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[*Paper G*]

THE STRUCTURE, LITHOLOGY AND GENESIS OF THE
MAGNESIAN SERIES OF THE NORTHWEST-
ERN STATES

[ABSTRACT]

By C. W. HALL

An investigation of the dolomites of the upper Mississippi river valley was begun more than a year ago.* The studies to follow have been only in part carried out. This paper, presented at the meeting of the Academy held December 6th, 1892, contained historical matter, a discussion of the method of the study pursued, and a presentation of some microscopic results. In view of the writers' intention to take up again the lines of experimentation and examination begun, and the lack of space in this Bulletin, at the present time only a summary is given of the points discussed and the results then set forth.

But that some of the results of the field work and necessary comparisons may be available, it is thought best to present a key to the nomenclature of the Magnesian series. This is given on the basis of the naming applied in the paper of the authors just cited. The names were derived by an historical process and are apparently in undisputed use at the present time. In order that the formations may be recognized in the field under the names assigned to them and that the literature may be used without confusion, this key has been prepared. Dr. F. W. Sardeson has assisted in its tabulation.

*The general results of the investigation have been published elsewhere owing to the unavoidable delay in the publication of this Bulletin. For these results the reader is referred to "The Magnesian Series of the Northwestern States," by C. W. Hall and F. W. Sardeson, Bulletin Geol. Soc. America, Vol. VI, 1895, pp. 167-198, with one plate.

Of the names which occur in the Minnesota Geological and Natural History Survey Reports, the meaning is as follows :

ST. LAWRENCE means St. Lawrence,

in the Second Annual Report (1873), p. 152.
 in the Final Report, vol. 1 (1884), p. 424.
 " " " 2 (1888), p. xxi.
 " " " " p. 70.
 " " " " p. 119.
 " " " " p. 160.
 " " " " p. 381.

ST. LAWRENCE means Oneota,

in the Fourth Annual Report (1875), p. 32.
 in the Fifth " " (1876), p. 29.
 in the Final Report, vol. 1 (1884), pp. 217-223.
 " " " " p. 254.
 " " " " p. 282.

JORDAN means Jordan

in the Second Annual Report (1873), p. 47.
 in the Final Report, vol. 1 (1884), p. 426.
 " " " 2 (1888), p. 21.
 " " " " pp. 70-71.
 " " " " p. 121.
 " " " " p. 161.
 " " " " p. 138.

JORDAN means New Richmond Sandstone,

in the Fourth Annual Report (1875), p. 35.
 in the Fifth Annual Report (1876), p. 28.
 in the Final Report, vol. 1 (1884), pp. 217-221.
 " " " " p. 252.
 " " " " p. 284.
 " " " " p. 335.

MAGNESIAN LIMESTONE means Oneota,

in the Final Report, vol. 2 (1888), p. 21

LOWER MAGNESIAN means Oneota,

in the Final Report, vol. 2 (1888), pp. 9, 12, 36.
 " " " " pp. 70-72.
 " " " " p. 409.

LOWER MAGNESIAN means Oneota, New Richmond and Shakopee together,

in the First Annual Report, (1872), pp. 78, 80.
 in the Fourth " " (1875), p. 32.
 " " " " p. 87.
 in the Final Report, vol. 1 (1884) p. 253.
 " " " 2 (1888) p. 124.
 " " " " p. 162.

- MAIN BODY OF LIMESTONE** means Oneota and Shakopee,
in the Final Report, vol. 2. (1888), p. 382.
- NEW RICHMOND** or **RICHMOND** means New Richmond,
in the Final Report, vol. 2 (1888), p. 9, 11, 37.
" " " " p. 80-83
" " " " p. 388.
- SHAKOPEE** means Shakopee formation,
in the Fourth Annual Report (1875), p. 38.
in the Fifth Annual Report (1876), p. 26.
in the Final Report, vol. 1 (1884), pp. 217-219.
" " " " p. 252.
" " " " p. 285.
" " " 2 (1888) p. 21.
" " " " pp. 9, 10, 38.
" " " " pp. 70-73.
- SHAKOPEE** means Oneota, New Richmond and Shakopee together,
in the Second Annual Report (1873), p. 138.
in the Sixth Annual Report (1877), p. 120.
in the Final Report, vol. 1 (1884), p. 336.
" " " " p. 429.
" " " 2 (1888), p. 124.

In the Wisconsin Geological Survey reports, especially the Final Reports of the Survey of 1873-1879, the name Potsdam sandstone is uniformly used for all the formations from and including the Jordan sandstone downwards into the Cambrian. The name Madison beds or sandstone is consistently used for an upper part of the Potsdam, and also the name Mendota beds or limestone for the next lower part. As now known, these two formations are equivalent to the formations in Minnesota, respectively Jordan (syn. Madison) sandstone and St. Lawrence (syn. Mendota) formation. Unfortunately the rules of nomenclature here require the newer names to yield. The change can be easily applied because the displaced names were consistently used in relation to the geologic formations. Detailed citation is therefore not necessary.

The name Lower Magnesian limestone is applied in the Wisconsin reports without discrimination between the upper, Shakopee, and lower, Oneota, dolomite, both of which formations the name covers, excepting by one author, L. C. Wooster (vol. 4, 1882, p. 106), who distinguishes the Lower Magnesian proper (i.e., Oneota) from the Willow River beds (i.e., Shakopee) and designates the sandstone between them New Richmond.

In Iowa the small extent of surface exposures is productive of fewer descriptions. The name Potsdam sandstone included all formations below the Lower Magnesian limestone, and the name Lower Magnesian covered all rocks to the St. Peter sandstone until recently. McGee uses the name Oneota for the formation exclusive of the Shakopee and New Richmond.* Charles R. Keyes follows McGee in his studies of the current year.†

The further topics of the paper are summarized as follows:

1. In Minnesota there are two well defined dolomite formations, Oneota and Shakopee. Below these is a great thickness of sandstone and green shales into which a few stray bands of dolomite enter and give dolomitic character to certain layers of the St. Lawrence. Above the Shakopee, after more than one hundred feet of sandstone, comes the Galena series characterized by a weakening of the dolomitic habit through the occurrence of a limestone with less than fifteen per cent. of magnesium carbonate.

2. A marked faunal break separates the St. Lawrence formation from the sandstone beneath; another break occurs between the Oneota and Shakopee, the two dolomites named above, and a third between the Shakopee and St. Peter sandstone. These three faunal breaks establish at least three faunas and three corresponding time divisions between the Algonkian and the St. Peter (Chazy).

3. Below the St. Lawrence, and extending downwards to Algonkian rocks, lies a sandstone, generally a very pure quartz sand but locally of a varying composition, which is recognized by paleontologists as upper Cambrian. Above the upper Cambrian lies the Lower Calciferous, carrying the St. Lawrence sandstone, shale and dolomite; the Jordan sandstone and the Oneota dolomite; then follows the upper Calciferous consisting lithologically of the New Richmond sandstone and Shakopee dolomite.

4. The clean, purely quartzose condition of the sandstone formations associated with the dolomites, together with the semi-

*The Pleistocene History of Northeastern Iowa, by W. J. McGee, Eleventh Ann. Rep. Director U. S. Geol. Survey, 1890, part. I, p. 332.

†The Geological Formations of Iowa, by Charles Rollin Keyes. Iowa Geological Survey, Vol. I, First Ann. Rep. for 1892. Des Moines, 1893, p. 23.

crystalline character of the shales associated with them, leads to the conclusion that the dolomites and all associated rocks must have undergone extensive chemical changes.

5. The dolomites assume many interesting characters. The development of rhombohedral grains is a very general process; the structure of the rhombohedra presents many crystallographic features; locally too, the formation of a siliceous oolite is equally characteristic of the Shakopee.

December 6, 1892.

[*Paper H*]

METEOROLOGICAL STATISTICS

By WILLIAM CHENEY

These statistics are the result of personal Meteorological Observations, made at Minneapolis, Minnesota, by William Cheney, voluntary observer United States Weather Bureau since 1864. The tables here given cover the period from 1883 to 1894 inclusive and are followed by a Summary of mean weather conditions and dates of maximum and minimum temperatures.