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A PLEISTOCENE SECTION FROM DES MOINES SOUTH TO
ALLERTON.

BY JOHN L. TILTON.

ABSTRACT.

1. A valuable series of exposures is now to be found along the railroad from Des Moines to Allerton.
2. A detailed description of some of the outcrops.
3. General observations and relations.

The grading of a new railroad line from Des Moines to Allerton, passing from Polk through Warren, Marion, Lucas and into Wayne county, affords an excellent opportunity to secure parts of a Pleistocene section from Des Moines south nearly across the southern half of the state from a series of exposures such as have never before been available in this region. The section is a key to the Pleistocene of south central Iowa, serves to connect previous work there with that yet to be accomplished in that region and in north central Missouri, and also affords data for comparison with the excellent records which Shimek has obtained along the Missouri river in western Iowa.

The first important exposure south of Des Moines is immediately north of the small railroad station known as Coon Valley (see Des Moines Quadrangle, T. 78 N., R. 23 W., Ne. $\frac{1}{4}$ of Sec. 21). The cut is about a quarter of a mile long. For two-thirds of that distance from the west the Des Moines shales may be seen, the surface rising gradually to a height of twenty feet above the track near the center of the cut. What lies immediately on the shales is already concealed by talus in the west third of the cut; but just east of the highest point of the shale may be seen two boulders of greenstone each about a foot in diameter embedded in a dense clay blotched with black and brown and resting on the disintegrated upper portion of the shale. Above these boulders is three to four feet of dark brownish clay not distinctly separable from the clay enclosing the boulders. Eighty feet farther east there rests on the Des Moines shales four feet of this dense clay, blue in color but brown along cracks, with pebbles of quartz and sand-

stone and fragments of shale. The upper portion grades upward into a distinct layer of dark oxidized material. Another eighty feet to the east the lower part of the reddish brown clay is found to be the weathered top of the Des Moines shale; and, in one place above the clay, with no plane of separation, is four feet of a dark brownish laminated silty material containing an abundance of plant fibers. Apparently this upper deposit is continuous under talus with the upper part of the brownish deposit to the west. Throughout the remaining distance to the east end of the cut a bluish silty deposit two to three feet thick rests on the clay containing fragments of plant fiber, with a two-inch plane of oxidation visible in places between them. Above this deposit to the soil is a bed of grayish loess which in places is very fossiliferous. Near the west end of the cut the loess is twelve to fifteen feet thick, distinctly laminated, and containing an abundance of fossils. For perhaps four feet there is a four-inch plane of oxidation between the brown loess above and the gray below, but elsewhere no such plane is visible.

The drift containing the two boulders is unquestionably Kansan, though local evidence here is not fully conclusive. In tabular form these descriptions stand as follows:

	Feet.
6. Soil, yellowish	1-2
5. Loess, brown above where weathered, brownish where less weathered, gray where not weathered, distinctly laminated; with a few horizontal planes of marked oxidation; and abundance of concretions and loess fossils.....	12-15
4. Fine clayey deposit like silt, white where dry, bluish where damp	2
3. Dark brownish laminated silty material, with abundance of plant fibers	4
2. Clay, dense, with streaks of black and brown, with a few pebbles of quartz, chert and sandstone, and two boulders (Kansan Drift.)....	4
1. Shale, mostly clayey, upper portion much weathered (Des Moines)	20

Half a mile south of Avon a steam shovel is at work opening a gravel pit close to the one where years ago Mastodon or Elephant remains were reported found at a depth of about sixteen feet. For five feet from the surface the deposit is a dark sandy loam, very slightly laminated, and containing Kansan pebbles of all kinds scattered through it and lying in all possible positions. The pebbles are of all sizes up to a very few three inches in diameter, the average of the largest being perhaps one inch. One rounded mass of sand (a sand boulder or cobble) four inches in diameter contained a two-inch pebble in its lowest portion. At the bottom of the five feet the deposit is more distinctly a sand and gravel.

The lowest sand and gravel with the Mastodon or Elephant remains is referred to the Aftonian interglacial interval.

A mile south of Hartford (see Milo Quadrangle, T. 77 N., R. 22 W., east half of section 29) a long and deep cut reveals considerable variety:

	Feet.
6. Soil	2
5. Loess, brownish above where weathered, gray below, laminated, root marks numerous, two places fossiliferous, traces of horizontal planes of oxidized iron visible.....	9
4. Clay and fine sand, like a silt.....	1
3. Clay, two inches of dark, then three feet of blue, changing into three feet of dark brownish crumbly clay, free from plant fibers but containing a large amount of oxide of iron; in places grading below into..... (Gumbo; Dallas)	6
2. Clay, light brownish above, darker brown below, with pebbles and small cobbles; layer of Kansan pebbles seen in places; drift filled with characteristic pebbles and small cobbles of red quartzite, greenstone and granite..... (Kansan Drift)	10
1. Shale, mostly clayey..... (Des Moines)	10

Near the center the Des Moines shales appear above the bottom of the cut and rise gradually southward till they attain a height of about ten feet, from which the surface drops rapidly beneath the level of the cut. This valley side in the coal measures is rendered conspicuous by a thin seam of carboniferous matter that follows the side of the valley. The Kansan drift, wanting in a portion of the cut, is here a conspicuous deposit filling the old valley side in the Des Moines shale. Toward the south the line of pebbles and the several deposits that succeed may be seen passing beneath the level of the cut. The weathered portion and the soil here become thicker. The lowest brown clay of No. 3, not clearly separable from the portion above, contains a few small pebbles, and rests on a layer of pebbles characteristically Kansan. The deposits above the distinct Kansan drift mantle the hill. The change toward uniformity due to weathering and to creep may be followed out horizontally from the more unchanged portion within the hill to deep black soil on the side of the hill.

In the long cut through the high ground two and a half miles east of Sandyville (see Milo Quadrangle, T. 76 N., R. 22 W., Ne. 1/2 of section 24) the following section appears:

	Feet.
6. Soil	2
5. Loess, brown above, gray below, with numerous somewhat horizontal bands of oxidized material very conspicuous in places....	8
4. Clay, bluish where damp, gray where dry, extending down into numerous holes somewhat hemispherical in shape three to five feet in diameter in the deposit below. (Gumbo; Dalls)....	1-2

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|----|--|---|
| 3. | Clay, brownish blue with many hemispherical holes three to five feet in diameter apparently worn into its surface; a few pebbles up to three-fourth of an inch in diameter; no gravel nor pebbles visible in bottom of holes.....(Gumbo; Dallas) | 6 |
| 2. | (Line of pebbles seeming to mark a plane of erosion); clay, brownish, with many pebbles and bowlders of red quartzite, decomposed granite, etc.....(Kansan Drift) | 3 |
| 1. | Shale, mostly clayey.....(Des Moines) | 6 |

The gumbo (numbers 3-4) is separated into two portions by a plane that seems to be a plane of disturbance rather than erosion or weathering. No pebbles appear in the hemispherical projections of number 4 into number 3, as there would be if such places were potholes. The plane seems due to renewed advance of the Kansan ice.

In Lucas county close to the county line (Nw. $\frac{1}{4}$ of Ne. $\frac{1}{4}$ of section 2, English township) a steam shovel was at work cutting five feet deep into a dense blue clay beneath several feet of Kansan drift that contained characteristic bowlders and pebbles. One bowlder was a large bowlder of blue clay like the basal clay there found but also containing fragments of coal. This seems either a bowlder of Nebraskan drift, or a Kansan bowlder of Des Moines shale worked over and incorporated into the Kansan drift. In the latter case any evidence of stratification which the clay may have had when in the form of Des Moines shale had been lost. In the bottom of a trench a little further south is a somewhat similar dense bluish black clay with nothing separating it from the distinct Kansan drift seen in the hills. Several other somewhat similar cuts occur within six miles to the south toward Chariton in which the drift exposed is distinctly Kansan drift.

At Chariton a good section is obtained by combining the outcrops found in the three cuts beginning at the crossing of the Chicago, Burlington and Quincy railroad and extending south to Chariton river. At the railroad crossing the two feet of soil is on the gumbo, the upper portion of which is here brown through oxidation, the lower portion gray, containing small pebbles especially of quartz and granite rarely over half an inch in diameter. Next, without any line of pebbles and underneath the above mentioned clay, is the brownish, weathered and bowlder-bearing phase of the Kansan drift, well exposed in the long cut two hundred yards to the south, where the exposure gives about fifteen feet filled with large sand bowlders and numerous and characteristic bowlders of decomposed granite, greenstone, quartzite, and brown, yellow and red chert. In the trench by the river there is included a bed

of sand six feet thick, fine, irregularly bedded, and iron stained, beneath which lies fifteen feet of dense clay, brown above, blue below, with numerous small pebbles of chert and quartz, exposed down to low water in the river and apparently extending below the bed of the stream. Professor Kay finds the Kansan drift here continuous in one place from the top of the hill to the bottom of the trench.

Half a mile distant on the south side of the river sand that is apparently post-Kansan rises above the level of the track. Here the section is as follows:

	Feet.
4. Soil, and brownish yellow subsoil.....	3
3. Sand, fine, gray	7
2. Sand, yellow and white, stratified, 1½ ft.; sand, very fine and white, 2 ft.; sand deeply oxidized, stratified..... (Bottom of trench west side of track.)	10
1. Sand in hole dug beneath bottom of trench.....	3

A somewhat peculiar enclosure of sand in Kansan drift is found in Benton township (T. 71 N., R. XXI W., Sw. ¼ of the Ne. ¼ of section 32). Here, beneath five feet of the weathered phase of the Kansan with numerous boulders, cobbles and pebbles of greenstone, granite and red quartzite, is a thin sandy and brownish plane that appears to mark a plane of weathering. Beneath this plane there is exposed five feet of dense brownish clay free from grit, without red quartzite and without greenstone, but with numerous cracks filled with lime.

Further south there is but one cut that extends much into the Kansan drift. That is in section 31 of Union township, Wayne county (Tp. 70 N., R. XXI W., Ne. ¼ of the Sw. ¼ of section 31). Here, beneath the yellowish, oxidized phase of the Kansan is the bluish phase of the same clay with its grit and pebbles. Beneath this there is a layer of oxidized material found in the south third of the cut; elsewhere, an irregular undulating top of a dense brownish clay free from red quartzite.

GENERAL OBSERVATIONS AND RELATIONS.

The Des Moines shales are frequently found above the level of the track from the outcrop near Coon Valley to the northern boundary of Lucas county (section 2 of English township). Close to Whitebreast creek in Marion county (section 26, Franklin township) the railroad cut reveals a high hill of Des Moines shales with but a thin soil at the top. South of the northern part of Lucas county the shale appears but once (in section 10 of Lincoln township). Work in northern Lucas county, where grading is not yet completed, may possibly bring to light a few other exposures later.

No Nebraskan drift was found exposed. If present at all it should be looked for beneath the river deposits. Unfortunately for complete observation the cuts are, of course, in the hills only, while fills occupy the valleys.

Beds referable to the Aftonian interglacial deposits are found only at Avon in the deepest portion of the gravel pits. No sections of bog nor of peat are revealed. At the crossing of Wolf creek (Tp. 71 N., R. XXI W., Ne. $\frac{1}{4}$ of the Sw. $\frac{1}{4}$ of section 28) the creek in changing its channel has cut into a dark, somewhat stratified deposit, resembling an Aftonian deposit found in the Simpson College well; but there is no evidence at present at hand to determine the age of this deposit at Wolf creek.

The weathered phase of the Kansan drift is frequently exposed from Carlisle to Chariton. South of the high hills of Des Moines strata along Whitebreast creek all the deep cuts into the Kansan reveal bowlders of stratified sand, the planes of stratification dipping in different directions in even adjacent bowlders. The porosity of the sand bowlders has made it possible for surface water to reach various parts of the clay readily and help extend the zone of oxidation, the relative absence of sand bowlders in the deeper portions seeming one reason why those deeper portions have been less oxidized than the more sandy portion above.

The Gumbo; Dallas Deposits. One of the most important relations which this series of exposures illustrates is the relation of the gumbo to the previously recognized Kansan drift. The gumbo as exposed along the railroad is a blue clay of varying thickness up to ten feet, without stratification, and with small pebbles chiefly of quartz and granite here and there in it, but compared with the ordinary Kansan drift almost pebbleless. From relations along the railroad the gumbo appears closely related to the Kansan drift, in places not separable from it and in other places partly or wholly absent, its place being taken by stratified sand. In Clarke county what is apparently the same kind of a deposit is found definitely at lower levels in places where its position does not seem due to wash and creep. The only conclusion that seems applicable is that this gumbo was laid down not only on the upland but in places, at least, along drainage lines determined before the gumbo was laid down. As those drainage lines are on the Kansan drift, they, and the gumbo which is in them, must be post-Kansan in age. While the gumbo has not been traced across the state mile by mile, the work in the different counties seems to make it clear that this gumbo of south central Iowa corresponds to the gumbo of southwestern Iowa, which gumbo Shimek

correlates as the Loveland. If the correlations of the gumbo alone were all that is involved it would be advisable to adopt the term Loveland for these gumbo deposits of south central Iowa. There is, however, a serious objection to the adoption of this term. The term Loveland as originally defined by Professor Shimek applies to a definite gumbo-like deposit and that only. In south central Iowa the gumbo may in places be traced horizontally into stratified sand; in places it is found to contain a few pebbles, and in places to be free from pebbles. The term Buchanan gravels was proposed by Calvin as the name for the gravels and the gravels only as found on the Kansan drift in Buchanan county. To adopt either of these terms would necessitate a change in the use of the term as originally defined. The writer therefore suggests the term Dallas for those deposits of whatever nature, partly gravel, partly sand, partly gumbo either without pebbles or with a few pebbles, formed in the closing stages of the Kansan ice age as the Kansan ice melted leaving a surface deposit over the Kansan drift in the Kansan upland and down along valleys which in places had by that time been eroded into the Kansan drift. The name is suggested by the town of Dallas in Marion county (Iowa) near which a considerable variation may be seen in the gumbo and associated deposits. A mile north of Dallas (Ne. $\frac{1}{4}$ of the Ne. $\frac{1}{4}$ of section 2) these Dallas deposits are pebble free beneath the soil, pebble bearing from eight to sixteen feet below the surface, and resting on a distinct sandy Kansan drift with its characteristic pebbles and boulders, which in turn rests upon the Des Moines shales. A similar relation is observed in each of several exposures toward the south as far as the Lucas county line. To the north an excellent exposure may be found near the Fairview school house (T. 75 N., R. 21 W., Sec. 3, Se. $\frac{1}{4}$ of the Sw. $\frac{1}{4}$), where gumbo is seen not distinctly separated from Kansan drift. It may also be seen in the long cut east of Sandyville as previously described. In Lucas county it is especially noticeable in sections 23 and 34 of English township, 10 of Lincoln township, at Chariton at the crossing of the C., B and Q. railroad, and in sections 8, 16 and center of 21 of Benton township. In Wayne county the relation may be seen in sections 5, 18, 30 and 31 of Union township, in the northwest part of Corydon township, in section 24 of Benton township, and section 2 of Warren township. (From Allerton to Lineville the railroad follows a divide.)

The name Dallas for these deposits is suggested to meet the need for a name that has not as yet been fully supplied. Should later a more acceptable term be found, or even an earlier term be given a new mean-

ing, such a term agreed upon will be welcomed by the writer; but Dallas deposits is the term which at present appears to him most acceptable.

The significance and bearing of the important fact mentioned in the above description of the Sandyville section, where a lower portion of the gumbo is described as presenting evidence that an upper portion had been pushed along over the lower, should not be overlooked. Such a relation has been used elsewhere as part of the evidence that an underlying drift is sub-Aftonian. Here the underlying drift is Kansan. This is the first time the writer knows of that such evidence has been presented of two movements in the Kansan itself (including the gumbo as a part of the Kansan drift.)

In places the low ground gumbo does not belong to the Dallas deposits but is a worked-over Dallas deposit washed from the higher ground along ravines and into the low ground, where a deposit similar to the gumbo of the upland may be found without a trace of stratification.

The brownish, laminated clay charged with plant fibers near Coon Valley (No. 3), and that crumbly and iron stained deposit without plant fibers near Hartford, seem related in time and possibly in conditions of deposition. The lower boundary of each is hard to distinguish from the gumbo; but the deposits are easily distinguished from the overlying silt-like deposits in the places named. They seem to mark varying conditions in an old land surface. In places dark bands appear at the surface, and in places traces of oxidation.

The loess. Distinct loess is only found in the northern portions of the area. The general difference between the brown and the gray portions seem due to weathering. It is also recognized that during the deposition great changes in climatic conditions took place which might affect what was surface at that time. Such is the similarity between weathered gumbo and weathered loess that it may be a portion of the soil in the southern part of the area should be described as partly loess; the deposit there immediately beneath the soil is gumbo.