COMPARISON OF SEVERAL DECORAH HORIZONS IN NORTHERN ILLINOIS

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The shales and shaly limestones between the Galena and Platteville formations, by reason of their distinct lithology and fauna at the type locality, have been given the formation name Decorah[1]. This formation is widespread in the Mississippi Valley, and changes radically in thickness and appearance from outcrop to outcrop. As recognized by Aberdeen[2] and defined by Kay[3], the formation contains two members, the Guttenberg (Guttenberg, Iowa) and the Ion (Ion, Iowa). The Guttenberg includes part of the "Oil Rock", so designated by the miners, which has been described by Grant and Burchard[4]. At Decorah, Iowa and northward the Guttenberg is a greenish shale. However, in the type area one mile north of Guttenberg and southeastward for thirty miles, the member is distinguished by gray to b r o w n, sublithographic thin-bedded fossiliferous limestone with interbedded chocolate-colored shale interspersed between wavy bedding planes. The overlying Ion is characterized by calcareous shale and argillaceous limestone near the type section in northeastern Iowa, but it becomes a dolomite and is scarcely distinguishable from the basal Galena formation forty miles southeastward in the vicinity of Dickeyville, Wisconsin.

Three locations have been chosen for comparison where the Decorah horizons are not readily separated from the underlying Platteville and the overlying Galena formations. They are: (1) Rockford Quarry near the northwest limits of the city of Rockford, SE. ¼ sec. 15, T. 44 N., R. 1 E., Rockford Quadrangle; (2) roadside quarry at Lowell Park, three and one-half miles north of Dixon, Illinois, in the SE. ¼ NE. ¼ sec. 18, T. 22 N., R. 9 E., Dixon quadrangle; and (3) along the north bank of the Vermillion River, Lowell, Illinois, SE. ¼ sec. 8, SW. ¼ sec. 9, T. 32 N., R. 2 E., LaSalle and Ottawa quadrangles.

The basal Decorah is difficult to delimit because the Spechts Ferry, the upper member of the Platteville, is variable in thickness and lithology. In the three areas studied the Spechts Ferry member either is not recognizable or is not present, so that the upper Platteville "glass rock" zones come in contact with the Gut-

[1] Calvin, Samuel, Geology of Winneshiek County: Iowa Geol. Surv., vol. 16, p. 84, 1906.
[2] Aberdeen, E. J., the location of the break between the Galena and the Platteville limestone: M.S. Thesis, Northwestern University, 1931.
[3] Kay, G. M., Ordovician Mohawkian Ostracoda: Lower Trenton Decorah fauna: Jour. Paleontology, vol. 14, p. 234, 1940.
[4] Grant, U. S. and Burchard, E. F., Lancaster-Mineral Point Folio: U. S. Geol. Survey Geologic Atlas No. 145, p. 6, 1907.

FIG. 1.—Rockford City quarry, SE. ¼ sec. 15, T. 44 N., R. 1 E., Rockford quadrangle. The head of the hammer rests on a thin shale bed, unit 5 of the measured section.

tenberg member of the Decorah. Lithologically, and even faunally, no striking difference exists between the two. Eastward from the type area, the upper part of the Guttenberg-Ion sequence as defined by Kay[5] is a dolomitic limestone or dolomite, each outcrop varying in lithology. A species of a *Prosopora*, a usable marker in northeastern Iowa, has not been reported in the localities named. Gradational contacts between the upper Decorah and Galena are common in northern Illinois. In subsurface studies, the Decorah formation is recognized by its color, density, chert, and its shaly facies[6]. In these outcrops examined the shaly partings, though present, are not numerous.

A detailed measured section of the Rockford quarry follows.

The Spechts Ferry member of the Platteville formation either is not represented or is not recognizable. Beds 2-8 inclusive are regarded as the lower Decorah. The only lithological likeness to the type section Guttenberg member of the Decorah formation is in beds 5 and 6, which show a few shaly partings and wavy uneven bedding planes. Characteristic fossils are *Columnaria halli*, *Streptelasma corniculum*, and small *Strophomenids*. The Ion member in this quarry is even more difficult to recognize, if present at all. Beds 7-11 are sparingly fossiliferous and lithologically do not vary appreciably

[5] Kay, G. M., The Orodovician system in the Upper Mississippi Valley: Guidebook of the 9th Ann. Field Conference Kansas Geol. Soc., p. 289, 1935.

[6] Willman, H. B. and Payne, J. N., Geology and mineral resources of the Marseilles, Ottawa, and Streator quadrangles: Illinois Geol. Survey, Bull. 66, p. 65, 1942.

FIG. 2.—Roadside quarry 3½ miles north of Dixon, Illinois, at Lowell Park, SE. ¼ NE. ¼ sec. 18, T. 22 N., R. 9 E., Dixon quadrangle. The numbers are at the upper limits of the units.

from the Galena, which probably is present from No. 12 upward, if not from No. 9 upward. The Ion, if present, cannot easily be distinguished from the overlying Galena.

The Decorah sequence recognized at Rockford may be summarized as follows. Chert is common in beds 3, 8 and 9; the rock is a dolomite; fucoids are plentiful, but abundant near the top of bed 7; wavy beds and shaly partings can be distinguished; in the lower beds small amounts of carbonaceous shale give a bluish color.

A section restudied and measured at Lowell Park, near Dixon, is presented.

The Lowell Park section north of Dixon exhibits the transitional nature of the Decorah. Knappen[7] has called these beds the Lowell Park member of the Platteville, but states that they are of Decorah age. Here, as at Rockford, the Spechts Ferry member is not recognizable.

Bed No. 1 of the section probably is the uppermost "Blue"[8] of the Platteville. The rock is a sublithographic dolomitic limestone. Beds 2

[7] Knappen, R. S., Geology and mineral resources of the Dixon Quadrangle: Illinois Geol. Survey Bull 49, p. 54, 1926.
[8] Knappen, R. S., op. cit. p. 33.

(1) *Rockford Quarry (formerly Carrico Quarry), Rockton Avenue near the northwest city limits, SE. ¼ sec. 15, T. 44 N., R. 1E., Rockford Quadrangle, Illinois.*

		Thickness Ft.	In.
Galena formation			
15	Dolomite, buff, weathered, rotting; chert bands prominent in lower part*	25	
14	Dolomite, thin-bedded with chert; weathers buff	15	
13	Dolomite, buff, weathered; many gastropods; chert bands near top	7	6
12	Dolomite, buff, beds two to four inches thick, shaly partings prominent; fossiliferous with *Receptaculites* in the center of zone	5	8
Galena? or Ion member of Decorah formation?			
11	Dolomite, massive, gray-blue; forms upper blue bed of the quarry	2	5
10	Dolomite, thin-bedded, shaly	2	6
9	Dolomite, buff, massive, cherty, sparingly fossiliferous	5	3
Lower Decorah			
8	Dolomite, buff, beds three to six inches thick, very little chert	2	7
7	Dolomite, buff, beds about four inches thick, fossiliferous; *Strophomena* common and Streptelasma in basal twelve inches, fucoids	3	2
6	Dolomite, massive, blue-gray, carbonaceous, sparingly fossiliferous; *Streptelasma* near base; a few shaly partings	2	
5	Dolomite, shaly, iron-stained, wavy, fossiliferous; Echinoderm fragments, *Streptelasma*, and *Vanuxemia* present		3
4	Dolomite, buff, cherty, beds three to six inches thick; *Streptelasma* present	2	2
3	Dolomite, buff, thin-bedded, cherty, fucoidal; *Streptelasma*	3	6
2	Dolomite, gray, carbonaceous, dense	2	10
Platteville formation			
1	Dolomite, gray, dense, fossiliferous; *Trochonema beloitense* and *Lophospira bicincta* common	9	2

Covered, water in quarry pit pumped to low level.

* estimated

(2) *Roadside quarry and exposures three and one-half miles north of Dixon, Illinois, SE. ¼ NE. ¼ sec. 18, T. 22 N., R. 9 E., Dixon Quadrangle.*

		Thickness Ft.	In.
Galena formation			
	Covered cherty dolomite ¼ mile south along road, above No. 6.		
6	Dolomite, medium to thick beds, buff, cherty, dense, calcareous at base becoming more dolomitic near top with definite shaly parting below	5	10
Decorah formation			
Ion member			
5	Dolomite, calcareous, buff, fucoidal, cherty bands, thin to medium beds, silicified *Columnaria* and bryozoans present	7	6
4	Limestone dolomitic, massive, buff; a few chert nodules; *Columnaria* and *Streptelasma corniculum* present	6	8
Guttenberg member			
3	Limestone, dolomitic, buff to gray, thin-bedded, uneven, wavy; massive in upper eighteen inches	6	4
2	Limestone, buff, dense, 4 to 6 inch beds some of which are uneven and wavy; shaly partings, calcite vugs, small amounts of chert present; fossiliferous, *Streptelasma* present	6	10
Platteville formation			
1	Limestone, gray-blue, buff on weathered surfaces, beds four to eight inches thick, dense, glassy, bluish wavy shaly parting at top; pyrite present	2	7

Covered; Platteville limestone along banks of stream 25 yards north and approximately 20 feet below the level of the road-side quarry.

and 3 of the section are the equivalents of the Guttenberg member, based on lithologic similarities. Uneven dense wavy beds with shaly partings are characteristic, though not as easily detected as in the type area because of the variable thickness of the beds. Silicified fossils include *Streptelasma, Liospira, Zygospira,* and a few Echinoderm fragments. Beds 4 and 5 probably are the Ion. Lithologically these beds have little in common with the Ion of northeast Iowa. Number 5 is a striking fucoidal unit which is seen in the abandoned quarries in the northeast limits of the city of Dixon. This fucoidal zone may correlate with the number 7 horizon of the Rockford section. Number 6 is gradational into the typical Galena dolomite.

The suggestive Decorah horizons at Lowell Park may be summarized as follows. A definite lithologic change from Platteville below, but with gradation into the Galena above; gradual change from a limestone near the base to a dolomite above; chert is common throughout, but more plentiful in bed 5; fucoids range widely but are profuse in bed 5; *Streptelasma* and *Columnaria* are common fossils.

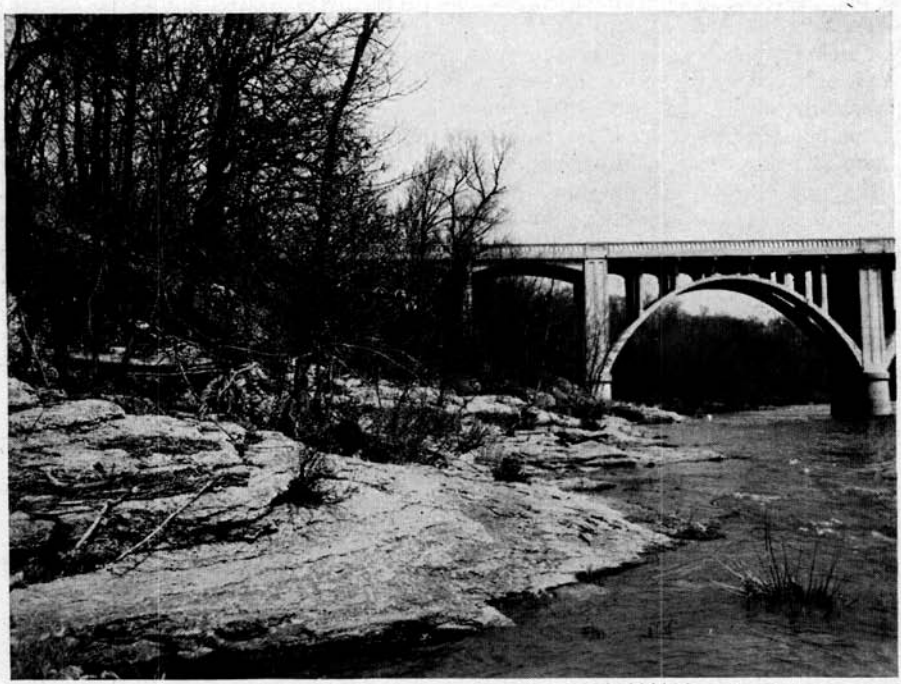

FIG. 3.—Decorah limestone along the Vermillion River at Lowell, Illinois, SE. ¼ sec. 8, T. 32 N., R. 2 E., LaSalle quadrangle. The black arrow is close to the Decorah-Galena contact, base of unit 12.

Ten miles southeast of LaSalle, the Vermillion River in cutting its valley across the LaSalle anticline exposes rock of Trenton age. This exposure may be followed upstream for nearly two miles from a point one fourth mile west of the old highway bridge. Beds dip from two to four degrees to the southwest, but east of the new highway bridge they are broken into great blocks and are greatly disturbed. Inaccuracy in measurements are possible, but the numbered beds do not appear to be repeated. The measured section (3) is given.

Bed No. 1 near the bend of the stream is the lowermost Decorah or the upper Platteville. Beds 2 through 6 are dense gray fossiliferous limestones with sparse amounts of chert. In lithology, as well as in the common occurrence of *Sowerbyella, Dalmanella,* and small *Rafinesquinas* these beds correlate with the Guttenberg of southwestern Wisconsin[9]. A lithologic break occurs at the base of bed No. 7, the rock becoming crystalline and massive upwards. The crystalline facies and the characteristic mottling, the presence of large *Rafinesquina* cf. *jeffersonensis* Bradley, and the many ramose bryozoans resemble Kimmswick lithology and fauna. The Ion horizon, as at Rockford and Dixon, is difficult to delimit. It possibly can be separated from the Guttenberg on lithologic grounds, but faunally the break is not distinct. Upward, the Decorah-Galena is gradational. A marked break occurs at the base of bed No. 12. Above the rock is less coarsely crystalline, more sparingly fossiliferous, and more massive. A zone of *Receptaculites* occurs eleven feet above the base of bed No. 12.

It is the opinion of the writer that the Galena and Decorah at this location represent a transitional phase between the Galena of northern Illinois and the Kimmswick of western Illinois and Missouri. The Ion member (beds 7-11) are correlated with the basal Kimmswick. The Decorah of Missouri probably should be correlated with the Spechts Ferry member or even lower in the Platteville, largely on the basis of the abundant presence of *Pionodema subæquata* in it, but it may extend into the Guttenberg.

[9] Bays, C. A. and Raasch, G. O., Mohawkian relations in Wisconsin: Guidebook of the 9th Ann. Field Conference Kansas Geol. Soc., p. 299, 1935.

TABLE OF ANALYSIS

	SiO_2	CaO	MgO	P_2O_5	R_2O_3	CO_2
Rockford No. 6*	3.8	29.8	20	tr.	1.09	45.34
Lowell Park No. 1	4.5	40.2	10.3	tr.	1.89	43.15
" " No. 2	4.84	49.7	2.81	tr.	.75	41.93
" " No. 6 (bottom)	5.60	26.90	18.90		.79	47.78
" " No. 6 (top)	2.50	30.20	20.40	tr.	.69	46.20
Lowell No. 3**	2.50	51.10	3.59		.49	42.35
" No. 11	.50	55.80	.59		.30	42.80
" No. 22	1.30	55.50	.17		.70	42.35

* Numbers refer to unit numbers of measured sections.
** 250 yards east of No. 5 of measured section, in bed of Vermillion River.

(3) *North bank Vermillion River, Lowell, Illinois, SE. ¼ sec. 8, SW. ¼ sec. 9, T. 32 N., R. 2 E., LaSalle and Ottawa Quadrangles.*

The higher beds dip westerly under the alluvium at about an angle of 3°.

		Thickness ft.	In.
Galena formation			
22	Limestone, similar to No. 21, *Receptaculites* at top	4	5
21	Limestone, buff, mottled, massive, solution pockets on weathered surfaces	2	6
20	Covered	1	
19	Limestone, massive, buff, mottled, solution pockets	1	4
18	Limestone, buff, beds four to eight inches thick	4	6
17	Limestone, gray, mottled, appears thin-bedded and spalls off on weathering	5	11
16	Limestone, gray-buff, medium to thin beds, fossiliferous with many ramose bryozoans	8	11
15	Limestone, massive, mottled, solution pockets, weathers buff	5	10
14	Limestone, gray, beds three to six inches thick; *Strophomenids* and ramose bryozoans profuse; chert	7	6
13	Limestone, buff-gray, mottled, solution pockets on the weathered surfaces; *Receptaculites* at the base	7	6
12	Limestone, buff-gray, mottled, thin beds, calcite vugs near top, becoming crystalline downward; small orthoceratites	10	10
Decorah formation			
Ion member			
11	Limestone, gray-buff, thin-bedded, mottled, crystalline; ten inch crystalline band prominent at base; fossiliferous, Echioderm stems, large ramose bryozoans, *Streptelasma corniculum* and *Dalmanella* common, faunal break at top	2	2
10	Limestone, massive, porous, mottled, pitted, Echinoderm fragments; two prominent crystalline bands eighteen inches apart in center, fauna similar to No. 11 above	6	6
9	Limestone, buff, mottled, crystalline	2	2
8	Limestone, buff-gray, massive, *Dalmanella* common	4	10
7	Limestone, heavy ledges, dolomitic, mottled, crystalline, porous, calcite vugs, fossiliferous; *Sowerbyella* and large *Rafinesquinas* cf. *jeffersonensis* Bradley common. *Rhynchotrema increbescens* at base	8	2
Guttenberg member			
6	Limestone, thin-bedded, crystalline, fossiliferous, spalls off on weathered surfaces, upper beds shaly	5	10
5	Covered, probably not over a few feet at most; area of uncertain dips.		
4	Limestone, medium to massive beds, cherty, fossiliferous; common fossils are *Sowerbyella, Dalmanella, Rafinesquina,* and trilobites including *Isotelus* and *Ceraurus*	12	6
	Note: About 300 yards east of No. 4 in a small ravine, three and one half feet of the same rock is exposed dipping two degrees to the west. The rock is limestone, gray, thin-bedded, cherty and fossiliferous; *Dalmanella* and *Sowerbyella* common; may represent the same horizon as No. 4 above.		
3	Dolomite, buff, cherty, nonfossiliferous	2	
2	Limestone, dense, glassy, beds three to six inches thick, slightly wavy; similar beds in the stream's edge a few yards to the west are cherty, and contain many small *Rafinesquina* as well as *Streptelasma* cf. *profundum*	2	2
Decorah or Platteville?			
1	Limestone, dolomitic, massive		10
	Covered, near bend in river approximately one mile east of the new Highway bridge.		

The Decorah formation at Lowell shows the following: Dense gray fossiliferous limestones at the base becoming more massive and crystalline upward; a moderate amount of chert in the lower beds and in bed No. 14; lower beds crowded with *Dalmanella;* the Ion member is difficult to delimit; upper horizons, especially the strikingly mottled beds, are suggestive of Kimmswick.

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