

KANSAS GEOLOGICAL SURVEY
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A Study of the Oread Formation, Pennsylvanian,
Along the Strike Across Kansas

by

Oren C. Baptist

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KANSAS GEOLOGICAL SURVEY
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A STUDY OF THE OREAD FORMATION, PENNSYLVANIAN,
ALONG THE STRIKE ACROSS KANSAS

by

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Mid-Continent Stratigraphy
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(T)

U.K.

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INTRODUCTION

Purpose of Study. The present study of the Oread formation at the outcrop across Kansas was undertaken by the 1941 class in Stratigraphy at the University of Kansas to provide opportunity for the members of the class to learn field techniques, study lithologic and faunal variations along the strike, and to solve, if possible, some of the existing problems, especially in southern Kansas, of classification and correlation of the members of this formation.

Field Work. The field work was done on holidays and week ends during the spring months of 1941. Altogether 12 days were required to visit many outcrops extending from the vicinity of St. Joseph, Mo., southwesterly to the southern edge of Kansas in southern Chautauqua County.

No attempt was made to measure in detail every outcrop visited, but rather the purpose of the field work was to get a complete and detailed stratigraphic sections at sufficiently close intervals across Kansas to permit ready correlation between members and facilitate recognition of variations in thickness, lithology and faunal content.

Detailed stratigraphic sections were made at selected localities by means of rule and Locke level where possible. In northern Kansas the resistant limestones of the Oread formation are separated by shales usually less than 15 feet

thick, with the result that this formation forms an almost continuous scarp with a narrow outcrop band that is easily measured with the Locke level and rule. However; in the southern part of the state the great increase in the thickness of the shales between scarp-forming limestones results in the spreading of the outcrop band to such an extent that plane table traverses are necessary to obtain the intervals between resistant members. On such traverses the dip of the beds must be ascertained and allowance made for it.

Lithologic specimens and fossils were collected at many localities for further study in the office.

STRATIGRAPHY

General. The Pennsylvanian rocks of Kansas consist of about 1200 to 2,000 feet of interbedded limestones, sandstones and shales which are exposed in a wide outcrop band across the eastern third of the state. Striking in a northeast-southwest direction, and dipping northwest about 25 feet per mile, they are covered by younger sediments in the western two-thirds of the state.

These rocks have been divided by Moore (1935) into three series named in ascending order: Des Moines, Missouri and Virgil.

The Oread formation at the base of the Shawnee group of the Virgil series is separated from the underlying Missouri series by the sandstones and shales of the Douglas group with the Lawrence shale at the top.

The Oread formation is predominately resistant limestones and, in common with the other resistant rocks in this part of the state, forms an almost-continuous eastward-facing cuesta across the state.

Good exposures are afforded in most places in road-cuts and quarries. Natural outcrops are usually badly slumped and show such a limited section that much piecing together is necessary in order to get a complete stratigraphic section of the formation.

New road cuts make possible more detailed study year after year thus aiding in solving many of the problems yet to be attacked.

P E N N S Y L V A N I A N S Y S T E M

VIRGIL SERIES

Douglas Group

Lawrence Shale

General. The Lawrence shale, named from the good exposures around Lawrence, Kansas, consists of thick nonmarine shales, with usually a thick sandstone at the base and containing locally thin limestones and coal.

Because this study was concerned mainly with the Oread formation, only the upper part of the Lawrence shale was studied at most places. However, all the recognized members were measured in detail at widely separated outcrops along their strike.

The soft shales and generally nonresistant sandstones of this formation weather easily and therefore form the slopes and floors of valleys beneath the prominent scarp formed by the resistant Oread limestone above. For this reason the Lawrence shale is seldom well exposed. Furthermore, these nonmarine sediments vary greatly from place to place, making positive identification and correlation even more difficult.

Ireland sandstone. The Ireland sandstone in the center of the west half of Sec. 17, T. 25 S., R. 15 E., (Sec. 21) consists of 16 feet or more of buff, fine-grained, cross bedded, resistant sandstone and minor interbedded sandy shales. The type locality of this member is along Ireland Creek on the Ireland farm 2 miles southwest of the locality mentioned above, or 5 miles southwest of Vates Center

Amazonia limestone. The Amazonia limestone occurs locally in the upper part of the Lawrence shale. Although reported as thick^{as} 13 feet in some places close to the type locality at Amazonia, Mo., the thickest observed during the present study was 3.6 feet in the NW, quarter sec. 32, T.59N., R. 34W., in Andrew county Mo. (sec 39). Here, thin slabby limestone and interbedded shales lie about 4.0 feet below a limestone-pebble conglomerate. This conglomerate may mark the position of the Toronto limestone, which is absent.

The Amazonia limestone in the center of the north one-half of sec. 24 T. 18S., R. 17E., (sec. 5) is a single massive bed 1.2 feet thick and is 34 feet below the top of the Lawrence shale. This bed is dark blue in color, weathers light cream, and has algal nodules the size of a pea scattered throughout. No other fossils are present. The Williamsburg coal lies just above the limestone, being separated from it by a half a foot of black shale containing much macerated plant material. The coal is only slightly over a foot thick has been mined commercially for some time.

The thinness of the Amazonia limestone, the absence of marine fossils, and the occurrence of continental sediments next above, leads to the conclusion that this bed represents the upper or receding algal, phase of the thick limestone as developed farther north.

Shawnee Group
Oread Limestone

General. The Oread formation as defined by Moore (1935) consists of four limestone members separated by three shales. In upward order these are: Toronto limestone, Snyderville shale, Leavenworth limestone, Neebner shale, Plattsmouth limestone, Heumader shale and Kereford limestone.

The thickness of the Oread at the type locality on Mount Oread in Lawrence, Kansas, is about 50 feet. Traced northward the thickness remains constant but to the south the shale increase in thickness so that in central Chautauqua county (secs. 31 & 33) the formation measures 150 feet. Further thickening of the shales and thinning of the limestones and the coming in of thick sandstones makes the tracing of all the members far into Oklahoma impossible.

Toronto limestone. The Toronto member, from its type locality at Toronto northward consists of 5 to 10 feet of brown, heavy bedded limestone and thin shale partings. Southward from Toronto this member is traced with difficulty. This is due to marked thinning of the member with a corresponding increase in the amount of shale present.

According to Delo (1928 p. 7) the "Lower Oread" (Oread of later authors) is absent south of Toronto and its place is taken by a continuation of the Lawrence shale which merges into the overlying Snyderville.

Careful field work discloses a thin-bedded limestone with layers of fossiliferous interbedded shales about 65 to 75

feet below the easily recognized Leavenworth limestone. This bed varies in thickness from about 6 feet to a foot or less, gradually thinning southward. Like unquestioned Toronto this limestone is often dark brown in color, but lighter colors are predominant at some outcrops. Unlike typical Toronto, the shale just under this limestone is often profusely fusulinidiferous.

Because of its stratigraphic position as the first limestone below undoubted Leavenworth, and because of faunal similarities, this thin limestone of southern Kansas is here classed as Toronto and correlated with that member.

The Toronto member was found to be absent at two widely separated localities but in each case its position is apparently marked by a limestone pebble conglomerate.

Northeast of St. Joaeph Mo. (Sec. 39) this conglomerate is 32 feet below the Leavenworth limestone and 1.8 feet above the Amazonia. It is about a foot thick and composed of limestone pebbles cemented by brown impure calcium carbonate.

Near Baldwin (sec. 35) this conglomerate is almost 7 feet thick and is 37 feet below the Leavenworth. The absence of Toronto limestone around Baldwin was noted by John Rich (1932 p. 140) who traced a fault with a displacement of about 20 feet through this area.

Snyderville shale. The Snyderville shale varies but little from 12 feet of thick to gray, blocky, sticky shale from Lawrence northward.

Excluding the abnormally thick shale above the conglomerate at Baldwin (sec. 35) the Snyderville gradually thickens and becomes more sandy southward until its maximum observed thickness of 77 feet is reached just south of Toronto (Sec. 22-23). From Toronto the member thins to about 62 feet near Fall River and maintains this thickness to the state line.

A marked increase in sand is noted in the southern section, becoming prominent around Langton so as to form an escarpment. This sandstone is buff, hard, fine grained and cross bedded.

A fresh water limestone measuring 1.5 to 2 feet thick appears about 50 feet below the Leavenworth limestone close to Sedan.

This shale member is unfossiliferous except the upper few inches just below the Leavenworth limestone. In this zone large Chonetes are common, often abundant. Ambocælia and Marginifera are also sometimes present.

Leavenworth limestone. The Leavenworth limestone, because of its distinctive and unmistakable appearance is sought as a horizon marker at each exposure. This member is a single unbroken bed of dense, hard, blue, fine-grained limestone which weathers cream on the outer surface. Fossils are commonly small brachiopods, gastropods and fusulinids. These appear black in a dark blue matrix.

The lateral persistence of this thin limestone is amazing. Its thickness is 1.5 to 2.0 feet across the state, varying

but little from place to place.

Heebner shale. The Heebner shale is almost as distinctive and persistent as the underlying Leavenworth limestone.

The lower half (about 2.5 feet) is black, platy shale. It is very thinly laminated and splits into large strong plates. Phosphatic concretions and conodonts are characteristic of this zone.

The upper half of the member is dark blue below and grades upward into buff clay which tends to break into rectangular blocks about two inches square. No fossils were found in this zone except at the very top at the contact with the Plattsmouth above.

Near Baldwin, where the Toronto limestone is absent, the Heebner shale displays the unusual thickness of 12 feet. The black zone is poorly represented and its place is taken by yellowish shale. This probably was a local deep spot in a broad continental, stagnant sea.

Plattsmouth limestone. The Plattsmouth limestone is the thickest, most resistant member of the Oread formation.

Near Toronto (sec. 22-23) less than 3 feet of Plattsmouth was found and this may be the total thickness, but this member increases in thickness both to the north and south from this point. The usual thickness for this member is about 20 feet. It is usually divisible into two zones. The lower 8 to 10 feet is hard, blue to tan, fine grained, splintery, in beds 1 to 2 feet thick and thicker are common. Fusulinids are common but not abundant throughout. *Enteletes* are common in

some zones and break out easily.

Dark blue chert occurs in some places near the top of this zone. The upper layers of this chert zone often contain white fusulinids, while these fossils are absent in lower chert zones.

The upper zone is characterized in the northern part of the state by thin, wavy beds of limestone separated by irregular, discontinuous, shale partings. Fusulinids and brachiopods are common. Around Sedan (Sec. 31-33) the upper zone stands in sharp contrast to that of the north. Here the upper zone is composed of massive beds up to 2 feet thick. Some of these beds are coarse crystalline. They weather into a very irregular cavernous, orange-brown, surface. Fusulinids are rare in these upper beds.

Heumader shale. The Heumader shale as here correlated varies greatly in thickness from locality to locality. It is less than 3 feet thick at Lecompton (Sec. 1-17) and Langton (Sec. 26-29), but is 44 feet near Fall River (Sec. 24) and 25 feet thick at Elgin (Sec. 34).

The member is clayey to sandy, and since the Kereford limestone seldom forms a scarp, good exposures are rare. Fossils are rare except near Burlington (Sec. 36-37-38) where bellerophontid gastropods are numerous.

Kereford limestone. The Kereford limestone is very variable from place to place and few generalizations can be made concerning its thickness, lithology or fossil content. The reader is referred to the chart accompanying this report.

This member is absent in some places but attains a thickness of 22 feet at Melvern. (sec. 14). At Fall River and southward, the Kereford horizon is marked by a few inches to 2 feet of thin bedded limestone, which in the extreme southern part of the state is overlain by a thick sandstone which is fossiliferous at its base and should, perhaps, be classed as Kereford.

Near Melvern, where the thickest section is observed, the upper part of this member consists of light gray to cream dense limestone, in regular beds 0.2 to 0.3 foot thick. Little shale is present and the division into flaggy beds is sharp. This zone is unfossiliferous except at the very base where a gradation into the more heavily bedded, fossiliferous, limestone below occurs.

List of Localities and Detailed
Stratigraphic Sections of the Oread Formation

Section Number	County	Description	
1	Douglas	SW $\frac{1}{2}$, Sec. 25 T12S., R19E.	1 mi. W of Lawrence
2	Douglas	NW $\frac{1}{4}$, 1-12-19	Adams Quarry
3	Leavenworth	CEL 7-11-21	$\frac{1}{2}$ mi. W Tonganoxie
4	Leavenworth	CWL 31-10-21	3 mi. NW of Tonganoxie
5	Franklin	CN $\frac{1}{2}$ 24-18-17	$\frac{1}{2}$ mi. W of Williamsburg
6	Coffey	CSL 7-19-17	1 $\frac{1}{2}$ E, 1 N of Waverly
7	Osage	SW $\frac{1}{4}$, SW $\frac{1}{4}$ 10-18-16	0.8 mi. S of RR viaduct, Melvern,
8	Osage	NW cor 10-18-16	RR cut Nelver,
9	Leavenworth	NE cor 22-8-22	4 mi. N. W. Leavenworth
10	Atchison	S $\frac{1}{2}$, 7 & N $\frac{1}{2}$ 18-6-21	Kereford Quarry Atchison
11	Doniphan	NW $\frac{1}{4}$ 20-3-22	1.1 mi. east of Blair
12	Doniphan	SW $\frac{1}{4}$ 34-4-21	WPA Quarry 2.7 mi. NE of Doniphan
13	Douglas	SW cor 33-14-19	2.5 west of jct. US 59 & 50N
14	Osage	NW $\frac{1}{4}$, NW $\frac{1}{4}$, 3-18-16	Roadcut .5 mi. N. of Melvern
15	Osage	SW $\frac{1}{4}$, 34-17-16	Quarry 2 mi. N of Melvern
16	Osage	NW cor 12-18-16	Roadcut and mine 2 $\frac{1}{4}$ mi. E of Melvern
17	Douglas	NE $\frac{1}{4}$ SW $\frac{1}{4}$ 34-11-18	RR Depot, Lecompton,
18	Douglas	SE cor 1-14-18	Roadcut $\frac{1}{2}$ mi. S of Lone Star
19	Douglas	Center 14-14-18	Lone Star Lake
20	Douglas	NW 35-13-19	$\frac{3}{4}$ mi. W of Three Sisters
21	Woodson	CW $\frac{1}{2}$ 17-25-15	Yates Center, 3 mi. W of
22	Greenwood	CWL 1-26-12	4 mi. W SW of Toronto
23	Greenwood	N $\frac{1}{2}$ line 9 & 10-26-13	3 mi. SW of Toronto

*Note: All townships are south, all ranges east. Thus the notation CEL 7-11-21 means the center of the east line of section 7, Township 11 south, range 21 east.

Section Number	County	Description*	
24	Greenwood	9-10-11, 28-12	1 to 3½ mi. W of Fall River
25	Elk	12-29-12	4 mi. S of Fall River
26	Elk	NE¼ SE¼ SW¼ 31-30-12	4.7 mi. ENE of Elk Falls
27	Elk	Center 33-30-12	1 mi. N, 1 mi. W of Longton
28	Elk	Center 23-30-12	3 mi. N of Longton
29	Elk	CSL 15-31-12	2.6 mi. S of Longton
30	Chautauqua	NW¼ 31-32-12	Sedan, 7 mi. N of
31	Chautauqua	CEL SE¼ 23-33-11	2 mi. N. of Sedan
32	Chautauqua	SW¼ SE¼ 33-33-11	0.5 mi. W of Sedan
33	Chautauqua	SW¼ 5-34-11	2.5 mi. SW of Sedan
34	Chautauqua	SW¼ 11-35-10	¼ mi. W. of Elgin
35	Douglas	Center 27-14-20	1.5 mi. NE of Baldwin
36	Coffey	SL SW¼ SE¼ 21-21-16	5 mi. E of Burlington
37	Coffey	C W ½ 14-21-15	Pecks Quarry 1 mi. N of Burlington
38	Coffey	SW¼ 11-21-15	2 mi. N. Burlington
39	Andrew (Mo.)	NW¼ 32 T59N-R34W	2 mi. SW of Rochester, Mo.
40	Greenwood	CNL 33-25-13	2.5 mi. W. of Toronto

*Note: All townships are south, all ranges east. Thus the notation CEL 7-11-21 means the center of the east line of section 7, township 11 south, range 21 east.

LISTS OF FOSSILS WITH LOCALITIES

These lists prepared by Maurice Wallace.

Toronto limestone

Triticites cullomensis 25, 20, 18, 1, 5, 29

Batostomella 25

Lophophyllidium 25, 20, 5, 16

Axophyllum 25

Marginifera Splendens #25, 21

Ambocoelia #25, 29

Dictyoclostas #25, 21

Composita #25, 21, 10

Myalina #25

Neospirifer 21, 1, 3

Chonetes granulifer 21 (very large)

Fistulipora 21, 20

Apagraphiocrinus 25, 20

Delocrinus 25

Rhipidomella 20, 29

Hustedia 20

Punctospirifer kentuckyensis 20, 21

Chonetes 20, 21, 10, 29

Algae 1, 3

Allorisma 1,

Marginifera 1, 10

Derbya 1, 10

Enteletes 21

Otonosia, 5

Aulopora 16

Snyderville shale

Hypsolentoma 19
 Fistulipora 19
 Bucanopsis 19
 Trachydomia 19
 Punctospirifer 19
 Myalina 36, 11, 30
 Astartella 36, 30
 Derbya 36, 11, 35, 10, 16 39
 Chonetes 36, 11, 35, 10, 34, 24, 30, 39
 Squamelaria 11
 Rhombopora 11
 Ambocoelia 10, 30
 Pharkidonotus 30
 Dietyoclostus 30
 Marginifera 30
 Holothurian spines 39
 Ammodiscus 39
 Ammodiscoides 39
 Nodosinella 39
 Cytherella 39
 Amphicites 39

Leavenworth Limestone

Marginifera splendens #3
 Fusilinids #3, 18, 10, 24, 34
 Rhipidomella 13

Punctospirifer 13

Ambococlia 13

Hustedia 13, 35

Enteleles 1,

High Spired Gastropods

Low Spired Gastropods

Bellerophonid Gastropods

Heebner shale

Ambococlia 13, 1, 22

~~Ammodiscus~~ 3, 1

Conodonts 3

Euphemites

Chonetes 1

Lissochonetes 1

Plattsmouth limestone

Triticites irregularis 17, 2, 1

Triticites plummeri 17, 2,

Caninia sp. 34

Enteleles 34, 2, 17, 16, 37, 3, 33

Neospirifer 34, 17, 3, 37

Squamularia perplexa 34, 37, 17

Linoproductus 34, 2

Composita 34, 17, 2, 3, 37, 1

Hustedia 17, 2, 33, 3

Chonetes 17, 37

Fistulipora 17, 2, 37, 8, 1

Punctospirifer kentuckyensis 17, 4, 37, 1
 Rhombopora 17, 2, 4
 Syringopora 17, 2,
 Ambocoelia 17, 37
 Dielasma bovidens 17, 2, 37
 Wellerella 2, 37, 10
 Echinoconchus 2
 Rhipidomella 2, 17, 3
 Lophophyllidium, 2, 17, 1
 Marginifera splendens 37
 Derbya #3, 37, 22, 17
 Acanthocladia 37
 Meekella 33
 Apagraphioerinus 37
 Dictyoclostus 13, 1, 2
 Otonosia 22
 Dibunophyllum #15

Huemader shale

Euphemites 38
 Euomphalus 38
 Myalina 38, 6,
 Astartella 24, 38
 high spire gastropods 38
 Pharkidonotus 38, 6
 Hustedia #6
 Ammodiscus #6
 Derbya 38
 Amphisites #6

Kereford limestone

Bairdia beedei, #2

Astartella #2

fusilinids #2, 14, 24, 17, 25, 4, 10

Parcilocrinus sp.

Allorisma #8

Juresania #8

Syringopora #8

Composita #8, 10

Derbya #8

Meekella #8

Echinoconchus #8

Chonetes #8

Hustedia #8, 17

Dielasma bovidens #8, 17

Wellerella #8

Dictyoclostus #8, 2

Linoproductus #8

Marginifera #8

Myalina 14, 6

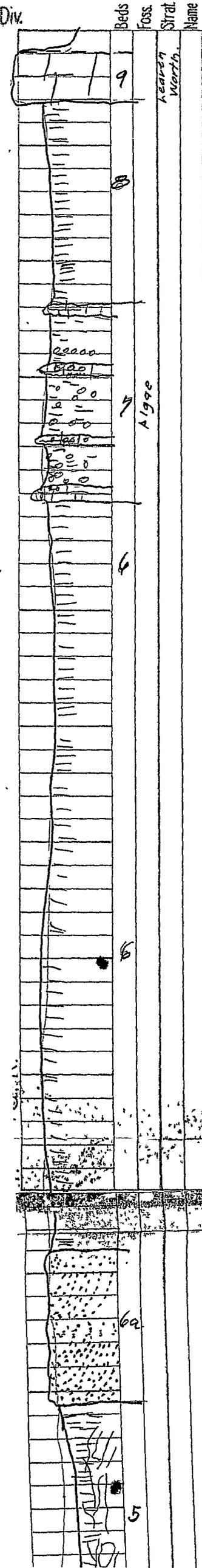
Pinna 14, 2

Fenestrellina 2

Osagia 24, 4, 6

Caninia #7, #8

Conularia #6



Div. T.32 S.R. 12 E County Chautauque

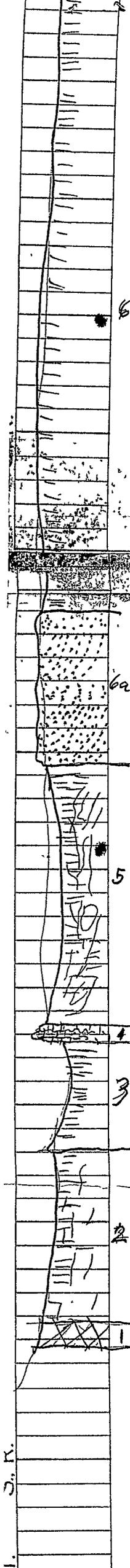
Sec. 31 Locality description- Sedan, 7.0 mi North of, along highway

Measured by- O. P. P. Date- May 1941

Remarks- p 53

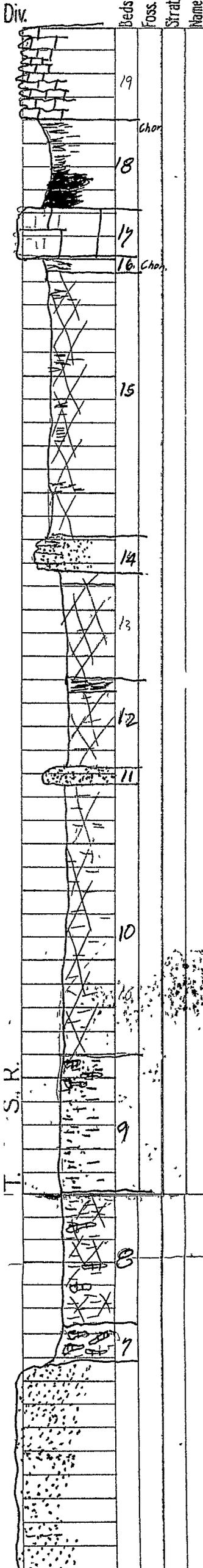
Bed No.	Description	Thickness
9	Limestone - Unexposed. Flat pre-oxidized hard blue weathers tan	—
8	Shale, yellow - clayey - poorly exposed	8.8
7	Algal zone. Resists. Dark blue same well cemented hard. Same soft shale & well defined ledges of hard.	8.6
6	Shale - Unexposed. Soft forms long slope between beds above and resistant sandstone below.	38.0 31.6
6a	Sandstone. Buff, fine grain hard. Well sorted, well cemented. Prominent scarp maker. Oak trees veg.	6.8
5	Shale. Closely & irregularly jointed. Irregularly arranged vertical joints makes yellow-like structure in horizontal plane. yellow, clayey	11.0
4	Limestone. Very fossiliferous. Chocomaed, rough on surface. Large fossils in granular, bluish druse. Chonetes, penetrate bryozoa. Marginifera, Ornatid fragments. No. P. subundata	0.8 4.6
3	Shale. Dark gray, fossiliferous. Ash gray on surface. Platystrophia, Ambocoelia, large Chonetes, Chonetina, Parahelonetes, Astartella, Plectambonites, Sq. Ornatid fragments. Many large M. galina at base	4.6
2	Shale Dark blue. Blocky. 0.1 vertical cracks weathers yellow. Non-fossil.	7.1
1	Shale - Red - poorly exposed	1.0*

- Chonetes, Penetrato hypozia.
- Margarites, Crinoid fragments.
- no. P. tubulata
- 3 Shale. Dark gray, fossiliferous, Ash gray on surface. M. lathraea, p. m. ambocellic, large Chonetes, Chonetina, P. harknessiana, Astartella, P. chonetiformis, Lg. Crinoid fragments, many large M. galina at base
- 2. Shale Dark blue. Blocky O. 1. Rectangles 7.1
Fossils yellow. Non-fossil.
- 1. Shale - red - poorly exposed 1.0+



Myalina, Chonetes
P. harknessiana
Chonetes

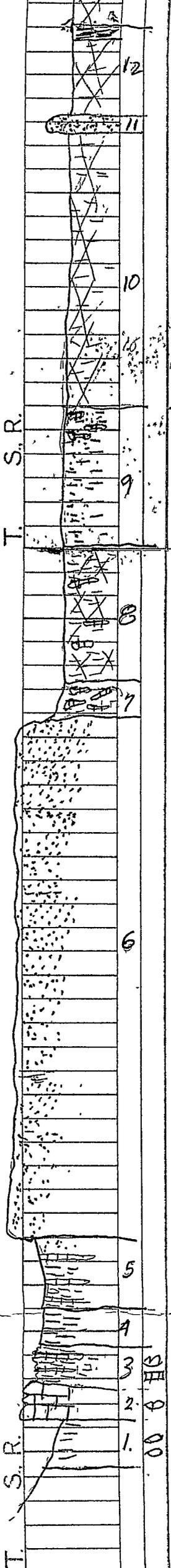
1.
2. R.



T. 31 S. R. 12 E County Elk

Sec. 15
 Locality description - Langton, 2.6 mi South of along highway
 Measured by - OCB
 Date - May 1991
 Remarks - 40 51

Bed No	Description	Thickness
19	Limestone - dense hard blue weathers cream only short distance in. Many bedded. Most beds 0.3' thick	4.0+
18	Shale - Dark gray, almost black in lower half weathers into black flaky pieces. Grades upward through dark gray, blocky sh. into yellow finely laminated clay just below ls. above. Channels in upper part	3.9
17	Limestone, dense hard blue weathers cream. single ledge	2.0
16	Shale - yellow laminated. Channels	0.6
15	Shale - Red powdery when dry. some yellow mottling	11.2
14	Sandstone & shale. Mostly shaly ss. with more shale at top	1.2
13	Shale - Red, weathers fine granular, clayey, blocky	4.3
12	Shale & mottled maroon and yellow with 0.8 metstone at top	3.6
11	Sandstone very hard, single ledge but laminated. Greenish-yellow, finely micaceous	0.6
10	Shale - red. Rematic concretions, weathers marble - size granular	11.7
9	Siltstones, sandy & shaly. Red mottled below - grades into buff sandy siltstones with buff nodules of lime at top	6.6
8	Shale. Red sh. red CaCO ₃ nodules. sh. breaks into pebble - size nodules. Red nodules irregular in shape	5.5
7	Shale and CaCO ₃ nodules. Fine grained block siltstones and irregular CaCO ₃ nodules about size of small fist. con.	1.5
6	Sandstone. Buff, fine grain, dense cross bedded hard in places. Weathers good scarp.	22.0
5	Shale, siltstone & thin layers of CaCO ₃ shale with marine fossils. Siltstone light - blue gray. Fossils stand out white in 0.65 layers of CaCO ₃ shale.	3.0
4	Shale - Olive-green, blocky	1.8
3	Limestone and shale. Limestone 0.1'	1.8
2	Limestone. Very dense, blue, hard, weathers tan. Greenish surfaces. Mottled ls. Blue calcite fossils and brown streaks when wet. Ambocula, and many broken shells and Orinoid fragments	2.0
1	Shale - yellow - laminated. Profusely fusulinid which weather out in large numbers.	2.0



- 11 sandstone very hard, single ledge but laminated. Greenish-yellow, only micaceous 0.6
- 10 shale - red. Gneiss-like concretions. 11.7
 weathered marble - soft - granular
- 9. siltstone, sandy & shaly. Red mottled below - cracks into buff sandy siltstones with buff nodules of lime at top 6.6
- 8 shale. Red sh. red CaCO₃ nodules. 5.5
 sh. breaks into pebble-size nodules. Red nodules irregular in shape
- 7 shale and CaCO₃ nodules 1.5
 fine grained block siltstone and angular CaCO₃ nodules about size of small stones
- 6 sandstone buff, fine grain dense cross bedded, hard in places. Makes good scars. 22.0
- 5 shale, siltstone & thin layers of CaCO₃ 3.0
 shaly with marine fossils. Siltstone light-blue gray. Fossils stand out white in 0.65 layers of CaCO₃ shale.
- 4 shale - blue-green, blocky 7.7
- 3. Gneiss and shale. Siliceous, 0.1' 1.8
- 2. Gneiss. Very dense, blue, hard, 1.8
 weathers tan. Gneiss surfaces mottled to blue calcite fossils and brown streaks when wet. Ambocoelia, and many broken shells and Orinoid fragments
- 1. shale - yellow - laminated. Profusely fossiliferous which weather out in large numbers. 2.0

T. S.R. I. S.R.

SH
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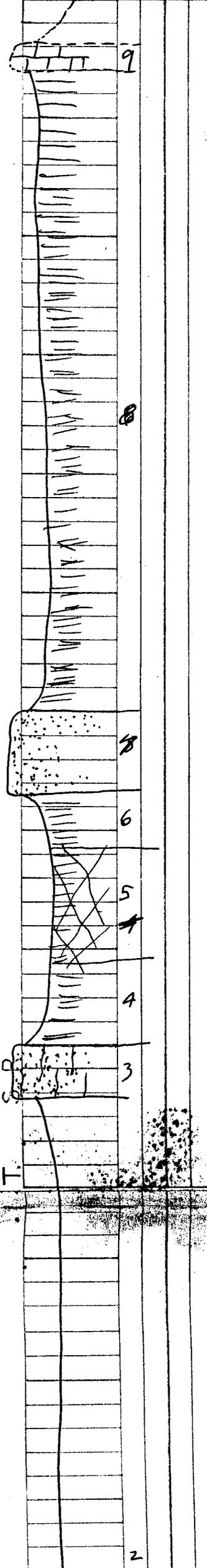
Div. Beds Foss. Strat. Name

T.24 S.,R. 13E County Greenwood

Sec. 9

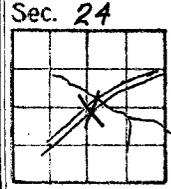
Locality description - Toronto, 3 mi SW. of along N-S County road, Toronto just S. of R.R. Leaves north at top hill 1/4 mi N. Measured by - Orin Baptist & Gene Mace Renelab May 1941
Remarks - Plane table to get Snyderville material
see Baptist notebook.

Bed No.	Description	Thickness
9	Yimertone - Dense, hard blue, weather gray. scarp, not well exposed	1.0+
8	shale - Red and gray green - poor exposure	29.0
7	sandstone - fine grained, glauconitic. light gray, hard laminar resistant	3.5
6	shale gray -	2.0
5	shale - green and mottled gray	5.0
4	shale - poorly exposed	3.8
3	sandstone - fine grained thin laminae blocky, light greenish gray	2.0
2	shales - silty shales poorly exposed - no resistant beds	33.7
1	Yimertone - base not exposed	8.0+

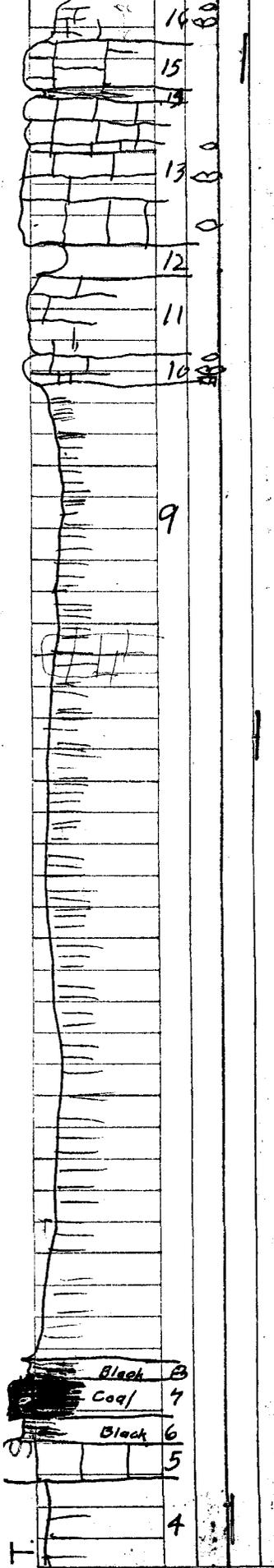


3
Div. Beds Foss. Strat. Name

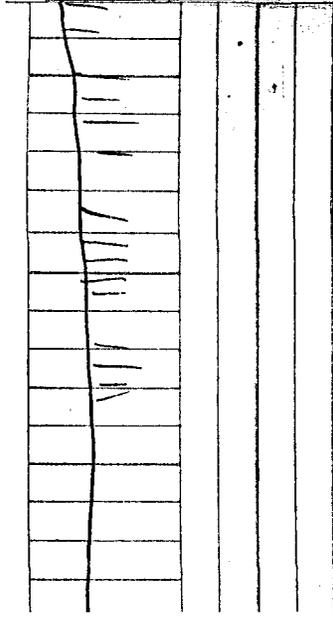
T. 18 S., R. 17 E. County Franklin

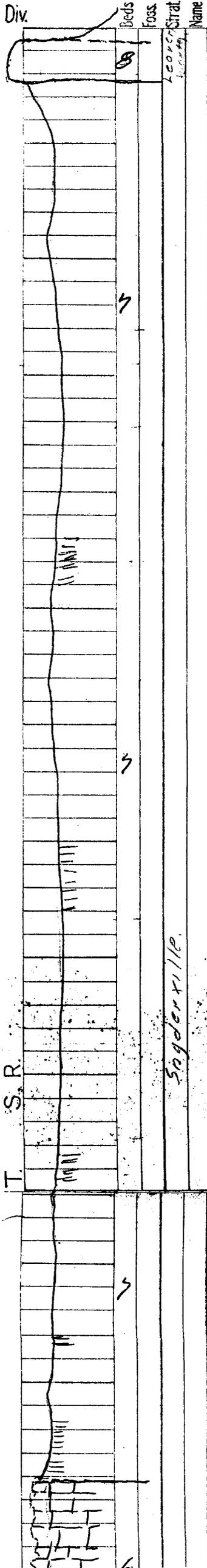


Sec. 24
Locality description - Williamsburg, 3/4 mile S.W. of.
along creek just S. of highway, but mostly
along hill where road cuts S.W. of creek.
Measured by - Oren C. Baptist. Date - March 25, 1941
Remarks - Page 8.



Bed No.	Description	Thickness
16	Yellow shale - mostly poorly exposed. Lower 1.0 is single bed with many small fusulines and brachs. Above yellow to dark dense hard shale with subconch. fract. weathers light grayish blue. Upper shale beds dark brown with calcite stringers	1.5
15	Limestone. Tan, dense, hard in which light-colored fossils stand out. Fossils weather into relief. a single ledge. many fusulines, Orinoid stems, and bryozoa	1.4
14	Shale Yellow finely laminated	0.4
13	Limestone. Brn, hard, weathers brn-gray Lower 1.5 in single bed. Very fossiliferous at base. fusulines abundant large brachs, derhya etc. Upper part, no shales but divided into 0.3 to 0.8 beds. Top layer hard with brn. stringers calcite.	4.6
12	Shale. - Poorly exposed. Yellow - clayey	1.6
11	Limestone like below but is mostly unfossiliferous	2.5
10	Limestone. Dark brown, finely speckled. Crowded with fossils which are lighter color giving mottled appearance. Neospirifer, fusulines, Orinoid stems, Punctospirifer	1.0
9	Shale and sandstone. Mostly yellow and blue shale except upper 6.0 very sandy	30.2
8	Shale. Black, very thin laminated, shaly strong. Much plant remains	0.5
7	Coal. Black powdery to hard coal with vertical joints	1.1
6	Shale black, thin lamin. Much plant remains and coaly material	0.6
5	Limestone. Dense blue with many irregular brn. streaks. Lt gray on weathered surface. Irregular weathered ridges parallel to bedding. Algal nodules size of pea. Single bed.	1.2
4	Shale & sandstone poorly exposed	33.8
3	Sandstone Buff to brown, fine grain, micaceous with carbonaceous material. Many ripple marks.	1.0
2	Shale & sandstone. Ripple-marked irregular sandstone and thin-layered blue & yellow sh.	4.6
1	Shale - base not exposed. Blue - fine laminated.	3.0+





T. 30 S., R. 12 E County Elk

Sec. 33

Locality description - Longton, 1 mi N, & 1 mi W. of
 along road near crest of hill.

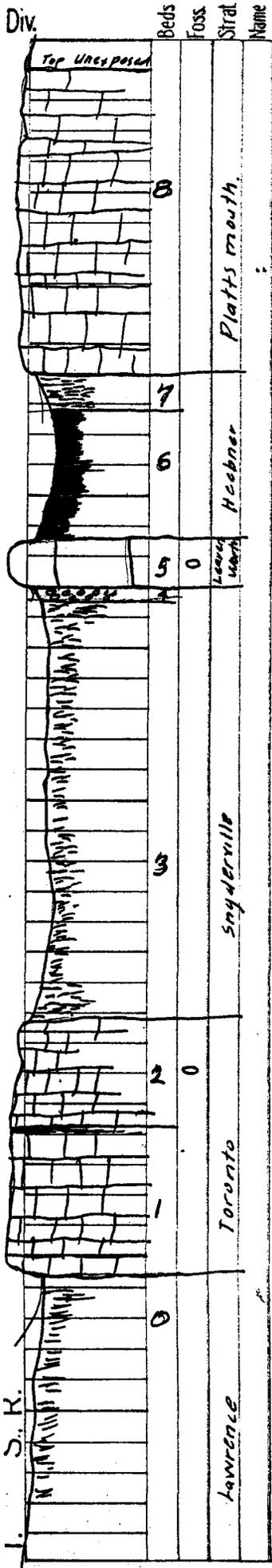
Measured by - Ben C. Gaptud Date - May 41

Remarks - p 56

Bed No.	Description	Thickness
8	Limestone. Dense blue, hard, weathers dark cream. Fossils - brachiopods.	poorly exp ^d 1.5'
7	Shale - covered	50.0
6	Limestone - covered	6.4
5	Limestone - Pebbly, mottled bluish and brown. Pebbles size of peas and larger are brown. Calcite fossils weather into relief on surface. Crinoid fragments, fusulines scarce, broken brach shells.	0.6
4	Shale - yellow - fine, clayey, ferruginous nodules.	0.2
3	Limestone mottled but mostly yellowish with bluish - tan as splotches and dendrites. Calcite fossils stand out on tan weathered surface. Crinoid fragments, broken brach. shells, fusulines scarce.	0.6
2	Shale - base not exposed yellow slightly mottled with cream & containing brown nodular streaks. Fusulines profuse and weather out by handful.	2.0'
1	Shale & sandstones - non-marine poorly exposed	14.0
0	Shale - red	5.0

T. 30 S. R. 12 E

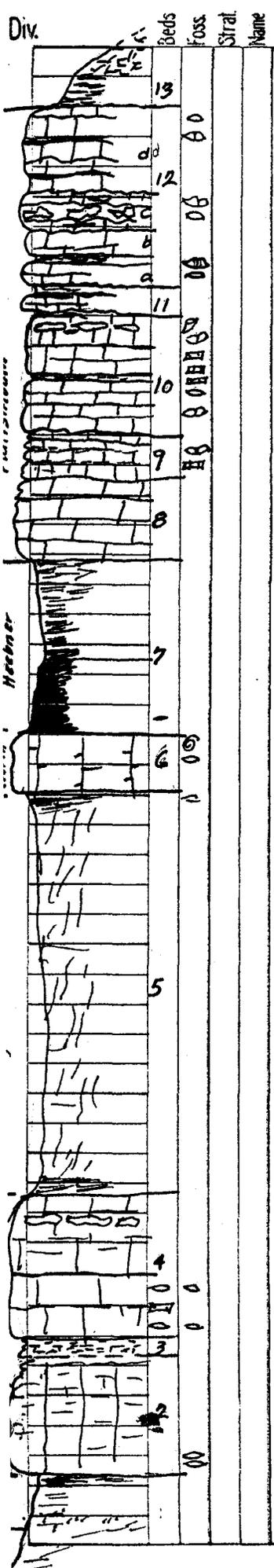
Snyderville



T. 14 S., R. 18 E County

Sec. 14 Locality description - Lone Star Lake, E. bank of
 spillway of.
 Measured by - *Arin Baptist* Date - *April 1991*
 Remarks - *P40*

Bed No.	Description	Thickness
8	Limestone. Poorly exposed, top unexposed. Massive bedded limestone with minor shale breaks.	10.0+
7	Shale. Well exposed. Yellow, chunky laminated clayey, weathers buff.	1.2
6	Shale - black fine, chunky laminated, breaks into big plates. (Total thickness 5.3')	4.1
5	Limestone. Dark blue dense, weathers cream. Black fossils. Gunflints, brachiopods.	1.5
4	Pisolithic zone. Dark blue pisoliths size of pea. Thickly crowded and set in dk. blue shale.	0.9
3	Shale. Lower 6.2' dark green, massive, blocky. Upper half dark blue, finely laminated weathers bluish-tan.	13.7
2	Limestone - Poorly exposed. Gunflints(?)	3.3
1	Limestone - Base & top (bed 2 above) well exposed. Cream, dense, hard, fine grain. Weathers tan. Beds ± 0.6' thick. (Total thickness 8.1)	4.8
0	Shale - Beautifully exposed	20.0+



T. 11 S. R. 21 E County Leavenworth

Sec. 7

Locality description - Tonganoxie, 1 mi. west of, in road cut along highway U.S.

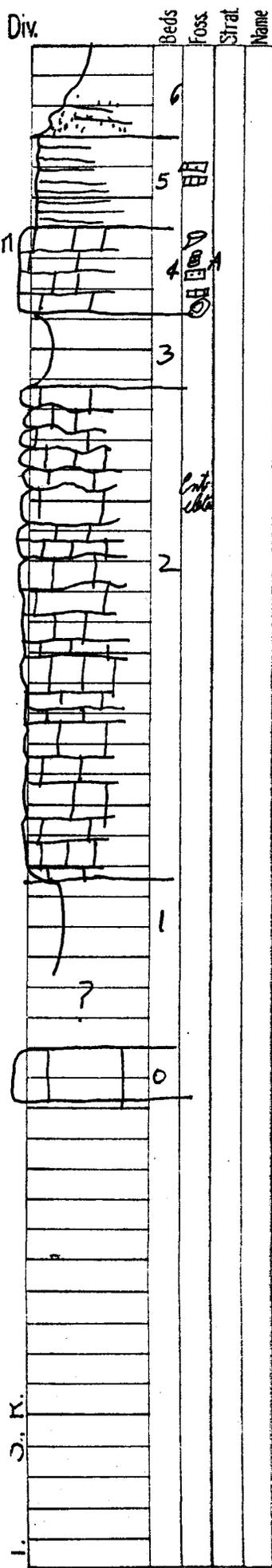
Measured by - Oren C. Baptist. Date - 3-22-41

Remarks - Page 1. Orchard N.B. #1.

Bed No.	Description	Thickness
13	Surface clay and shale. + 1.0' of sticky, blocky yellow clay, above which is red clay and soil	710.0
12	Limestone with some thin shale partings. Lower (a) bed is dense ls, brown on fresh and weathered surface. Many fusulinids and some shells, but not as abundant as next lower limestone. Some large <i>Dictyoelasma</i> . Next (b) approx 1.0' is limestone with 0.2' yellow flaky sh. at base. Fusulinids few. Next (c) 1.3. Three or four wavy beds of ls. and ch. ls. is gray and very hard with rather smooth fracture. Chert, dk. blue with abundant white fusulinids shown in x-section. Sharp boundary between ch. ls. Fusulinids <i>Megapora</i> spp. (d) 3.0. Several irregular beds of ls. with thin yellow clay partings. Dove-tan with irregular fracture. Fusulinids abundant at top. <i>Composita</i> , <i>Juraxania</i> , <i>Pentostrellina</i> , <i>Pleurospira</i> , <i>Dicladema</i> winoid stems, <i>Urosalpinx</i> , trilobite remains	6.0
11	Impure limestone and shale. Upper 1.0' dark yellow finely laminated, calcareous shale. Wavy beds. Irregular contact with ls. above.	1.0
10	Limestone and chert. Lower 1.0 like below with less shells. Fairly persistent but lower beds change some. Next 2.0 divided by 1" shale parting, very irregular. Lighter color than below. Dove tan, porous, fusulinids, <i>Urosalpinx</i> , <i>Pentostrellina</i> ? Upper 1.0 is ls. ch. ls. dove tan like below but non-porous. Very fossiliferous at top. Chert dark blue with white fossils. Nodules mostly 0.5 gone 0.5 from top. Ch. has wavy irregular but tend to be disoid in cross-section.	4.0
9	Limestone and shale. Four 5 beds of wavy bedded ls. separated by thin shale bands. ls. dense hard, dove, smooth fracture. Many brach shells form brown lines in dove sh. Many <i>Urosalpinx</i> stems, <i>Composita</i>	1.5
8	Limestone. A resistant unit but containing some thin shales. Dk. dove on fresh, lt. brown on weathered. Dense sh. with many ls. fossils. Caliche laminae near top. <i>Urosalpinx</i> , <i>Pentostrellina</i>	2.8

(Total thickness Plattsmouth 15.3)

- 7 shale. Lower 3.5 black, fossil. Very strong than flexible large 5.8
 shells. weather slate-gray, unfossil. Many small phosphatic
 concretions.
 above black platy hematitic sh grades into yellow
 calcareous sh. Small fusulines in blk. sh.
- 6 Siltstone. Dark blue on fresh, ~~to~~ cream on weathered 1.9
 Very hard, dense, smooth to subconch. fract. Vertical
 joints. Crinoid stems, echin. spines & plates. Gastropods,
 fusulines
- 5 Shale - Clay & yellow calcareous sh & thin layers of 13.4
 brown impure ls. near base. Blocky yellow sh which
 becomes darker near top. Thin fossil layer near top.
- 4 Siltstone. Dark brown, dense, subgranular with light 4.7
 calcite crystals like below at base, near top becomes
 more dense & breaks with more even fracture. It has
 sparkly with dendrites.
 Irregular ch. band 1.2 from top. ch. more or less
 irregular ellipsoidal. Ch. dk. tan breaks like litho ls.
 sharp contact with ls.
 Fusulines abundant in lower 2.0. Upper part
 unfossil. fusulines, crinoid stems bryozoa below.
- 3 Impure shale. Dk. brown impure ls with some calcite 0.6
 crystals with granular appearance.
2. Siltstone in most places a single massive bed 4.0
 of brown ls with vertical jointing in places in
 breaks near top. Tan-brown dense.
 abundant fusulines at base scarcer at top
 (Total thickness Toronto 9.3')
1. Shale. Only upper part exposed. Bluish tan, 3.0
 blocky, sandy in places. at top grades into
 dark brown limestone, shaly calcareous zone



T. 30 S., R. 12 E County Elk

Sec. 31
 Locality description - Elk Falls, 4.7 mi E-NE of.
 Near crest hill along Hitchins Creek
 Measured by - *Wm. D. ...* Date - May 1941
 Remarks - p 49

Bed No.	Description	Thickness
6	Siltstone & sandstone	5.0'
5	Shale - Gray fine grained weathers ash gray. Marine. <i>Isotelipora</i> , <i>Ornoid</i> fragments	3.0
4	Limestone Dense hard blue mottled with brown irregular beds about 0.4. Weathers into tan irregular. <i>Syringopora</i> , <i>Gastropoda</i> , <i>Pentamerus</i> , <i>Orthis</i> , <i>Leptophyllidium</i> , <i>Ambylophanelle</i>	2.8
3	Shale - Covered	2.3
2	Limestone. Gray bedded dense blue hard. <i>Entolites</i>	1.6'
1	Shale poorly exposed	
0	Limestone - Not in place. Single bed massive blue dense hard weathers cream.	1.8

Div. # Beds Foss. Strat. Name

T. 12 S., R. 19 E County Douglas

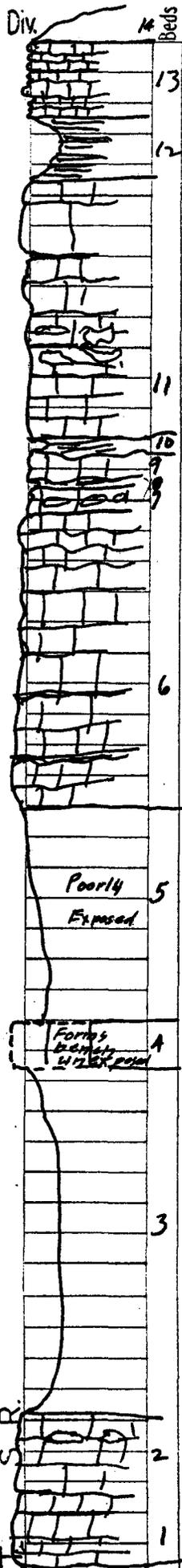
Sec. 1			
X			

Locality description - Lawrence, 4 mi NW. of Quarries
 on crest of hill
 Measured by - Maurice Wallace & Don Baph Date - 16-3-91
 Remarks -

Bed No.	Description	Thickness
13	Red soil	
12	Lo. Blue gray, weathers gray. Fine gran. Beds 0.2 - 0.3' thick. Many beds. Goniatites, Dicyclops, Composita, crinoid fragments, fastra. <i>Plectambonites</i>	2.7
11	Sh. Bluish-green, sticky, clayey	2.0
10	Limestone. Bluish gray to blue tan. Dense brittle, even fracture. Fossils break out white. Chert in zone 3.0 from base is dark blue with white fossils, esp. goniatites. <i>Entolites</i> , <i>Dicyclops</i> , <i>Massifer</i> , <i>Composita</i> , <i>Goniatites</i>	3.0
9	Shale. Buff, calcareous, weathers lt. yellow	0.1
8	Limestone. Lt gray, weathers brown. Earthy, impure.	1.0
7	Shale - Buff to gray, weathers light. Goniatites	0.2
6	Limestone. Cherty. Lt. to gray, fine gran with calcite xtz. Ch. lt blue, irregular follows - sand sized. No white fossils like ch. zone above. Crinoid plates <i>Goniatites</i> , <i>Dicyclops</i>	0.9
5	Limestone. Light bluish gray weathers brownish. Massive beds 1.0' or more esp. in lower part. Fossiliferous <i>Goniatites</i> , <i>Dicyclops</i> , <i>Plectambonites</i> , <i>Crinoid fragments</i> . (Total Plattsburgh 19.8')	3.8
4	Shale - covered	3.0
3	Limestone - Dense, hard, blue-gray, weathers cream. Horns bench on hillside but is not exposed	1.3*
2	Shale - covered	11.2
1	Lo. Lt brown, weathers brown ferruginous, irregular fracture. Lt tan chert	2.5
0	Lo. Brown - weathers dark brown. Poor exposure	2.1
	Shale - Unexposed	1.0*

Poorly Exposed

Forms a bench with a pool



#4

2. P 6.

Div.

Beds
Foss.
Strat.
Name

T. 10 S., R. 21 E County Leavenworth.

Sec. 31

Locality description - Tonganoxie, 3 mi. N.W. of. along highway
1/2 mi. S School

Measured by: Oren B. G. ...

Date: 3-22-41.

Remarks: p 6. NB #1

Bed No.

Description

Thickness

- | Bed No. | Description | Thickness |
|---------|---|-----------|
| 4 | Limestone. 0.5' at base blue, weathers cream. Next zone is thin-bedded yellow, non-fossil. Upper zone blue hard, dense, ls. weathers into relief. Very upper 1.1 nearly unfossil. Shaly at top. | 5.3 |
| 3 | Shale. yellow & greenish mixed clays. Unfossil. blocky. | 3.3 |
| 2 | Limestone. Irregular-bedded, but groups 1.0' or so tend to form units. Lower part dark blue on weathered. fusulinids weather into relief. Gastropods & Neoperisph. | 2.7 |
| 1 | Shale yellow clayey shale with thin ls. layers. Many fusulinids. | 3.0 |

Platts mouth

T. S. R.

Div.

Bevs
Foss.
Strat.
Name

T. 18 S., R. 16E County Osage

Sec. 10

Locality description- 0.8 South R.R. Viaduct, Melvern

x			

Measured by- Maurice Wallace

Date- 3-23-01

Remarks- Good Coral Collecting

Bed No.

Description

Thickness

4 ls. fine grain. lower part wavy bedded, upper part flaggy. Composite

14.0'

3 ls. argillaceous, mostly corals

0.5

2 Sh.

2.5

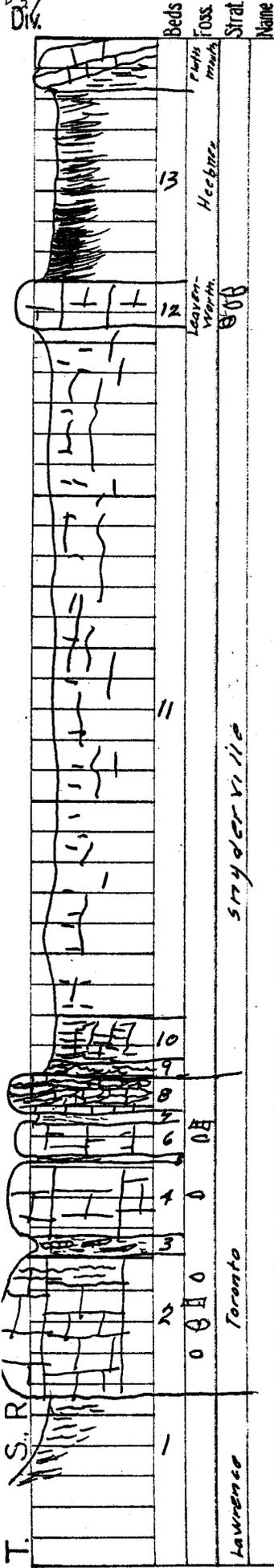
1. ls. fine grain, wavy bedded, cherty, fossiliferous. Fusulinids rare.

T. S. R.



18
p. 37
Div.

T. 14 S., R. 18 E. County



Sec. 1#
 Locality description - Lane Star, 0.6 Mi. S. of, along road where it climbs hill S. creek
 Measured by - *Don Baptist* Date - *April 1941*
 Remarks - *p 37*

Bed No.	Description	Thickness
13	Shale - Top slumped. Black, platy, fine sh. below and yellow, clayey sh above.	6.0+
12	Limestone. Dense hard blue; weathers cream with black fossils single bed. brachs, furculinds, graptolite stems	1.5
11	Shale. Poorly exposed. Yellow, sticky clay, a few poorly preserved fossils at top	22.5
10	Shale. Dk. drab gray with touch of blue. Fresh units 1" thick blocks. subcellular	1.6
9	Shale. Dk. green with small nodules of creamy white, irregular calc. Irregular bedding (total Styderville 24.5')	0.4
8	Limestone. Thin irregular beds, rubbly but no shale	1.2
7	Shale. yellow friable earthy	0.1
6	Limestone. A single bed but not as resistant as two beds below. Tan, very dense with few darker fossils & irregular calcite nodules. Weather to brown with pits 0.1" deep in places. Compacted, a few small furculinds, small stems	1.1
5	Shale parting. Brown, laminar, earthy	0.1
4	Limestone. A single bed like below. Furculinds mostly scarce except near center	2.3
3	Shale & Limestone. Both yellow-brown on surface. It is impure, soft yellow with tan calcite fossils. Small discs of ls.	0.4
2	Limestone. A single massive bed of very dense, lt. cream ls. with many calcite fossils (tan) well preserved. Weathers to tan uniform lt. brown uneven surface on which fossils stand in relief. Furculinds not abundant but present throughout. Bryozoa & brachs	4.4
1	Shale. Base unexposed. Dark gray, structurally weathered clay.	1.0+

Div.

Beds
Foss
Strat
Name

T. 4 S. R. 21 County Des Moines

Sec. 34

Locality description - Des Moines, 2.9 mi. N.E. of.
In W.P.A. quarry along Missouri River

X			

Measured by-

Date - April 1941

Remarks - Wallace & Bepko
Plattsburgh page 26 in Bepko notebook

Werkford

Hemader

Plattsburgh

Bed No.

Description

Thickness

8	Sandstone & shale. Gray, brown on bedding planes thin, clay, micaceous.	6.4
7	Shale - blue blocky	
6	Limestone. Dk brown, smooth on fresh surface. Many fossiliferous. Vertical joints	5.4
5	Limestone. Massive unbroken bed. many crinoid fragments and brachiopods	6.7
4	Shale parting - blue - wavy blocky	0.1
3	Limestone. Densate, dense fine grained. Dk. brown facies. Crinoid stems fossiliferous	6.7

80

80

60

50

40

30

S. K.

I.

