

THE PENNSYLVANIAN STRATIGRAPHY OF THE CARLINVILLE, ILLINOIS, QUADRANGLE*

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The northeast corner of the Carlinville quadrangle is at the intersection of 89° 45' west longitude and 39° 30' north latitude. This intersection is about one-half mile east of Virden and 20 miles south of Springfield.

Sedimentary rocks of Late Pennsylvanian age crop out in two general regions in the quadrangle. One region is in North Palmyra and South Palmyra townships and extends along Massa Creek and its tributaries nearly the length of the two townships. The other region of outcrops is in the vicinity of Carlinville, near the southern margin of the quadrangle, along Macoupin Creek and its tributaries.

THE CYCLOTHEMS OF THE QUADRANGLE

A number of cyclothem comprise the late Pennsylvanian (McLeansboro) rocks. Typically each cyclothem includes a coal and a marine limestone, but in this quadrangle the coals do not attain a conspicuous thickness, whereas the limestone is represented in all but one cyclothem.

When this quadrangle was mapped geologically in 1930-31 and the manuscript report written, the following cyclothem were recognized.

<i>Cyclothem</i>	<i>Approximate thickness</i>
Divide.....	9 feet
Upper LaSalle (now Upper Livingston).....	16 "
Lower LaSalle (now Lower Livingston).....	16-17 "
Upper Macoupin.....	7-12 "
Lower Macoupin.....	15-23 "

Centralia (Flannigan?).....	5 feet
Shoal Creek.....	35 "
Trivoli (exposed).....	34 "

Cyclothem exposures vary so greatly in thickness from place to place in the quadrangle that the above figures are but fair approximations of average thickness. In a recent recapitulation of cyclothem terms,¹ the Collinsville cyclothem occurs between the Trivoli and Shoal Creek cyclothem. At the time of completion of field work in this quadrangle, however, the Collinsville cyclothem had not been recognized in the vicinity.

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Trivoli cyclothem.—The full thickness of this cyclothem is probably not exposed in the quadrangle. Neither is the limestone present in the exposures, as it is in each of the other cyclothem. The cyclothem includes No. 8 coal, and in the dark shale above the coal *Lingula carbonaria* Shumard is abundant. Still higher in shale characterized by close-set joint planes is a species of *Aviculopecten* in considerable numbers.

Shoal Creek cyclothem.—This cyclothem is characterized by the absence of coal and by the presence of the most conspicuous limestone in the quadrangle, which has been called both Shoal Creek and Carlinville.² In the Carlinville and adjacent quadrangles, the name "Carlinville" is convenient and logical and in his studies in the quadrangle the author used the name "Shoal Creek" for the highest limestone in the quadrangle, mainly be-

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¹Weller, J. Marvin, Rhythms in Upper Pennsylvanian cyclothem: Trans. Ill. State Acad. Sci., Vol. 35, pp. 145-146, 1942.

²Payne, J. N., Structure of Herrin (No. 6) coal bed in Macoupin County, etc., Illinois: Illinois Geol. Survey Cir. 88, p. 5, 1942.

Ekblaw, Sidney, The question of the Shoal Creek and Carlinville limestones: Trans. Ill. State Acad. Sci. Vol. 25, pp. 143-45, 1932.

Worthen, A. H., Geology and Paleontology: Geol. Survey of Ill. Vol. VI, p. 3, 1875.

Weller, Stuart, The Geological Map of Illinois: Illinois Geol. Survey Bull. 1, p. 21, 1906.

Udden, J. A., Notes on the Shoal Creek limestone: Illinois Geol. Survey Bull. 8, pp. 118-119, 125, 1907.

cause an outcrop on an unnamed tributary to the West Fork of Shoal Creek in the outskirts of Litchfield contained numerous imbricated limestone fragments identified as belonging to that limestone.

The characteristic lithologic aspects of the lower limestone (the Shoal Creek) in this and nearby quadrangles are invariable. It ranges from 6 to 8 feet in thickness, and a shale parting, commonly about 8 inches thick, separates a lower foot of limestone from that above. Possibly this feature was not so obvious to the early investigators who saw the naturally weathered outcrops, before quarries fully exposed the somewhat massive aspects of the more recently modified faces. It varies from dark gray to almost black in some exposures, and its surface weathering color is a dark yellowish-brown. Its lower member commonly is even darker in color, is finely crystalline, and is frequently marked by widely diverging, more or less individually branching traces or imprints, possibly suggestive of a plant impression or of some crawling organism.

Fossils.—Fusulines have been included in the tentative list of fossils which has been written down for the quadrangle. However, Dunbar and Henbest have not noted them in the Shoal Creek,⁷ so to include them in the fossil list is possibly an error. Very common Pennsylvanian fossils have been secured from the limestone, but never in great abundance. The list follows: *Marginifera splendens*, *Neospirifer cameratus*, *Composita subtilita*, *Polypora* sp., *Astartella vera*, *Schizostoma cateloides*, *Naticopsis attonensis*, *N. torta*, and *Phillipsia* sp.

In the exposures in the northwest part of the quadrangle, in shales interbedded with the thinner limestones, species other than those in the above list have been found. Additional micro-organisms probably will be discovered. The following have been recognized: *Ammodiscus incertus*, species of *Tetrataxis* and *Tuberitina*, *Lingula carbonaria*, *Trigonoglossa nebrascensis*, *Orbiculoidea missouriensis*; *Euphemus carbonarius*, *Trepostira illinoisensis*, *T. sphaerulata*, *Nuculopsis ventricosa*, *Sphaerodoma primogenia* cf.

Centralia cyclothem.—The *Centralia* (Flannigan ?) cyclothem is not fully developed in the quadrangle. The coal and underclay are not represented. Where its limestone is in fullest development there are but few other lamina which seem properly to belong in this cyclothem. A maximum exposure of about 15 feet, in the east outskirts of Carlinville, is mostly sandstone and sandy shale with but little limestone. Some of this sandstone has the aspects of a channel sandstone.

Its limestone, however, is distinguished by the many fossil specimens it carries. Udden⁸ has a long list of species. From another outcrop than the one mentioned by Udden, Dr. Needham has made an extensive collection. Because of the brittle resistant nature of the reddish crystalline rock, perfect specimens are rarely obtained. Superficially the *Productid* element in its fauna makes it distinctive, but the rock probably contains many more forms of *Composita* than it does *Productids*. Prominent among the many exceedingly variable forms of *Composita* apparently is *C. trilobata* Dunbar and Condra. Probably *C. elongata* Dunbar and Condra also is present, its condition of preservation such that it frequently gives the impression that it is *Dielsma*.

Other fossils are: *Chonetes granulifer*, *Linoproductus prattenianus*, *Juresania nebrascensis*, *Composita subtilita*, probably other varieties of *Composita*, *Aviculopecten occidentalis*, and questionable species of *Myalina* ? and *Loxonema* ?. Stratigraphically, this exceedingly fossiliferous limestone is about 17 feet above the Shoal Creek limestone.

Macoupin cyclothem.—Wanless first published the name *Macoupin*⁹ without stating its derivation. From the abundant number of exposures of the limestone with its associated No. 9 coal on *Macoupin Creek* in the Carlinville quadrangle, the author in his field studies began to dub the limestone the "*Macoupin*." The cyclical application was first formulated by Dr. Wanless.

Of the several cyclothem in the quadrangle, the *Macoupin* probably is the best and most typically developed in a single exposure, in a short gully tributary to

⁷Dunbar, C. O., and Henbest, L. G., Pennsylvanian Fusulinidae of Illinois: Illinois Geol. Survey Bull. 67, pp. 13, 16, 1942.

⁸Op. cit., page 120. The "old Walker farm," the "Kirchoff farm," later.

⁹Wanless, H. R., Pennsylvanian section in Western Illinois: Bull. Geol. Soc. America Vol. 47, pp. 811-812, 1931.

Macoupin Creek, just north of Highway 4 and east of the crossing made by that highway over Macoupin Creek, in the NW. $\frac{1}{4}$ sec. 2, T. 9 N., R. 7 W., and sec. 35, T. 10 N., R. 7 W.

In addition to its display of the best developed coal in the quadrangle, the Macoupin cyclothem carries also a well-developed underclay. In this exposure the underclay is more than 8 feet thick, is structureless and bluish-gray, is calcareous except in the upper 9 or 10 inches, contains small calcareous concretions, and has minute crystals of pyrite and marcasite.

Although satisfactorily developed in this part of the quadrangle, farther north along Macoupin Creek perplexities of stratigraphy occur. The variations always occur below the recognized Macoupin limestone and include one or more thin fossiliferous limestones. One of the limestones has been said to be a "fresh-water" limestone and the other has been assumed to be the Centralia, although its texture, color, and fossil content are different. Possibly rudimentary fragments of other cyclothem than those recognized in this paper are present.

Fossils.—The fauna is marked by the presence of corals, crinoids, and gastropods which are practically absent from the Centralia limestone. J. Marvin Weller has recognized a large fauna in the field exposures and has given his tentative identifications to the author. The list includes: *Lophophyllum profundum*, *Orbiculoidea missouriensis*, *Rhombpora lepidodendroides*, *Marginifera splendens*, *Chonetes granulifer*, *Neospirifer cameratus*, *Ambocoelia planoconvexa*, *Leda beltristriata*, *Myalina swallowi*, *Phanerotrema grayvillensis*, *Schizostoma cateloides*, *Pseudorthoceras knoxense*, *Punctospirifer kentuckyensis*, and various species of *Myalina*, *Astartella*, and *Metacoceras*.

Upper Macoupin cyclothem.—This cyclothem, a rudimentary cyclothem according to Dr. Weller, is a series of interbedded limestones and shales, possibly only the marine segment of the cyclothem. In its best exposure it aggregates a little less than 8 feet. The two most prominent limestones in the cyclothem

range from bluish-gray to purplish in color, both hard and resistant, the lower of the two sparingly fossiliferous. The higher limestone, here called the Upper Macoupin limestone, ranges up to about 4½ feet in thickness, is marked by a *Productid* fauna, and is fossiliferous.

Fossils.—Its fossils include: *Derbya crassa*, *Pustula pustulosa*, *Neospirifer cameratus*, *Linoproductus prattenianus*, *Punctospirifer kentuckyensis*, *Ambocoelia planoconvexa*, and *Composita subtilita*.

Lower Livingston cyclothem.—The limestone of the Upper Livingston cyclothem has been called the "LaSalle" limestone by the author in a previously published abstract.¹⁰ In this usage, he was following a correlation suggested by Sidney Ekblaw.¹¹ Later usage, however, has substituted Livingston, Upper and Lower, for "LaSalle." Independently the author has been impressed by the general correspondence of the LaSalle with the Carlinville quadrangle Livingston, lithologically and faunistically, so that he favored Ekblaw's suggestion.

The conditions of sedimentation for the Livingston cyclothem make it somewhat difficult to discuss the Lower Livingston without constant reference to the Upper Livingston. The most noteworthy fact about the Lower Livingston in this quadrangle is that the marine limestone horizon is a locus of .8 thin limestone strata, ranging from one-half to 2 inches in thickness, and separated by fossiliferous shales up to 9 inches in thickness. Below these strata is a recognizable coal horizon with a little more than 4 feet of clay which may constitute the actual base of the Lower Livingston cyclothem. The limestone strata, as well as the shales, are extremely fossiliferous, containing many specimens and probably several species of *Murchisonia*, *Aviculopecten*, *Bellerophon*, and species of possible *Worthenia*. It was from some of these strata, also, that Geis obtained fossil *Pedicellariae*.¹²

Upper Livingston cyclothem.—The chief stratigraphic interest in this cyclothem, probably, is that it contains the prominent limestone member, the "Shoal Creek" and "LaSalle" of authors. It is the uppermost of the Pennsylvanian

¹⁰Ball, J. R., Some Pennsylvanian limestones of the Carlinville quadrangle, Illinois: Trans. Ill. Acad. Sci., Vol. 26, page 97, 1934.

¹¹Op. cit., page 145.

¹²Geis, H. L., Recent and fossil *Pedicellariae*: Jour. Paleontology, Vol. 10, pp. 439-441; 448: pls. 60, 61, 1936.

strata in the same gully tributary to Macoupin Creek which displays also all the preceding cyclothems, with the exception of the Trivoli. The limestone is the uppermost in the gully exposures farther east and south in the quadrangle as well, and it has been traced beyond the confines of the quadrangle by Wanless, Sidney Ekblaw, and many others.

In several of the drill records of the quadrangle, the thickness of the limestone ranges up to 12 feet and is about the same in the surface exposures. A relatively thick black platy shale underlies the limestone in many of its outcrops. The shale is resistant to weathering and erosion and is responsible for low waterfall ledges. It is nearly 3 feet thick and is fossiliferous, containing pelecypods, fish spines, and scales, and conodonts.

Fossils.—Fossils weather out readily from the Upper Livingston limestone, and large collections have been taken. *Lophophyllum profundum*, *L. profundum radicosum*, and large species, either *Lophophyllum* or *Campophyllum* ? are abundant. There are numerous plates and ossicles of crinoids, and many brachiopods and gastropods, including *Chonetes granulifer* and *Chonetes* sp., *Margifer splendens*, *M. wabashensis*, *Wellerella tetrahedra*, *Dielasma bovidens*, *Neosporifer cameratus*, *N. triplicatus*, *Punctosporifer kentuckyensis*, *Ambocoelia planoconvexa*, *Composita subtilita*, *Platyceras trigonalis*, *Treospira sphaerulata*,

Naticopsis ventricosa, and species compared with *Wellerella osagensis*, *Cyrtolites ? gillanus*, *Aclisino condito*, *A. swallowana*, and recognized *A. stevensana*.

In the thin limestone band horizon of the Lower Livingston cyclothem, *Jonesina arcuata*, *J. gregaria*, and a species of *Primitia* have been recognized. The list for the Upper Livingston cyclothem is not complete, nor has it been completely checked over, but enough has been cited to show it a very characteristic Pennsylvanian fauna of Illinois.

Divide ? cyclothem.—This probably is but a channel sandstone, so designated by Wanless,¹³ as it includes only sandstone and shale. It, or a similar sandstone, cuts through a considerable stratigraphic range if it is the same sandstone which has been observed in several places in this and in quadrangles west and north of the Carlinville. It is observed to have a major thickness of about 10 feet in the quadrangle and, in the field work, was called the "McWain" sandstone because of its several outcrops on the McWain properties along Macoupin Creek.

SUMMARY

Eliminating the "Divide" cyclothem, then, from the list named in this paper, the quadrangle exhibits actually about 100 feet of McLeansboro strata which properly may be included in its cyclothems.

¹³*Op. cit.*, page 812.