum plane.

Detailed Sections

Section 1

Doniphan County, WC of section 7, T. 2, R. 20 E.

Topeka limestone

	Thickness in feet
Limestone, fusulines; not in place?	?
Covered.	2.7
Limestone, light gray, massive, very fossiliferous, brachiopods, gastropods, bryozoa.	1.3
Shale, light green.	.3
Limestone, light brown, platy, laminae in relief,	.2
Siltstone, grey-brown, micaceous, plant remains; rubbly limestone at base, gastropods, ostracodes.	2.0
Shale, green.	.5
Limestone, light greenish-gray, argillaceous, small tall gastropods in lower part.	1.6
Shale, greenish gray.	2.5
Limestone, light gray, massive, weathers buff, Derbya .	1.3
Shale, greenish limey, very fossiliferous, echinoid spines, brachiopods, bryozoa.	1.5
Limestone, light gray with dark chert 6 inches from top in bands, massive beds, vertical joints.	1.6
Shales, limey, fossils, sample taken.	.8
Limestone, light gray, fossils.	.3
Shale, buff, fossils, fusulines, sample taken.	.5
Limestone, light gray, weathers buff, fusulines, brachiopods, bryozoa.	1.0
Shale, blue clayey, micaceous.	3.3
Limestone, gray platy, sandy, with fish teeth.	.8
Estimated shale interval.	2.0
Limestone, "cone-in-cone".	.3
Shale and limestone, nodular, very fossiliferous, brachiopods, bryozoa, crinoid remains.	1.3
Limestone, brown, corals, crinoid stems, Derbya, black chert up to 6 " thick near top, massive.	3.3
Shale, buff to gray, calcareous, Leiorhynchus.	.6
Limestone, light gray, gastropods, crinoids, Bryozoa.	.5
Shale, green clayey, marine fossils in upper part.	1.3
Shale, black, base covered, pelecypods.	?

Section 2

Atchison County, SE NE of section 11, T. 4. R. 19 E.

Topeka limestone

	Thickness in feet
Limestone, not measured in creek	---

Calhoun shale

Shale, dark blue, soft.	5.9
Coal horizon.	.1
Shale, black, containing ostracodes, coaly.	2.5
Sand, micaceous	.2
Shale, dark	8.0
Limestone, dark blue, hard, dense, numerous crinoid stems, brachiopods.	.7
Limestone, bluish weathering brown, abundant sponges, Ambrlysiphonella, molluscs.	1.5
Shale, covered, black to sandy, with thin micaceous sandstone five feet below top.	15.0

Ervine Creek limesonte

Limestone	10.0

Section 3

Atchison County, NE SE of section 34, T. 4, R. 19 E.

Topeka limestone

	Thickness in feet
Limestone, gray, not definitely in place, fine grained, abundant molluscs.	1.0
Shale - covered	4.5
Limestone, gray, weathers yellow, molluscs in lower part, ramose calcite markings etch out on weathering.	1.7
Shale, gray, green clayey, soft.	1.7
Limestone, brown, argillaceous, slabby, echinoid spines, Aviculopecten.	1.8
Shale, greenish, weathering brown, calcareous.	1.5
Limestone, gray, weathering buff, massive in part. some irregular bedded, argillaceous, siliceous fossils in upper part.	4.8
Shale, largely covered sandy micaceous, carbonaceous material.	8.0
Limestone, gray, massive, honeycomb weathering, contains fusulines.	2.8
Shale, dark grey at base, olive green above, calcareous, contains Leiorhynchus.	.5
Limestone, wavy thin beds containing bryozoa, crinoids	.4

Calhoun shale

Shale, section mostly covered thin sandstone and limestone about 10' above Ervine Creek with Jonesina aff. Howardensis, also carbonaceous plant remains.	1.5

Ervine Creek limestone

Limestone, wavy bedded gray limestone containing abundant fusulines in lower beds, yellowish algae in upper beds.	.5
Limestone, massive, gray	.9
Limestone, thin, even	.2
Shale, dark, black carbonaceous streaks, lower 6 " slaty black.	

Rock Bluff limestone

Limestone	1.8
Shale	?

Section 4

Atchison County, C of section 1, T. 5, R. 19 E.

Topeka limestone

	Thickness in feet
Limestone, medium gray, massive, robust fusulines, bryozoa, echinoid spines, crinoid stems, neospirifer.	
Concealed.	
Limestone, medium gray, massive very fossiliferous; gastropods, pelecypods, bryozoans, small brachiopods, Juresania, Ambocoelia.	.9
Limestone, thin bedded fossiliferous.	.6
Shale, light greenish silty shale, brown to gray, plants at top.	2.4
Limestone, brown, massive, honeycomb weathering. few fossils, brachiopods.	1.4
Shale, gray, clayey, with rotten limestone member which is fossiliferous; echinoid spines, Rhombopora, Productids, Ambocoelia. 19.6" of gray shale at top; 8.7" of gray, rubbly argillaceous limestone in middle; 31.7 " of greenish gray shale, plastic at base.	5.0
Limestone, dark gray, massive, weathers brown. Black chert 1" to 2" in diameter near middle, crinoidal	2.4
Limestone, grey, weathers brown - shale partings, basal 10" contains Rhombopora, fenestellids, echinoid spines, gastropods; next 6 " with short, fat fusulines, next 7 " with algae. fusulines remainder a brown, nodular limestone with Dictyoclostus, Neospirifer, Echinoconchus.	3.2
Shale, black to chocolate, plant material, laminated.	.7
Limestone, nodular, brown, carbonaceous	.2
Shale, green clay, sticky; lower 2.5 feet mostly concealed, may include soft rotten limestone.	7.7
Limestone, massive, brown, fusulines at base, Dictyoclostus, Rhombopora, Neospirifer, Derbya.	3.1

Calhoun shale.

Shale, Black-gray, just above micaceous sandy shale containing plants.	5.5

Section 5

Atchison County, SW SW of section 15, T. 5. R. 19 E.

Shale covered

Topeka limestone

	Thickness in feet
Limestone, covered, contains fusulines, bryozoans, crinoid stems, brachiopods.	1.3
Limestone, nodular, fossiliferous.	.4
Shale, sticky clay, gray.	2.3
Limestone, gray, massive, fossiliferous, fine, dense.	.9
Shale.	4.3
Limestone, oolitic, granular.	1.8
Shale and limestone; limestone about 2" thick. rubbly , echinoid remains in upper shale.	3.7
Limestone, dark grey, containing black chert. fragments bryozoa, crinoids, etc.	2.0
Limestone, Osagia.	2.0
Limestone, gray, fusulines.	1.0
Shale, fissile, micaceous. chocolate, bryozoa, Derbya in upper half.	.5
Silt, gray, weathers brown.	.2
Limestone, nodular, sandy.	.3
Shale, green, sandy, micaceous.	.2
Shale, blue-green, sticky clayey, at base of section	?

Section 6

Jefferson County, SW SW of section 9. T. 10, R. 17 E.

	Thickness in feet
Coal Creek limestone	
Limestone, white, nodular, very fossiliferous	2.4
Holt shale	
Shale, gray, fossiliferous	1.1
Shale, black fissile	1.5
Du Bois limestone	
Limestone, massive, blue-gray	.5

Section 7

Shawnee County, NE NW of section 3, T. 11, R. 16 E.

Coal Creek Limestone

	Thickness in feet
Limestone, white, nodular, fossiliferous	2.0

Holt shale

Shale, buff above; black, fissile below	4.0

Du Bois limestone

Limestone, blue, dense, Derbya, gastropods	.6

Turner Creek shale

Shale and limestone, thin bedded, brachiopods, Myalina	1.6
Limestone, blue-gray, molluscan, high spired gastropods	.8
Shale, gray	1.7
Limestone, gray, massive, Osagia	1.7
Shale, gray-green	4.3

Hartford Limestone

Limestone, nodular, algal, Osagia	1.0
Shale and limestone, thin bedded, bryozoa	2.0
Limestone, massive, gray weathers brown; fusulines throughout; Osagia present except in the lower 1 1/2 feet. Chert layer 5 feet above base.	6.8
Shale, gray, plant remains; 2 in. of micaceous sandstone at the base	2.1
Limestone, massive, gray weathering brown, crinoidal	4.0
Shale, buff	.5
Limestone, gray, fusulines; Osagia in upper part	.5

Calhoun Shale

Shale, gray to blue, 2 inch coal seam 10 in. below top. Section mostly covered	25.7
Sandstone, massive, cross-bedded, micaceous.	

Section 8

Jefferson County, NE NE of section 5, T. 11, R. 16E.

	Thickness in feet
Coal Creek limestone,	
Limestone, white, nodular, fossiliferous	2.05
Holt shale	
Shale, black fissile, with 3" of gray shale at top	2.5
Du Bois limestone	
Limestone, massive, blue-gray, vertical joints, Derbya, gastropods, fusulines	.7
Limestones and shales interbedded	3.0
Limestone, gray, massive, fossiliferous, Dictyoclostus	

Section 9

Shawnee County, SC of section 14, T. 11, R. 16, E.

	Thickness in feet
Topeka limestone	
Limestone, fusulines in lower part, Osagia above. Persistent chert layer 10' below top of 3' layer exposed in quarry.	
Calhoun shale	
Mostly covered	6.5
Sandstone, brown, micaceous	4.3
Shale, chocolate	15.3
Sandstone and shale interbedded	9.0
Shale with thin sandy zones	17.3
Ervine Creek limestone	
Limestone, yellow, rotten	2.5
Limestone, dense, gray, wavy-bedded	4.3

Section 10

Shawnee County, SW of section 14, T. 11, R. 16 E.

	Thickness in feet
Calhoun Shale	
Limestone, yellow, rotten	2.0
Ervine Creek limestone	
Limestone, wavy-bedded, grey, fossiliferous	10.5
Limestone, block, fissile shale at base	3.1
Rock Bluff	
Limestone, blue, grey, massive limestone, fusulines, vertical jointing	2.6

Section //

Coffey County, SW SE of section 7, T. 19, R. 15 E.

Lower Topeka limestone

	Thickness in feet
Limestone, white, gray, weathers yellow, thin wavy beds, abundant fusulines.	2.0
Limestone, brown, Amblysiphonella, corals, crinoid stems, abundant Osagia.	2.0

Calhoun shale

Shale, blue or gray, sticky, partly covered, sandy.	16.9
Limestone, brown, "fossil hash", fusulines, abundant Osagia, crinoid fragments.	1.0
Sandstone, tan fine-grained, micaceous.	2.5

Section 12

Coffey County, SE SW of section 10, T. 19, R. 15 E.

Lower Topeka limestone

	Thickness in feet
Sandstone, gray, fine-grained, weathers tan.	1.0
Limestone, gray, weathers brown, with some beds of brownish limestone, Amblysiphonella, Ottonosia, brachiopods, etc.	2.7
Shale, greenish, gray below, yellow above.	6.5
Limestone, white, fusulines.	.3

Calhoun Shale

Shale, upper 8" marine fossils, Rhombopora, Derbya, etc., plastic dark below with plant remains. Upper 9's highly fossiliferous. Rhombopora, Chonetes, marginifera, etc. calcareous.	6.0
Sandstone, buff, fine micaceous, grades into sandy shale.	2.0

Section 13

Coffey County, NE NW of section 36, T. 20, R. 13E.

Topeka limestone

	Thickness in feet
Limestone, nodular, brown and white, irregular bedded.	4.0

Calhoun shale

Covered interval, probably shale.	13.3
Limestone, fossiliferous, Osagia, top exposed.	?
Sandstone, brown, fine-grained, ferruginous, exposed but small parts of the slope covered.	16.2
Limestone, brown, molluscan	.3

Section 14

Coffey County, SE SW of section 18, T. 20, R. 14 E.

Ervine Creek limestone

	Thickness in feet
Limestone, white, nodular, wavy bedded, fusulines, bryozoa, Ottonosia, Dictyoclostus	3.0

Shale, gray, buff, upper soft, yellow, coaly layer 2.4' below limestone.	2.5
Shale, dark, fossiliferous	1.3
Shale, black, fissle	1.0

Bluff Rock limestone

Limestone, gray crystalline, composed largely of fossil fragments, fusulines, resemble a typical "middle limestone", dense, vertical joints	.8
Limes tone, white, nodular, Ottonosia, fusulines, gastropods.	.8
Shale	.7
Limestone, light blue-gray, irregular bed varying considerably in thickness, white, a "fresh-water limestone"	.8
Shale, greenish, grey with algae nodules	.5

Section 15

Greenwood County, SE SW of section 25 , T. 25, R. 11 E.

Topeka Limestone	Thickness in feet
Limestone, thin-bedded, bluish-gray, very fossiliferous, chonetids, fusulines, Polypora, Derbya	1.0
Shale, sandy, buff	3.0
Limestone, massive, dark blue, molluscan, Osagia	1.0
Shale, limey, fusulines	2.5
Shale and thin limestones, fusulines	5.0
Limestone, brachiopods, chonetids, fusulines	.5
Shale and thin limestones	6.0
Limestone, gray Osagia, Derbya, crinoidal fragments in upper part; fusulines in middle; Osagia in lower part .	3.5
Limestone, blue-gray, weathering brown, massive; abundant Ottonosia, Punctospirifer, gastropods, productids, Polypora	1.2
Shale, calcareous	.5
Limestone, massive, blue, earthy; crinoidal fragments brachiopods, Ottonosia	.8
Calhoun Shale	
Shale, buff, largely covered	9.0
Limestone, wavy-bedded, weathers brown	3.0
fossils occurred in the beds as follows:	
a. Brachiopods, bryozoa	
b. Ottonosia	
c. Amblysiphonella, Linoproductus	
d. Ottonosia	
e. Fusulines, productids	
f. Myolina	
Shale, sandy, micaceous, blue-gray, Myalina	2.5
Limestone, shaly, brown, Derbya, Myalina, gastropods	.5
Shale, covered	17.0
Ervine Creek	
Limestone	

Section 16

Greenwood County, NE SW of section 32, T. 26, R. 11 E.

	Thickness in feet
Severy shale	
Shale, blue, sticky	?
Topeka limestone	
Limestone, gray	.7
Limestone, gray, Myalina, Osagia, top of bed ripple-marked, shallow water	1.2
Limestone, white, fusulines, abundant echinoid spines in top.	3.2

Section 17

Greenwood County, SC of section 1, T. 23, R. 12 E.

	Thickness in feet
Topeka limestone	
Limestone, gray, algal	6.0
Limestone, massive, gray	4.0
Covered	10. 5
Calhoun shale	
Limestone, blue, nodular, brachiopods	.6
Limestone, thin in upper part, lower not exposed	3.0
Sandstone, buff	5.0

Section 18

Elk County, NW SW of section 11, T. 31, R. 10E.

Topeka limestone

	Thickness in feet
Limestone, gray weathers brown, thin bedded, wavy, fusulines abundant.	2.5
Shale, poorly exposed, abundant Rhombopora zone at the top.	21.8
Limestone, gray, thin, wavy-bedded, fusulines gastropods, Derbya	3.0
Limestone, gray, fusulines	.8
Sandstone, gray, massive, fine, hard sandstone Pleurophorus.	1.5
Limestone, sandy, Rhombopora zone	

Section 19

Elk County, SW SE of section 6, T. 30, R. 11 E.

Topeka limestone

	Thickness in feet
Limestone, buff weathers brown, fusulines	9.0

Calhoun Shale

Mostly covered, abundant Rhombopora at top	4.8
Shale	12.3
Limestone, gray, dense	.5
Covered	7.5
Limestone, gray-blue, fusulines, Ottonosia	1.0
Covered	8.8

Ervine Creek

Limestone, gray, wavy, Ottonosia

Section 20

Chautauqua County, SWNE of section 10, T. 35, R. 9 E.

Topeka limestone

	Thickness in feet
Limestone, upper 6" gray, crystalline, fusulines, Osagia at top, lower massive gray weathers brown, sandy.	5.2
Shale, poorly exposed, very fossiliferous, chonetids	8.5
Shales, blue	4.3
Limestone, gray, fusulines	.5
Covered with limestone exposed in lower part, blue-gray crystalline	8. 0
Shale, brown, calcareous, largely covered	5.1
Limestone, gray, crystalline, few Osagia	1.1
Covered	4.1
Limestone, brown, weathered, fusulines	.9
Shale, gray, mostly covered	7.0

Ervine Creek limestone

Limestone, thin wavy beds, buff, crystalline	2.5
Limestone, massive, gray, crystalline, Osagia	1.8

Interval from top of "Red Lime to Batchelor Creek	90.0
" " " " " " " Church	109.0

Section 21

Chautauqua County, NE NW of section 8, T. 34, R. 10 E.

Topeka limestone

	Thickness in feet
Sandstone, buff, weathering red brown	1.0
Limestone, nodular and interbedded buff shales, poorly exposed, fusulines	7.0
Covered	4.0
Limestone, dense, blue, weathers brown, Ottonosia, fusulines.	1.9
Covered	2.0
Limestone, gray, buff, dense, Ottonosia, fusulines, brachiopods	.9
Covered	2.5

Ervine Creek

Limestone, nodular, gray weathers white
fusulines.