GEOLOGIC NOTES

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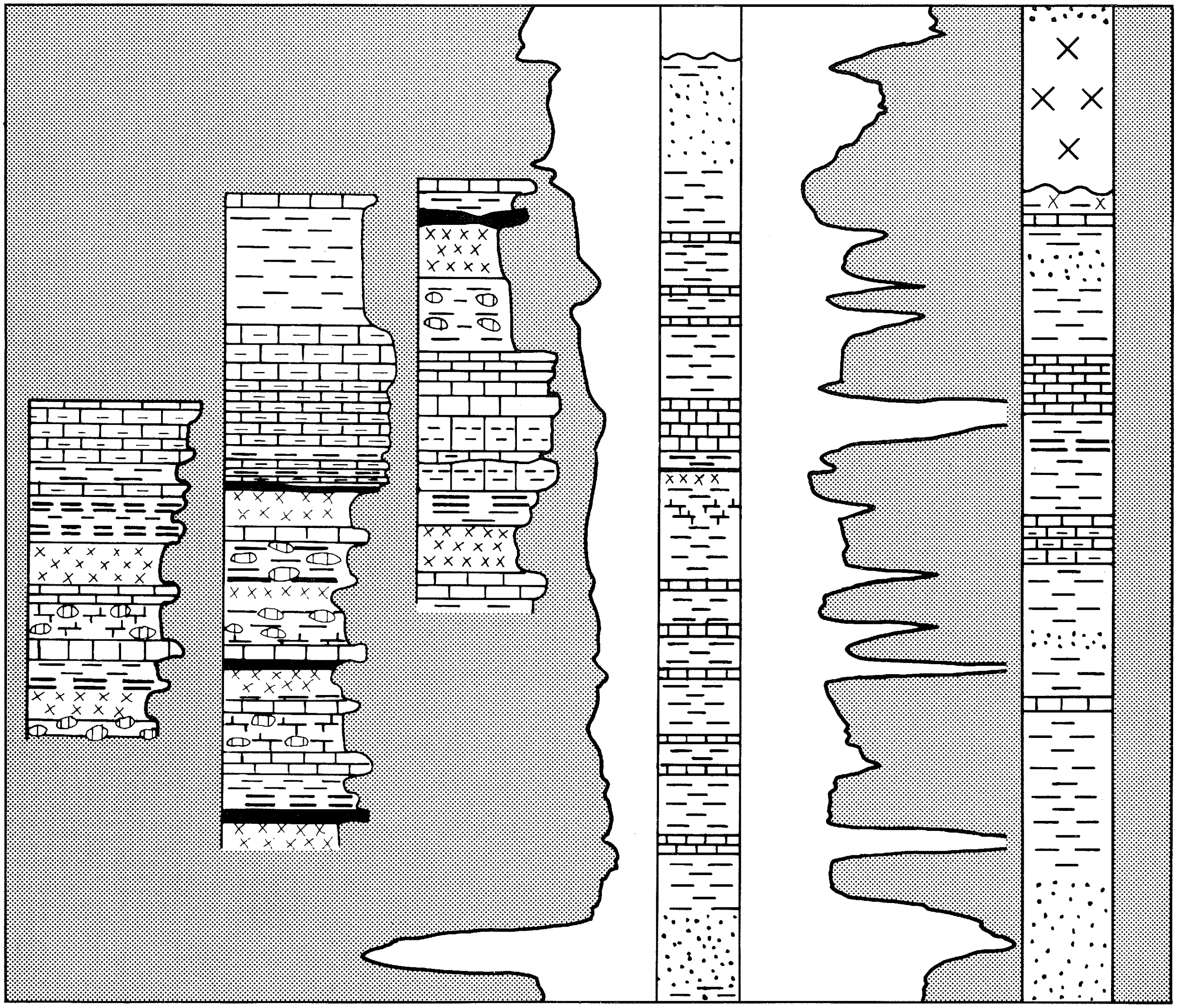

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CONTENTS

Revised correlations of the Shoal Creek and La Salle Limestone Members of the Bond Formation (Pennsylvanian) in northern Illinois

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The Shoal Creek Limestone and the La Salle Limestone, both members of the Bond Formation (Pennsylvanian), have been correlated with a number of limestone units over the years. From the late 1930s until 1975 the La Salle was considered to be correlative with the Millersville Limestone Member (called Livingston Limestone in eastern Illinois), and the Shoal Creek was tentatively correlated with several limestones in northern Illinois. Hopkins and Simon (1975) correlated the Shoal Creek Limestone Member with the La Salle Limestone Member. Data presented in the two cross sections in this report show that the Shoal Creek is correlative to an unnamed limestone occurring about 50 feet below the La Salle Limestone in northern Illinois. A tentative correlation of the La Salle Limestone with the Millersville is also suggested by these data.

PREVIOUS WORK

Before 1939, correlations of the Shoal creek were rather tenuous and were based on very limited data. Worthen (1875) and Udden (1907) suggested that the Shoal Creek and other thick limestones in the upper part of the Pennsylvanian—such as the yet unnamed La Salle, Livingston, and Millersville Limestones—might be equivalent. Wanless (1932 and 1939) shows the Shoal Creek below the La Salle Limestone. Wanless and Weller (1944) and Cooper (1946) correlated the Shoal Creek with the Hicks Limestone Member (Willman, 1931) in northern Illinois. Wanless (1956) and Kosanke et al. (1960) correlated the Shoal Creek Limestone with the Hall Limestone Member and dropped the Hicks Limestone as a valid term in northern Illinois.

The La Salle Limestone, named by Cady in 1908 (p. 128), has sometimes been correlated with the Millersville Limestone and sometimes with the Shoal Creek Limestone (Van Den Berg, 1956). From the late 1920s until 1975, most geologists correlated the La Salle with the Millersville Limestone (Weller, 1936; Newton and Weller, 1937; Dunbar and Henbest, 1942; Cooper, 1946; Stevenson, 1955; Wanless, 1956; Kosanke et al., 1960). These correlations were based largely on faunal and lithologic similarities with only minor help from physical stratigraphy (because of the scarcity of subsurface data).

In 1975, Hopkins and Simon tentatively correlated the Shoal Creek Limestone with the La Salle Limestone. Hopkins (personal communication, 1980) stated that this change was based largely on preliminary unpublished work using drill hole data then available.

BIOSTRATIGRAPHIC DATA

Biostratigraphic zonation using the macroinvertebrate faunas of the Shoal Creek, La Salle, and Millersville Limestones has so far been largely inconclusive. Diverse, abundant macroinvertebrate faunas have been identified in all three limestones: in the La Salle limestones, 177 species (Griffin, 1931; Strimple and Moore, 1971); in the Millersville Limestone, 40+ species (Worthen, 1875; Gilliam and Schram, 1975); and in the Shoal Creek Limestone, 31 species (Lee, 1926). Most of these species are wide-ranging forms in the Pennsylvanian of Illinois that are not useful for zonation.

Fusulinids have not been helpful so far in the correlation of the La Salle Limestone within the basin. *Triticites ohioensis* and *T. venustus* are found in the Millersville, and *Triticites ohioensis* is found in the Livingston (Dunbar and Henbest, 1942). In recent unpublished work, R. C. Douglass reported finding *Triticites* sp. of *T. venustus* in the Shoal Creek near New Haven, Illinois (Tom Kehn, USGS, personal communications, 1981).

The conodont faunas of La Salle, Livingston, Millersville, and Shoal Creek Limestones are abundant and quite diverse (Stevenson, 1955; Collinson et al., 1972; and Martin, 1974). From statistical studies of species abundance and diversity of conodonts, Stevenson (1955) concluded that the La Salle is equivalent to the Millersville and that the Shoal Creek Limestone is stratigraphically lower. Stevenson concluded that stratigraphic zonation based on occurrence of conodont species was not feasible because all

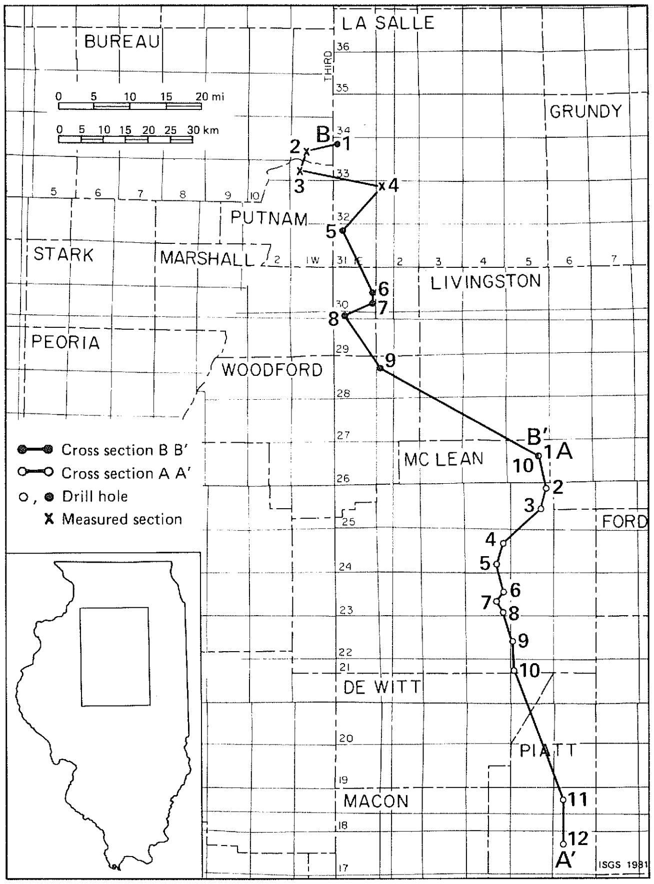

FIGURE 1. Locations of cross sections.

the identified species in the Shoal Creek Limestone are present in the Millersville Limestone.

Because detailed palynological zonation of the Bond and Mattoon Formations has not been carried out, correlations by use of spores are thus very tenuous. Peppers (personal communication, 1979) says that the spore assemblage in the coal beneath the La Salle Limestone seems to suggest a correlation of the Shoal Creek Limestone with the La Salle Limestone.

Cooper's suggestion (1946) that the La Salle could be correlated with the Millersville was based on lithologic similarities, stratigraphic position, and fauna. According to some geologists, Cooper's correlation was based entirely on his study of ostracodes (this is not clear from his text). However, close comparison of the faunas listed for the La Salle, Livingstone, and Millersville Limestones with the fauna listed for the Shoal Creek Limestone seems to indicate that the first three limestones do have very similar ostracode faunas. These three limestones also have a somewhat more diverse fauna (with more genera represented) than does the Shoal Creek. It appears that correlation of the La Salle with the Livingston and Millersville is favored by consideration of ostracode faunas.

PHYSICAL STRATIGRAPHY AND CORRELATIONS

Geologic cross section and supporting data

Data from two geologic cross sections, A-A' and B-B' (plate 1), provide primary evidence supporting the correlation of the Shoal Creek Limestone to a limestone beneath the La Salle Limestone in northern Illinois. The data from cross section A-A' also suggest the possibility that the La Salle Limestone correlates with the Millersville Limestone. Figure 1 shows the location of the cross sections. Figure 2 gives sources for data used for preparing cross sections.

Data utilized for geologic cross section A-A' (plate 1) consist mostly of electric logs from oil test holes and structure tests. A-A' extends from the northeastern portion of McLean County (T. 26 N., R. 5 E.) through central and southern McLean to central Piatt County (T. 17 N., R. 6 E.). Sample studies were also available for test holes 3 and 4, and a driller's log was available for test hole 7. Cross section A-A' (plate 1) represents a condensed version of an original work copy that included many additional data points not shown. The original cross section extended as far north as T. 27 N., R. 5 E., Livingston County; a data point spacing of one test hole per mile was used where possible for better control on correlations.

A second cross section, B-B', constructed as a supplement to cross section A-A', contains electric logs from oil tests, descriptions from coal shafts, driller's logs from water wells, and described sections. Cross section B-B' shows continued correlation of the Shoal Creek Limestone to an unnamed limestone beneath the La Salle Limestone in its type area. B-B' extends from east central La Salle County (T. 33 N., R. 1 E.) through southeastern Bureau, northeastern Putnam, eastern Marshall, and northeastern Woodford Counties to northeastern McLean County, where its last test hole is the first hole of section A-A'. B-B' indicates the correlation of type La Salle Limestone to the thick limestone present at the north end of section A-A' at a depth of about 40 feet. This limestone unit has been extensively quarried in the area immediately north in Livingston County, and a number of quarries are still active in the area.

Correlation of the Shoal Creek Limestone

In section A-A' the Shoal Creek Limestone can be traced from test hole 12 in south-central Piatt County to a limestone 75 feet below the La Salle Limestone in test hole 5, and 60 feet below the La Salle in test hole 4. Further north in section A-A', the Shoal Creek Limestone lies 35 to 50 feet below the La Salle Limestone. Section B-B' shows that the Shoal Creek Limestone occurs beneath the Hall Limestone Member (test hole 1, and described sections 2-4).

The data presented in these two geologic cross sections indicate that the Shoal Creek Limestone is not correlative with the La Salle Limestone Member in northern Illinois but rather with a limestone 40 to 50 feet below the La Salle Limestone (test holes 1-5, section B-B').

This limestone, correlative with the Shoal Creek Limestone, also lies some 15 to 20 feet below the type

Hall Limestone reported in described section 2 in section B-B′ (see also test holes 1, 3, and 4 in B-B′). The described sections illustrated in numbers 2 and 3 of B-B′ and in figure 3 are from unpublished work by Willman (1931). Willman applied, in descending order, the names Hall, Hicks, and Turner to the "cyclical formations" and the limestones that occur in the interval from the top of the Lonsdale Limestone Member to the base of the underclay below the La Salle Limestone (fig. 3). Cooper (1946) and Wanless (1944, 1956) defined Willman's units as cyclothems.

Figure 3 illustrates the changes in nomenclature for the Hall, Hicks, and Turner Limestones since their introduction by Willman in 1931. The Hall Limestone, as described by Willman (1931), Wanless (1944, 1956), and Cooper (1946), included 3 feet of limestone and the overlying 8-foot interval of nodular limestone (capped by 4 feet of limestone) that occurs 15 feet below the La Salle Limestone. The name Hicks Limestone was applied to (1) the limestone shown to be correlative with the Shoal Creek Limestone in described section 3, in B-B′, and (2) the overlying 9 feet of calcareous shale and nodular limestone. The name Turner Limestone was applied to the 12-foot zone of limestone, nodular limestone, and limestone that lies 8 feet below the Hicks Limestone (fig. 3). Kosanke et al. (1960)

Section AA′

Number	County Number	Section	Twp	Rn	County	Type of data
1	416	14	26N	5E	McLean	E-log
2	682	1	25N	5E	McLean	E-log
3	104	14	25N	5E	McLean	E-log and sample study
4	361	12	24N	4E	McLean	E-log and sample study
5	365	26	24N	4E	McLean	E-log
6	345	13	23N	4E	McLean	E-log
7	371	23	23N	4E	McLean	E-log driller's log
8	61	36	23N	4E	McLean	E-log
9	363	19	22N	5E	McLean	E-log
10	57	7	21N	5E	McLean	E-log
11	15	8	18N	6E	Piatt	E-log
12	47	8	17N	6E	Piatt	E-log
Section BB′						
1	1806	6	33N	1E	La Salle	E-log
2	Type exposure of Hall Ls., Willman 1931	33	16N	11E	Bureau	outcrop
3	Turner Lake Section Willman 1931	29	33N	1W	Putnam	outcrop
4	Baily Falls, near type La Salle Ls.	6	32N	2E	La Salle	outcrop
5	1871, 27	5	31N	1E	La Salle	E-log, driller's log and coal test
6	13	13	30N	1E	Marshall	Mine shaft
7	91, 15, 23	24	30N	1E	Marshall	D-log
8	9	5	29N	1E	Marshall	Mine shaft
9	2	7	28N	2E	Woodford	Mine shaft
10	416	14	26N	5E	McLean	E-log

ISGS 1981

FIGURE 2. Sources of data used in preparation of cross sections.

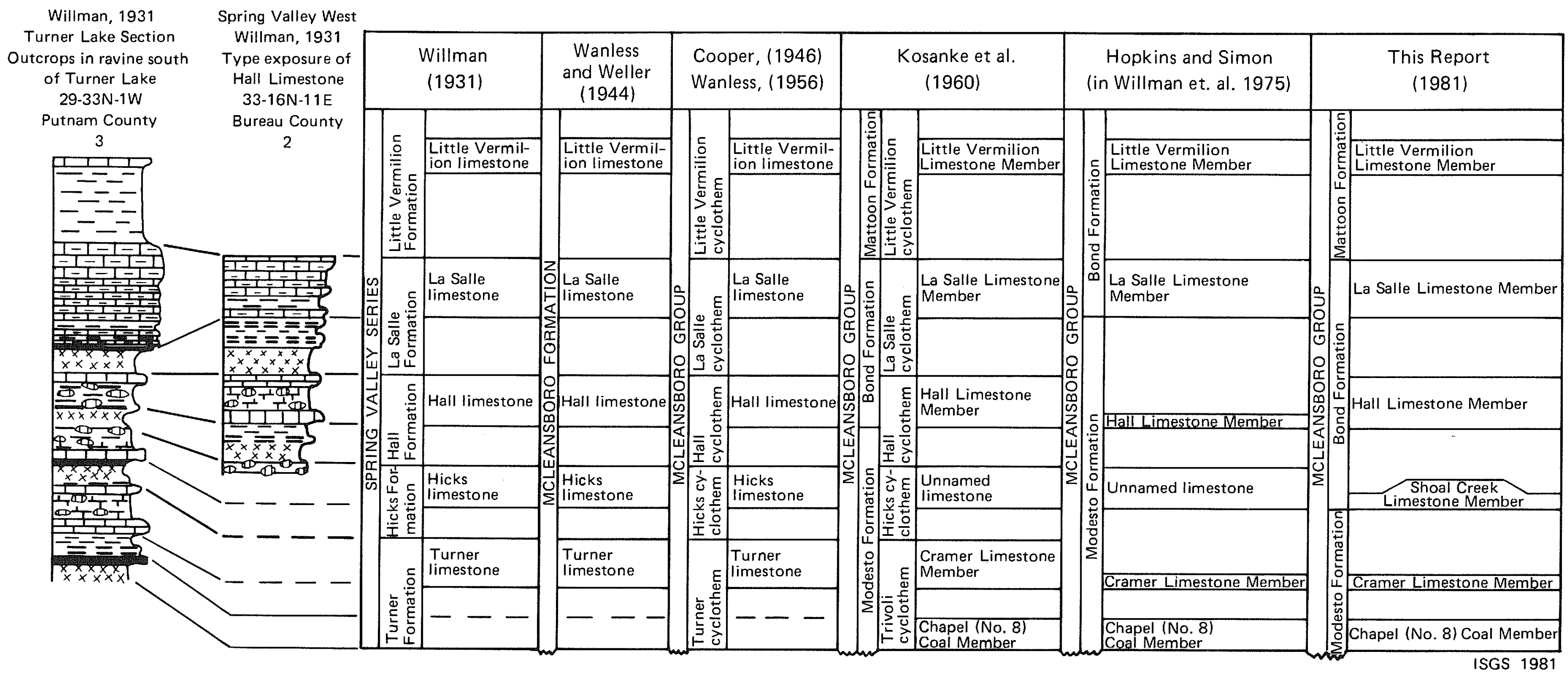

FIGURE 3. Development of the stratigraphic classification of the upper part of the Pennsylvanian System in northern Illinois.

dropped the Hicks Limestone as a valid name, leaving the limestone that is correlative with the Shoal Creek Limestone unnamed (fig. 3). In the same paper he dropped the name Turner Limestone and applied the name Cramer Limestone (used for the correlative of the Turner in western Illinois) to this limestone (fig. 3).

Hopkins and Simon (*in* Willman et al., 1975) adopted the nomenclature of Kosanke et al. for these units (fig. 3), but they restricted the name Hall Limestone to the basal 3-foot limestone of Willman's 15-foot unit, rather than including the overlying 12-foot interval (fig. 3). The Cramer Limestone was also defined as the first limestone occurring above the Chapel (No. 8) Coal; thus it, too, was restricted to the basal 3-foot limestone bed instead of the entire 12-foot interval originally described by Willman (fig. 3).

The interval between the La Salle Limestone and the lower 3-foot bench of the Hall Limestone as given by Hopkins and Simon, p. 196 (Willman et al., 1975), is incorrectly given. A 45-foot thickness is indicated for this interval when, in fact, it is 24 feet as reported in Willman's measured section for the type Hall Limestone. In some copies of Willman's (1931) description of this section, a shale in this interval was incorrectly given as 18 feet 3 inches thick when it should have been described as only 3 inches thick (Willman, personal communication, 1980).

The Hall Limestone, as originally described by Willman (1931), is herein readopted by this report (fig. 2 and cross section B-B'). Thus, the Hall Limestone at its type section (Sec. 33, T. 16 N., R. 1 E., Bureau County) lies some 15 feet below the La Salle Limestone and consists, in descending order, of: 4 feet of irregularly bedded, gray, fossiliferous limestone; 8 feet of calcareous greenish-gray shale with abundant limestone nodules; and 3 feet of fine-grained, green, gray and red limestone containing abundant marine fossils.

On the basis of the preceding discussion, it is apparent that the Shoal Creek Limestone is correlative with the unnamed limestone that lies 30 to 50 feet below the La Salle Limestone and 15 to 20 feet below the Hall Limestone. Thus the name Shoal Creek Limestone Member is herein extended to this limestone in the northern part of the Illinois Basin.

Correlation of the La Salle Limestone

The La Salle Limestone is clearly traceable on section A-A' from test hole 1 in northeastern McLean County to test hole 7, where it rises up and thins out into a sandstone-siltstone body. In test holes 8 through 10 the horizon of La Salle Limestone is not readily traceable, and its approximate position has been indicated by a dashed line. Much of the Bond Formation above the Shoal Creek Limestone is absent in northeast De Witt and in the north half of Piatt Counties because of Pleistocene erosion; thus, only one test hole, no. 11, has been utilized between test hole 12, where the first Millersville Limestone is present, and test hole 10, where sandstone and siltstone occurring at the inferred "La Salle horizon" are present.

Two correlations with strata in the central part of the Illinois Basin are possible from the data presented on section A-A'. The first is a possible correlation of the La Salle Limestone with the Millersville Limestone. The projection of the La Salle Limestone from test hole 7 to test hole 10 and subsequently to the Millersville Limestone in test hole 12 seems to be logical. The La Salle Limestone in test hole 7 and its "horizon" in test holes 8 through 10 is slightly more than 100 feet above the Shoal Creek Limestone, and in test hole 12 the Millersville Limestone is about 160 feet above the Shoal Creek Limestone. As an alternate correlation, the La Salle Limestone may be equivalent to part of the shale interval 50 feet below the Millersville Limestone in test hole 12 about 100 feet above the Shoal Creek Limestone. The La Salle Limestone may pinch out entirely and accordingly would not be represented by any limestone in test hole 12.

A tentative correlation of the La Salle Limestone with the Millersville Limestone is herein proposed. Further substantiations or modifications may be made as new data become available.

CONCLUSIONS

Biostratigraphic data

On the basis of data presented in this study, the following conclusions can be made regarding the correlation of the Shoal Creek and the La Salle Limestone Members.

- Biostratigraphic zonation of macroinvertebrates is generally not very useful in the correlation of Pennsylvanian-age limestones in Illinois because the ranges of the macroinvertebrates extend through much of the Pennsylvanian System of Illinois.
- Biostratigraphic zonation on the basis of species occurrence of microinvertebrates is not feasible because of the wide-ranging stratigraphic occurrence of individual species of upper Pennsylvanian microfossils in the Illinois Basin.
- The abundance and diversity of microinvertebrate species seem to infer a more direct relationship between the La Salle, Millersville, and Livingston Limestones than between the Shoal Creek and La Salle Limestone.
- More data on stratigraphic ranges of spores will be required in order to establish palynological zones for the Bond and Mattoon Formations.

Physical stratigraphic data

- The Shoal Creek and La Salle Limestones are not correlative on the basis of physical stratigraphy.
- The Shoal Creek Limestone Member is present in northern Illinois 30 to 50 feet below the La Salle Limestone; the use of this stratigraphic name is therefore extended to northern Illinois.
- The La Salle Limestone seems to be correlative with either the Millersville Limestone or with a shale zone 50 feet below the Millersville Limestone in Piatt County, on the basis of projections of Geologic Section A-A'. Until better data are obtained, the La Salle-Millersville correlation seems more likely and is herein proposed on a tentative basis.

REFERENCES

Cady, G. H., 1908, Cement making materials in the vicinity of La Salle: Illinois State Geological Survey, Bulletin 8, p. 127-134.

Collinson, Charles, M. J. Avcin, Rodney P. Norby, Glen K. Merrill, 1972, Pennsylvanian conodont assemblages from LaSalle County, northern Illinois: Illinois State Geological Survey, Guidebook 10, 37 p.

Cooper, C. L., 1946, Pennsylvanian ostracodes of Illinois: Illinois State Geological Survey, Bulletin 70, 177 p.

Dunbar, C. O., and L. G. Henbest, 1942, Pennsylvanian Fusulinidae of Illinois: Illinois State Geological Survey, Bulletin 67, 218 p.

Gilliam, J. K., and F. R. Schram, 1975, The fauna and paleontology of a Pennsylvanian shale: Transactions of the Illinois State Academy of Science, v. 68, no. 2, p. 136-144.

Griffin, Judson Roy, 1931, The Fauna of the La Salle Limestone: Ph.D. thesis, University of Illinois.

Horne, John C., 1965, Environmental study of the Bond Formation of the Illinois Basin and the Kansas City Group of the northern and central mid-continent: Master's thesis, University of Illinois.

Horne, John C., 1968, Detailed correlation and environmental study of some late Pennsylvanian units of the Illinois Basin: Ph.D. thesis, University of Illinois.

Hughes, Delores M., 1972, Petrography of the La Salle Limestone (Penn.) La Salle County, Illinois: Master's thesis, Northern Illinois University, De Kalb.

Kosanke, R. M., J. A. Simon, H. R. Wanless, and H. B. Willman, 1960, Classification of the Pennsylvanian strata of Illinois: Illinois State Geological Survey, Report of Investigations 214, 84 p.

Lee, Wallace, 1926, Description of the Gillespie-Mt. Olive Quadrangles: U.S. Geological Survey Geographic Atlas Folio 220, 14 p.

Martin, M. D., 1974, La Salle Limestone (Upper Pennsylvanian), conodonts of La Salle County: Master's thesis, University of Illinois.

Newman, W. A., J. M. Weller, 1937, Stratigraphic studies of Pennsylvanian outcrops in part of southeastern Illinois: Illinois State Geological Survey, Report of Investigations 45, 31 p.

Stevenson, Wilbur L., 1955, Pennsylvanian conodonts of Illinois: Master's thesis, University of Illinois.

Strimple, H. L., and R. C. Moore, 1971, Crinoids of the La Salle Limestone (Penn.) of Illinois: The University of Kansas Paleontological Contributions, Article 55 (Echinodermata II).

Taylor, E. F., and G. H. Cady, 1944, Structure of the Millersville Limestone in the north part of the Illinois Basin: Illinois State Geological Survey Report of Investigations 93, p. 22-26.

Van Den Berg, Jacob, 1956, Pennsylvanian stratigraphy above the Shoal Creek Limestone in Illinois: Master's thesis, University of Illinois.

Wanless, H. R., and J. M. Weller, 1932, Correlation and extent of Pennsylvanian cyclothems: Bulletin of the Geological Society of America, v. 43, p. 1003-1016.

Wanless, H. R., 1939, Pennsylvanian correlations in the eastern interior and Appalachian coal fields: Geological Society of America Special Paper 17, 130 p.

Wanless, H. R., and J. M. Weller, *in* R. C. Moore, et al., 1944, Correlation of Pennsylvanian of North America: Bulletin of the Geological Society of America, v. 55, no. 6, p. 657-706.

Wanless, H. R., 1956, Classification of the Pennsylvanian rocks of Illinois as of 1956: Illinois State Geological Survey, Circular 217, 14 p.

Willman, H. B., 1931, General geology and mineral resources of the Illinois Deep Waterway from Chicago to Peoria: Ph.D. thesis, University of Illinois.

Willman, H. B., Elwood Atherton, T. C. Buschbach, Charles Collinson, John C. Frye, Jerry A. Lineback, and Jack A. Simon, 1975, Handbook of Illinois Stratigraphy: Illinois State Geological Survey, Bulletin 95, 261 p.

Worthen, A. H., 1875, Geology and Paleontology, Geological Survey of Illinois, v. 6, 532 p.

Revision of nomenclature for the Springfield (No. 5) Coal Member of Illinois

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More than 100 years ago mining of the Illinois No. 5 Coal Member began in west-central Illinois in the vicinity of Springfield, and at almost the same time, in southeastern Illinois near Harrisburg. As a result of the wide geographic separation of these areas, the separate names, "Springfield" and "Harrisburg," were applied to the No. 5 Coal in the different areas and were retained even after it became apparent that two names had been applied to the same coal.

This report describes the history of the dual nomenclature and summarizes major geologic characteristics of the No. 5 Coal. The single name, Springfield, will be applied to the No. 5 Coal in all future reports of the Illinois State Geological Survey and is recommended for use throughout the Illinois Basin Coal Field.

PREVIOUS NOMENCLATURE

The history of nomenclature of the No. 5 Coal is summarized in table 1. Lesquereux (Worthen, 1866, p. 208-237) was the first to apply a numbering system to Illinois coals. In trying to document a parallelism between Illinois and western Kentucky, he numbered the coals in Illinois with the numbers used in Kentucky. Later, realizing that a correlation error had been made and that many of the coals, as numbered in Illinois, did not correlate with coals of similar numbers in western Kentucky, Worthen (1868, p. 1-16) revised the numbering system and used "Coal No. 5" to refer to the coal then being mined at a depth of 230 to 250 feet near Springfield in Sangamon County and to the lower coal along Kickapoo Creek near Peoria in Peoria County. He indicated that the No. 5 Coal is probably correlative with the No. 9 Coal of western Kentucky. Worthen (1870, p. 99) applied "No. 5" to a coal being mined in the vicinity of Cuba in Fulton County; this is incorrectly cited by Willman et al. (1975) as the first use of the term "No. 5" to refer to this coal. Worthen (1873, p. 312) again described "Coal No. 5" as the coal being mined at a depth of about 200 feet in the Howlett shaft near Springfield.

By 1883, Worthen was referring to this coal in the vicinity of Springfield as "coal No. 5, or the Springfield coal, as it is sometimes called...." (p. 6). In that report, he also referred to the coal as "Springfield coal" without using the numerical notation. Shaw and Savage (1913) throughout their report called this coal the "Springfield

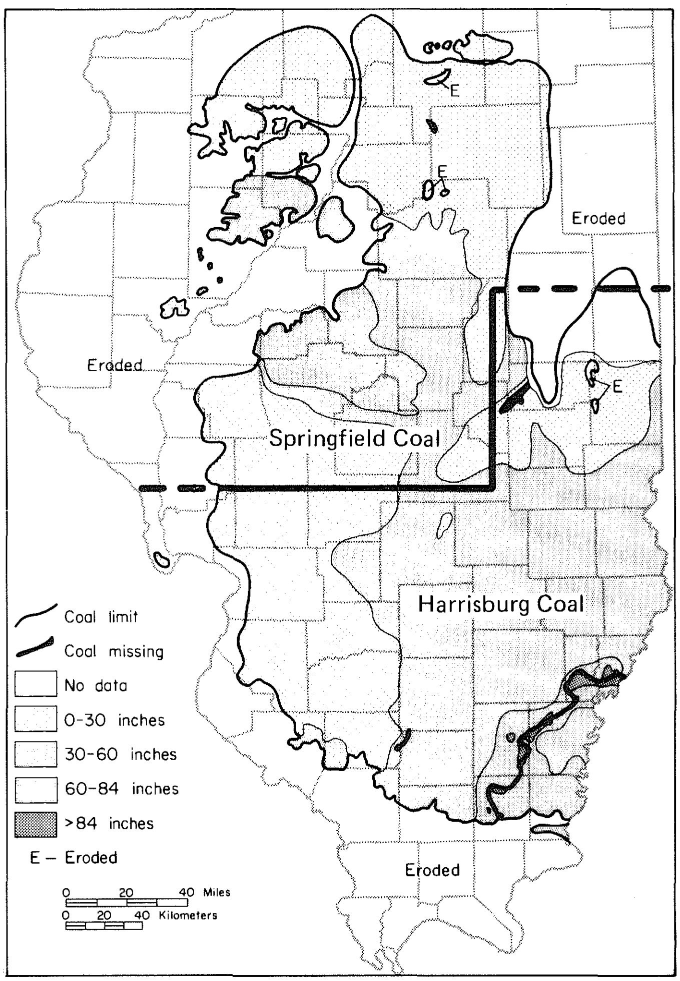

FIGURE 4. Extent and generalized thickness of the Springfield Coal Member (after Willman et al., 1975). Terminology of areas is derived from Cady, 1952.

coal," using "No. 5" only in a caption and the phrase, "formerly known as No. 5." The term "Springfield Coal Member (V)" is used for this coal in Indiana (Shaver et al., 1970).

DeWolf (1907) used the name "Coal No. 5 (Harrisburg Coal)" as a title in a report on coal in Gallatin and Saline Counties. However, throughout the report he used the numerical reference and omitted the name. Shaw and Savage (1912) formally applied the name "Harrisburg" to this coal and used the current reference of "Harrisburg (No. 5) Coal."

Cady (1916) referred to this coal statewide as "Coal No. 5 (Harrisburg or Springfield)." Weller and Wanless (1939) applied "Springfield" to the northern and western parts of the state and "Harrisburg" to the southern and eastern parts. Cady (1952) used the arbitrary scheme of applying "Harrisburg" to O'Neil areas 16, 17, and 21 through 32, restricting "Springfield" to all other O'Neil areas (fig. 4). Recently, the terms "Harrisburg-Springfield (No. 5) Coal Member" (Smith and Stall, 1975) and "Springfield and Harrisburg (No. 5) Coal Members" (Willman et al., 1975) have been used to refer to this coal seam statewide.

THICKNESS AND EXTENT

The Springfield Coal underlies approximately two-thirds of the state of Illinois and extends from outcrops in Gallatin County in southeastern Illinois to Henry County in northwestern Illinois, a total distance of nearly 300 miles (fig. 4). It is commonly 4 to 8 feet thick, but is thin or missing in parts of western and northern Illinois. It has been mined extensively in widely separated parts of the state. The coal rises to the bedrock surface (usually concealed by glacial drift) at the southern, western, northern, and northeastern margins of the Illinois Basin Coal Field, but occurs at a depth of more than 1,200 feet in the Fairfield Basin of southeastern Illinois.

PALYNOLOGY

Palynological investigations of the Springfield Coal have been conducted by Brokaw (1942), Kosanke (1950), and Peppers (1970). The relative abundance of major miospore taxa in the Springfield Coal near Springfield is shown in figure 5. Taxonomically, *Lycospora, Laevigatosporites, Thymospora, Cappasporites,* and *Anapiculatisporites spin-*

TABLE 1. History of nomenclature of the No. 5 Coal Member.

	Northern	Western	Southern	Eastern
Worthen, 1866	No. 9 coal		No. 9(?) coal[a]	
Worthen, 1868	coal No. 5	coal No. 5		
Worthen, 1870	coal No. 5			
Worthen, 1873	coal No. 4[b]	coal No. 5		
Worthen, 1875			coal No. 5	
Worthen, 1883		coal No. 5 or Springfield coal		
De Wolf, 1907			Coal No. 5 (Harrisburg Coal)[c]	
Shaw and Savage[d], 1912		Springfield (No. 5) coal	Harrisburg (No. 5) coal	
Shaw and Savage[d], 1913		Springfield (No. 5) coal		
Cady, 1916	Springfield (No. 5) coal		coal No. 5 (Harrisburg or Springfield)[e]	
Wanless, 1939	Springfield (No. 5) coal	Springfield (No. 5) coal	Harrisburg (No. 5) coal	
Weller and Wanless, 1939	Springfield (No. 5) coal	Springfield (No. 5) coal	Harrisburg (No. 5) coal	Harrisburg (No. 5) coal
Moore et al., 1944		Springfield (No. 5) coal	Harrisburg coal	
Cady, 1952	Springfield (No. 5) coal	Springfield (No. 5) coal	Harrisburg (No. 5) coal	Harrisburg (No. 5) coal
Wanless, 1956		Springfield (No. 5) coal	Harrisburg (No. 5) coal	Harrisburg (No. 5) coal
Kosanke et al., 1960	Springfield (No. 5) Coal	Springfield (No. 5) Coal	Harrisburg (No. 5) Coal	Harrisburg (No. 5) Coal
Smith and Stall, 1975	Harrisburg-Springfield (No. 5) Coal	Harrisburg-Springfield (No. 5) Coal	Harrisburg-Springfield (No. 5) Coal	Harrisburg-Springfield (No. 5) Coal
Willman et al.[f], 1975	Springfield (No. 5) Coal	Springfield (No. 5) Coal	Harrisburg (No. 5) Coal	Harrisburg (No. 5) Coal

[a] Based on a comparison of Lesquereux' (in Worthen, 1866) section from Shawneetown with Smith (1957) and the occurrence above Lesquereux' No. 9 coal of a shale containing *Avicula rectilaterarea.*

[b] Worthen illustrates a composite stratigraphic section (based on outcrops along Kickapoo Creek and its tributaries) that indicates coal No. 4 as the lowest coal and coal No. 5 as absent. The lowest coal along the Kickapoo southwest of Peoria is No. 5.

[c] De Wolf restricted the designation of "Coal No. 5 (Harrisburg Coal)" to a title, and refers to the coal throughout the text as Coal No. 5.

[d] The terms "Springfield (No. 5) coal" and "Springfield coal (No. 5)" are used interchangeably throughout the report; "Harrisburg" is used in a similar manner. However, generally the numerical designation is dropped in the text and the coal is referred to as "Harrisburg coal" or "Springfield coal."

[e] Cady used this term in referring to the coal statewide. He used only "Harrisburg" in referring to the coal in the area of the report (Jefferson, Franklin, and Williamson Counties).

[f] Willman et al. indicated that the term "Springfield and Harrisburg (No. 5) Coal Members" should be used to refer to the coal bed as a whole.

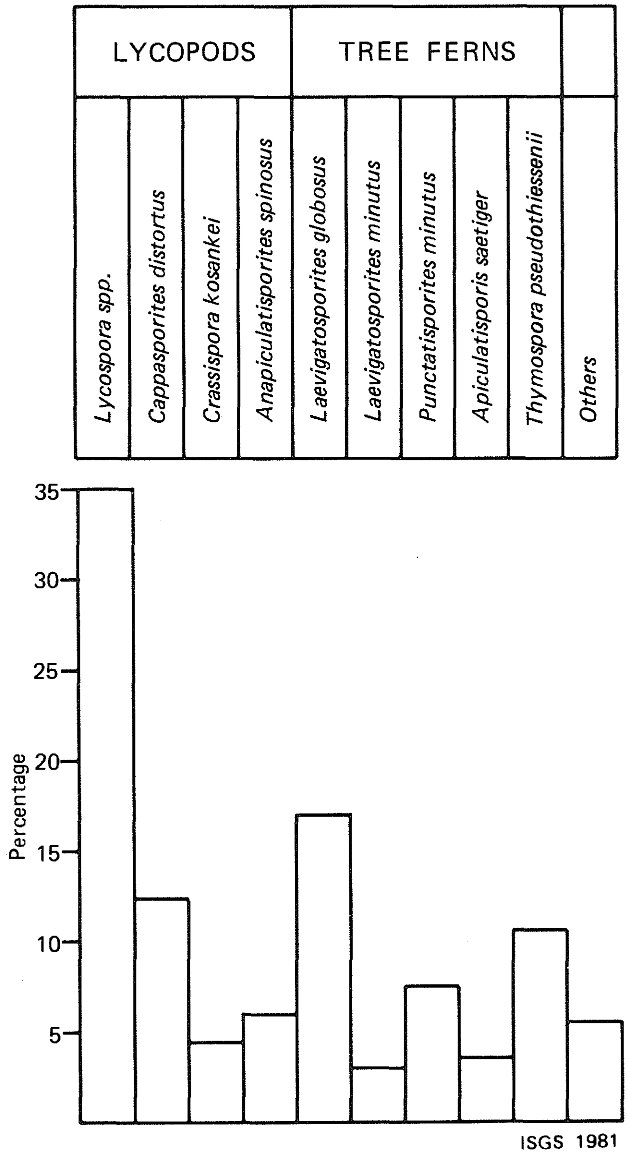

FIGURE 5. Relative abundance of major miospore taxa in the Springfield Coal Member near Springfield.

osus make up most of the spore assemblages. The spore assemblages in the Springfield Coal are characterized by subequal amounts of spores of lycopod plants and tree ferns.

AGE AND CORRELATION

The Springfield Coal belongs to the upper part of the Desmoinesian Series and, in terms of European time stratigraphy, is of late Westphalian D age (Peppers, in press).

The Springfield Coal has been correlated with the Harrisburg Coal almost since the latter was named. Although Shaw and Savage (1912) did not state that the two coals are equivalent, they noted the resemblance of the distinctive black, laminated shale overlying the coal at Harrisburg and the Springfield Coal near Springfield and elsewhere in the state. Cady (1916) felt that the Springfield Coal mined at Harrisburg was equivalent to the Springfield (No. 5) Coal of Fulton and Peoria Counties and included them both in the term, coal No. 5 (Harrisburg or Springfield). Since Cady's report the Springfield and Harrisburg Coals have been correlated in every major classification of Pennsylvanian strata in Illinois including that of Wanless (1939, 1956), Moore et al. (1944), Kosanke et al. (1960), and Hopkins and Simon (*in* Willman et al., 1975). The correlation of the two coals has been based on physical characteristics in diamond drill cores and geophysical logs, similarity of surrounding strata, and palynology. Hopkins and Simon (p. 189) stated that "The Springfield (No. 5) Coal Member and the Harrisburg (No. 5) Coal Member....are the same unit, but separate names are retained because of long established usage...."

Because these terms refer to the same coal, and because the term "Springfield" was used first, the term "Harrisburg" will be dropped as a formal member name and the term "Springfield" will be applied to the No. 5 Coal in all future reports of the Illinois State Geological Survey. The preferred reference to the seam will be "Springfield Coal," but "Springfield (No. 5) Coal" and "No. 5 Coal" will also be permitted. The Tri-State Committee on Correlations in the Pennsylvanian System of the Illinois Basin has recommended that the name "Springfield Coal" be used throughout the Illinois Basin Coal Field.

TYPE SECTION

Type sections for the Springfield and Harrisburg Coal Members were established by Wanless (1956). The type section of the Springfield Coal consists of subsurface exposures in coal mines in Section 16, in T. 16 N., R. 4 W., in Sangamon County. The type section for the Harrisburg Coal is found in subsurface exposures in coal mines in the vicinity of Harrisburg, Saline County. The type section of the Springfield Coal Member, as used in this paper, remains the same as that for the coal at Springfield, with the addition of subsurface exposures in coal mines in the vicinity of Harrisburg as a reference section.

REFERENCES

Brokaw, Arnold Leslie, 1942, Spores from Coal No. 5 (Springfield-Harrisburg) in Illinois: Master of Science Thesis, University of Illinois.

Cady, G. H., 1916, Coal resources of District VI: Illinois State Geological Survey, Illinois Cooperative Coal Mining Investigations, Bulletin 15, 94 p.

Cady, G. H., 1952, Minable coal reserves of Illinois: Illinois State Geological Survey, Bulletin 78, 138 p.

DeWolf, F. W., 1907, Coal investigation in the Saline-Gallatin field, Illinois and the adjoining area, *in* Campbell, M. R., Contributions to economic geology 1906, Part II—Coal, lignite, and peat: U.S. Geological Survey Bulletin 316, p. 116-136.

Kosanke, R. M., 1950, Pennsylvanian spores of Illinois and their use in correlation: Illinois State Geological Survey, Bulletin 74, 128 p.

Kosanke, R. M., J. A. Simon, H. R. Wanless, and H. B. Willman, 1960, Classification of Pennsylvanian strata of Illinois: Illinois State Geological Survey, Report of Investigations 214, 84 p.

Moore, R. C., et al., 1944, Correlation of Pennsylvanian formations of North America: Geological Society of America Bulletin, v. 55, no. 6, p. 657-706.

Peppers, R. A., 1970, Correlation and palynology of coals in the Carbondale and Spoon Formations (Pennsylvanian) of the northeastern part of the Illinois Basin: Illinois State Geological Survey, Bulletin 93, 173 p.

Peppers, R. A., in press, Comparison of miospore assemblages in the Pennsylvanian System of the Illinois Basin with those in the Upper Carboniferous of western Europe: Compte Rendu, Ninth International Congress of Carboniferous Stratigraphy and Geology, Urbana, Illinois, 1979.

Shaver, R. H., et al., 1970, Compendium of rock-unit stratigraphy in Indiana: Indiana Geological Survey Bulletin 32, 229 p.

Shaw, E. W., and T. E. Savage, 1912, Description of the Murphysboro-Herrin quadrangles: U.S. Geological Survey Geologic Atlas Folio No. 185, 15 p.

Shaw, E. W., and T. E. Savage, 1913, Description of the Tallula-Springfield quadrangles: U.S. Geological Survey Geologic Atlas Folio No. 188, 12 p.

Smith, W. H., and J. B. Stall, 1975, Coal and water resources for coal conversion in Illinois: Illinois State Water Survey, Illinois State Geological Survey, Cooperative Resources Report 4, 79 p.

Wanless, H. R., 1939, Pennsylvanian correlations in the Eastern Interior and Appalachian coal fields: Geological Society of America, Special Paper 17, 130 p.

Wanless, H. R., with contribution by Raymond Siever, 1956, Classification of Pennsylvanian rocks of Illinois as of 1956: Illinois State Geological Survey, Circular 217, 14 p.

Weller, J. M., and H. R. Wanless, 1939, Correlations of minable coals of Illinois, Indiana, and western Kentucky: American Association of Petroleum Geologists, Bulletin, v. 23, no. 9, p. 1374-1392.

Willman, H. B., Elwood Atherton, T. C. Buschbach, Charles Collinson, J. C. Frye, M. E. Hopkins, J. A. Lineback, and J. A. Simon, 1975, Handbook of Illinois Stratigraphy: Illinois State Geological Survey, Bulletin 95, 261 p.

Worthen, A. H., 1866, Geology: Geological Survey of Illinois, v. 1, 504 p.

Worthen, A. H., 1868, Geology and palaeontology: Geological Survey of Illinois, v. 3, 572 p.

Worthen, A. H., 1870, Geology and palaeontology: Geological Survey of Illinois, v. 4, 508 p.

Worthen, A. H., 1873, Geology and palaeontology: Geological Survey of Illinois, v. 5, 619 p.

Worthen, A. H., 1875, Geology and palaeontology: Geological Survey of Illinois, v. 6, 532 p.

Worthen, A. H., 1883, Geology and palaeontology, Part I, Geology: Geological Survey of Illinois, v. 7, 373 p.

The Turner Mine Shale Member: a newly named stratigraphic unit of the Carbondale Formation

W. John Nelson

The black shale that occurs between the St. David Limestone Member and the Dykersburg Shale Member or the Springfield (No. 5) Coal Member is herein named the Turner Mine Shale Member of the Carbondale Formation, Kewanee Group, Desmoinesian Series, Pennsylvanian System (fig. 6).

The Turner Mine Shale is named for Turner No. 1 Mine, an abandoned slope mine located in the SW¼ NE¼, Section 27, T. 9 S., R. 4 E., Williamson County, Illinois on the Crab Orchard 7½-minute Quadrangle. The shale at this mine is known from 15 diamond-drill cores drilled by the Soil Conservation Service and logged by the Illinois State Geological Survey. Copies of the core descriptions are available for public inspection in the Geologic Records Room at the ISGS. The type section of the Turner Mine Shale is the portion of Core B-41 (ISGS Storage No. C-12753) between the depths 52.7 and 56.7 feet. This core was drilled approximately 1990 feet from the north line and 2080 feet from the east line of Section 27 and is preserved in the core library of the ISGS. Several other cores and portions of cores from the Turner Mine site also are in permanent storage as reference sections.

Throughout the Illinois Basin Coal Field the Turner Mine Shale either overlies the Springfield Coal directly or is found above the Dykersburg Shale, which overlies the Springfield. The Turner Mine Shale is overlain by the St. David Limestone or, where that unit is missing, by the Canton Shale Member or possibly by younger clastic units. The Turner Mine Shale ranges in thickness from less than an inch to more than 8 feet, but normally is 2 to 5 feet thick.

The Turner Mine Shale is a typical Pennsylvanian black fissile shale like the Anna, Excello, and Mecca Quarry Shale Members of the Carbondale Formation. Its lithology is remarkably uniform throughout its range. Typically it is thinly laminated, hard and brittle, and smooth to finely silty. Mica and small pyritized shell fragments may be present; disseminated pyrite also is common. The black color is due to abundant but finely divided organic matter. Because the shale is low in density and high in natural radioactivity, it is easy to recognize on gamma ray-neutron or density logs. Fossils are scarce; the only variety recognized in the Turner Mine cores was a pectinoid pelecypod.

The upper contact with the St. David Limestone generally is irregular and in many cases displays thorough bioturbation, where abundant fine shell debris from the limestone has been intermixed with the upper few inches of the shale. This burrowed zone is softer and weaker than the rest of the unit, is often mottled gray or greenish-gray, and lacks fissility. The main fissile portion of the Turner Mine Shale contains regularly spaced vertical joints lined with calcite. Large, rounded spheroidal concretions up to four feet across and composed of dense, dark gray, fine-grained limestone with pyritic rims are common especially near the base of the unit. The basal contact with the Dykersburg Shale may be gradational, as in the type section, or abrupt and possibly erosional. The Turner Mine Shale/Springfield Coal contact is normally very abrupt.

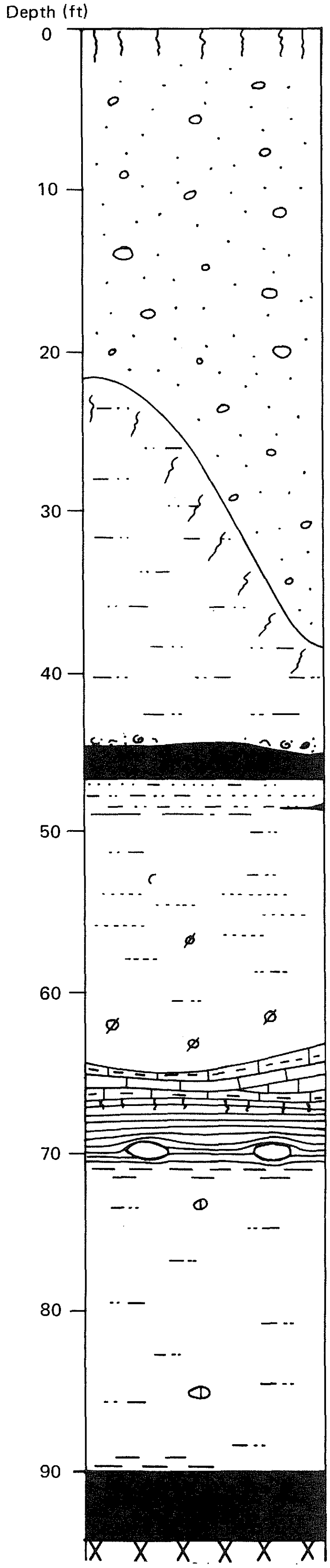

FIGURE 6. Generalized stratigraphic section at Turner Mine site (based on 15 closely spaced cores)

Stratigraphic reassignment of the Hagarstown Member in Illinois

Myrna M. Killey and Jerry A. Lineback

The Hagarstown Member of Illinoian age was informally named the Hagarstown beds by Jacobs and Lineback (1969) and formally elevated to rank as a member of the Glasford Formation by Willman and Frye (1970). The unit is currently defined as consisting of glacially derived gravel, sand, and gravelly till that overlies the Vandalia Till Member; it contains the Sangamon Soil at the top and is commonly overlain by Wisconsinan loesses. The gravel and sand occur in a distinctive belt of linear to curved ridges and knolls, referred to as "the ridged drift of the Kaskaskia Basin." These ridges and knolls extend from the Shelbyville Morainic System of Wisconsinan age in Shelby and Macon Counties to St. Clair County, and are widely scattered across other west-central and south-central counties (fig. 7). The sharp ridges, greater relief, and generally uneven topography of the "ridged drift" area contrast with the essentially featureless and flat Illinoian till plain.

The ridges generally consist of well-sorted gravel and interbedded sand; the gravels are often cross-bedded and may exhibit some calcitic or ferruginous cementation (J. M. Fox, personal communication, 1982). The composition of the knolls (kames) is more variable: they contain poorly- to well-sorted gravel, sand, and ice-thrusted blocks of till and bedrock. Outwash plains of poorly sorted to well-sorted sand and gravel are present between the ridges in many places. The ridges and knolls are thought to be eskerine in origin or to have resulted from infilling of crevasses by glacial outwash during stagnation of the glacier that deposited the Vandalia Till Member (Jacobs and Lineback, 1969; Leighton, 1959; Leighton and Brophy, 1961). It is also possible that some outwash may have emanated from younger glaciers or from the ablating Vandalia ice farther north (Burris et al., 1980; J. P. Kempton, personal communication, 1982).

The member is named for Hagarstown, Fayette County, five miles west of the type section. The type section is in a gravel pit in Hickory Ridge, SW NW, Section 30, T. 6 N., R. 1 E., Fayette County, where Hagarstown deposits are about 30 feet (9 m) thick. Elsewhere the ridges may rise as much as 100 feet (30 m) above the general level of the drift plain; the knolls are generally more subdued in topographic expression, usually less than 50 feet (15 m) high. They occur as isolated hillocks on the till plain or in clusters or aligned with trends of ridges. Detailed work has been done recently on a portion of the ridged drift; a description of one of these deposits is presented by Burris et al. (1981).

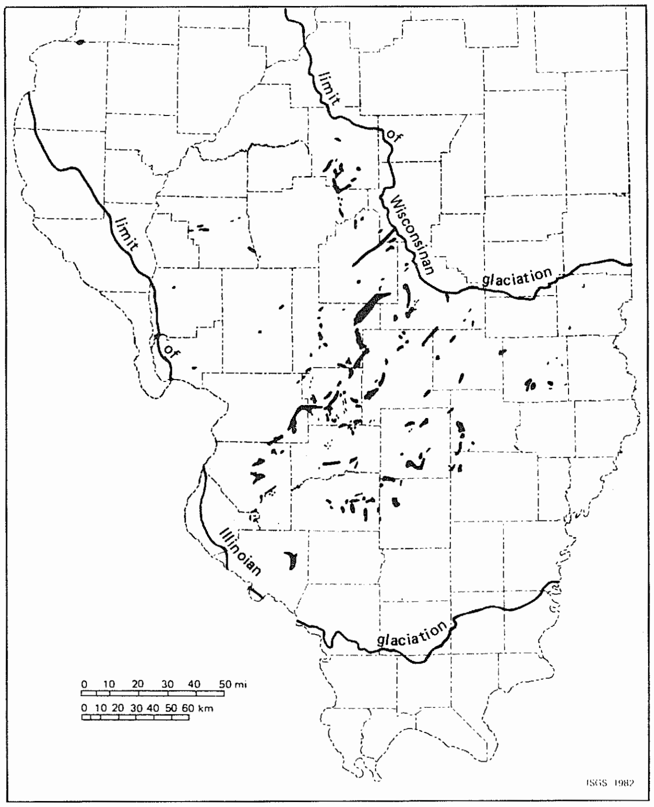

FIGURE 7. Distribution of the Hagarstown Member in southern and western Illinois as related to limits of Illinoian and Wisconsinan glaciation (modified from Lineback, 1979).

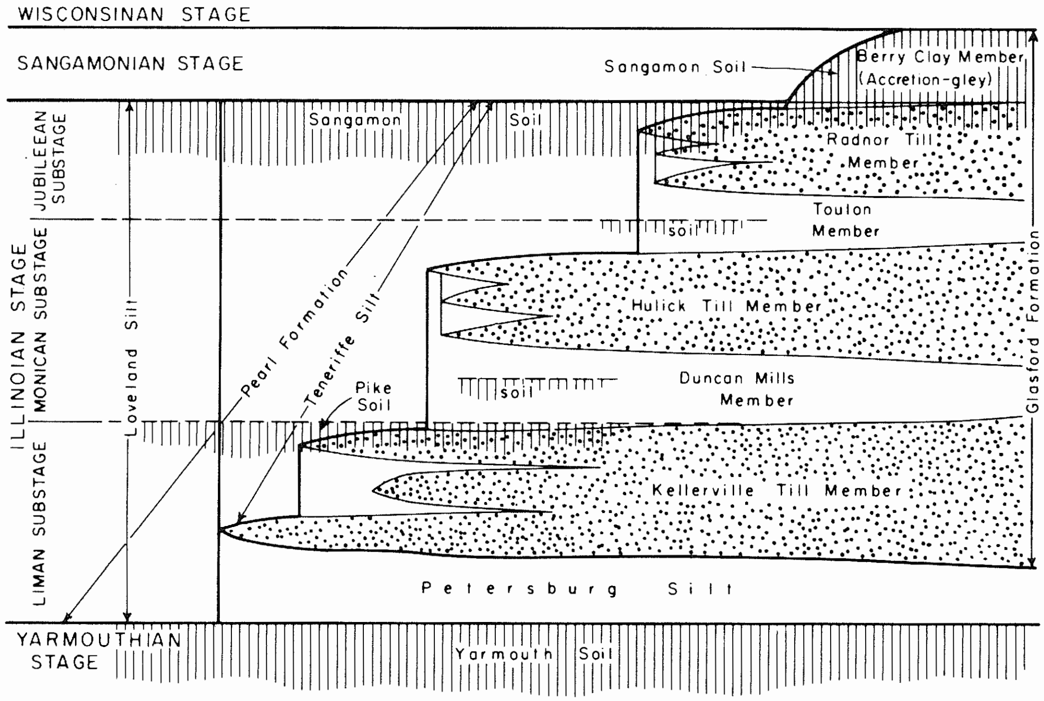

FIGURE 8. Relationship between the Pearl Formation and other formations and members of Illinoian age in central and western Illinois (Willman and Frye, 1970).

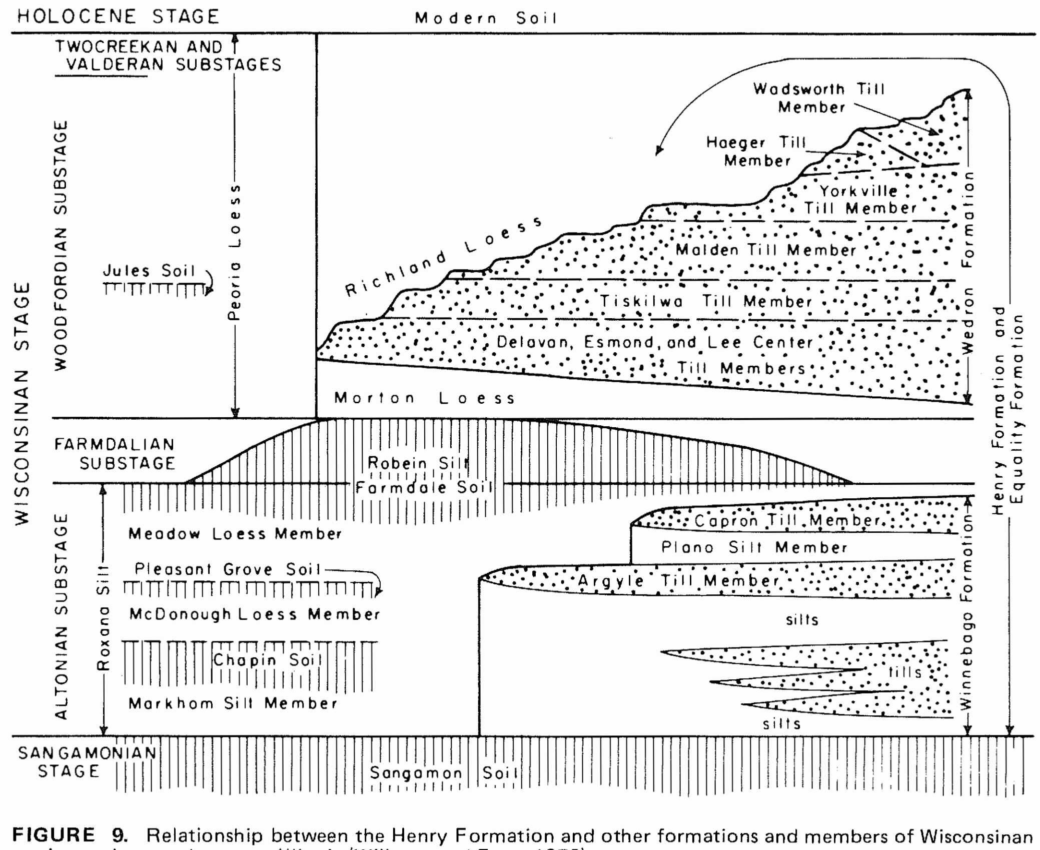

FIGURE 9. Relationship between the Henry Formation and other formations and members of Wisconsinan age in northern and western Illinois (Willman and Frye, 1970).

The types of materials just described have already been defined as contained in the Pearl Formation of Illinoian age (Willman and Frye, 1970):

> The Pearl Formation is also present as outwash on the Illinoian till plain, mainly in front of Illinoian moraines and in isolated kames and crevasse deposits. In the complex relations of the Kaskaskia ridged drift, the outwash is not readily differentiated and is included along with the youngest till in the Hagarstown Member of the Glasford Formation (p. 60).

This statement left open (H. B. Willman, personal communication, 1982) the possibility of reassignment of the ridged drift once the necessary information became available. Since 1970, deposits that have been called Hagarstown have been found on Illinoian tills other than the Vandalia. These Hagarstown-like materials were mapped as Hagarstown on the Quaternary deposits of Illinois map (Lineback, 1979).

According to Willman and Frye (1970), the Pearl Formation includes glacially derived sand and gravel that has the Sangamon Soil developed in its top, overlies Illinoian or older drift or bedrock, and is overlain by the Roxana Silt of Wisconsinan age (fig. 8). The Pearl thus occupies a relationship to Illinoian tills analogous to the relationship of the Henry Formation outwash to Wisconsinan tills

ICE CONTACT DEPOSITS	OUTWASH PLAINS	VALLEY TRAINS

Henry Formation

Wasco Member	Batavia Member	Mackinaw Member

Pearl Formation

Hagarstown Member	unnamed member	unnamed member

ISGS 1982

FIGURE 10. Analogous stratigraphic relationship between the Pearl Formation of Illinoian age and the Henry Formation of Wisconsinan age.

(fig. 9). The Wasco Member of the Henry Formation (Willman and Frye, 1970) consists of ice-contact deposits of sand and gravel occuring in kames, eskers, and deltas, with many of these deposits commonly containing irregular masses, lenses, and balls of till. Because the Hagarstown consists mostly of ice-contact sediments as described above, it is analogous to the Wasco Member of the Henry Formation, as illustrated in figure 10.

On this basis, the Hagarstown Member is herein removed from the Glasford Formation and included as a member of the Pearl Formation. The member is here formally defined as glacially derived sands and gravels of Illinoian age occurring as ice contact deposits; it includes ridges and knolls formed as eskers, kames, and crevasse fillings. The Hagarstown generally contains the Sangamon Soil in its top and is overlain by Roxana Silt and Peoria Loess.

As is also true of Henry Formation sands and gravels—particularly of the Wasco and Batavia Members—specific areas of Hagarstown deposits can be traced under succeeding tills northward (fig. 11). However, at present these are separated stratigraphically by vertical cut-off from sand and gravel surficial deposits of the Pearl Formation; the definition of the Glasford Formation (Illinoian tills) includes intercalated outwash deposits which may or may not be continuous with surficial outwash deposits southward.

The large stagnant-ice deposits of the Hagarstown Member are characterized by variability in grain size, sorting, and bedding; they grade into ablation deposits composed primarily of till-like material, mudflows, and scattered water-laid deposits on the one hand and relatively clean, well-sorted, well-bedded sand and gravel on the other. When enough information has accumulated to differentiate these various types of outwash deposits in the Pearl Formation both lithologically and geomorphically (as has already been done for the Henry Formation), the justification will exist for naming additional members in the Pearl Formation analogous to the Batavia and Mackinaw Members of the Henry Formation.

ACKNOWLEDGMENTS

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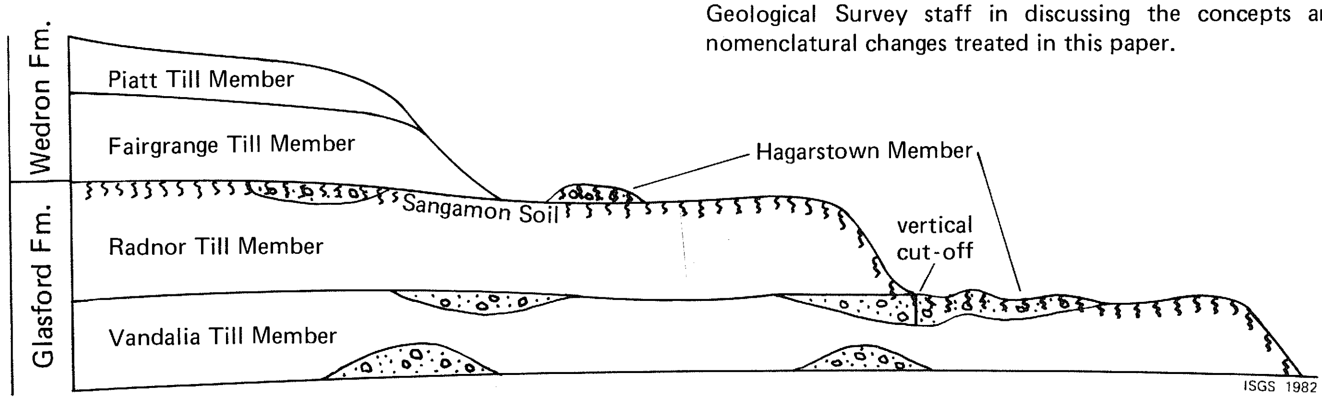

FIGURE 11. Relationship of surficial Hagarstown Member to tills and intercalated sand and gravel deposits of the Glasford and Wedron Formations (from J. P. Kempton, personal communication).

REFERENCES

Burris, C. B., W. J. Morse, and T. G. Naymik, 1981, Assessment of a regional aquifer in central Illinois: Illinois State Water Survey and Illinois State Geological Survey Cooperative Groundwater Report 6, 79 p.

Jacobs, A. M., and J. A. Lineback, 1969, Glacial geology of the Vandalia, Illinois, region: Illinois State Geological Survey, Circular 442, 23 p.

Killey, M. M., J. M. Fox, J. K. Hines, and E. D. McKay (in preparation), Surficial geology of Madison County: Illinois State Geological Survey, Circular.

Leighton, M. M., 1959, Stagnancy of the Illinoian glacial lobe east of the Illinois and Mississippi Rivers: Journal of Geology, v. 67, no. 3, p. 337-344.

Leighton, M. M., and J. A. Brophy, 1961, Illinoian glaciation in Illinois: Journal of Geology, v. 69, no. 1, p. 1-31.

Lineback, J. A. (compiler), 1979, Quaternary deposits of Illinois (map): scale 1:500,000, Illinois State Geological Survey.

Willman, H. B., and J. C. Frye, 1970, Pleistocene stratigraphy of Illinois: Illinois State Geological Survey, Bulletin 94, 204 p.