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THE LAMINATED PLEISTOCENE SEDIMENTS OF THE CEDAR RAPIDS REGION*

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In the vicinity of Cedar Rapids there are extensive deposits of laminated sands within, and adjacent to the valley of the Cedar River and its tributaries. These lie above the till of the Iowan Substage and are associated for the most part with the highest terrace found along the Cedar River and its tributaries in Linn County. The presence of the laminated sediments has been noted by others, but no detailed study appears to have been made of them in the region of Cedar Rapids. During the active building program in Cedar Rapids many exposures were made in basement excavations and furnished a good opportunity for study.

Norton (1895) has briefly described the laminated deposits as preloess sands which, "In origin seem intimately connected with the wash of the till by the water of the melting ice sheet and with the fluvio-lacustrine conditions and slack drainage of the loess epoch which followed." Shipton (1914) described an exposure of "distinctly stratified" sands at 13th street, between E and F avenues in Cedar Rapids, and concluded they were of Pleistocene Age. They were about fifteen feet above the Cedar River, and he decided that they represented an old sand bar. This particular exposure no longer exists, but numerous excavations in that vicinity have shown that the stratified sands described by Shipton are the same type of deposits as are reported in this paper. Leighton (1914) also described (Plate X) a similar deposit in a tributary valley of the Iowa River. Like those in the Cedar valley, the laminated sediments were exposed in a terrace and capped by loess. The deposits are described as of glacial origin, being formed in an overloaded stream or where existed a decrease in gradient. Kay and Miller (1941) have described the Iowan terrace gravels to considerable length and noted their stratification, but have not described the finer sediments in the Cedar Rapids region.

When these laminated sediments were first examined by the senior author, they appeared varve-like, though they were in structural detail definitely unlike such sediments. The laminations are alternately light and dark in color and extend horizontally many feet through the exposures. The laminae vary in thickness from a

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small fraction of an inch to nearly a foot and are sharply defined. The darker laminae generally contain finer sediments than the lighter laminae. Further investigation has shown that all of these deposits are not horizontal, but also occur dipping at angles of 15° to 25° like the foreset beds in a delta. Also the composition of the horizontal laminae has been found to vary from silt to cobble gravel.

At present about forty of these exposures have been examined in Linn County. Nearly all are in the valley of the Cedar River and its tributaries. Most of them are in the highest terrace of the Cedar River system, although a few are above this terrace, and are located in what probably were depressions in the Iowan drift plain. All of the deposits showing laminations were found to be covered by a mantle of loess that varies in thickness from several inches to about three feet.

Two good exposures are now present at Van Vechten Park (Fig. 1) and in the quarry directly across the river above the city sewage disposal plant (Old Snouffer Quarries). In both exposures only horizontal lenses are present, though they show a slightly undulating character. The thickness of the deposits is approximately twelve feet, and they are underlain by Iowan glacial drift.

A study of the highest terrace of the Cedar River and its tributaries shows that this terrace on the northward side of the river extends back into the outwash plain of the Iowan ice. This indicates that the age of the terrace deposits is Pleistocene, and their deposition was apparently as suggested by Leighton (1914). Near the Cedar River the highest terrace is approximately forty feet above the present water level.

If the laminated sediments have resulted from melt-water deposition, it would appear that the sediments should be coarser in the vicinity of the moraines. This apparently is the explanation for the coarse, laminated deposits found in the highest terrace in the meander scar of Squaw Creek, in Section 29, Township 83 N., Range 6 W. The moraine of the Iowan ice is about one-fourth mile from the exposure. The lighter colored laminae are composed of cobble gravels, with cobbles ranging up to four inches in diameter. The darker colored laminae are composed of pebble gravel and sand (Fig. 2).

During the retreat of the Iowan ice the valley of the Cedar River was evidently swollen and in places more than a mile wide, as is shown by the areal extent of the highest terrace. Into this swollen river flowed overloaded tributaries of which Cold Stream was one. As the Iowan ice melted back, the length of Cold Stream was extended and it became much braided. Deltaic sediments were laid down in standing or slack water. Subsequently, these glacial sediments were incised and formed the high terrace along the Cedar River and up the channels of the tributary valleys. The discovery of typical deltaic beds of the foreset and topset types in the valley of Cold Stream (Sec. 8, Township 83 N., Range 7W.) (Figs. 3 and 6) led to a stream table experiment which would simulate as closely as possible the development of that valley. The soil used in the experiment came from an excavation on the Coe College campus, and is the same material as the laminated sands. A slope about 10 feet long with a gradient of about 3 degrees was built. This ended in water four inches deep. The depth of the water was controlled and water was supplied from a city main and direeted by a rubber hose of one-half inch diameter. The rate of flowage was about one-half gallon per minute. This constructed topography appears to be similar to that upon which the valley of Cold Stream was formed when the Iowan ice began its retreat. The first experiment was run for a period of three weeks. During that time an extensive delta was built up in the water. The stream bed was cut down and later the channel near its mouth was partially filled with sediments. Terraces appeared in the stream-table channel and islands on the delta. The water tank was then drained and the delta was allowed to become partially dry before sectioning was begun. The first section was made longitudinally through the medial part of the delta (Fig. 4). This section showed very diagrammatically the structure of top, fore, and bottomset beds. It was possible to trace many topset beds across the delta to their inclination as foreset beds, and along the bottom of the tank as bottomset beds (Fig. 5). Near the upper end of the delta many of the foreset beds were truncated and overlain by topset beds similar to those shown in the Cold Stream deposit (Fig. 6). The most outstanding feature of this and other sections was the structural similarity of the laminated deposits to those found in the high terraces of the Cedar River.

The second run of the stream table experiment was done with the same material and a similarly constructed topography. However, the speed of the water was increased to about 2 gallons per minute and sediment was fed into the channel at the nozzle of the hose. This increased the load of the stream and built up the delta more rapidly. The experiment was run for one week. After the delta had reached considerable size, it became a subaerial feature upon which distributaries meandered. The tank was drained and the sediments were allowed to become partially dry. Then a medial longitudinal section was cut through the delta and some distance up the channel of the stream. The deposits again showed characteristic deltaic bedding. Again the similarity of the laminations in the stream table deposits and those of the Cedar valley were very striking. The laminae or lenses of silt, sand, and gravel were as definite as they are in the field, and every form that has been seen in the field has been found in counterpart in the delta or channel deposits of the stream table. The alternating lenses of coarse and fine silts appeared to be due to differential sedimentation, i.e., the coarser, lighter colored sediments were deposited in distributaries of greater volume and velocity than when finer, darker colored silts were deposited. These conditions resulted as the main distributaries meandered from side to side across the delta plain.

It is noted above that the Pleistocene laminated deposits are capped by a loess mantle. The graduation of the sub-aqueous and aeolian deposits is imperceptible. Some of the early aeolian silts were apparently deposited in water, and finally, as the Iowan ice retreated and channels were cut into the flood plain, true loess was formed on the terraces. Subsequent down cutting of the Cedar River channel has caused the formation of the high terrace. The lower terraces all appear to be without a mantle of loess indicating their later age, and the time during which the loess mantle of the high terrace was deposited.

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EXPLANATION OF PLATES I AND II

Fig. I. Exposure of laminated sediments in the highest terrace of the Cedar River in Van Vechten Park of Cedar Rapids. The laminae are overlain by subaqueous silt and capped with approximately three feet of loess.

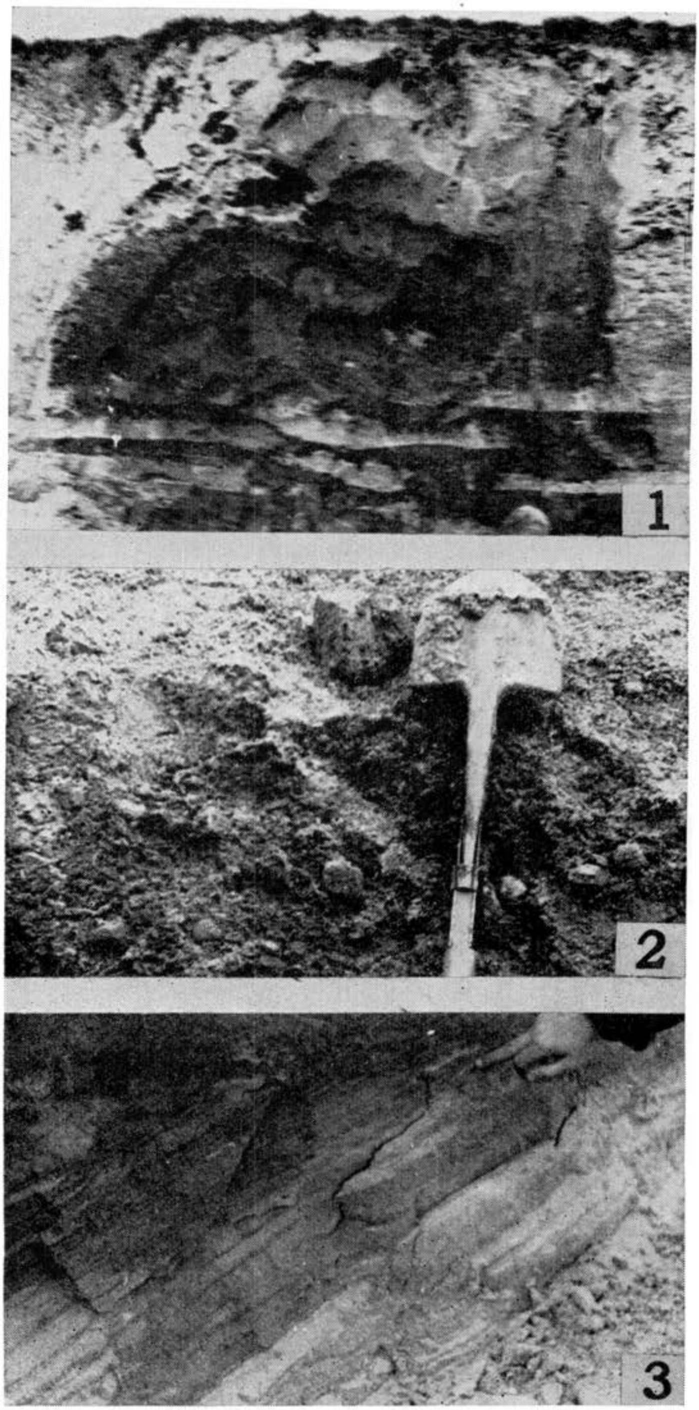
Fig. 2. A lamina of pebble and cobble gravel exposed in the highest terrace of Squaw Creek. Only a lighter colored lamina is shown.

Fig. 3. Foreset beds exposed in the highest terrace of Cold Stream. These dip at angles of 15° to 25° downstream and are overlain by nearly horizontal topset beds.

Fig. 4. Longitudinal section through the stream table delta deposit showing the character of bedding.

Fig. 5. Longitudinal section of the stream table delta, showing bottomset, foreset and topset beds. It is suggested that the exposures illustrated in Figures 3 and 6 are of the type of sedimentation shown in the stream table deposits.

Fig. 6. Exposure of nearly horizontal laminae in the highest terrace of Cold Stream valley, showing the light and dark colored beds in contact with truncated foreset beds. This exposure was located near that shown in Figure 3.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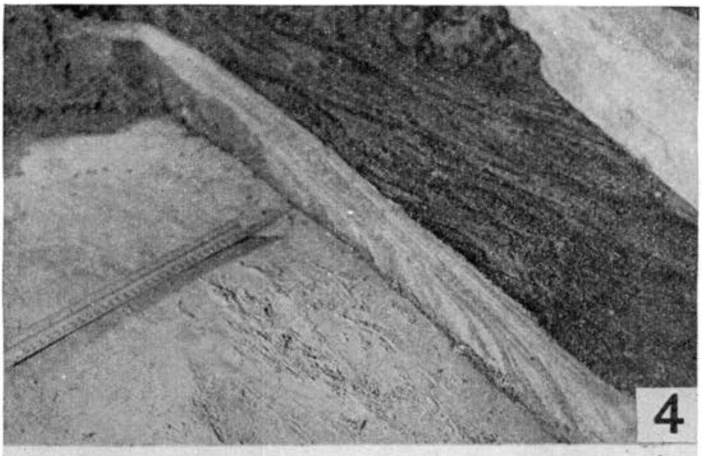
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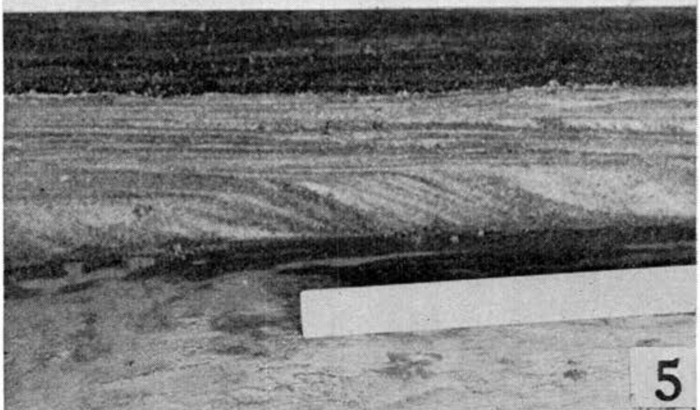
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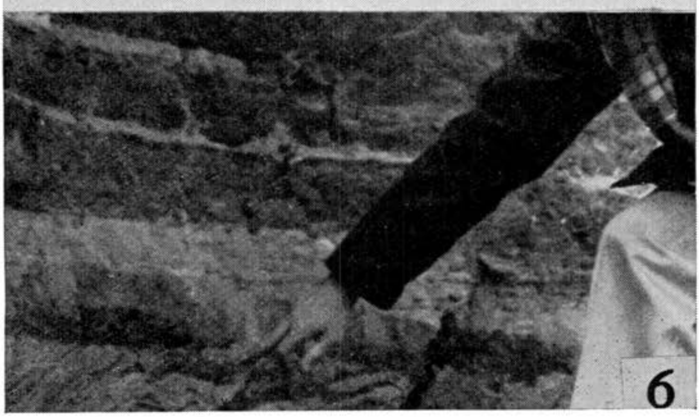
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