COMMENTS ON STRATIGRAPHIC RELATIONSHIPS IN THE LANSING, DOUGLAS, AND PEDEE GROUPS, EASTERN KANSAS

by

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MONTGOMERY COUNTY

A good exposure of the Weston and Stranger occurs in the mound just north of Elk City. Here occurs about (approx) 70 feet of gray clay shale overlain by 5 feet or so of even reddish calcareous sandstone. The contact at the base of the SS is fairly even and does not suggest an unconformity. Above the sandstone is about 30 feet or less of arenaceous shale containing one or more beds of flaggy sandstone. Apparently the Westphalia ls is gone unless it is represented in the massive SS since the 1½ foot blueish Haskell ls. with the Myalina Zone at the base is next. Above the Haskell occurs a covered interval of 40 feet or 20 apparently clay shale, overlain by a reddish-brown friable SS which holds up the mound.

A better exposure of these beds occurs at the center of the E. edge sec. 21, T. 31, R. 13. At this place occurs 20 feet or more of gray clay sh. at the base overlain by 1.7 feet reddish-buff limy SS., even and blocky. Above this is 16.5 feet greenish gray clay sh., of which the upper 3 feet is limy and fossiliferous, bearing abundant Myalinas, Chonetina ? rare, Rhipidomella pecosi, etc. Next occurs the Haskell 1 foot of dense, dark blue blocky ls. with abundant Cryptozoon marklets. A suggestion of worm borings was noted at the top of the bed. Above the Haskell is exposed 22 feet of bluish-gray clay shale with abundant limonite concretions. At the base of this shale occurs small dense, gray ls. concretions (spherical) containing a small orbiculoid brachiopod. Sparsely distributed through this shale occur poorly preserved fossils, Pleurotomarid (like Wortherina but without nodes), Pharkidonotus, Chonetina, Rhipidomella, Lophophyllidium?, Trepospira sphaerulata? The interval or 30 ft. to the top of the sandstone bench is covered but probably the upper 10 feet consists of sandstone.

Beyond the 2 foot limy sandstone in this section the only suggestion of an unconformity occurs in the Lawrence and <u>not</u> in the Stranger.

On the road near the center sec. 3, T. 32 S., R. 13 E., both the Westphalia and Haskell limestones are present. They are rather poorly exposed, but the interval between the two is clearly of the order of 35 feet. There seems here to be a small amount of sandstone beneath the Westphalia. Immediately south, across Salt Creek, a great sandstone comes in below the Westphalia. It is 40 feet or more thick, reddish-brown, cross-bedded and makes prominent rocky bluffs. The position of this sandstone can be clearly determined at the W. edge of sec. 22, T. 32 S., R. 13 E. Here the Westphalia and Haskell crop out along the road. These limestones occur at the base of a mound of Yates Center sandstone and in turn tower above a lower plain in

which gullies have exposed a great sandstone less than a quarter of a mile to the east. The Haskell limestone here is but 8 inches thick, Dark bluish-gray, has Cryptozoons markings, and shatters easily into thin plates. It is underlain by a Myalina bearing shale. The Westphalia limestone is a fissile gray limestone 2 feet or less thick and bearing a large number of fusulinids and an alga of the Osagia type.

At the little mound at the NE cor. 15, T. 32, R. 13, the Stranger sandstone is gone. Nearly the exact point $\frac{1}{4}$ mile south of the mound can be determined as the northern extension of this sandstone. This mound which occurs $1\frac{1}{2}$ miles due north of the last mentioned locality represents a facies seen across Salt Creek to the north. The mound is capped by Yates Center sandstone and contains both the Westphalia and Haskell limestones well down the slopes. There seems to be no sandstone in this section below the Yates Center. A quarter of a mile to the S or East and a half mile to the west a great sandstone occurs stratigraphically just below these limestones.

The mound two miles south of Elk City affords a distinct contrast to the section at the outlier a mile north of the town. Whereas the northern mound has very little sandstone in it, being capped by Yates Center ss. the southern mound is nearly all sandstone and the limestones were not found, although they may occur there.

Southward from Elk City and Salt Creek several sandstones appear between the Stranger and Yates Center, rendering the stratigraphy somewhat confusing.

Many of this sandstone masses occur with clean contacts in greenish clay shale which abounds in limonite concretions. The Yates Center ss continues to be the great scarp maker clear into Oklahoma. Although the whole section from Stanton to Oread contains much sandstone, the sandstone is clearly subordinate to greenish-gray or gray marine clay shale. Some exposures are very misleading in this respect since the thin flaggy sandstones and thick irregular massive ones tend to weather out and creep down slopes so that in roadside exposures sandstone may be seen from bottom to top of a hill. Reddish flaggy sandstones become quantitatively important in the upper part of the Weston and at various horizons in the Lawrence.

OKLAHOMA

The sandstones in Osage County mapped under the various names Hula, Gas, Cheshewalla and Torpedo, all belong to the Stranger.

Several sandstones appear in the interval between Stranger (base) and Yates Center and locally are prominant. A lot of sandstone occurs at the Stanton horizon having appeared south of Elk River in Kansas, becoming more prominant southward, although locally missing as at the mound W. of Bartlesville. The Yates Center includes apparently the Buck Point sandstone and Bowham. If the Haskell ls. exists in this region it is very obscure.

CHAUTAUQUA COUNTY

In section 31, T. 32 S., R. 13 E., there appears a 14 foot limestone just below the Yates Center ss, and apparently well above the horizon of the Haskell. In the northern part of the same section this limestone is apparently cut out by overlap of the Yates Center. At no other place was the ls. observed. It is as yet futile to speculate as to whether the limestone has always been local or whether this is a local remnant of a once persistant ls. of about 3 feet of ferrugenous, irregular limestone. This ls. with the Stranger below holds up a plain for many miles around Tonganoxie and Lawrence. Throughout this region the Haskell is overlain by argillaceous shale with limonite concretions.

Transfer to Platte Co. Mo. notes. Base of p. 7.

DOUGLAS COUNTY

At Lawrence the Haskell has attained most of the character which make it an excellent horizon nearly to the Oklahoma line. It consists of 3 feet of bluish, dense, even limestone bearing a few Marginefera. The limestone bears the concentric larvellar markings sometimes called Cryptozoon and near the top occurs horizontal, carbonaceous trails or borings which produce small flattened openings upon weathered surfaces. These structures are sometimes spoken of as fucoids.

Three feet below the Haskell, and separate from it by sandy calcareous shale, occurs a layer of septarian concretions. These were noted around Tonganoxie but do not persist far to the south.

The Plum Creek coal, over a half-foot thick, occurs about 9 feet below the Haskell. In the vicinity of Lawrence there is practically no sandstone in the Lawrence shale, the formation being composed principally of sandy shale and clay shale. There occurs a coal bed in the upper part and a maroon clay layer near the top. Since there is a coal bed a short distance below the Oread over a great area, I assume that these exposures constitute a continuous bed. I shall refer to this coal as the Ransomville, after a town in Franklin County, where it is mined.

Near Vinland there appears just above the Haskell a great sand body in the Lawrence shale. In a number of places around Baldwin the base of the marine sandstone laps down onto and below the Haskell, clearly bearing unconformable relations to the older beds.

It has been suggested to me that where the Haskell has been breached that the eastward facing scarp above the Stanton may be formed by Lawrence sandstone rather than Stranger, and such may be the case. It has also been suggested to me that perhaps the only unconformity in the section actually belongs in the Lawrence and everywhere laps downward on older strata to the eastward, making it appear older than the Haskell whereas it is actually younger. I have considered this view fairly and cannot subscribe to it since at a great many places I have found unconformable relations above and below the Haskell. consistently for great distances. I have considered the alternate possibility that the limestone at Baldwin and west of Ottawa below an unconformity may not be the Haskell. I have discarded this thesis after tracing nearly continuously the outcrop from Baldwin to Haskell Institute and a typical expance east of Lawrence on 15th st. Furthermore, there exists at approximately the same horizon throughout a great distance along the outcrop a limestone displaying identical characters from place to place. The Plum Creek coal is well developed at Baldwin and W. of Ottawa where it occurs just below the Haskell.

PLATTE CO., MO.

In the region of the Pedee group, near Weston and Iatan in Platte Co. Missouri, there is but little ev dence of an unconformity between the Stanton and Oread north of latitude 39°20'. A generalized section above the Stanton in this region includes at the base 70 feet of bluish-gray clay shale with abundant limonite concretions. At the base and near the top occur fossil-bearing horizons in which species of Chonetina and Rhipidomella are common.

Above the Weston is the Iatan limestone consisting of 10 feet of relatively unfossiliferous, drab limestone which characteristically weathers out in huge blocks. A species of Marginifera is the only common fossil in the formation. I did not encounter a single specimen of the "large brachiopods" sometimes said to be highly characteristic of the Iatan. A small species of Triticites occurs at the top of the formation.

Above the Iatan occurs 10 feet or so of flaggy soft buff sandstone and interbedded shale overlain by two feet or so of argillaceous shale. Above this there is a half foot of fissile silty limestone with a thin coal bed at the base. In suceeding order there is a half foot of dark-gray sandy ls. which is sparsely fossiliferous. The thin coal becomes prominent around Leavenworth at the expense of the limestone since the latter occurs chiefly on the east side of Missouri River. As I shall attempt to demonstrate this coal bed is of extreme importance in establishing the correlations farther south. I shall refer to it as the Plum Creek coal from an exposure at the center of section 4, T. 8 S., R. 22 E. on Plum Creek NW of Leavenworth.

In the vicinity of Weston and Iatan there occurs above the Plum Creek coal and associated local limestones 3 feet of limy shale and 5 feet of gray clay shale, extremely fossiliferous, bearing especially great numbers of Chonetina and Euphenurs. Above the fossiliferous shale occurs a limestone ranging from a half foot to 2 feet or so in thickness. The upper half is usually buff, platy and granular ls and the lower part nodular brittle ls. I correlate this limestone with the Haskell on basis of nearly continuous tracing.

Above the Haskell occurs a hundred feet or more of argillaceous and sandy shale with limonite concretions in the lower part. Above this shale lies a thin coal bed, at least in the Leavenworth region, then 24 ft. gray silty shale, a thin bed of maroon clay and 10 or 15 feet of gray clay shale to the base of the Oread.

South of latitude 39°20' in Missouri and south of Overmile Creek at Fort Leavenworth the section is very different. A great sandstone succession appears in the southern area overlapping the Weston and Iatan northward.

In the Leavenworth vicinity there occurs as much as 100 feet of marine sandstone and sandy shale resting unconformably upon various parts of the Stanton and Weston. I have never seen this deposit in the places that the Iatan still exists. It appears with great abruptness, a character which led Hinds and Greene to describe this great sandstone as a channel deposit.

In a study of Wyandotte county to the southeast of Leavenworth, Jewett and I found the Stanton to be overlain unconformably by a great sandstone, the same as that of the Leavenworth region. Southwestward into the southeast corner of Douglas County the sandstone lies directly on some part of the Stanton, commonly containing a few feet of limestone conglomerate. Southward from the latitude of Baldwin the Weston shale reappears and thickens consistently. It will be seen that this sandstone is not a channel deposit as commonly conceived but more probably a very broad floodplain deposit, built perhaps by several rivers.

In the region south and west of Leavenworth the Haskell was seen at several places, distinctly above the great sandstone succession. I have constantly kept in mind the suggestion that the Stranger ss. could conceivably cut down toward the east from a position above the Haskell and only seeming to dip westward below the Haskell. Upon this point hinges the possibility that the Haskell and Iatan are the same. As a matter of fact, I have determined that as truly as the Iatan is older than the Stranger, so is the Haskell a younger formation, and the lower limit of the Lawrence shale, so long placed at the Iatan, is in reality bounded by a much younger unit which Dr. Moore has termed the Haskell.

At a natural exposure just W. of the NW cor. sec. 30, T. 9 S., R. 22 E., the Haskell is well shown, differing from the exposures north of the Stranger country in having increased to about 3 feet. The lower foot is a buff sandy ls., very fossiliferous, with mollucks and a Choretina. Above this is 1.7 of shattered, nodular fossiliferous ls., overlain by .6 foot of granular X-bedded, platy ls. bearing spherical phosphatic nodules.

The Plum Creek coal was not seen at this locality because of poor exposures, but at the center of S. side sec. 22, T. 10 S., R. 21, northeast of Tonganoxie the coal is well exposed below the Haskell. In the Tonganoxie region the Haskell consists of about 3 feet of ferrugenous irregular ls. This ls with the Stranger below holds up a plain for many miles around Tonganoxie and Lawrence. Throughout this region the Haskell is overlain by argillaceous shale with limonite concretions.

PEDEE AND DOUGLAS GROUPS IN

FRANKLIN COUNTY.

Of the Pedee Group only the Weston shale is represented. It consists of from a minimum of possibly 25 feet to nearly 80 feet of bluish-gray argillaceous clay containing limonite shell concretions. No fossils have been found as yet in the Weston. Apparently the formation thickens rather consistently southwestward to Marais des Cygnes River where it measures 75 feet in the escarpment southwest of Ottawa.

Judging from topography the thickness is irregular but rarely is it possible to obtain measurements because of the considerable horizontal distance between the base and top of the Weston. Rarely does the Stanton crop out closer than 2 miles to the Stranger and local structure all through this country makes it difficult to obtain altimeter data. Good exposures of the upper part Weston may be seen at a number of places along roads---SE part sec. 22, T. 15 S., R. 20 E., center W. Edge sec. 34, T. 15, R. 20, W. of center 30/15/20, $\frac{1}{4}$ mi E of SW cor. 25/15/20, SW cor. 4/16/19, SE cor. SW$\frac{1}{4}$ 20/16/19, E of NW cor 16/17/19, NW cor. SW$\frac{1}{4}$ sec. 14/17/19, center S side 20/17/19, center N side 18/17/19, just E of SW cor 18/17/19, center S side 19/17/19, just E center W side 21/18/19, SE cor 11, 19/19, W of SE cor 14/19/19,

From topog. it appears that the Weston is quite thin in the NW part T. 18 R 19 and middle T 16, R 19, but this cannot be determined; for some reason expression is very poor.

The Stranger formation consists of from possibly zero to 50 feet, sandstone below and shale above, locally clay shale. At the top occurs in northern part a thin limy, brown fossiliferous sandstone above which occurs a foot or so of sandy calcareous shale replete with Myalina sp. Ten to 15 feet below the Myalina zone occurs a persistent coal which may be locally obscure or absent. It ranges from an inch or less to 8 inches. Tha maximum occurs (observed) in the NW part of sec. 15, T. 14, T. 18. The upper and shaly part of the form. is exposed at several places on the roads around sec. 15, T. 17, R. 18, and in sec. 11, T. 17, R.18; also in sec. 26, T. 15, R. 19. The lower part of tne form. consists of buff cross-bedded ss. which weathers in sandstone cliffs 40 feet or more as in the center of sec. 11, T. 17, R. 18.

This sandstone is exactly like the one in the Lawrence shale and cannot be distinguished from it <u>except</u> in the rare case where the Stranger, Haskell, and Lawrence ss can all be <u>seen</u> in a single section. Such a fortunate circumstance occurs in sec. 11/ T. 17/ R. 18.

The Haskell ls. is well exposed in the road about .3 of a mile north of the center S. side 11/17/18 on the private road to Red Bird camp. At this locality occurs a northwestward flowing gully in which the Stranger ss. is well shown below the Haskell. At the center of the above section cliffs of Stranger ss may be seen along the Marais des Cygnes.

It should be kept in mind that where the Lawrence ss. has cut below the Haskell there is not way to determine the contact. In such event the Lawrence may rest on Weston. The Haskell is missing by unconformity at most places in the county.

At or near the base of the Stranger occurs a thin-coal, measuring about 4 inches or less. At some places as at E of NW cor. 16/17/19 and center E. edge 16/17/19 the coal seems to occur in the Weston since there is no ss. below it. This is not the case, however, because the wedge-end of ss. may be seen below the coal at center N. side 18/17/19 and generally there is from 2 to 10 feet ss. below the coal. This coal may be seen at: S of center 18/18/19, over S. side 17/18/19, center E. side 1/18/18, center E. side 16/17/19, just E. NW cor 16/17/19, just E. NW cor. 17/16/19. All road cuts.

At the base of the Stranger? there locally occurs from one to 8 feet of brown or buff sandy ls. cg. composed of brown ls. pebbles, clay balls, and limonite concretions firmly cemented in a gray or buff sandy ls. Occasionally fragments of charcoal and rarely worn shells occur. The pebbles are generally less than 1" in diameter. The cg. is commonly thin- and cross-bedded, but may be massive. Lences of this cg (or one at base of Lawrence) occur at NE cor. SE$\frac{1}{4}$ 15/17/19, center S. side 19/17/19, NE cor. NW$\frac{1}{4}$ 19/ 17/ 19, just W. of NE cor. 14/19/19, just W. of SE cor. sec. 14/19/19.

At no place were sharp channels seen or weathered, laterized surfaces. In T. 18 & 19, R. 19 & 18, the Stranger makes a great upland plain with hay fields and other crops. A second terrace in T. 18, R. 18 occurs 55 or more above, it may be the Lawrence sandstone.

The Haskell limestone is discontinuous and only rarely preserved in Franklin Co. It is about 1.3 feet thick composed of fine-grained gray blocky ls. containing peculiar carbonaceous horizontal worm burrows or trails. These branch in a manner suggesting fucoids and are like the structures in S. Bend so-called by Hinds & Greene. Concentrically banded algae, "marklets", are well developed and are highly characteristic of this bed. Predominant fossils are Echinoconchus moorei? and Marginifera sp.

The Haskell is well-exposed along the highway in the stream at the center sec. 26/15/19 and at the center S. side same section. Also in the southern side sec. 19/20/15. On the south side of the river near the NW cor. SE$\frac{1}{4}$ sec. 11/ T. 17/ R. 18, .3+ miles north of center south side 11/17/18, several places along north and east side sec. 15/17/18.

It is, however, gone at most places. The shale at the base of the Lawrence consists of from 0 to 10 feet or more of gray, clay sh. with limonite concretions. It is bounded above by an unconformity at the base of a 50 foot sandstone. The clay sh. may be seen at the NW cor. SE$\frac{1}{4}$ sec. 11/17/18 and at some of the other loc. where the Haskell is found.

At most of the exposures of the Haskell southwest of Ottawa, mentioned above, there occurs in the same section 50 feet or more of X-bedded, buff ss. weathering into massive ledges or into thin slabs. It overlies unconformably older strata. Some idea of the importance of the unconformity is gained from evidence discovered by John Rich.

At the SE cor. 15/17/18 by a creek occurs a 30 foot wall of ss. overlying tilted and beveled clay sh. In the base of ss. are incorporated conglomerate and blocks of coal in all orientation up to 6 ft. by 3 in. in size. The only available coal of such thickness nearby occurs 15 feet ± below the Haskell at the NE part of the same section. Supposing this coal to be the source of the coal breccia then there were <u>several hundred</u> feet of strata eroded from the region to lay bare the coal.

This great sandstone loses its identity when the Haskell is cut out except perhaps in T. 18, R. 18 where there are two great ss platforms.

Above the Lawrence ss occurs 30 feet or so of sandy gray sh. with locally a 1 foot coal bed 20 feet or so from the top. This is the coal mined at Ransomville.

ANDERSON COUNTY

The Pedee presents much the same stratigraphy in Anderson that it does in Douglas County. Only the lower part of the Weston shale remains, the upper part and the Iatan having been removed preceding Stranger time. The Weston consists of a few score--50 to 80 feet or so of argillaceous, bluish gray shale with a few limonite shell concretions. A marked change is seen in the relations of the Virgil beds to the Weston. Whereas only a few miles to the north and east good exposures of an unconformable contact of Virgil on Weston are seen, no such exposure was encountered in Anderson County. The clay shale of the Weston gives way to silty or slightly arenaceous flaggy beds of the Stranger with no recognizable break. At a few exposures around Wesphalia there is scarcely any sandstone or sandy shale in the Stranger, indeed in the entire Douglas group. At some places at N. part 1/17/21 there is some slabby buff ss. 10 feet or 20 below West.

In the vicinity of Westphalia there occurs a thin ferruginous ls. about 60 feet above the Stanton. This limestone ranges between 1.2 and two feet in thickness. At all exposures it contains great numbers of well preserved Triticites belonging to a species definitely smaller than but in general form resembling Triticites secalicus. Locally the limestone is made up of these fusulinids to the near exclusion of other fossils. Other fossils belonging to Neospirifer and some species of Crinoid were noted. Hereafter I shall refer to this limestone as the Westphalia limestone. It is typically developed in good roadside exposures at the NE cor. sec. 20, T. 21 S., R. 18 E. and near the center of the north side of sec. 12, T. 21 S., R. 17 E. At the former locality there is about 50 feet of shale above the river flood plain, the upper 20 feet being well exposed and showing no hint whatsoever of a break below the Westphalia limestone. The shale is a drab to buff clay with silty slabs of an inch or two scattered through it. Above the Westphalia at the same locality there occurs 17 feet of gray silty clay with limonite shell concretions. This is superceded by $1\frac{1}{2}$ feet of platy even siltstone and in turn by a few feet of reddish slabby sandstone.

This section taken alone affords but one interpretation in light of what has already been said. That is, that the Westphalia limestone is the Iatan and that the reddish sandstone at the top of the section is the Stranger. Another section bearing out this interpretation occurs along the middle of the north edge of sec. 12, T. 21, R. 17 north of Westphalia. Here was exposed in stratigraphic order 7 feet of bluish-gray clay sh. with limonite concretions, 1.8 feet of ferruginous, Triticites-bearing limestone, the Westphalia bed, six feet of silty, drab shale, .6 foot buff clay, overlain by .1 foot of structures vermillion sandy clay of cinnebar color, .5 buff clay and 6 feet or so buff, slabby, irregular sandstone. I had interpreted the red layer as a laterite bed, developed at an old weathered surface.

I am not yet decided whether or not the sandstone mentioned above marks an unconformity or is a local feature--this is certain, that the sandstone above the Westphalia at the two localities mentioned does not figure in the stratigraphy south of Anderson Co. and I believe it is not the Stranger.

With the exception of the aforesaid sections, the Haskell limestone lies a few feet above the Westphalia generally between 8 and 15 feet separated by slabby calcareous ss. beds. Locally, around Westphalia there occurs a foot of dark gray, platy, X-bed limestone a foot or so below the Haskeld overlain by calcareous shale bearing Myalina and algal nodules.

The Haskell consists of 1.6 feet gray, blocky, fine-grained ls. It contains Cryptozoan markings and bears flattened, horizontal worm borings or trails near the top. It has a small species of Triticites and a Marginifera as the commonest forms.

This formation so discontinuous in Franklin County is apparently continuous across Anderson County, having been observed at scores of places north of Westphalia.

The Haskell is excellently exposed just east of the center S. side sec. 13, T. 12 S., R. 17 E.

You will recall that a sandstone horizon occurs in southwestern Franklin County just below the Oread. This sandstone definitely disappears at the northwest corner of Anderson County and is represented across the county by clay shale and sandy shale.

The Lawrence shale consists of at the base 60 feet of drab, olive-gray and buff clay shale, somewhat arenaceous in the upper part overlain by a foot of greenish underclay and a 4 in. coal, the Ransomville bed. Above this is 16 feet of buff and gray papery sandy shale overlain by the Weeping Water member of the Oread. The interval from the Haskell to the Ransomville coal is well exposed along the E. side secs. 14 and 23, T. 20 S., R. 17 E. The interval from the coal bed to the Oread was measured at the NW cor. 11/T. 20, R. 17.

COFFEY COUNTY

In the vicinity of Aliceville and in the country immediately west of Westphalia there appears most abruptly a great sandstone in the Lawrence and one at a lower horizon probably the Stranger. In most of T. 22 & 23 R. 17 the Westphalia and Haskell seem to be missing since they were not observed except for an exposure of the Westphalia bed in the NW$\frac{1}{4}$ sec. 21, T. 22, R. 17. At Aliceville, SW cor. sec. 4, T. 22, R. 17 may be seen an unconformable contact of a sandstone on a clay shale. This is, I believe, Stranger sandstone since a second sandstone occurs to the east considerably higher. The latter is part of a scarp that overlooks the Haskell at Westphalia. In passing it may be noted that the term Leroy as once applied to the lower part of the Douglas is a particularly poor one since that town in Coffey County lies in the midst of a great alluvial plain and the name except by definition could not readily apply to any Pennsylvanian unit.

WOODSON COUNTY

In Woodson County sandstone above the Weston and sandstone in the Lawrence make two escarpments which truly become magnificant topographic features south of Yates Center into Wilson and Montgomery Counties.

In the north east part of Woodson County in Ts 23 & 24, T. 16. The sandstone in the Lawrence is quite prominent forming a great upland plain above whose western margin the Oread rises obscurely but a scant 20 or 30 feet. Some tens of feet below this plain occurs a second escarpment somewhat more poorely defined than the higher one. It is produced by sandy layers above the Weston. At no place in Woodson County north of the Rose Dome does the Weston show a sharp contact with the sandy layers that I am considering Stranger. In the northeast part of the county 60 feet or more of gray clay shale rise above the great Stanton plain, capped by a few feet of slabby and even sandstone intercolated between shale beds similar to those below. The Westphalia and Haskell were not observed north of Yates Center, but the topography would indicate that the plain above the Stranger escarpment is the dip slope of a limestone.

At Yates Center the beds from the Westphalia to the Oread limestone incl. are well exposed.

The lowest rocks exposed at the center of the NW$\frac{1}{4}$ sec. 1/25/15 include 4 feet or so of gray, silty, clay shale, overlain by 4 feet of brown, ferruginous, irregularly bedded ls, replete in the lower part with small species of Triticites. This is beyond question the Westphalia bed. It is overlain by 6 feet or so of shale containing a greenish clay below, structureless black clay at the middle, and a buff limy bed above bearing algal nodules and Myralina.

This is overlain by the Haskell limestone comprising 2.2 feet of even, blocky, bluish-gray, fine-grained limestone in a single layer. As elsewhere it contains the Cryptozoan markings and irregular, horizontal tubules near the top.

Above the Haskell occurs 6 feet of gray clay shale overlain unconformably by 10 feet or so of irreg. bedded reddish-buff ss. The sandstone is overlain by about 120 feet of poorly exposed shale and sandstone similar to that at the base. The covered interval I believe is chiefly sandstone.

Two miles W. of Yates Center the Oread is exposed with 20 feet or so of shale (sandy) separating it from the sandstone. Since the relations of this ss. are so clear around Yates Center I shall refer to this as the Yates Center member of the Lawrence.

Exposures were too poor to enable me to locate the Ransomville coal in this area.

Southward from Yates Center the sandstone above the Weston becomes sufficiently resistent to produce a prominant escarpment, although not such an imposing feature as that of the Yates Center sandstone. It may be that the Haskell and Westphalia beds are discontinuous in the region about the Rose Dome south of Yates Center for those limestones were not seen in several areas and where they occur, as at the middle of the E. edge sec. 16, T. 26, R. 15, they form prominent outcrops. At one place in the Rose Dome area was noted an unconformable contact of Stranger ss. on Weston shale. This exposure occurs at the SE cor. sec. 28, T. 26 S., R. 15 E. The section here includes 60 feet or so of gray clay shale overlain with clean, irregular contact 4 feet of massive, irreg., blocky reddish fine ss. This is overlain by 20 feet or more of flaggy sandstone which forms an upland plain containing the Westphalia and Haskell limestones.

These limestones present about the same characters that they have at Yates Center. The Haskell differs only in having a dark bluish gray color on fresh surface rather than the light gray of the northern exposures. The shale between the two limestones is light greenish in the Rose Dome area.

Along the E. side of sec. 9, T. 26 S., R. 15 E., there occurs above the Haskell about 90 feet of light greenish-gray clay shale containing some flaggy siltstone in the shale near the top. This is overlain, apparently unconformably by 20 feet or more of reddish brown, thin-bedded sandstone. The beds above this crop out many miles to the west and it was impracticable to attempt to get a section of them at this latitude.

The Weston shale thickens greatly near the southern line of Woodson County in T. 26, R. 15. In section 30, allowing for a steep south dip the Weston is somewhat over 100 feet. The lower part consisting of brittle, nearly black platy shale (~~melamorphand?~~ metamorphosed) and the upper part of buff clay sh.

WILSON COUNTY

The Stranger-Weston escarpment enters Wilson County in T. 27 S., R. 15 E. Here the escarpment is quite high as a result of a thickening of the Weston shale to 100 feet and more. It is overlain by sandstone and sandy shale without a clean contact, there being a gradation apparently from clay shale to shaly sandstones. It is difficult at most places to obtain good exposures of the sandy part because along the escarpment the resistent portion has been removed and there is no good apparent excuse for the escarpment at all.

The Westphalia and Haskell beds were seen at a number of places 3 or 4 miles northeast of Coyville and south of that town. Apparently the outcrop is continuous in the county north of Verdigris River, but erosion pushes the limestone back under the brow of the Yates Center ss. escarpment where it is difficult to find, the lower plain there being developed on the Stranger. It should be emphasized that wherever these limestones are seen it is on a dip plain and they outcrop plainly over many acres. The limestones are well exposed at many places just north of New Albany and in the upland south of Fall River in the county just south of New Albany.

At the latitude of Fredonia a marked change occurs in the Stranger sandstone. At the Turin Mounds, outliers of sandstone on Weston shale at Fredonia, there is 135 feet of gray clay sh. overlain unconformably with a clean irregular contact by 20 feet or so of massive reddish friable sandstone that weathers in huge craggy masses. I was at first disposed to believe that this was Yates Center sandstone brought down onto Weston by an eastward overlap. This is not the case, however, since at a number of places in T. 29 S., Rs. 13 & 14 E., a massive sandstone, definitely below the Haskell and Westphalia beds overlies the Weston with a sharp contact. The sandstone is not shaly nor is the shale below, sandy.

A generalized approximate section for this township includes at the base 135± feet of gray clay sh., 30 feet of buff massive X-bedded sandstone, a few feet, 10 or less, of shale overlain by 3 feet of Triticites ferruginous ls., the Westphalia. This is overlain by 8 or 10 feet of greenish clay shale and 2 feet of dark bluish gray dense, blocky ls., the Haskell. The Haskell is overlain by 60 feet or more of bluish-gray argillaceous shale containing limonite concretions and in turn by 30 feet or more of cliff-forming, reddish-brown ss. The beds above this sandstone are eroded back to the westward for many miles.

In T. 30 S., R. 14 E., the sandstone above the Weston breaks down into shaly and flaggy sandstone showing no sharp contact with the Weston. The Westphalia and Haskell beds are at least locally absent. The limestone lentils mapped in this area by Schroader in the Independence folio belong to the Westphalia and Haskell. The line that he gave on the map

includes both limestones where they are present. I suspect that the limestones are more nearly continuous north of Elk River than represented on the Independence map, but they are certainly discontinuous. For example the two limestones, overlain by several 10ns of feet of clay shale occur on the mound at the NW cor. sec. 31/ T. 30/ R. 14 E. A half mile to the north across Duck Creek there occurs only sandstone and sandy shale at the same horizon as the limestones to the south. This sandstone is some scores of feet lower in elevation than the scarp maker of the Lawrence and topographically lie, nearly on the dip plain of the Stranger.

Jim Sheldon
Harrison

R13E R14E R15E R16E R17E

1 2 3 4 5 6 7 8 9 10 11 12 13

WILSON COUNTY · NEOSHO CO

T 31 S

Corbin
T32S R17E

Water Sample Analysis
Obs Possible Well

Cistern a Haul

T32S R15E

T 32 S

INDEPENDENCE

T 33 S

EPENDENCE
T 33 S R15E

T 34 S

CHAUTAUQUA COUNTY · COFFEY VILLE · LABETTE COUNTY

T 35 S

COFFEYVILLE

WASHINGTON COUNTY · NOWATA · OKLAHOMA

1 7 13

R13E R14E R15E R16E R17E