TYPICAL LOWER MISSISSIPPI VALLEY SILURIAN LITHOLOGY IN SOUTHEASTERN WISCONSIN

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Introduction. Silurian rocks of Niagaran age cropping out in the lower Mississippi valley possess a peculiar lithology which serves readily to identify them. The strata commonly are of argillaceous limestones with a dense to finely crystalline texture associated with a limited occurrence of shales. In the lower half or third of the section the most distinctive lithological feature is a mottled coloration, irregular areas of greenish gray resting in a matrix of deep red.

Above the reddish facies the limestones are persistently a pale green, thin and platy patches of shale are interbedded, and the mottled areas are purple and much less conspicuous. The limestone of the upper beds is comparatively soft and earthy. Near the top of the type section of the Bainbridge limestone in Missouri the gray to pale green limestones grade virtually into a clay near the contact with the Helderbergian rocks.

Lithology of the general nature indicated above is persistent in the Niagaran Series of the lower Mississippi River drainage area and is represented from western Tennessee through southern Illinois and in scattered outcrops as far west as the Arbuckle Mountains. The lithologic features identify the Niagaran strata in a general way, but gradational changes from one formational unit to another are more difficult to detect.

Lithology of Niagaran rocks in the upper Mississippi basin. The Silurian strata in the northern states are well known for their dolomitic character, their massive bedding, and for the common blue-gray to buff coloration which prevails. Chert is fairly plentiful and the fossils, when present, are larger and more conspicuous than in the southern part of the valley.

The coloring of Niagaran rocks near Burlington, Wisconsin. Limited and local coloring effects in the lower part of the Niagaran strata in Wisconsin have been noted occasionally by observers however, and several references appear in the literature.[1] Some of the red color is in strata immediately overlying the iron deposits at or beneath the base of the Silurian, but Alden[2] in 1918 noted that reddish strata lying higher than those associated with the iron deposits had been penetrated by the wells of southeastern Wisconsin. Alden[3] was unable to see the ocherous rocks in place, but described the general color effects from fragments. Inasmuch as the strata are well exposed at present, but chiefly because of the strong resemblances to Silurian lithology in the Lower Mississippi Valley, a brief description of the exposure is offered in this paper.

Red, shaly dolomite in the Burlington Quarry. The quarry is one mile west of Burlington in the NE¼ NE¼ sec. 36, T. 3 N., R 18 E., Spring Prairie township. It is on the east bank of White River, a small stream draining Lakes Como and Geneva. The surroundings are of great natural beauty and evidently the drift is very thin over the thin-bedded dolomite exposed in the quarry. The quarry is opened to a depth of about 26 feet, but only the upper 17 feet are exposed clearly in the quarry face. A generalized section of the east face of the quarry shows the strata as tabulated in table I.

Floor of Quarry. Above surface of pond, reported to be 20 feet deep, well bedded strata rising for 3 or 4 feet, are seen. These strata are slightly more massive and apparently of a light yellow to greenish color, faintly marked in bands.

The Fauna. Fossils are gathered in sparse numbers from these rocks, the Wisconsin Reports listing about one-half dozen from this locality,[4] although the quarry long has been famous for its rather large specimens of *Bumastus imperator* (Hall). Units 5 and 10 of the above section are known to contain micro-fossils. George E. Burpee,[5] working under the direction of R. T.

Shrock, has noted a foraminiferal zone extending through a depth which evidently takes in the horizon of this quarry and which in persistent thickness he has recognized in other wells. Fragments of other fossils in some abundance have been recognized by Burpee, including a predominance of brachiopods in about the horizon of the No. 10 unit in the section. Unit No. 5 of the section contains a fragment which is probably *Bumastus imperator*, and that fossil is reported by the quarrymen as coming from rocks at or below the present floor of the quarry.

Distribution of red and mottled dolomites in Wisconsin and Illinois. Investigators have noted the frequent occurrences of red strata in the wells of southeastern Wisconsin which are not associated with the iron-bearing strata at the base of the Silurian. Occasional red stains in the Niagaran have been observed elsewhere, particularly Brillon, but these occurrences will not be traced further in this connection.

TABLE 1.—SECTION IN BURLINGTON QUARRY, NE¼, NE¼ SEC. 36, T 3 N., R. 18 E., SPRING PRAIRIE TOWNSHIP, WISCONSIN.

Silurian System, Niagaran Series:	Thickness		Depth	
	Feet	Inches	Feet	Inches
12. Dolomite, in beds averaging 2½ inches in thickness, dense, yellowish gray with faint traces of green and black		8		8
11. Dolomite, in 2 to 3 inch beds, dense, with color bands up to ½ inch in thickness, colors faint shades of gray or green	2	2	2	10
10. Dolomite, shaly, colors about the same as in unit above, the shaly portion near the base in large, wavy sheets, bedding surfaces covered with a network of long ridges and furrows, resembling algal remains; small brachiopods		8	3	6
9. Dolomite, thin-bedded, indistinct bedding laminae, dense, earthy, deep green with occasional lighter bands, a more purple banding near the base	1	2	4	8
8. Shale, grading laterally into green, platy dolomite, the shale light green, with limonite and manganese stains		½	4	8½
7. Dolomite, shaly, dark green, poorly laminated		5	5	1½
6. Dolomite, shaly, dull gray, weathering to a deeper greenish color		1½	5	3
5. Dolomite, flaggy, laminated, with planes of the laminae showing mottled coloring, pink in an area of green, fossil fragments and solution pits from which fossils have disappeared	3	1	8	4
4. Dolomite, earthy, compact, greenish gray		6	8	10
3. Dolomite, a somewhat massive bed, compact, resistant, with prominent color bands, greenish gray alternating with pink above, but near the base, in a band 4½ to 5 inches thick, a deep red color appears	1	1	9	11
2. Dolomite, thin-bedded, compact, colors not vivid, but in bands of faint green, and a less vivid red than above; some concretion centers and calcitic vugs	2	2	12	1
1. Dolomite, in slightly thicker beds, banded colors of deep red, alternating with bands of yellow, yellowish green and limonite; bedding surfaces show mottled patches of grayish green in a field of red similar to the Dixon or Bainbridge formations of Missouri	5	10	17	11

Several interesting occurrences of the same type of colored dolomites have been observed in northern Illinois. C. L. Bieber has directed the writer to old quarry workings in Aurora in the north part of the city and on the west bank of the Fox River. Here, specimens of a thin-bedded dolomite, a deep red in color, have been secured. A few blocks of a brick-red, flaggy dolomite have been built into abutments along Highway 25, south of Batavia. L. E. Workman[6] has located rock of this character in two of the quarries near that city. He reports, also, that an Aurora well shows the red rocks about 20 feet above the top of the Alexandrian Series of the Silurian. A quarry operating in a silty, thin-bedded yellow dolomite is situated several miles south of Belvidere, Illinois, but this Silurian rock is said to be Edgewood in age.[7]

Age of the reddish dolomites. In some Silurian studies emphasis naturally has been placed upon the convincing evidences for northerly communications during middle Silurian times.[8] Other investigators have considered the probabilities for open connections southerly during the same Period.[9] The evidence as supported by the macro fossils is not very satisfactory, as far as it has become known, to supply much detail concerning communication channels. Evidence afforded through microscopic studies, on the other hand, is becoming more convincing. The work of Dunn, Priddy, Workman and others suggests that, on the basis of evidence afforded by microscopic organisms of a mobile nature, and on the basis of insoluble residues, details of correlations are coming within reach.

Workman[10] has found that specimens from the Burlington quarry submitted by the writer, and which include those from Nos. 1 and 12 of the section, include the numerous foraminifera discovered by Burpee. Mr. Workman also finds the specimens from the Burlington quarry to be identical with those examined earlier by him from the Batavia quarries. This seems to establish the age of the Burlington quarry rock as Osgood, according to Workman's earlier determinations.

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[1] Thwaites, F. W., Recent discoveries of Clinton iron ore in eastern Wisconsin; U. S. G. S. Bull. 540, p. 341, 1912.

[2] Alden, W. C., The Quaternary geology of southeastern Wisconsin, with a chapter on the older rock formations: U. S. G. S. Prof. Paper 106, pp. 89-90, 1918.

[3] Op. cit., page 90.

[4] Chamberlin, T. C., Geology of Wisconsin, Vol. II, Pt. II, Geology of eastern Wisconsin, pp. 372, ff, 1877.

[5] Burpee, G. E., Insoluble residues of the Niagaran Series in Wisconsin, unpublished Master's Thesis, University of Wisconsin, 1932.

[6] Workman, L. E., personal communication.

[7] Kremer. Frank, and Lamar, J. E., Limestone resources of Illinois: Ill. Geol. Surv. Bull. 46, p. 93, 1925.

[8] Weller, Stuart, The Paleontology of the Niagaran limestone in the Chicago area: Chi. Acad. of Sciences, Bull. IV, Part I, pp. 12-22, 1900.

[9] Ulrich, E. O., Revision of the Paleozoic Systems: Bull. G. S. A. 22, pp. 485-486, 1911.

[10] Workman, L. E., Contributions to correlations of Silurian Systems in northeastern Illinois through study of insoluble residues: Bull. G. S. A., vol. 50, No. 12, Part 2, p. 2015, 1939. (Abstract) and personal communication.