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The Buchanan Gravels: An Interglacial Deposit in Buchanan County, Iowa

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fauna, and its record of anomalous conditions of deposition. In the field the distinction between the Le Claire and the Anamosa stages are even more easily recognized, though faunally the two stages are intimately related. In the Anamosa stage oblique bedding is unknown; lithologically the rock is an earthy, finely and perfectly laminated dolomite, not highly crystalline in its typical aspect, and too impure for the manufacture of lime. It may be quarried in symmetrical blocks of any desired dimensions, while the Le Claire limestone breaks into shapeless masses wholly unfit for building purposes. The quarry beds of the Anamosa stage are quite free from fossils, but along the Cedar river in Cedar county the brachiopod fauna of the upper part of the Le Claire reappears in great force in a stratum four feet in thickness, up near the top of the formation. The beds of the Anamosa stage are very undulating, and dip in long, graceful, sweeping curves in every possible direction. The knobs and bosses and irregular undulation developed on the sea bottom as a result of the peculiar condition prevailing during the Le Claire age, persisted to a greater or less extent after the age came to an end, and it was upon this uneven floor that the Anamosa limestone was laid down. The puzzling flexures of the Anamosa limestone, and the puzzling variations in altitude at which it occurs, were largely determined by irregularities in the upper surface of the Le Claire formation.

THE BUCHANAN GRAVELS: AN INTERGLACIAL DEPOSIT IN BUCHANAN COUNTY, IOWA.

BY SAMUEL CALVIN.

About three miles east of Independence, Iowa, there are cross-bedded, water-laid deposits of sand and gravel of more than usual interest. The beds in question occur near the line of the Illinois Central railway. The railway company indeed has opened up the beds and developed a great gravel pit from which many thousands of carloads have been taken and used as ballast along the line.

Overlying the gravel is a thin layer of Iowan drift, not more than two or three feet in thickness, but charged with gray

granite boulders of massive size. Some of these boulders may be seen perched on the very margin of the pit, and some have been undermined in taking out the gravel and have fallen to the bottom. The surface of the whole surrounding region is thickly strewn with Iowan boulders. It is evident that the Iowan drift sheet was spread over northeastern Iowa after the gravels were in place.

These sands and gravels are now so incoherent that they may be excavated easily with the shovel, and yet there is no evidence that the glaciers that transported the overlying boulders and distributed the Iowan drift cut into them, or disturbed them, to any appreciable extent. The Iowan ice sheet was probably thin, and all the loose surface materials in front of its advancing edge were frozen solid. The thickness of the gravels is somewhat variable, owing to the uneven floor upon which they were deposited, but it ranges from fifteen to twenty feet. The beds have been worked out in places down to the blue clay of the Kansan drift.

Throughout the gravel bed, but more particularly in the lower portion of it, there are numerous boulders that range in diameter up to ten or twelve inches. These boulders are all of the Kansan type. Fine grained greenstones predominate. Proportionally large numbers of them are planed and scored on one or two sides. Those that are too large to be used as ballast are thrown aside on the bottom of the excavation, and in the course of a few seasons many of the granites and other species crumble into sand. The contrast between the decayed granites of the Kansan stage and the fresh, hard, undecayed Iowan boulders in the drift sheet above the gravels, is very striking. Many of the boulders from the gravels are coated more or less with a secondary calcareous deposit, a feature not uncommon among boulders taken directly from the Kansan drift sheet in other parts of Iowa.

As to their origin the Buchanan gravels are made up of materials derived from the Kansan drift. As to age they must have been laid down in a body of water immediately behind the retreating edge of the Kansan ice. There are reasons for believing that the Kansan ice was vastly thicker than the Iowan, but the temperature was milder, and so when the period of melting came enormous volumes of water were set free. That strong currents were developed is evidenced by the coarse character of the material deposited as well as by the conspicuous

cross bedding that characterizes the whole formation. Some of the larger boulders found at various levels throughout the beds were probably not directly transported by currents, but by floating masses of ice. While, therefore, the gravels lie between two sheets of drift, and for that reason may be called interglacial, probably Aftonian, they yet belong to the time of the first ice melting, and are related to the Kansan stage of the glacial series as the loess of northeastern Iowa is related to the Iowan stage.

While the Illinois Central gravel pit is the typical exposure of the Buchanan gravels, the same beds are found widely distributed throughout Buchanan, Linn, Jones, Delaware and probably other counties. One exposure that has been utilized for the improvement of the county roads occurs on the hilltop a mile east of Independence. Another, used for like purposes, is found a mile and a half west of Winthrop. The county line road northeast of Troy Mills cuts through the same deposit. Throughout the region already indicated there are many beds of similar gravels, but in general they are so situated as not to show their relations to the two beds of drift.

The Buchanan gravels, it should be remembered, represent the coarse residue from a large body of till. The fine silt was carried away by the currents and deposits of it should be found somewhere to the southward. It may possibly be represented, in part at least, by the fine loess-like silt that forms a top dressing to the plains of Kansan drift in southern Iowa and regions farther south.

RECENT DISCOVERIES OF GLACIAL SCORINGS IN SOUTHEASTERN IOWA.

BY FRANCIS M. FULTZ.

The discoveries of localities showing glacial scoring in southeastern Iowa have been somewhat numerous during the last few years. In a paper presented before this body a year ago¹ I called attention in detail to the different known exposures

¹Glacial Markings in Southeastern Iowa. Proc. Ia. Acad. Sci., Vol. II, p. 213. Des Moines, 1895.