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The Red Oak-Stennett-Lewis Traverse of Iowa

G. E. Condra

University of Nebraska-Lincoln

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NEBRASKA GEOLOGICAL SURVEY

Paper Number 3

THE RED OAK-STENNETT-
LEWIS TRAVERSE
OF IOWA

BY G. E. CONDRA AND J. E. UPP



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Conservation & Survey Division
113 Nebraska Hall
University of Nebraska-Lincoln

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The Papers of the Nebraska Geological Survey are reports on special research projects. They are more restricted in content than the Bulletins of the Survey.

The Red Oak-Stennett-Lewis Traverse of Iowa

BY G. E. CONDRA AND J. E. UPP

This report is based on a study of the Pennsylvanian beds exposed in the Nishnabotna Valley in Iowa, between 1½ miles northwest of Red Oak and about 2 miles northeast of Lewis, a distance of about 25 miles. The southern part of our traverse is on the south-flank of the Jones Point Deformation, which is known as the Redfield anticline.* The section north of Griswold is thought to be in the Bartlett syncline and the one at Lewis is located where the strata lift northwestward from this syncline.

Our investigation is part of a regional study which is being made through cooperation with other states. Its purpose is to determine what relation the exposed strata of the traverse hold to the Nebraska sections and to establish a close correlation of the Iowa beds with those of the type localities in Nebraska and Kansas. Although the purpose is purely scientific the results of this and similar stratigraphic study have use in other phases of geological investigation and in economic development.

Acknowledgment.—Mr. C. E. Busby drafted the figures of this report and Mr. G. W. Dunn, Jr., typed the manuscript.

Previous Work.—The exposures of this traverse have been studied and described by White,¹ Lonsdale,² Smith,³ Tilton,⁴⁻⁵ and others. White (1) and Lonsdale (2) describe some of the outcrops of the area with considerable accuracy, but do not

* According to Tilton, the Thurman-Wilson fault and the Redfield anticline extend northeastward from about two miles north of Thurman, past northwest of Red Oak. Limestones in the lower part of the Wabaunsee group are exposed southwest of Red Oak and the Platts-mouth limestone outcrops at a higher level northwest of the city. Tilton (5) attributes this unusual relation of the strata to faulting and Smith (7) accounts for it by dip southeastward.

¹ White, C. A., *The Geology of Iowa*; Iowa Geol. Surv., Vol. 1, 1870.

² Lonsdale, E. H., *Geology of Montgomery County, Iowa*; Iowa Geol. Surv., Vol. IV, 1895, pp. 381-451.

³ Smith, Geo. L., *Stratigraphy of the Missouri Stage*; Iowa Geol. Surv., Vol. XIX, 1908, p. 636.

⁴ Tilton, John L., *The Geology of Cass County, Iowa*; Iowa Geol. Surv., Vol. XXVII, 1916, pp. 174-276.

⁵ Tilton, John L., *The Missouri Series of the Pennsylvanian System in Iowa*; Iowa Geol. Surv., Vol. XXIX, 1919-20, pp. 263-265.

classify the strata. Lonsdale's sections at Stennett were re-measured by Dr. Smith (3) and correlated as Platte shale, Forbes limestone and Braddyville limestone. According to present usage, the horizons Smith thought he was describing, are the Tecumseh, Deer Creek, Calhoun and Topeka. However, we find that the strata at Stennett are older than these horizons.

Tilton (5) describes the various sections in this traverse and correlates the formations and members with those of Nebraska, Kansas and Missouri. He classifies the beds (ascending order) as the Oread, Kanwaka, Lecompton, Tecumseh, Deer Creek, Calhoun and Topeka and attempts to correlate them with those in the Platte Valley of Nebraska, which had been classified erroneously by Condra & Bengtson (6).

The Problem.—In 1926, the senior author visited the outcrops at Stennett and concluded that they are probably mis-correlated in the reports of the Iowa Geological Survey. Then, in 1926, he and Dr. Carl O. Dunbar collected fossils from the horizons at Stennett and found that the correlation was not well founded. This raised the problem which we have studied and are reporting upon in this paper.

The authors ran a traverse through the exposures of this area in 1928, measured the sections in 1931, re-studied them in 1932 in order to obtain new information resulting from erosion and the opening of quarries, and, finally (1933), the sections were re-checked for incorporation in this report.

It should be noted here that much of the area through which this traverse runs is mantled with the Dakota group of sandstones and shales and by thick Pleistocene deposits, leaving scattered exposures of the Pennsylvanian strata in the valleys. This condition has made the stratigraphic study of the Pennsylvanian here unusually difficult and has retarded progress in such investigation.

Our correlations are shown in the following sections.

⁶ Condra, G. E., and Bengtson, N. A., The Pennsylvanian Formations of Southeastern Nebraska; *Nebr. Acad. Sci.*, Vol. IX, No. 2, 1915.

⁷ Smith, Geo. L., Contributions to the Geology of Southwestern Iowa; *Iowa Acad. Sci.*, Vol. 25, 1918, pp. 521-537.

THE RED OAK QUARRY SECTION

(See Columnar Section No. 1)

Location: West of the river, northwest of Red Oak; in the SW $\frac{1}{4}$ of Section 17, T. 72 N., R. 38 W. This location is reached from Red Oak via Highway No. 34 west to the first cross-road west of the river, thence north 1 $\frac{1}{2}$ miles to a lane leading southeast to the quarry.

The strata here dip southeastward. Our section is based on exposures in the old quarry and in a trench-like opening made in this quarry in 1932. Fortunately, our section has been measured at the most opportune times. It is as follows:

1. Plattsmouth limestone, about 24' 8" exposed:

- (1) Limestone, in recent opening, top eroded, about 1' remaining; stone bluish-gray, badly shattered, quite fossiliferous, with some osagea. The approximate altitude at the top of the limestone is 1052 feet.
- (2) Shale, poorly exposed, bluish-gray, argillaceous, with some calcareous material, 4' 6"-5'.
- (3) Limestone, gray, irregular, contains nodular calcite and some disseminated chert, base uneven, weathers rounded and yellowish-brown, not very fossiliferous, 1'-1' 4".
- (4) Limestone, medium dark gray, massive, fine-granular, dense, weathers gray and brownish, forms large blocks, contains abundant fossils as crinoid joints, echinoid spines, brachiopods, high-spired gastropods and bellerophontids, 1' 6".
- (5) Limestone, gray, massive, fine-grained, with a dark chert zone near top and some chert scattered throughout, upper and lower surfaces uneven, *Triticites* abundant; contains brachiopods, etc.; thickness, about 3' 6".
- (6) Shale, olive colored, bedded, weathers crumbly, 2".
- (7) Limestone, light gray, massive, abundant *Triticites*, 1' 1"-1' 2".
- (8) Shale, olive to gray, very limy, and some disintegrated limestone with abundant *Triticites* and large crinoids, 8"-9".
- (9) Limestone, dark bluish-gray, argillaceous, fine-grained, massive, weathers with some brownish specks, 8". It has a few small crinoids and *Triticites*.
- (10) Shale, bluish-gray, calcareous, weathers yellowish, 1".
- (11) Limestone, light gray to bluish-gray, weathers brownish-gray and very uneven, contains abundant *Triticites* and brachiopods, and has a dark band of chert 2"-5" thick near the top; total thickness, 4'.
- (12) Shale, olive colored, bedded, 1"-2".
- (13) Limestone, gray, massive, contains abundant brachiopods and *Triticites*, 5' 8". This limestone was observed in a pit dug by the quarry contractor in 1932.

2. Covered slope to the river level, about 17'. The Heebner shale and the Leavenworth limestone probably are in this slope.

Note: Smith & Tilton did not measure a section at the Red Oak quarry. However, Tilton (5) did measure and describe the exposures at Riverview park (now abandoned),

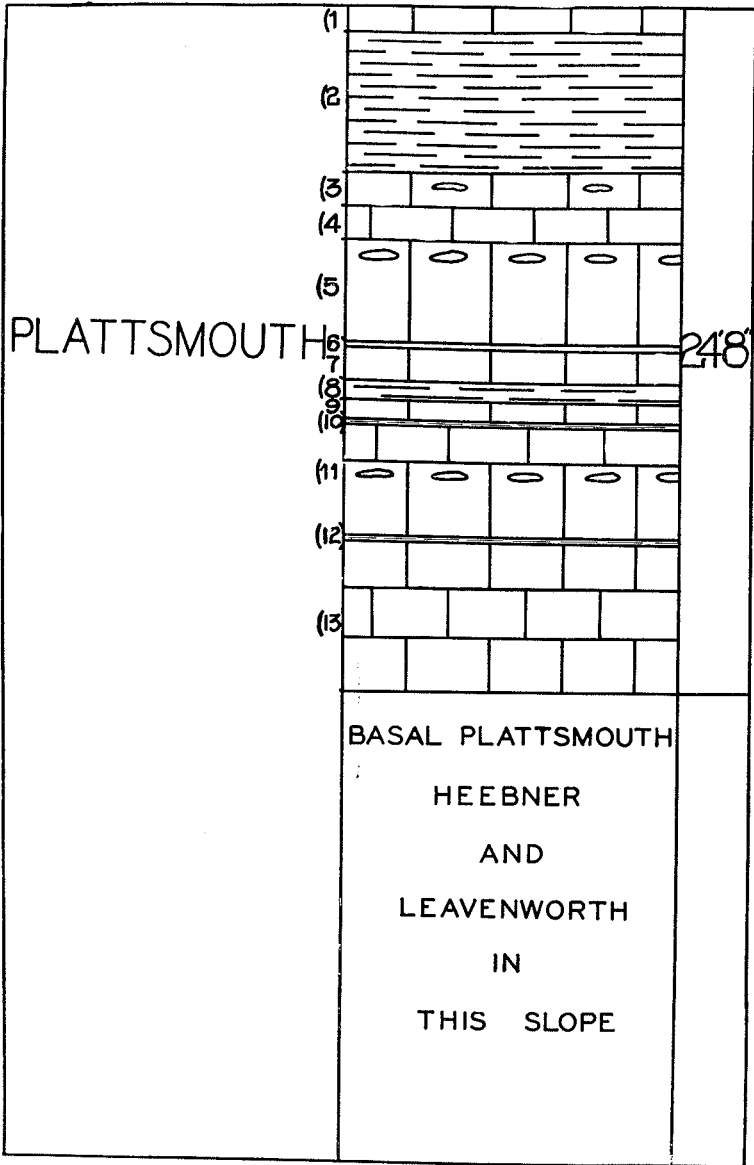


Figure 1. Columnar Section 1, northwest of Red Oak.

located about one mile northeast of this quarry, and classified them as the Oread.

During the quarrying in 1932 a top limestone (division (1)) and a shale (division 1 (2)) were uncovered above the highest limestone exposed in the old quarry, but the face of the old quarry became badly covered with overburden and is not now in good condition for zonal study. Also, the opening recently made on the top limestone and shale is being effaced by the slumping of till.

About all that remains of the former exposures in the vicinity of Riverview Park, located in the NE of Sections 17, T. 72 N., R. 38 W., is a few feet of limestone and shale shown in the left bank of the river, just above the water level. This outcrop is at the bridge on the side-road west of Highway No. 48.

~~GAMBLE~~
SECTION AT THE ^{GAMMEL} ~~GAMBLE~~ QUARRY

(See Columnar Section No. 2)

Location: N $\frac{1}{2}$ of Section 3, T. 72 N., R. 38 W. This is south of the river and railroad; about 1 mile south and $\frac{1}{2}$ mile west of Stennett; 4 miles north and $\frac{1}{2}$ mile east of Red Oak, and about 2 $\frac{1}{2}$ miles north and 2 miles east of the Red Oak Quarry. The strata dip southeastward. The altitude of the top of Division 1 (5) in the section is 13 feet above the railroad located nearby. The section:

1. ~~Plattsburgh~~ limestone, about 23' 2", exposed in quarry and an excavated pit:
 - (1) Limestone, top eroded; about 1' 6" in east end of quarry; stone light bluish-gray, fine-grained, with *Chonetes*, *Ambocoelia*, etc.
 - (2) Shale, 6' 6" or more:
 - a. Shale, bluish-gray or dark, blocky, 1'+.
 - b. Limestone, dark gray, soft, with many *Ambocoelia*, 4"-6".
 - c. Shale, bluish-gray, with seams and nodules of lime, very calcareous, contains *Ambocoelia*, *Composita*, *Derbyas*, *Wellerella*, *Rhombopora*, small horn corals, crinoid joints, etc., 2' 6"-3'.
 - d. Shale, olive colored, blocky to bedded, has soapy feel when wet, contains *Lingula*, *Orbiculoidea*, etc., 2'+. Fossils were collected from Division 1(2) as follows: *Composita subtilita*, *Ambocoelia planoconvexa*, *Derbya crassa*, *Jurcsania nebrascensis*, *Marginifera wabashensis*, *Chonetes granulifer*, *Hustedia mormoni*, *Wellerella osagensis*, crinoid segments and plates.
 - (3) Limestone, light gray to bluish-gray, massive, dense, top and bottom even, forms large blocks, contains abundant osagea, and a few other fossils, 1' 10". This is the top limestone exposed at the Red Oak Quarry.
- Spring Branch Limestone { (1) (2) (3)
- Stull shale { (2) (3)
- Clay Creek { (3)

PILOT BRANCH SECTION

(See Columnar Section No. 3)

Location: Just northeast of Stennett; at the road cut and high creek bank just southwest and south of where the road turns eastward; in creek banks farther east; at waterfall and cut bank on main branch of creek south of junction with north branch, and at waterfall and cut bank $\frac{3}{8}$ mile up the north branch; in Section 26, T. 73 N., R. 38 W. The strata dip southeastward. The composite section:

1. Lecompton formation, 17' or more:
 - (1) Avoca limestone, shown above cutbank south of low waterfall in SE $\frac{1}{4}$ of Section; stone now covered, but it is represented by a few blocks on the slope; thickness, ?.
 - (2) King Hill shale, badly covered on south branch, i.e., in the SE $\frac{1}{4}$ of Section 26; well exposed in cutbank just northeast of waterfall in the NE of Section 26, about 6':
 - a. Mudstone, calcareous, irregular, weathered yellowish, 1'.
 - b. Shale, bluish-green, massive, 2' 6"-3'.
 - c. Mudstone, nodular, calcareous, weathered yellowish, about 1'.
 - d. Shale, bluish-green, massive, blocky, about 2'.
 - (3) Beil limestone, at waterfall in NE $\frac{1}{4}$ of Section 26 and just south of waterfall in SE $\frac{1}{4}$ of this section, about 3' 6":
 - a. Limestone, bluish-gray, massive, fine-grained, with thin crust of pellets on top, forms large rectangular blocks, weathers brownish or gray, carries *Triticites*, crinoid joints, bryozoa, brachiopods, *Bellerophon*s, *Syringopora*, etc., 1' 9".
 - b. Shale, exposed at cutbank in SE $\frac{1}{4}$ of Section 26, bluish-gray, with calcareous material, weathers yellowish, carries brachiopods, bryozoa, crinoid joints, *Campophyllum torquium*, etc., thickness, about 1'.
 - c. Limestone, gray, badly shattered and weathered yellowish, very fossiliferous, 8"-1'. The following fossils were collected from the sub-zones of Division 1(3): *Triticites*, *Chonetes granulifer*, *Marginifera lasallensis*, *Rhipidomella carbonaria*, *Composita subtilita*, *Enteletes hemiplicatus*, *Dictyoclostus portlockianus*, *Derbya kansasensis*, *Neospirifer triplicatus*, *Fenestella*, *Cyclotrypa barberi*, *Rhombopora*, *Fistulipora*, many *Myalina swallowi*, *Campophyllum torquium*, *Lophophyllum profundum* and *Syringopora*.
 - (4) Queen Hill shale, in cutbank south of waterfall in SE $\frac{1}{4}$ of Section 26, about 5':
 - a. Shale, bluish-gray, argillaceous, massive, about 1' 10".
 - b. Shale, black, bedded, 2".
 - c. Shale, olive colored, argillaceous, 7".
 - d. Shale, black, fissile, 2' 6".
 - (5) Big Springs limestone, in cutbank as above, bluish-gray, massive, soft, earthy, with few fossils, 1'-1' 2".
- (6) 2. Doniphan-Humader shale, in cutbank in the SE of Section 26, about 5'; upper 3' largely bluish, argillaceous shale with lime seams filled with *Chonetes*, *Linoproductus prattenianus*, *Derbyas* and *Aviculopectens*; lower part badly covered. The linoproductids are 2' and 2' 6" below the top of the division. This division is poorly exposed high in the bluff south of the turn in the road, northeast of Stennett.

- ~~3. Plattsmouth limestone, about 26' exposed+~~
- (7)(1) ~~Limestone, poorly exposed in top of road cut just northeast of Spring Branch Stennett; measured at the waterfall on Pilot Branch, in SE of Section 26, about 7':~~
- a. Limestone, gray, finely granular, massive, with some chert, about 2' 6"; upper surface with many echinoid spines; the other fossils are *Derbyas*, crinoid joints, etc.
 - b. Shale, olive, with crinoid joints, 4"-6".
 - c. Limestone, gray, irregular, more or less slabby; fine-grained, *Linoproductus* very common, with some *Compositas* and crinoid joints, about 2'.
 - d. Shale, 1'-1' 6" at waterfall.
 - e. Limestone, gray, dense, massive, with *Ambocoelia* and *Chonetes*, 1'.
2. Kanwaka shale.
- (1)(2) Shale, at highway-cut northeast of Stennett, 6' 6"-7':
- a. Shale, largely dark gray, black where wet, about 1'.
 - b. Limestone seams and limy shale, weathers yellowish, with abundant *Ambocoelia*, some *Chonetes* and *Lophophyllum*, one large nautiloid cephalopod, and crinoid joints, etc., 2'-3'.
 - c. Shale, bluish-gray, calcareous at top, weathers yellowish, about 1'.
 - d. Shale, dark bluish-gray, with *Lophophyllum*, *Derbya*, *Aviculopectens* and *Polypora*, about 1' 4".
 - e. Shale, olive, dark when wet, blocky to bedded, with *Lingula* and *Orbiculoidea*, 1'.
- (2)(3) Limestone, bluish-gray, dense, massive, top and bottom even, forms large blocks, osagea common, with small *Triticites*, *Rhomboporas*, etc., 1' 7". Best shown in cutbank south of turn in road northeast of Stennett at an altitude of about 10 feet.
- (3)(4) Shale, in high creek bank southeast of roadcut, about 3' 10":
- a. Shale, bluish-gray, argillaceous, bedded, weathers buff, 1' 6".
 - b. Shale, dark blue to black, plastic, at places fissile, 10".
 - c. Shale, bluish-green, argillaceous, 1' 2".
 - d. Shale and lime seams, transition to next below, 4".
- (5) Limestone, in creek bank, about 8' exposed to creek bed; upper massive, cherty, fossiliferous, separated by two shale seams filled with *Triticites secalicus*; lower 4' bluish-gray and earthy.
3. Oread

Correlation: Divisions 1 and 2 of the Pilot Branch section have been eroded from the Gamble Quarry section. The Plattsmouth limestone subdivisions of the Pilot Branch section are nearly identical with those of the Gamble quarry.

Division 2 of the Pilot Branch section is correlated as Doniphan-Heumader, because the 5 feet of sediments here represent in age, the following beds: Doniphan shale, Big Springs limestone, Kanwaka shale, Kereford limestone and the Heumader shale. The Big Springs limestone does not extend this far north, which brings the Doniphan and Kanwaka into contact, if they are here. Then, too, the Kereford, if here, is represented only by the thin, fossiliferous, limy seams which, at places, occur also in the upper part of the Heumader shale.

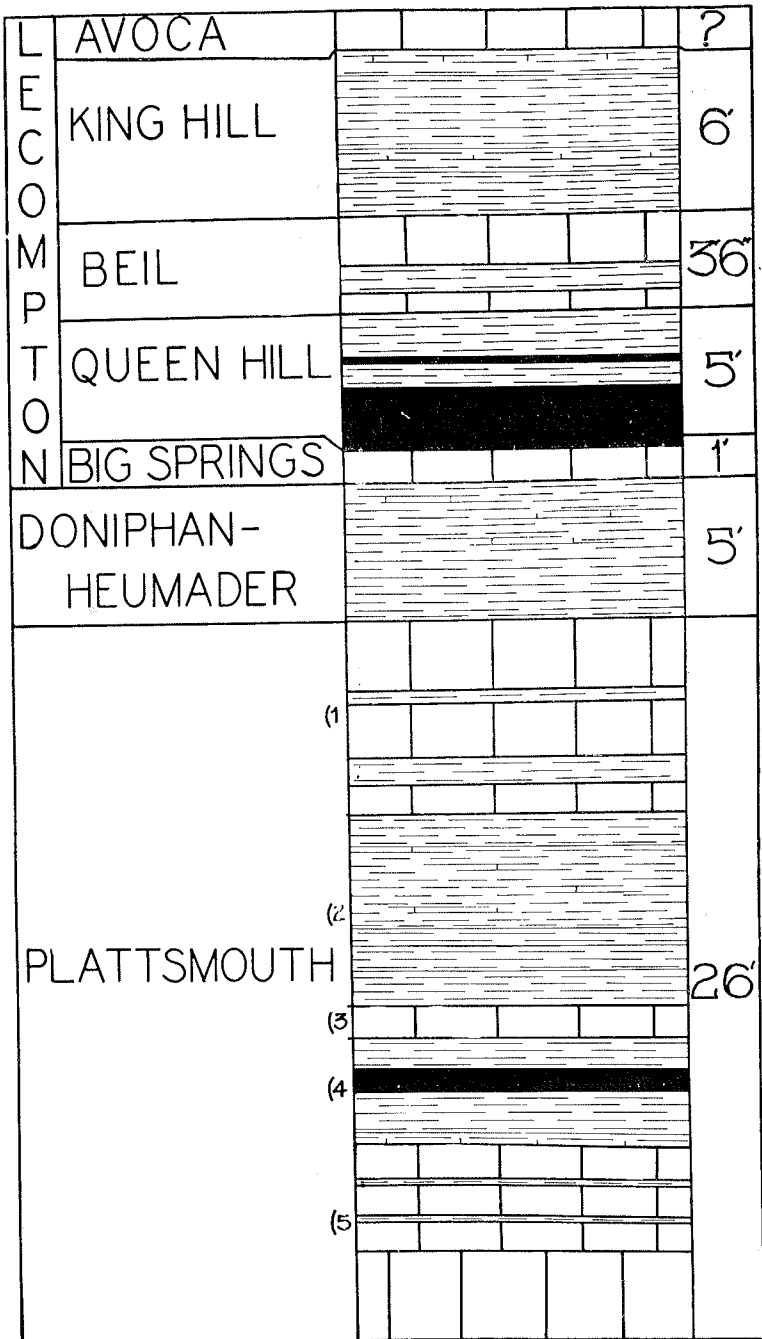


Figure 3. Columnar Section 3, on Pilot Branch, northwest of Stennett.

Consequently, if the Kereford is not in this section, the Kanwaka and the Heumader may be in contact, or if the Kanwaka has failed, as seems to be true, the Doniphan and Heumader coalesce. Therefore, it cannot be decided with certainty whether this subdivision is composed of a single age unit or of more than one unit, and, if so, what one or ones. The shale units that should occur in this part of the section thin rapidly northward from Kansas. There is in this five feet of the section what in southeastern Nebraska or in Kansas would be the two lower members of the Lecompton formation, the Kanwaka formation and the two topmost members of the Oread formation. The combined thickness of these units in the "Kaw" Valley of Kansas is 60 to 70 feet, compared with 5 feet at Stennett, Iowa. Apparently, most, if not all of Division No. 2 at Stennett, is the Heumader shale, recently defined by Dr. Moore as the zone between the Kereford and Plattsmouth limestones.

SECTION AT THE QUARRIES NORTHWEST OF STENNETT

(Compiled after Lonsdale *)

Location: West of river, at Fate and other abandoned quarries; in sections 22 and 27, T. 73 N., R. 38 W. A bluff-line road leads northward from the highway west from the south side of Stennett to the quarries and natural exposures.
Section:

1. Limestone, top eroded, badly shattered and slumped, thickness, ?.
2. Shale, badly covered, basal part calcareous, 6' or more.
3. Limestone, gray, fine-textured, one bed, massive, 1' 7".
4. Shale, gray, argillaceous, dark at base, weathers buff, 3' 4".
5. Limestone, cherty in lower part, 3' 10". Abundant *Triticites secalicus*.
6. Shale, weathered buff, 1'.
7. Limestone, bluish-gray, 8".
8. Limestone, gray, cherty in upper part, 1' 7".
9. Limestone, gray, 4'. Abundant well preserved *Triticites secalicus* and *T. plummeri* which, although considered a typical Deer Creek fossil, has also been noted in the Plattsmouth at the type locality.
10. Shale, argillaceous, 2".
11. Limestone, two beds, both cherty, 2' 2".
12. Limestone, dark gray, soft, 1' 5".
13. Shale, bluish-gray, argillaceous, 1' 6".
14. Shale, dark, fissile, 1' 4".

* Lonsdale (2. p. 393).

Correlation: Divisions 1 to 4 of this section are divisions 3(1) to 3(4) of the Pilot Branch section. Division 1 here is 1(1) at the Gamble quarry. Division 3 here is 3(3) at the Pilot Branch section, 1(3) at the Gamble quarry and 1(1) at the Red Oak quarry. Also, the succeeding subdivisions of the Plattsmouth limestone (down to and including No. 11) are correlative with subdivisions in the preceding sections.

Divisions 13 and 14 of the above section constitute the Heebner shale and next below it is the Leavenworth limestone.

Note: In 1924, the senior author saw exposures of the Heebner shale and the Leavenworth limestone in the river bank near the site of an abandoned mill located northwest of Stennett. This was at the time of low water, after the river had cut hard against its right bank. The thickness of the shale was found to be about 3 feet, and about 1 foot of a blue limestone (Leavenworth) was exposed at the water level.

Discussion: New exposures in the vicinity of Stennett, resulting from normal erosion, and the opening of a quarry, have offered us a better basis for stratigraphic study than was had by White, Lonsdale, Smith and Tilton. This has enabled us to zone the outcrops and carry a sequence from section to section.

Certain sub-zones in the Plattsmouth, filled with *Triticites*, are very persistent. The *Ambocoelia-Chonetes* zone in the shale below the top of the Plattsmouth is distinctive. It persists in the sections at the Gamble quarry, on Pilot Branch and northwest of Stennett, and is the zone in the excavation at Folsom, Iowa, and in the outcrops north of Plattsmouth, Nebraska.

We were fortunate in being able to extend our Stennett section up to the Queen Hill shale, Beil limestone, King Hill shale and Avoca limestone. The zones and sub-zones of these are identical with those in the exposures at Folsom and near the Haynies station in Iowa and in the outcrops in the Weeping Water Valley of Nebraska. These distinctive beds at the top of our section disprove the former correlation that have been made at Stennett. They are above the Plattsmouth and the Deer Creek is not exposed in our traverse.

The Plattsmouth or main member of the Oread has about the same subdivisions here as at the Snyderville quarry located four miles west of Nehawka,⁸ Nebraska, except that its shaly zones, second and fourth from the top of the formation, are thicker here. Also, the fossils, especially the *Triticites*, and the chert are similarly disposed. The Oread and the Deer Creek, though similar in some respects, are essentially unlike. They differ enough in lithology, faunal content and subdivisions to enable the worker to identify either formation irrespective of its sequence in the general section. In fact, one who has studied the fusulinids of the Plattsmouth rather closely at the type locality, and has made a similar study of these fossils in the Ervine Creek limestone member of the Oread, as in Mills County, Iowa, would at once, distinguish between the Deer Creek and the Oread. Plainly, on this basis alone, the so-called "Deer Creek" beds at Stennett would be correlated as the Plattsmouth.

GRISWOLD SECTION

Location: Three and one-half miles north of Griswold; south bank of river, east of bridge on road from Griswold; SW of Section 17, T. 75 N., R. 37 W. The altitude of the base of this section is about 1080 feet. That of the railroad station at Griswold is 1098 feet. Section:

Plattsmouth limestone, about 15' 6" exposed:

1. Limestone, shale seams, 5' 10":
- Spring Branch (1) Limestone, poorly exposed, gray, massive, 6".
- (2) Shale, bluish-gray, bedded, 2"-4".
- (3) Limestone, light gray, massive, weathers buff, fossiliferous, 5".
- (4) Shale, poorly exposed, 2".
- (5) Limestone, gray, massive, weathers buff, contains many brachiopods, 11'; distinguished from underlying beds by absence of chert.
- (6) Limestone, bluish-gray, nodular and lensing, shattered, with some shale, cherty, 2' 6".
- (7) Limestone, bluish-gray, argillaceous, fine-grained, fossiliferous, contains abundant black chert, 1' 1".
2. Kanwaka Shale, bluish-gray, weathered buff, quite limy, with nodular material, very fossiliferous, contains crinoid joints, *Ambocoelia*, *Chonetes*, bryozoa, etc., 1' 10"-2' 2".

⁸ Condra, G. E., Stratigraphy of the Pennsylvanian System in Nebraska; Nebr. Geol. Surv., Vol. 1, Second Series, 1927, pp. 168, 169.

- Kanwaka Shale* {
3. Limestone, bluish-gray, massive, fine-grained, argillaceous, weathers buff to rusty brown, very crinoidal, top surface filled with small *Chonetes granulifer*, *Derbyas*, *Margimifera*, productids and small horn corals, 6"-8".
 4. Shale, about 7':
 - (1) Shale, buff to bluish-gray, with many *Ambocoelia*, 2".
 - (2) Limestone, very irregular, nodular, filled with *Ambocoelia* and crinoid joints, 2".
 - (3) Shale, bluish-gray to olive, blocky, with *Ambocoelia*, *Dielasma*, *Composita*, *Derbya*, crinoid joints, etc., 1' 2".
 - (4) Shale, dark, black when wet, has slight purplish color when dry, bedded, filled with small *Ambocoelia*, 6".
 - (5) Shale, bluish-green, blocky, weathers crumbly, no fossils observed, 5'+.
- Oread* → 5. Limestone, top exposed in bed of river, light bluish-gray, dense, almost lithographic, nodular, top very irregular, contains some green shale stringers.

Correlation: Divisions 1, 2, 3 and 4 of the above section are 3(1), 3(2)a, 3(2)b, and 3(2)c-e of the Stennett section.

Note: There are badly covered outcrops of the Pennsylvanian limestones and shales across the valley northeast (SE of Section 8) from the Griswold section, where some quarrying was done years ago. The exposures there are now too badly covered for measurement and correlation. Tilton (5, p. 265), describes sections on Spring Creek (NW of Section 9) and on Indian Creek (SW of SW of Section 5). The lower zones of the Plattsmouth and the shale above them occur at these places, but are now badly covered.

LEWIS SECTION

(See Columnar Section No. 4)

Location: West of river; southwest of town; on the Roberts farm; in the deep sides of a drainage canal recently excavated through a spur of the upland in the SW of Section 16; at an abandoned quarry in the NE of Section 9; in the ravines west of the river; in the NE of Section 16, all in T. 75 N., R. 37 W. About 40 years ago, limestone was quarried low in the valley-side at a point about $\frac{1}{5}$ mile north of the ravines where some of our measurements were made. It was there that White (1, p. 374), made his section. However, the quarry face and the natural exposures which he saw are now covered or nearly so. The site of the old quarry is just west of where a drainage canal touches the bluff-line. The strata dip southwestward. The composite section:

1. Plattsmouth limestone, about 29' 6" :

(1) Limestone, exposed in ravines, 6' 6" :

Spring Branch^a. Limestone, light gray, massive, weathers light gray to slightly buff, contains abundant large *Bellerophons*, also large *Myalinas*, high-spined gastropods, horn corals and *Triticites*, 2' 10"-3'. The altitude of the top of this limestone probably is about 1147 feet and that of the railroad station at Lewis is 1157 feet.

b. Shale, bluish-gray to olive, bedded, 1' or more.

c. Limestone, 2' 6" :

(a) Limestone, dark bluish-gray, fine-grained, conchoidal fracture, irregularly bedded, 4"-6".

(b) Shale, bluish-gray to olive, bedded, 2".

(c) Limestone, dark bluish, almost black, very fine-grained, upper and lower surfaces moniliform, 8".

(d) Shale, bluish-gray, bedded, 2".

(e) Limestone, dark bluish-gray, dense, massive, contains abundant nodules of black chert, *Composita*, *Neospirifer*, *Chonetes*, bryozoa, 1' 2". The composite collection of fossils in 1(1)a-c is as follows: *Chonetes granulifer*, *Camerinella boonensis*, *Echinoconchus semipunctatus*, *Rhombopora*, *Polypora*, *Composita subtilita* and *Derbya*.

(2) Shale, bluish-gray to olive, bedded, contains limy layer near top and in basal portion, entire thickness very fossiliferous, with *Septopora biserialis*, *Rhombopora lepidodendroides*, *Derbya*, *Neospirifer triplicatus*, *Echinoconchus semipunctatus*, *Lophophyllum profundum*, *Chonetes granulifer*, bellerophontids, *Margifera wabashensis*, *Composita subtilita*, *Rhipidomella carbonaria*, *Dictyoclostus portlockianus*, *Ambocoelia planoconvexa*, crinoid joints, etc., 2' 3".

(3) Limestone, dark bluish-gray, argillaceous, massive, weathers buff, contains *Chonetes*, *Rhombopora*, *Ambocoelia*, crinoid joints, etc., 4"+.

(4) Shale, well shown in one ravine, bluish-gray, bedded to blocky, 7' 6".

(5) Limestone, in ravine and canal, 5' 6" :

a. Limestone, light gray, massive, weathers light gray, almost made up of small *Triticites* which are much smaller than those in the limestone below, 10".

b. Shale, olive to bluish-gray, bedded, contains some Fusulinids, 6".

c. Limestone, light gray to brownish-gray, massive, somewhat argillaceous, weathers a distinctive yellow-buff with rounded slabby surfaces, about 4'+. This limestone is filled with large *Triticites secalicus* which weather white against the yellow-buff of the matrix giving a characteristic appearance to the rock.

(6) Shale and seams of limestone, about 3' 6" :

a. Shale, bluish-gray to olive, limy, contains many limy seams, weathers buff, about 2'.

b. Shale, bluish-gray, less limy than the above, very fossiliferous, 1' 6"; fauna: *Cyclotrypa barberi*, *Fenestella*, *Polypora*, *Fistulipora*, *Composita subtilita*, *Neospirifer triplicatus*, *Margifera wabashensis*, *Chonetes granulifer*, *Punctospirifer kentuckyensis*, *Ambocoelia planoconvexa*, *Derbya*, *Dictyoclostus portlockianus* var. *crassicosatus*, crinoid and echinoid spines.

*Kanwaka
Shale*

*Kereford-
Plattsmouth*

Kereford- (7) Limestone, 4' 2":

Plattsmouth

- a. Limestone, light gray, slabby, dense, to crystalline, very argillaceous, transitional to shale above forming a reentrant, 10"-1'.
 - b. Limestone, light gray to bluish-gray, dense, lithographic, conchoidal fracture, massive, contains *Composita*, *Neospirifer*, *Rhombopora*, *Polypora*, etc., also a scattering of chert, 10".
 - c. Limestone, nearly filled with dark to black chert, the limestone contains small horn corals, an abundance of small crinoid joints, productids, *Ambocoelia*, bryozoa and *Chonetes*; thickness, about 8".
 - d. Limestone, light gray to brownish, very dense, almost lithographic, massive, cut by numerous stringers of calcite, basal portion shaly forming reentrant and transition to shale below. The upper surface of this limestone contains numerous horn corals, *Composita*, crinoid joints, bryozoa; thickness totals 1' 8". A composite section from the sub-zones of 1(7) contains: *Echinoconchus semipunctatus*, *Linoproductus pratentianus*, *Dictyoclostus portlockianus*, *Punctospirifer kentuckyensis*, *Chonetes granulifer*, *Composita subtilita*, *Derbya*, and *Lophophyllum profundum*.
2. Heebner shale, about 2' 2":
- (1) Shale, bluish-gray to olive, bedded to blocky, somewhat limy, weathers buff, contains *Derbya*, productids, *Ambocoelia*, *Composita*, *Lingula*, *Orbiculoidea*, *Schizodus*, *Schizostoma* and crinoid joints, 1' 2".
 - (2) Shale, dark gray, bedded to blocky, unctuous, contains numerous small pelecypods, 2"-4".
 - (3) Shale, black, fissile, upper portion contains *Orbiculoidea* and *Lingula* with a *Schizostoma*, 8".
 - (4) Shale, dark gray, calcareous, mealy, very fossiliferous, with *Ambocoelia*, *Chonetes*, *Rhombopora*, *Pinnatopora*, crinoid joints, etc., 2".
 - (5) Shale, plastic, weathered yellowish, 1".
3. Leavenworth limestone, 2' 11" exposed:
- (1) Limestone, light gray, weathers buff, very argillaceous, probably weathered top of limestone below, contains numerous bryozoa and brachiopods, 5".
 - (2) Limestone, dark bluish-gray, lithographic, very blocky, splintery fracture, top very regular, contains numerous calcite and some disseminated black chert sparingly, thickness, 2' 6" on bed of river.

Correlation: Divisions 1(1) to 1(4) of this section are the subdivisions exposed in the Griswold section, however, there is some small chance that division 1(1) may be a zone of the Beil limestone, the lower limestone zones of it having pinched out between Stennett and this location. This would mean, also, that the Queen Hill shale and the Big Springs limestone have failed northward between Stennett and Lewis, as the Spring Branch limestone and the Kanwaka shales have done between northwestern Missouri and Stennett. More likely, the Lewis section, as now exposed, does not reach up to the Beil limestone.

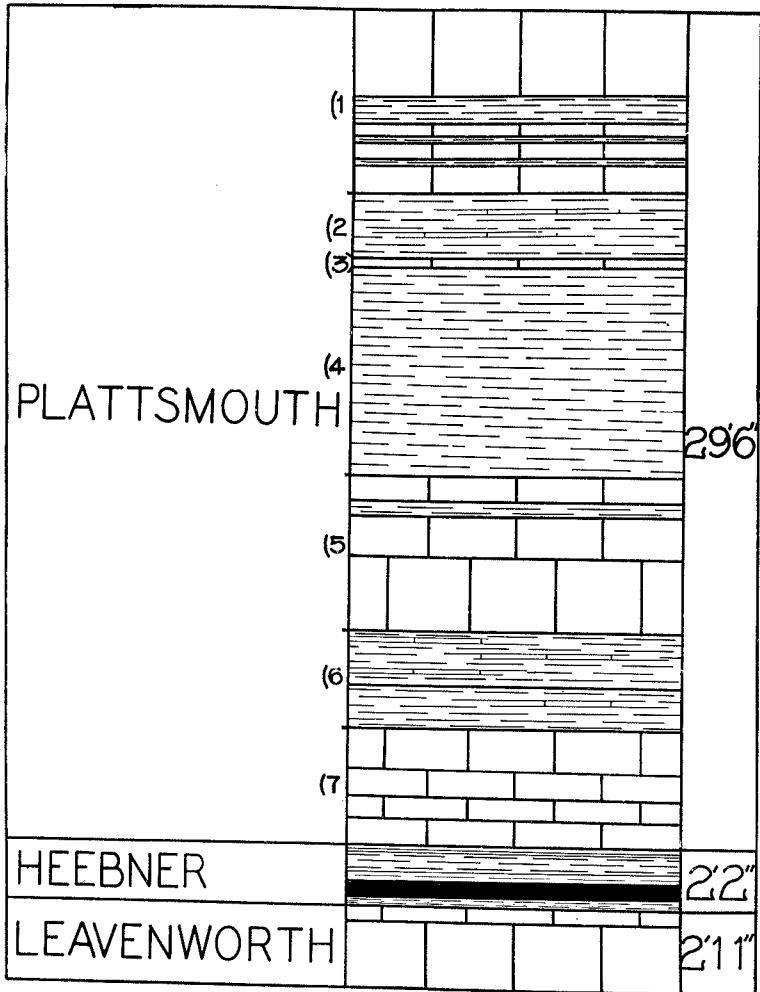


Figure 4. Columnar Section 4, southwest of Lewis.

The correlation between Stennett and Lewis shows that the subdivisions are identical except that 3(3) of the latter probably does not reach northward to Lewis, and the beds in the lower part of the Plattsmouth have a thickness of 18 feet at Stennett compared with about 13 feet at Lewis.

When we first observed that the lower beds of the Plattsmouth are thinner at Lewis than at Stennett, it was believed that Division 2 of the Lewis section might be a basal zone in the Plattsmouth, and not the Leavenworth. However, further study caused us to discard this view.

EXPOSURES NORTHEAST OF LEWIS

These are about $3\frac{1}{2}$ or 4 miles northeast from the northernmost exposures of the Lewis section. They are northeast of Lewis, in the south bank of Turkey Creek, and in a south-side ravine of this creek valley. Both exposures are in Section 1, T. 75 N., R. 37 W., the main one being near the center of the section, and the other being about $\frac{1}{8}$ mile west of the road on the east side of the section. Formerly, there were small outcrops in Section 6 located east of the exposures noted above. They are now completely covered.

The beds exposed on Turkey Creek, northeast of Lewis, are the zones of the Plattsmouth which are filled with *Triticites secalicus*. The altitude of the exposures is about 1120 to 1130 feet.

CONCLUSIONS

1. The strata exposed along the Nishnabotna Valley between northwest of Red Oak and north of Stennett dip southeastward; in the stretch in the vicinity of Griswold they lower some in the Bartlett syncline; they then rise northwestward in the Lewis section.
2. The Severy, Topeka, Calhoun and Deer Creek formations are not exposed in this traverse.
3. The Oread formation outcrops in all of the sections in our traverse. Its Leavenworth member is the oldest horizon exposed and the Avoca limestone member of the Leampton formation is the youngest horizon exposed.

4. The Plattsmouth member of the Oread formation was wrongly correlated as the "Forbes limestone" by Smith and as the Deer Creek by Tilton.
5. The Kereford limestone member of the Oread probably does not persist to this area and the Heumader member of this formation thins northward.
6. The Plattsmouth subdivisions persist in our section as follows:
 - a. Zone 6 persists and becomes quite cherty at places.
 - b. Zone 2 thickens from Nebraska to and through our section.
 - c. Zone 3 thins out northward, beyond which Zone 2 coalesces with Zone 4.
 - d. Zone 4 thickens from Nebraska to our sections.
 - e. The main, lower part of the Plattsmouth (in 3 zones) thins and its middle zone becomes more shaly in the northern part of our traverse.
7. The Kanwaka shale does not reach northward to this area.
8. The two lower members of the Lecompton formation probably do not extend to this traverse.
9. The Avoca, King Hill, Beil and Spring Branch members of the Lecompton in the Pilot Branch section probably were not observed by Lonsdale, Smith and Tilton.
10. Most of the members exposed in this traverse are uniform and remarkably persistent. Particularly is this true of the Beil limestone, which is one of the most distinctive members of the Pennsylvanian system.