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A STUDY OF THE CHERTS OF THE OSAGE SERIES OF THE
MISSISSIPPIAN SYSTEM.

BY FRANCIS M. VAN TUYL.

The presence of a considerable amount of chert in the Burlington and Keokuk limestone members of the Osage series has been the cause of frequent comment, but no critical study of the material has ever been made.

The chert attains its maximum development in the upper division of the Burlington limestone known as the Montrose chert. But nodules and inconstant seams of the same material appear, also, in the lower levels of the Burlington and frequently characterize the Keokuk limestone. In the latter formation, however, the chert is found at no definite level and is entirely wanting at some localities.

The present investigation was confined mainly to a study of the Montrose chert, although some attention was given to the chert from other horizons.

Outcrops of the Montrose chert may be studied satisfactorily in the neighborhood of Augusta, Iowa. But excellent facilities for studying the unweathered chert were afforded, also, in the power plant excavation at Keokuk. Discontinuous bands and lentils of chert ranging up to 18 inches, or more, in thickness occur at this level.

Crinoidal limestone is associated with the chert of this age and at times this may predominate, but usually the chert is in excess. In some layers chert is the dominant constituent and it often incloses pockets and rounded masses of limestone. On the other hand, layers of limestone inclosing nodules of chert frequently appear. Between these two types of occurrence there is every gradation.

The crinoidal texture of the limestone, and even its color, are sometimes faintly exhibited by the chert, and occasionally fragments of the stems of crinoids and other fossils, which may or may not be silicified, are imbedded in the material. Some of the chert, however, shows no trace of fossils although it may occur in a very fossiliferous limestone. Megascopically, the contact of the chert with the limestone seems to be fairly abrupt, but chemical and microscopic studies of the material show that the silica permeates the limestone some distance back from the contact. Upon weathering, the chert cleaves from the limestone on account of differential expansion and contraction, and if calcareous fossils are present these are soon dissolved out to leave moulds. Exposure, also, tends to render the chert brittle and rotten and large masses sometimes break down readily into heaps of small angular blocks.

Microscopic study of the material shows it to be for the most part, of the chalcedonic variety of quartz, but some of the silica is apparently in an opaline condition.

With respect to the origin of the cherts of the Osage series there have been differences of opinion. Hovey¹, who made a study of the cherts of Missouri for the Missouri Geological Survey, examined some material from this horizon.

His general conclusion is that the cherts are due to chemical precipitation, probably at the time of the deposition of the strata in which they occur, or before their consolidation. No good evidence of the existence of silica secreting organisms was found by him in the cherts.

Buckley and Buehler² regard the chert of the Burlington and Keokuk limestones of southwestern Missouri as being in part an original precipitate and in part a secondary product resulting from the silification of the limestone. By them the fossiliferous chert is thought to have been deposited contemporaneously with the limestone, while the chert which contains fossils is regarded as a replacement product.

The evidence gathered by the writer during his investigation of the cherts of this area supports the view that the material has resulted entirely from the replacement of the limestone. The fossiliferous nature of much of the chert and the gradation of chert through siliceous limestone to pure limestone substantiates this view. Furthermore, the irregularity and discontinuity of the chert bands and nodules argues strongly against any theory which regards the chert as original. The evidence of the secondary nature of the chert is also strengthened by the occurrence of isolated patches of limestone completely surrounded by chert. Such remnants clearly suggest a former continuity of the limestone.

The time of the replacement of the limestone is not well known, but it is believed that the process must have proceeded contemporaneously with the recrystallization of that rock.

The source of the silica is a matter of conjecture. Little is known, as yet, concerning the possible existence of silica secreting organisms in the Osage seas. Microscopic study of several thin sections of chert from the Burlington and Keokuk formations revealed the presence of a few sponge spicules in only one sample. It is probable, therefore, that much, if not all, of the silica is of inorganic origin, having been deposited in a colloidal condition upon the bed of the sea while the limestone was being formed.

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