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PLEISTOCENE EXPOSURES IN CEDAR RAPIDS AND VICINITY.

W. D. SHIPTON.

Lying as it does near the border of the Iowan drift sheet, in hilly country deeply eroded by Cedar river, it might be expected that the city of Cedar Rapids would contain interesting exposures of Pleistocene deposits. Since any geological description of the region was published, the stripping of quarries, cutting of streets, etc., has led to the creation of many new exposures. Some of these will prove more or less temporary in their nature, and it is in the belief that no time should be lost in making permanent records of them, that the descriptions herein contained are here presented. Acknowledgments are due Doctor Gow for his many valuable suggestions and corrections in the writing of the paper.

The North Western quarries are situated directly south of Cedar Rapids just east of the Chicago and North Western railway line. To the west of the tracks there is a slope of a few rods to Cedar river. The quarries consist of a row of deeply eroded hills, which vary greatly in height. The rock was formerly used for building purposes, but at present it is used entirely for railway ballast, it being crushed at the quarries. The following geological strata are found here:

7. Alluvium
6. Loess
5. Buchanan gravels
4. Kansan drift sheet
3. Fayette breccia
2. Kenwood shales
1. Wapsipinicon limestone—Otis beds

The Wapsipinicon exposure consists of the Otis beds. It is very compact, especially near the base; but graduates upward into thin layers of shale. The rock ranges from a light drab to a brown or reddish color. It may assume a light grey color upon weathering. It is very crystalline in character. Much calcite is found in the massive form and occasional pockets are found which consist of whitish, translucent, hexagonal crystals. Seams of calcite are numerous. Lying unconformably upon the Otis are the Kenwood shales. These have been discussed by geologists as the Independence shales, but, although they have the same geological position, they are different in character. Also the Independence shales fauna is not to be found here. There is a sharp line of separation be-

tween the Otis and the Kenwood. Near the north end of the quarry are several hills which consist almost entirely of Fayette breccia. This breccia, according to Norton, consists of fragments of Davenport limestone embedded in Cedar Valley. It is a conglomerate mass of limestone pebbles, nodules and fragments cemented firmly together. As the matrix is composed of Cedar Valley limestone, the breccia is fossiliferous.

The Kansan drift sheet begins the Pleistocene part of the exposure. Many interesting and peculiar formations are found here. The Kansan is a very coarse granular clay. Upon being exposed to the weather it assumes a dark yellow color. This is an old Kansan gully.

Immediately above the Kansan comes a band of Buchanan gravels, ranging in thickness from six inches to two feet. The gravel is very coarse and consists of the usual material. The stratification is very distinct and has a typical red coloration. The strata follow the contour of the hill. This is possible, as the stripping cuts at right angles to the old Kansan gully.

The loess is very fine-grained and is of a soft silky material. It is ashen in color. Near the top of the exposure, the loess assumes a heavier color owing to the vegetation and ground water, which have that effect upon it. The texture becomes very nearly that of the Kansan drift, although it is not so coarse. In the western part of the state the weathered Kansan drift has been mistaken for loess, as reported by Gow, and the texture of the weathered loess is certainly much like that of the Kansan. The loess of this exposure varies in thickness from several feet to about twenty feet. It is thicker at the top of the hill than in the valley regions. The reason for this is that when it was deposited it was deposited equally in the valley and on the hill, but the power of erosion is greater in the valley and thus the loess has been eroded faster, leaving a greater amount upon the hill. The concretions of lime carbonate, which are known as loess-kindchen, and which assume many peculiar shapes, are common in this particular formation. Ferruginous casts, which are known as pipe-stems, and are formed about rootlets, are also quite common. The stratification is distinct if carefully looked for. The lines are red and represent different stages in the development of the hill. Each streak probably originated as a band of vegetation which was later covered. The strata are thicker towards the summit of the hill and they follow the contour. Here is a good illustration of the æolian hypothesis. The material was furnished by the old river bars and was blown to its present position. The same is probably true of most of the loess banks of the Mississippi Valley. Upon the top of the loess is a band of recent alluvium, which ranges from one to three feet in thick-

ness. This covers only the gully and hillside, but not the summit of the hills.

Just across Cedar river and a little to the north of the North Western quarries are the Snouffer quarries. They consist of the same Otis beds, and also of the massive calcite, as well as the pockets of hexagonal crystals.

North of the Snouffer quarries is an old brick-yard. At this place we have an excellent exposure of about twenty feet of pure, fine-grained, yellow loess.

At Vernon Heights was an old quarry which had a vertical exposure of about fifteen feet of fossiliferous Fayette breccia. This quarry has lately been destroyed by filling and is now completely hidden from view. Scattered outliers of Fayette breccia are found along the Cedar Rapids and Marion railway.

Another excellent exposure of yellow loess is to be found in one of the cuts of the Mount Vernon Interurban, one mile east of Cedar Rapids. It is about twenty feet in thickness and is decidedly yellow in character.

On 13th street, between F and E avenues, we have an interesting exposure of Pleistocene sands. The sands are about fifteen feet above river level, and about one block from Cedar lake, which is an old ox-bow. The sands are distinctly stratified and represent the old sand bar of the river, the strata being horizontal. In point of age, of course, these sands are very recent.

At the end of 12th street, going north, is a very fine exposure of loess. The bank is about seventy-five feet in height and eight hundred feet in length. The particular thing of interest is that it is nearly all gray loess. In some places yellow loess enters in. But where we find the gray loess alone it is very pure. The color, however, is not constant. Loess-kindchen are very common, some of which attain a very large size. They are the largest that have been found by the writer in Linn county. Vegetable matter is found nearly forty feet below the top of the bank. This would indicate that at one time that was the surface of the exposure. Throughout the loess is stained with iron in large quantities. Here is a good example of how a loess bank will retain its vertical slope under the direct action of weathering. This exposure is only four years old, the rest of the hill having been removed for ballast by the Rock Island railway. There has been very little weathering and the exposure stands as originally made.

On the west side of Cedar Rapids, at the Chandler Hill, is a peculiar formation. At the foot of the hill, or the present ground level, we have

the upper surface of the Kansan drift capped by a thin stratum of Buchanan gravels. Just above this is a thin strip of unstratified Iowan sands, probably about four feet in thickness. This is distinctly Iowan, because of the large unrotten boulders. About one block to the south of this exposure is a clay bank forty feet in height and consisting altogether of typical Kansan drift. The upper level of this is, therefore, forty feet above the Buchanan at the base of the hill. Again to the southwest we have a thick strip of Buchanan gravels, which is just opposite the Chandler home and is thirty-five feet above the Kansan exposure just mentioned. The intermediate ground has been built over and cannot be successfully studied. The situation at first glance would indicate that the Chandler gravels are post-Iowan. But after carefully studying them, the conclusion must be drawn that they are Buchanan. The boulders are rotten, so rotten that a spade will go right through them; they are all well rounded, and a very large amount of iron is in the exposure. The gravels are, therefore, too old to be post-Iowan. They must, then, be Buchanan. Now the question comes, how is it possible that less than three blocks away we find the same Buchanan gravels seventy-five or eighty feet lower, all connecting evidence being destroyed? This surely cannot be the work of erosion. The conclusion is simply this: As the Iowan glacier advanced, it crumpled the Buchanan gravels up ahead of it. The gravels were probably frozen and were, therefore, crumpled up to their present position. A similar case of this kind, but on a much smaller scale, has been described by Leighton at the Iowa river crossing of the Interurban railway running between Cedar Rapids and Iowa City.

At the top of B avenue hill, east of the river and about the same level as the Chandler exposure just mentioned, but about two miles distant, we have a twelve-foot cut. The lower part consists of stratified and partially cemented sands about three feet thick. Above come seven or eight feet of granular joint clay, which does not contain any pebbles or gravels whatever. There is no trace of stratification, either aqueous or æolian. It has been deeply invaded by roots of grasses and trees, and is to be interpreted as loess whose consistency has been altered by weathering. The underlying sand is probably immediately postglacial in origin, so that the crest of the hill may be taken as forming a portion of the old post-Iowan outwash plain, and is interpreted as being of Peorian age.

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