The Contact Between the Glenwood and Platteville Formations*

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Introduction.—Several phenomena at the contact of the Glenwood and Platteville formations have considerable significance. This contact is exposed along a line between Minneapolis, Minnesota, and Guttenberg, Iowa, along an arc through southwestern Wisconsin, and in the Oregon-Dixon area of Illinois. The Glenwood formation overlies the St. Peter sandstone and underlies the Platteville dolomite.

Difference in lithology between the upper Glenwood and the lower Platteville formations.—The Glenwood formation,[1] varying in thickness in exposures between 0 and 29 feet, is separated from the St. Peter sandstone by an erosional disconformity with a maximum relief of at least 45 feet. The St. Peter sandstone, therefore, was locally emergent throughout the deposition of the Glenwood formation and continuous into Platteville time.

The Glenwood formation is characterized by: (1) Diversity of rock types, grading from sandstone through shale to sandy dolomite, and (2) a peculiar texture of the sandstone.[2] A typical section of the formation in the vicinity of Oregon is as follows:

		Thickness Feet
(1)	Soft green shale	5½
(2)	Argillaceous sandstone	5½
(3)	Very sandy dolomite and dolomitic sandstone	12
(4)	Argillaceous sandstone	6

The green shale formation of the upper Glenwood contains more or less sand, principally in the lower half but locally in the upper half.

The lower Platteville formation consists of buff to brownish-gray dolomite which locally contains argillaceous and sandy layers, some local beds having a sand content of 77 per cent. Sandstone pebbles and phosphatic nodules occur in the basal Platteville beds which are more or less fossiliferous with brachiopods, gastropods, and triblobites, whereas the green shale beds of the upper Glenwood formation are sparingly fossiliferous with *Lingula*.

The contrast in lithology indicates a contrast in environments during the deposition of the Glenwood shale and the Platteville dolomite. Shallow muddy waters prevailed during Glenwood deposition and more

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or less clear waters existed during the deposition of the Platteville dolomite.

Rounded pebbles of sandstone in the basal Platteville dolomite.—Locally in the vicinity of Oregon, more or less rounded pebbles of sandstone varying from 3 to 12 mm. in the longest dimensions occur near the base of the Platteville dolomite. The interstices of the aggregates are filled with dolomite similar to the enclosing rock. All the grains of sand are of the St. Peter type, well-rounded and frosted. These show that the St. Peter sandstone was emergent during the deposition of the lower Platteville.

Phosphatic nodules in the basal Platteville dolomite.—The phosphatic nodules occur in a zone 10 to 30 inches thick in the basal dolomite, sandy dolomite, and dolomitic sandstone of the Platteville formation. This zone has been traced over a wide area in the Upper Mississippi Valley. The matrix beds are more or less pyritic and fossiliferous. The nodules, varying in shape and size, are of three types: (1) Gastropod molds, (2) varicolored and more or less glossy nodules, and (3) phosphatized and pyritized aggregates of sand.

Pettijohn[3] observed phosphatic nodules associated with large limestone pebbles and "corrosion surfaces" in dolomite or limestone in the basal Platteville formation near Minneapolis. The phosphatic pebbles, which are partly fragments of gastropods and brachiopods, are largely black and contain many fine crystals of pyrite. He postulated that during a period of non-deposition, following a period of normal limestone deposition, phosphoric acid was formed by the solution of shells and other carbonates in the limestone, and that this reacted under anaerobic or reducing conditions with ammonia generated by decaying organic matter to form phosphates, the sulphides accounting for the black color. He concluded that since phosphatic pebbles are associated with a period of non-deposition, they indicate disconformities.

In contrast to these observations on the basal Platteville beds, the writer has observed no limestone pebbles or corrosion surfaces or any evidence to indicate that the deposition of limestone preceded the period of non-deposition. It is believed, therefore, that it is not necessary for the deposition of limestone or dolomite to have preceded the period of non-deposition in order to produce conditions favorable to the formation of phosphatic nodules. The very first deposits of Platteville age are without fossils and contain only a few phosphatic nodules. The most abundant nodules are often in a very fossiliferous bed. It is postulated (1) that phosphorus, ammonia, and hydrogen sulphide were derived from the solution and decay of organic matter rich in phosphorus in amounts proportional to the rate of destruction of life, and (2) that the phosphates were precipitated under reducing conditions[4] about nuclei of undissolved phosphatic material within or outside of shells.

According to Aberdeen,[5] who studied the phosphatic pebbles at the base of the Decorah, the formation of the phosphates followed a period

of non-deposition brought about by the development of a profile of equilibrium. She postulated that the phosphates resulted from certain chemical reactions caused by the decay of life destroyed by a change of environment. These conditions would be equally applicable to explain the phosphatic nodules in the basal Platteville dolomite. The diastem or unconformity thus indicated by the presence of phosphatic nodules in the basal Platteville dolomite is further confirmed by the lack of gradation from Glenwood to Platteville beds.

Phosphatic nodules and disconformities are found at the base of the Platteville, Decorah, Galena,[6] Maquoketa,[7] and Edgewood[8] formations. This occurrence is significant and indicates that stratigraphic breaks may be located by the occurrence of phosphatic nodules.

Conclusions.—(1) The Glenwood and Platteville formations are separated by a disconformity, shown by: (a) The difference in lithology; (b) rounded pebbles of sandstone in the basal Platteville dolomite; (c) phosphate nodules in the basal Platteville dolomite.

(2) An historical resume is as follows: (a) Final deposition of the upper shale of the Glenwood formation; (b) a period of non-deposition; (c) change of relations of land and sea; (d) deposition of dolomite, sands, clays, and pebbles accompanied by a partial destruction of life, the decay of animal matter, and the precipitation of phosphatic nodules and pyrite; (e) normal deposition of Platteville dolomite.

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