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Drouth conditions in southern Iowa in 1934, led the Highway Commission to undertake an unusually large number of road projects in that part of the state, in order to give the most employment where economic distress was most severe. One such project included the surfacing of secondary roads north and northeast of Mount Pleasant. In checking over material possibilities for this project, rock outcroppings along Big Creek north of Mount Pleasant were re-examined and new facts brought to light by this restudy have led to the conclusions reached in this paper.

A section typical of those visible in this locality, and better exposed than most, is that in the north bank of Big Creek near the old quarries in NE¼ SE¼ section 28, Marion Township. Following is the succession of beds exposed:

Number	Description	Feet
7	Slope, glacial clay with much residual gravel and chert in the lower portion.	10
6	Limestone, much weathered and broken.	1½
5	Limestone, coarse-grained, crinoidal, hard, sound, with some chert.	1½
4	Limestone, drab, coarse-grained hard and sound at the bottom, but the bulk of it finer-grained, somewhat shaly, and partly unsound. At the top is ½ foot of soft clay shale. Chert nodules scattered throughout total about 10%.	6
3	Shale, soft, with two ledges of coarse-grained, fossiliferous, hard, sound limestone, totaling 1½ feet thickness.	4
2	Limestone, gray, coarse-grained, crinoidal, medium hard to hard, probably sound though now showing some evidence of weathering. In the top foot is an almost continuous band of about six inches of dark colored chert.	7
1	Unexposed to creek.	5

The following species, collected along the weathered slopes from these beds, have been identified by Dr. A. K. Miller of the State University of Iowa (1):

Corals
Zaphrentis sp.
Amplexus sp.
Crinoids
Platycrinus sp.
Pachylocrinus sp.

Bryozoans
Fenestella, 2 sp.
Brachiopods
Cliothyridina sp.
Spiriferella plena
Spirifer keokuk
Dielasma burlingtonensis (?)
Echinoconchus alternatus
Rhipidomella cf. R. dubia
Reticularis sp.
Orthotetes sp.

In addition to the species identified are numerous fragments of crinoid stems and plates, of species unrecognized. Dr. Miller is of the opinion that this assemblage is of upper Burlington or lower Keokuk age.

A zone apparently the same as that described in the foregoing section has been quarried on the west bank of Big Creek south of northwest corner section 34, Marion Township. There is now no definite exposure in the quarries, but a small gully a few hundred feet southeast shows 11 feet of a fine-grained shaly and unsound limestone, with about five percent of scattered chert nodules, and two or three thin beds of hard crinoidal limestone. This bed probably passes beneath the old quarries.

About five feet of cherty limestone, coarse-grained hard and sound at the top, and fine-grained and softer below, can be made out near the north end of the bridge near center NW$\frac{1}{4}$ section 34, and again a few hundred feet west. There are some signs of a weathered drab shale above. The limestone here is probably equivalent to the beds exposed, or just above those exposed in the gully mentioned in the preceding paragraph.

Imperfect and limited exposures north of Big Creek in NE$\frac{1}{4}$ NW$\frac{1}{4}$, and south and west of the creek, south and west of center, section 34, indicate the same series of beds as those previously described. Near center SE$\frac{1}{4}$ section 34, there is exposed what is probably the equivalent of the upper portion of Bed Number 2 of the section given, it being here about 18 feet above the creek level. No rock outcrops are found farther upstream (east) on Big Creek.

Outcroppings in and near old quarries near the southwest corner of section 21, Marion Township, give the following approximate section:

NUMBER	DESCRIPTION	FEET
3	Limestone, coarse-grained, fossiliferous hard, sound.	2 (App.)
2	Unexposed, about	6
1	Limestone, yellowish-gray, coarse-grained, fossiliferous, hard, sound, in several regular beds, with two or three chert bands, and a four-inch seam and a two-inch seam of shale.	5

The top of the exposed stone here is about 25 feet above the creek level. The fossil content of Beds No. 1 and 3 includes numerous fragments of crinoid stems and plates.

A limestone ledge which is probably the equivalent of No. 1 of the section just given appears in the bed of a small stream just south of Big Creek about half a mile west. Limited outcrops a few feet above water in SW¼ NW¼, and again near the east quarter-corner, of section 20, Marion Township, show hard coarse-grained crinoidal limestones.

Frequent exposures in and near the old quarries near the center of section 30, Marion Township, show typical St. Louis beds, consisting of white hard fine-grained limestones above, and softer massive brown magnesian limestones below. Minor folding, and at some points brecciation, is not uncommon. The St. Louis is exposed nearly to the water's edge. In small gullies on both sides of Big Creek through the south half of NE¼ section 30, there can be seen beneath these St. Louis beds an irregular zone of a few feet of siliceous sandstone and conglomerate, underlaid by a drab shale which may be only a few feet, and is certainly not much more than 20 feet, in thickness. The outcrops are too much obscured by overwash to permit observations of stratigraphic details. Beds of coarse-grained crinoidal limestone rise a few feet above water at a few points in the banks of Big Creek here.

The foregoing observations in NE¼ section 30, lead to the conclusion that the Osage strata crop out beneath the St. Louis there, and that they dip persistently to the southwest. A persistent westward dip is observed in the outcrops in sections 28 and 34, Marion Township, and may be present in sections 21 and 29, though exposures there are not continuous enough to permit dip observations. There can thus be no doubt, from stratigraphic, lithologic, and paleontologic evidence, that the strata appearing in sections 20, 21, 28, 29, and 34, are referable to the Osage stage, and probably to the Keokuk formation.

As stated above, conditions of exposure in NE¼ section 30, Marion Township, where both the Keokuk and the St. Louis appear, are not good enough to permit definite conclusions as to the stratigraphic relationships. The occurrence of shale indicates the presence of the Warsaw, and the siliceous sandstones and conglomerates above it point to the possibility of unconformity between it and the St. Louis. The lack of thickness of the Warsaw here, as compared with what might be expected, is another indication of unconformity. Possibly the Warsaw succeeds the Keokuk con-

formably, but was in large measure eroded away before the deposition of the St. Louis. Well sections (2) at Mount Pleasant, about three miles south, do not indicate any great thickness of shale between the St. Louis and the Keokuk which might be assigned to the Warsaw.

The area in which the Osage lies next beneath the drift is not easily determined with any degree of accuracy. Its boundary on the south is quite definite, being marked by the edge of the high upland on which Mount Pleasant is built. The boundary to the southwest is accurately located by the exposures in the NE$\frac{1}{4}$ section 30, Marion Township. It is not so plain to the west, but may be placed with reasonable accuracy along the edge of the high ground west of Lynn Creek.

The nearest known rock outcrops directly to the east of the Keokuk exposures on Big Creek are those in the northwestern part of Des Moines County, which are unquestionably of Burlington age. On Brush Creek below New London, and almost directly southeast from the Big Creek exposures, the St. Louis is well exposed, and has been quarried.

Private wells at, or near New London (3) indicate depths up to 200 feet to bedrock, and the town well there (4) reports no rock above 273 feet depth. The altitude of the rock in most of the town of New London may thus be placed at 600 to 500 A. T. Since the St. Louis exposures on Brush Creek rise to about 680 A. T., it seems probable that at New London the St. Louis is missing, and that the Osage lies next beneath the drift.

Records of farm wells eight miles northwest of New London and again in the north part of Canaan and Marion Townships (5) show bedrock at elevations of 600 A. T. or lower, with the exception of one, in section 15, Canaan Township, which shows 630. In view of the fact that the Osage on Big Creek northeast of Mount Pleasant rises to elevations of 660 to 680, it thus seems unlikely that the country rock to the east is stratigraphically any higher. No rock exposures on Big Creek east of section 34, Marion Township, are known.

The exposures near Winfield have been quite conclusively identified by Van Tuyl (6) as of St. Louis age. Rock altitudes at this point are about 620 A. T., indicating that the rock in section 15, Canaan Township, at elevation 630 may be St. Louis.

Consideration of all these points leads to the conclusion on the basis of present information, that the outcroppings on Big Creek north of Mount Pleasant, do not represent an Osage inlier in the

St. Louis, but are at the northwest end of an anticlinal fold which brings the Osage to the preglacial surface through most of New London, Canaan, and Marion Townships, and the adjacent portion of Wayne and Center Townships, as shown on the map (Plate I).

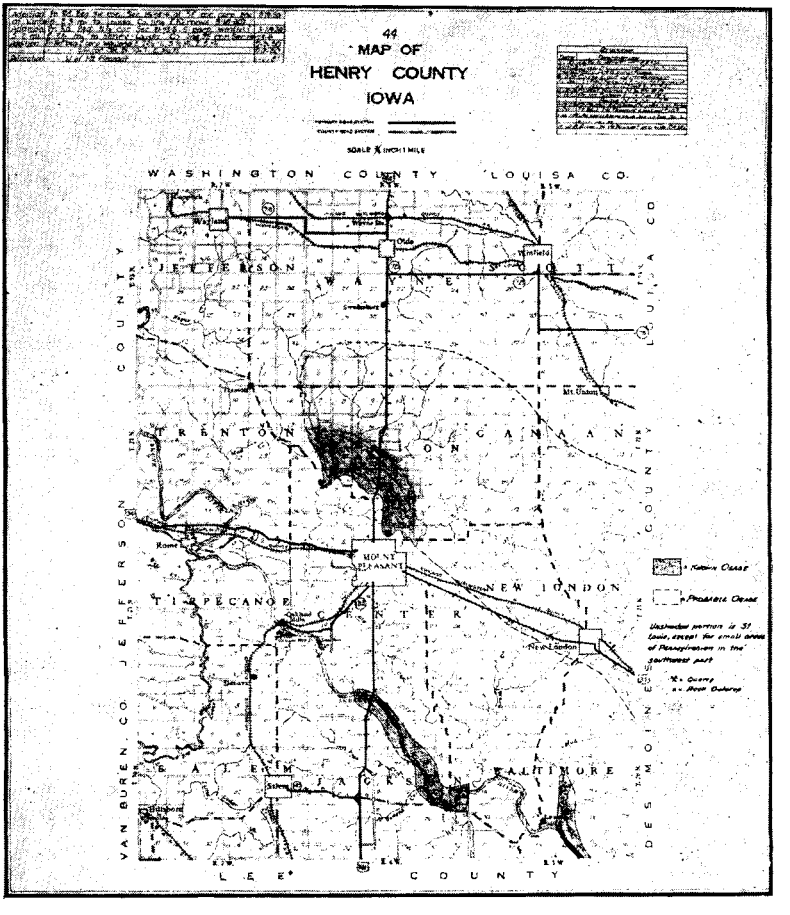

Plate I. Geological Map of Henry County

In fact, some extremely low rock elevations in wells in section 11, Marion Township, and section 6, New London Township (500 A. T., or lower), indicate that inliers of Kinderhook may be present at those points. The area of Osage, as thus mapped, is continuous with that previously mapped by Keyes (7) in Des Moines County.

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