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SOME CHESTER OUTCROP AND SUBSURFACE SECTIONS IN SOUTHEASTERN ILLINOIS

BY

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UNUSUAL OOLITE GRAINS FROM THE STE. GENEVIEVE LIMESTONE

BY

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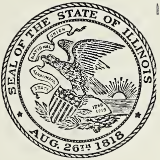

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SOME CHESTER OUTCROP AND SUBSURFACE SECTIONS IN SOUTHEASTERN ILLINOIS[1]

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INTRODUCTION

This paper is intended to aid studies of the Chester series by presenting electric logs of several formations alongside the descriptions of corresponding cores or outcrops, and, for the basal Chester, insoluble residue zones. For the electric logs, lithologic interpretations are shown in the central columns. For the cores and outcrops, the rocks are described in some detail. Fine dashed lines extending from the electric log to the graphic log are meant to draw attention to the similarities of succession. The locations of all wells, outcrops, and cores are shown on the index map of southeastern Illinois (fig. 1). The Chester formations illustrated include the Kinkaid, Degonia, Clore, Palestine, Menard, Golconda, and Renault (Downeys

[1] Published with permission of the Chief, Illinois State Geological Survey, Urbana, Illinois.

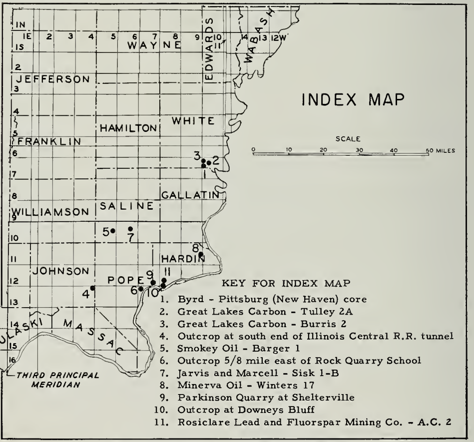

FIG. 1.—Locations of cores and outcrops

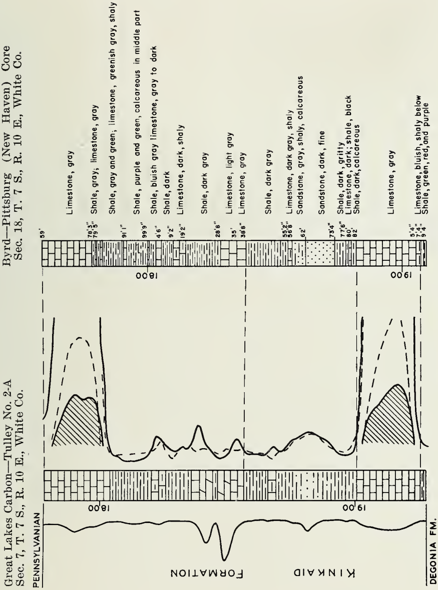

Fig. 2.—Kinkaid formation

Bluff and Shetlerville) formations.

Kinkaid Formation (Fig. 2)

The Kinkaid formation in the "New Haven" core (drilled in 1913 and described by Savage[2]) is shown graphically with the corresponding portion of the electric log of a well about 3/8 mile to the northeast.

The Kinkaid in the core is immediately overlain by Pennsylvanian sandstone and conglomerate and is underlain by the Degonia shown in fig. 3. Outstanding features of the Kinkaid in both core and electric log are the massive upper and lower limestones. The intervening portion includes some limestone in its central and sandstone in its lower part. At the base are a few feet of green, red, and purple shales.

Degonia Formation (Fig. 3)

The "New Haven" core and electric logs of nearby wells show three sandstone beds within 100 feet below the Kinkaid formation. Oil geologists in this area generally put the upper two beds in the Degonia formation, and the third bed in the Clore formation, as is done here. It is possible that when the Degonia formation is traced in detail from the type locality in western Illinois across to this area, the bounds shown here may be modified.

Clore Formation (Fig. 3)

The Clore formation in this area consists mainly of shale, shaly limestone, and sandstone. The prominent sandstone in the upper part is known to oil geologists as the "Clore sand." Commonly more green shale is encountered than is reported from the "New Haven" core.

Palestine Formation (Fig. 4)

The Palestine formation in the "New Haven" core is 105 feet thick and consists of sandstone except for about 5 feet of shale and shaly sandstone near the top, and minor shale laminae. The Palestine formation in southeastern Illinois generally is thinner than this, averaging about 55 feet, and it usually includes a larger proportion of shale.

Menard Formation (Figs. 4 and 5)

There is an unconformity below the Palestine formation, and in many parts of southeastern Illinois the Menard includes higher beds than are present in the "New Haven" core (fig. 4). The "massive Menard" occurs between the depths 2170′6″ and 2205′ in the core, and the "little Menard" between 2214′9″ and 2219′9″. The "little Menard" is often sandy in this part of the state.

Few electric logs are available near the Menard outcrop described by L. E. Workman[3] and shown in fig. 5. The formation is sufficiently uniform, however, for the electric log of the Smokey Oil-Barger No. 1 well, about 18 miles northeast of the outcrop, to show considerable similarity. Neither the upper nor the basal portions of the formation are exposed in the outcrop. The top of the "massive Menard" is at 63′11″ in the outcrop. In the well the Menard is underlain by shaly sandstone of the Waltersburg formation.

Separation of the basal Menard shale from underlying Waltersburg shale is usually difficult. Some geologists prefer to mark the base of the Menard formation by the base of the "little Menard" limestone.

Golconda Formation (Fig. 6)

The Golconda formation in south-

[2] Technical files, State Geological Survey, Urbana, Illinois.

[3] Field notes. L. E. Workman. State Geological Survey, Urbana, Illinois.

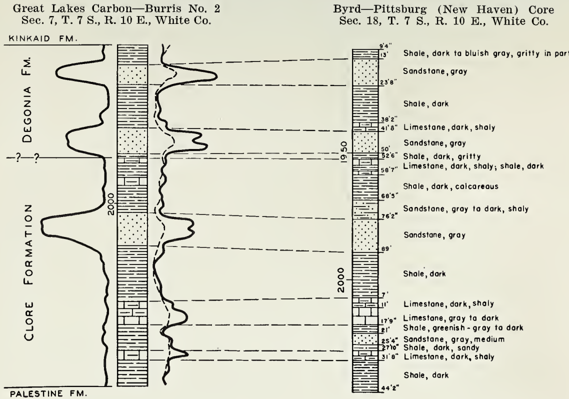

Fig. 3.—Degonia and Clore formations

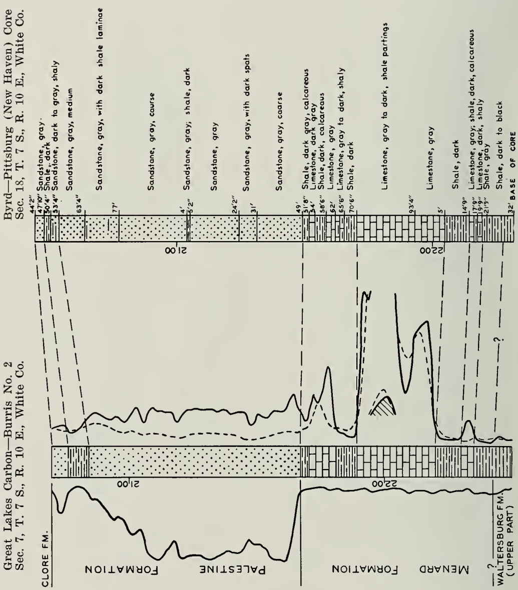

FIG. 4.—Palestine and Menard formations

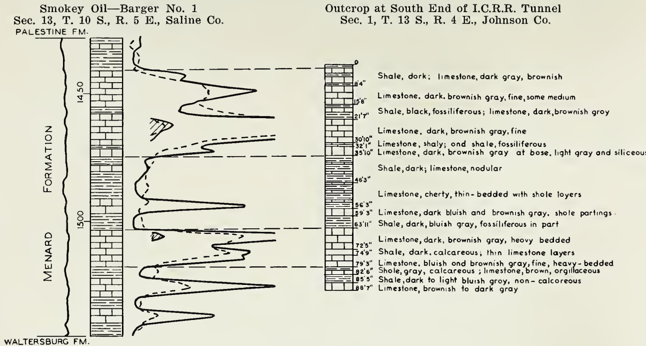

Fig. 5.—Menard formation

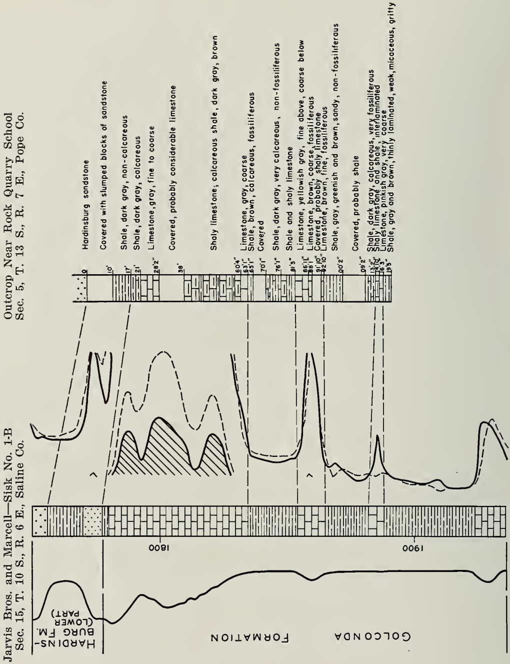

Fig. 6.—Golconda formation

eastern Illinois typically includes at the top dark gray, red, and green shales with thin, brown, sublithographic dolomite. The bulk of the formation consists of a zone which is dominantly limestone, underlain by a zone which is dominantly shale. At the base is the "Barlow limestone," with sometimes a few feet of basal shale. The "Barlow" is a thin extensive bed, often mapped to show subsurface structure. In the sections illustrated, most of the upper shale zone was eroded before deposition of the Hardinsburg formation. The "Barlow limestone" is shown in the electric log at the base of the Golconda. Samples show that in this well the "Barlow" is immediately underlain by dark gray silty shale and sandstone of the Cypress formation. The lower part of the Golconda is not exposed in the outcrop section described by L. E. Workman.[3]

The electric log is from a well located about 17 miles north of the outcrop.

Renault (Downeys Bluff and Shetlerville) Formation

(Figs. 7 and 8)

The lower part of the Chester in Hardin County has been called the Renault formation. Frank Tippie[4] correlates the upper part of the Renault with the basal Paint Creek of western Illinois, and has proposed the name "Downeys Bluff" for this member of the Paint Creek, based on the type section shown in fig. 8 and located at Downeys Bluff in NW¼, SE¼, sec. 5, T. 13 S., R. 8 E. The remainder of the Renault is here referred to as the Shetlerville member.[5]

The Downeys Bluff and Shetlerville are illustrated by an electric log (fig. 7), the outcrop section at Shetlerville[6] (fig. 7), Tippie's type section for the Downeys Bluff[4] (fig. 8), and the core[6] (fig. 8) from which he describes insoluble residue zones of the Renault formation.[7] Tippie subdivides the Renault into five zones, A to E, based on insoluble residues. These zones are shown for the core and approximated for the electric log and two outcrop sections.

In the electric log (fig. 7) it is impracticable to pick the contact of the Shetlerville on the underlying Levias member of the Ste. Genevieve formation, so the position of this contact is estimated. In the Parkinson quarry section (fig. 7), the sublithographic limestone at 15 to 18.5 feet is correlated with the sublithographic limestone at depth 223.8 feet in the core (fig. 8), and therefore is placed in the C zone of the Shetlerville formation.

Acknowledgments

Mr. A. H. Cronk, Superintendent, Rosiclare Lead and Fluorspar Mining Company, Rosiclare, Illinois, has given permission to describe the lithology of part of the core from the Rosiclare Lead and Fluorspar Mining Company—A. C. No. 2 diamond drill hole. Thanks are extended to various members of the Illinois State Geological Survey for their help.

[3] Field notes. L. E. Workman. State Geological Survey, Urbana, Illinois.

[4] F. E. Tippie, Subsurface Stratigraphy of Lower Chester Formations in Parts of Illinois and Western Kentucky. Ill. State Geol. Survey, unpublished manuscript.

[5] cf. Lexicon of Geologic Names of the U. S., U. S. G. S. Bull. 896, p. 1985.

[6] Described by F. E. Tippie, Technical files, State Geological Survey, Urbana, Ill.

[7] F. E. Tippie, Insoluble Residues of the Levias and Renault Formations in Hardin County, Illinois: Trans., Illinois State Acad. Sci., Vol. 36, No. 2, December 1943, p. 155.

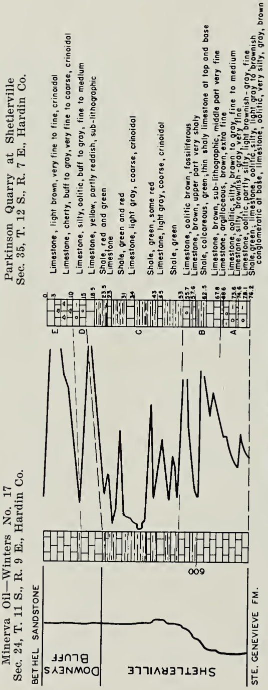

Fig. 7.—Renault (Downeys Bluff and Shetlerville) formation

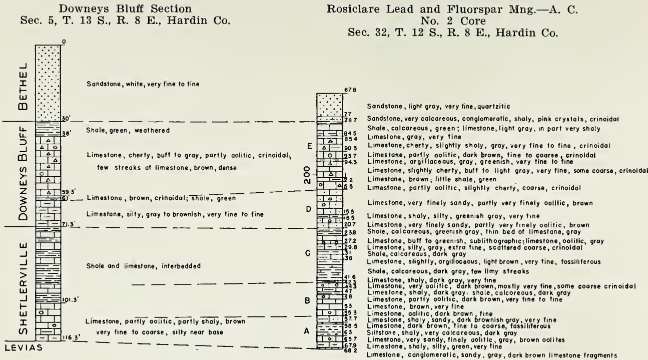

FIG. 8.—Renault (Downeys Bluff and Shelterville) formation

UNUSUAL OOLITE GRAINS FROM THE STE. GENEVIEVE LIMESTONE*

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In connection with other studies of Illinois limestone resources it was noted that a massive bed of oolite, 6 to 8 feet thick, in the upper part of the Ste. Genevieve formation in the quarry at Anna, Illinois, contained oolite grains and other grains of unusual character as compared to the common Ste. Genevieve type oolite grains, which are characterized by rounded centers, mostly of undeterminable origin surrounded by one or more annular calcite deposits. Pictures of a number of these unusual grains are included. No attempt is made to interpret the origin of the grains themselves, or their broader significance in relation to the mode of formation or subsequent history of the Ste. Genevieve formation, because the data now available are inadequate, but some interesting possibilities are self-evident from the pictures (figs. 1-6).

The specimens studied were prepared by sawing and grinding a plane surface on each, and etching the surface with dilute hydrochloric acid. This produced a semi-polished finish which revealed well the textural details of the specimens. Insoluble impurities projected above the surfaces of the specimens. The figures shown are made from photomicrographs taken by reflected light at magnifications of 12 to 30X, except as otherwise noted.

The unusual grains observed may be classified into five groups: (1) oolite grains with recognizable fossils as centers; (2) compound oolite grains; (3) grains composed of oolite rock; (4) oolite grains with clear crystalline calcite centers; and (5) partial or disrupted grains. The number of photomicrographs shown for each type of grains is not necessarily proportional to the numbers occurring in the samples studied.

Heinz Lowenstam of the Survey staff identified the fossils.

Description of Figures

Figure 1 is a photomicrograph of typical Ste. Genevieve oolite taken at a magnification of 10X. Some grains have large dark calcite centers surrounded by a single ring of calcite. Others have smaller centers with one or more annular deposits around the center. The dark areas between the grains are also clear crystalline calcite in this figure and other figures which follow.

Figure 2 shows grains of the type that have fossils as centers. In the upper left is an oolite grain composed of a foraminifera, possibly endothyra, surrounded by a single ring of calcite. In the lower left is a grain whose center is an arm plate of a crinoid having two annular deposits around it. Grains with crinoid arm plate centers are generally abundant in the Ste. Genevieve oolite. The grain in the upper right shows a longitudinal cross-section of a minute gastropod surrounded by a

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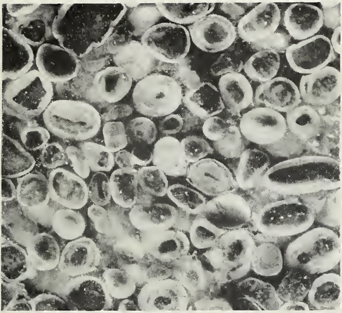

Fig. 1.—Typical Ste. Genevieve oolite.

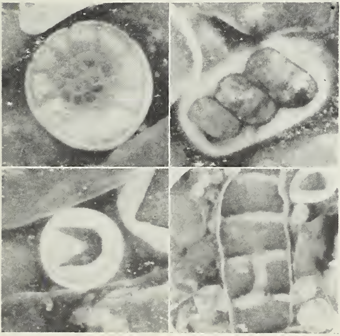

Fig. 2.—Oolites with recognizable fossil centers.

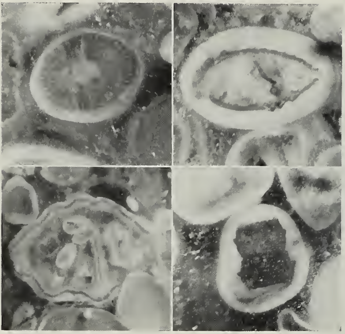

Fig. 3.—Oolites with recognizable fossil centers.

single thick calcite ring. The grain at the lower right is a fossil, not positively identified, but possibly a longitudinal section of a crinoid stem showing a residual central canal. Note the thinness of the calcite ring around this fossil. This last photomicrograph has a magnification of 12X as compared to 30X for the other grains shown.

Figure No. 3 shows more grains with fossil centers. In the upper left is a cross-sectioned coral with a single calcite ring. A transverse cross section of a brachiopod with a single thin white calcite ring is shown in the lower left. The interior of the brachiopod contains other smaller oolite grains. In the upper right is another brachiopod in longitudinal cross section surrounded by a thick deposit of calcite, as is likewise a piece of crinoid stem in the lower right, which is displayed in longitudinal cross section. All grains shown have a magnification of 30X.

Figure No. 4 shows in the upper left a compound oolite grain having two well defined centers surrounded by annular calcite deposits. A third center appears on the right side of the grain. The outermost thin calcite ring surrounds this third center as well as the rest of the composite grain. The other grains shown in the figure are oolite rock. They have no annular deposits around them and appear to have been derived from a consolidated oolite which was being eroded at the time the bed from which these specimens came was deposited. The oolite grains within the fragments of oolite rock are of the type previously described as usual for the Ste. Genevieve formation. The photomicrographs in

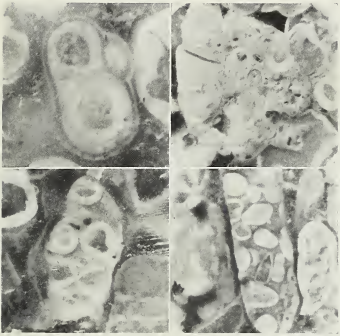

Fig. 4.—Compound oolite grain and grains of oolite rock.

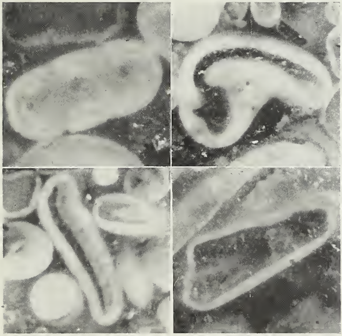

Fig. 5.—Compound oolite grain and grains with clear crystalline calcite centers.

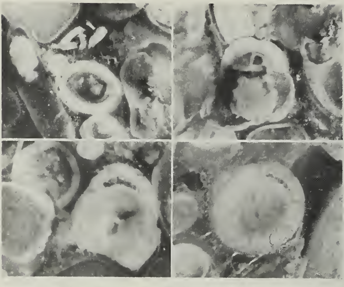

FIG. 6.—Partial grains and disrupted grains.

this figure have a magnification of 12X, excepting the upper left which has 30X.

Figure No. 5 shows in the upper left another compound grain with 3 centers, all enclosed by a calcite ring. The remainder of the figure illustrates oolite grains with clear calcite centers, which in the photomicrographs are dark gray or nearly black. The grain in the lower left is one whose center is only half crystalline calcite. The grain in the upper right appears to have had a brachiopod, shown in longitudinal cross section, as its center. The white calcite envelope on the concave side of the shell is of unusual thickness. The grain in the lower right is of interest because of its angular outline. The photomicrographs in this figure have a magnification of 12X.

Figure No. 6 shows the disrupted and partial grain type. In the lower left disruption of the exterior portion of the grain is evident, probably as a result of the growth of crystalline calcite, indicated by the dark area. The same phenomenon is shown in the grain at the lower right and in the upper left. Also in the upper left there appears the white calcite envelope of an oolite grain which has been broken and deformed and whose center is no longer evident. Partial grains, which appear to be the result of the solution of one grain at its contact with another, are well shown on the left side of the lower left picture. In the upper right picture, a series of two partial grains are shown. In the whole grain projecting silica casts a shadow on the surface. The photomicrographs in this figure have a magnification of 25X with the exception of the upper right which has 10X.

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