

UNIFYING NOMENCLATURE IN THE PENNSYLVANIAN SYSTEM OF THE ILLINOIS BASIN

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ABSTRACT

Nomenclature in the Pennsylvanian System of the Illinois Basin includes numerous local and regional names that have been applied to correlative units over many years of geological investigation. The Tri-State Committee on Correlations in the Pennsylvanian System of the Illinois Basin was formed by the geological surveys of Illinois, Indiana, and Kentucky to standardize this terminology among the three states. To date, seven stratigraphic names have been recommended to replace 15 existing names. Carthage limestone, West Franklin limestone, Herrin coal, Springfield coal, Houchin Creek coal, Servant coal, and Colchester coal.

INTRODUCTION

Stratigraphic nomenclature of Pennsylvanian rocks in the Illinois Basin includes local and regional names that have been applied to correlative units in the course of many years of geological investigation. During the 1800s and early 1900s, geological surveys were confined primarily to the margins of the basin,

where most of the outcrops are located. After the advent of widespread drilling for oil and gas, numerous records of subsurface geology became available, permitting regional stratigraphic analysis and correlation. It was then apparent that the existence of a Pennsylvanian stratum with more than one name was very common. Although many attempts have been made in the past to systematize terminology in the Pennsylvanian System, a multiplicity of names persists.

During the late 1970s, the need for a systematic review of Pennsylvanian nomenclature became evident. Consequently, the geological surveys of Illinois, Indiana, and Kentucky formed the Tri-State Committee on Correlations in the Pennsylvanian System of the Illinois Basin. This Committee consists of representatives from the three state surveys, with ad-hoc participation by members of the U.S. Geological Survey. The purpose of this committee is to standardize terminology in the Pennsylvanian System among the three states. This paper summarizes the work of the Committee to date. Emphasis thus far has been on selecting appropriate names of key beds for basinwide use. No recommendation is made with respect to stratigraphic rank because of varied usage among the three states.

METHODOLOGY

Committee members have examined three sources of information in arriving at basinwide correlations and recommendations presented in this paper. First, literature pertinent to the history of nomenclature of a particular unit was reviewed. Next, the unit was traced in the subsurface by means of geophysical logs and plotted on cross sections. Finally, available biostratigraphic data were considered to evaluate their support for the proposed correlation.

Several workers have examined the spore assemblages of Pennsylvanian coals in the Illinois Basin. Palynology of Illinois coals has been investigated by Brokaw (1942), Kosanke (1950), Peppers (1964), Peppers and Pfefferkorn (1970), and Phillips and Peppers (in press). Indiana coals above the Colchester have been examined by Guennel (1952). Peppers (1970 and in press) has investigated coals throughout the basin. In addition, Peppers (1983, personal communication) has a large amount of unpublished data on the palynology of western Kentucky coals.

A principal cross section was constructed using geophysical logs from coal and oil test holes and lithologic descriptions of cores from coal test holes. The line of principal cross section is shown in Figure 1. Copies of this section are available for inspection at each of the three surveys. Spacing of datum points averages about one hole per mile (1.6 km). Datum for the section is the Springfield coal. This section connects areas where earlier work in the basin has established a framework of correlations, where the key units have been identified in the subsurface, and where older existing sections in survey files provide a background of detailed correlation. Other sections were constructed to tie the principal cross section to type areas.

When agreement has been reached on use of a name, a recommendation is made to each state survey. The recommendation contains the history of the name and its synonyms, a description of the work completed by the Committee, and the suggestion of a name (together with type and reference sections) for use throughout the Illinois Basin.

PENNSYLVANIAN STRATIGRAPHY

Pennsylvanian strata in the Illinois Basin consist predominantly of shale, siltstone, and sandstone. Many of these clastic units are lenticular and discontinuous and are difficult to correlate from outcrop to outcrop or between drill holes. Units having the most lateral continuity are coals, black shales, and marine limestones.

The lower part of the Pennsylvanian System (Morrowan and Atokan Series) is dominated by sandstone, siltstone, and shale and contains only a few thin and discontinuous coals and limestones. The middle part of the Pennsylvanian (Desmoinesian Series) contains widely indentifiable units. The units easiest to correlate are coals, including such commonly mined ones as the Herrin, Springfield, and Colchester. Coals in the upper part of the Pennsylvanian (Missourian and Virgilian Series), are generally thin, although some are widely traceable. The most widely identifiable strata are limestones (e.g. Shoal Creek/Carthage limestone). Beds in these series tend to be in several localized erosional remnants.

RECOMMENDATIONS

The Committee has recommended names for seven stratigraphic units (Fig. 2) for use throughout the basin. Locations of the type and reference sections are shown in Figure 1.

Carthage Limestone

The Carthage limestone generally is found in a single stratum that is commonly 6 to 8 feet (1.8 to 2.4 m) thick, but can be 20 feet (6 m) thick in some locations. It consists of bluish gray to light gray, finely crystalline limestone that contains diverse marine faunas. Owen (1856) applied the term Carthage to this limestone in western Kentucky where present usage is the Carthage Limestone Member of the Sturgis Formation. The term Shoal Creek was introduced in Illinois by Engleman (1868). Wier and Gray (1961) extended the use of this term to Indiana. In Illinois and Indiana it is now known as the Shoal Creek Limestone Member of the Bond Formation (Fig. 2).

We have correlated the Shoal Creek Limestone Member of Illinois and Indiana with the Carthage Limestone Member of Kentucky based primarily on subsurface geophysical data. These data have substantiated earlier correlations that were based primarily on subsurface data (e.g., Wanless, 1939, 1956; Kosanke et al, 1960). Peppers (1983, personal communication) has correlated the New Haven coal that lies directly beneath the Shoal Creek in Illinois with an unnamed coal that lies beneath the Carthage in western Kentucky. These coals are characterized by the great abundance of *Punctatisporites minutus* and the rather common occurrence of *Alatisporites*. The New Haven (and correlative coals) is also the only coal in the upper part of the Pennsylvanian in the Illinois Basin that contains a significant number of specimens of *Thymospora obscura*.

Because the term Carthage is slightly older, the Committee herein recommends it as a basinwide unit name. We recommend that the type locality for the Carthage, designated by Owen (1856), which is an outcrop in the bank of the Ohio River one mile west of Uniontown, Kentucky, be retained. The type locality for the Shoal Creek, as defined by Kosanke et al (1960), should be retained as a reference locality.

West Franklin Limestone

The West Franklin in the eastern part of the Illinois Basin consists of sparsely fossiliferous to fossiliferous limestone interbedded with shale and may contain one or more thin coal beds. In western Kentucky up to four separate limestone strata with thinner intervening shales have been reported, but in eastern Illinois and Indiana a maximum of three strata is known to be present. Total thickness of the West Franklin commonly ranges from 10 to 20 feet (3 to 6 m), but the limestones are lenticular and the total interval thickens to as much as 50 feet (15 m) in parts of western Kentucky.

Owen (1839 p. 8) was the first to mention the limestone exposed in the high bank of the Ohio River at West Franklin, Posey County, Indiana. Lesquereux (1862, p. 296-297) described the stratigraphy of the limestone at West Franklin and referred to it as the West Franklin limestone. Collett (1884, p. 61-62) adopted Lesquereux's name. Shrock and Malott (1929) traced this limestone south into Kentucky and west into Illinois. Easton (1943) referred to the limestone in eastern Illinois as the West Franklin Limestone. Current usage (Fig. 2) in Indiana is West Franklin Limestone Member of the Shelburn Formation (Shaver et al, 1970) and in Illinois, West Franklin Limestone Member of the Modesto Formation (Willman et al, 1975). In Kentucky, Norwood (1878, p. 319-320) used the term Madisonville for a limestone in Hopkins County that is correlative with the West Franklin. That term has been in use in western Kentucky for many years; the limestone currently is known as the Madisonville Limestone Member of the Sturgis Formation (Kehn, 1973).

Our correlation of the West Franklin and Madisonville limestones is based on detailed analysis of geophysical logs, and it substantiates earlier correlations (e.g., Collett, 1884; Wanless, 1939; Kosanke et al, 1960).

We recommend that the term West Franklin be used for this limestone throughout the tri-state area of the Illinois Basin. The term West Franklin is slightly older than Madisonville and is presently used in two of the three Illinois Basin states. We also recommend that the type section be the exposures described by Lesquereux (1862) and Collett (1884) near the town of West Franklin in the SE1/4 SE1/4 Section 24, T. 7 S. R. 12 W., Posey County, Indiana.

Herrin Coal

The Herrin is one of the thicker and more widespread coals in the Illinois Basin. It ranges in thickness from a few inches to as much as 15 feet (4.5 m); over broad areas it averages 6 to 7 feet (1.8 to 2.1 m). It generally is characterized by a prominent claystone parting (the "blue band"), normally 1 to 3 inches (2.5 to 7.6 cm) in thickness, that occurs in its lower portion.

The term Herrin was formally applied to this coal in Illinois by Shaw and Savage (1912, p. 6). Its present designation is the Herrin (No. 6) Coal Member (Carbondale Formation) (Willman et al, 1975). The term Herrin Coal Member (Dugger Formation) was introduced for usage in Indiana by Wier (1970). Ever since Owen first described this same coal in western Kentucky, it has been called the No. 11 coal in this area. In 1916 Lee called this coal the Herrin or No.11 coal, but other workers preferred No. 11 coal and the term remained until Williamson et al (1979) reapplied the name Herrin to this coal. It is now known in western Kentucky as the Herrin coal (W. Ky. No. 11).

Correlation of the Herrin Coal Member of Illinois and Indiana with the Herrin coal (W. Ky. No. 11) of Kentucky has been based on physical correlations made by earlier workers (e.g., Lee, 1916; Wanless, 1939). The cross section constructed by this committee, based primarily on subsurface geophysical logs, confirms these earlier correlations. Peppers (1983, personal communication) has examined samples of this coal from Indiana and western Kentucky, as well as Illinois (Peppers, 1970). The Herrin coal is dominated by *Lycospora granulata*; *Laevigatosporites minutus* is subdominant. *Schopfites* is absent from the Herrin, although it is present in the underlying Briar Hill coal in Illinois and Bucktown coal in Indiana. In contrast, the next overlying coal bed, the Jamestown coal, has a low diversity of spores, containing more *Vesicaspora wilsonii* and *Cappasporites distortus*, fewer *Lycospora*.

The committee recommends that the basin-wide usage of this term be continued as it presently is in the nomenclature of the three Surveys. The type section for the Herrin was established by Shaw and Savage (1912). This section comprises subsurface exposures in mines near Herrin, Williamson County, Illinois.

Springfield Coal

This coal is the most widely recognized and mined coal in the Illinois Basin. It is commonly 4 to 8 feet (1.2 to 2.4 m) thick. In southwestern Indiana, it reaches 13 feet (4 m) in thickness. In southeastern Illinois and southwestern Indiana, where this coal is overlain by the gray, silty Dykersburg Shale Member and correlatives, it locally is split by shale partings that are in places several tens of feet thick. Throughout the remainder of the basin, it is overlain by a black fissile shale.

The terms Mulford and No. 9 coal were first used by Owen (1856, p. 15) for this coal in western Kentucky. After Owen, however, this term was not used again, and the coal was simply known as the No. 9 coal until Williamson et al (1979) reinstated the term Mulford coal (W. Ky. No. 9). In Illinois this coal until very recently had two names, the Springfield (No. 5) Coal Member (Worthen, 1883) and the Harrisburg (No. 5) Coal Member (Shaw and Savage, 1912). The term Springfield will be used throughout Illinois in future publications of the Illinois State Geological Survey (Trask, Palmer, and Peppers, 1983). Use of the term Springfield was extended to Indiana by Wayne, Johnson, and Keller (1966), who cited an unpublished manuscript. Burger and Wier (1970) formalized this name in Indiana to Springfield Coal Member (V).

The committee's correlation of the Springfield coal in Illinois and Indiana with the Mulford coal in Kentucky is based in part on subsurface physical correlations, which confirm other earlier physical correlations of the coals (e.g., Worthen, 1868; Ashley, 1909). Peppers (1983, personal communication) has also used palynology to correlate the Springfield and Mulford coals. Spore assemblages in this coal are about equally divided between those spores that were produced by lycopods and those produced by ferns. *Anapiculatisporites spinosus* reaches its maximum abundance in this coal. *Laevigatosporites globosus*, *L. minutus*, *Thymospora pseudothiessenii*, and *Schopfites* are all common.

The committee recommends the term Springfield as the unit name for this coal throughout the Illinois Basin. It already has widespread use in Illinois and Indiana. We also recommend that the type section for the Springfield remain as established by Wanless (1956). This section comprises subsurface exposures in abandoned coal mines in Section 16, T. 16 N., R. 4 W., Sangamon County, Illinois.

Houchin Creek Coal

This thin but extensive coal ranges up to 4 feet (1.2 m) thick in southwestern Indiana, southern and northern Illinois, and western Kentucky. It is generally underlain by a thin underclay and overlain by a thick, black fissile shale.

The term Houchin Creek was introduced by Fuller and Ashley (1902, p. 2) for the coal that is prominent along Houchin Creek in Pike County, Indiana. This unit had previously been designated Coal IVa by Ashley (1899, p. 90). Present usage in Indiana (Shaver et al, 1970) is the Houchin Creek Coal Member (IVa) of the Petersburg Formation (Fig. 2). Wanless (1931) applied the term Summum to this coal in western Illinois. In western Kentucky the coal was referred to as the 8b coal (Glenn, 1912) until Beard and Williamson (1979) introduced the term Ruff. The Summum (No. 4) Coal Member and Ruff coal (W. Ky. No. 8b) have been correlated with Houchin Creek by many previous workers (e.g., Wanless, 1939; Kosanke et al, 1960; Peppers, 1970).

We correlated the Houchin Creek, Summum, and Ruff coals using subsurface geophysical logs to confirm earlier physical correlations. Though the Houchin Creek is difficult to distinguish palynologically from the Springfield, Peppers (1983, personal communication) has been able to separate the two based on higher frequency of *Alatisporites* and *Reinschospora* in the Springfield and higher frequency of *Verrucosiporites*, *Lophotriletes*, *Dictyotriletes*, *Recticulatesporites*, and *Vesicaspora* in the Houchin Creek.

We recommend the older term Houchin Creek for use throughout the Illinois Basin and a section described by Wier (1961, unpublished manuscript) in the SE1/4 NE1/4 SW1/4 Section 3, T. 3 S., R. 7 W., Pike County, Indiana, as the type section. The exposure is in the abandoned highwall of a surface mine now on property owned by the state of Indiana. In 1980, a reference core of the Houchin Creek (Indiana Geological Survey drill hole SDH 306, 26.8-27.2 feet) was taken from the SE1/4 NE1/4 NW1/4 Section 2, T. 2 S., R. 7 W., Pike County. We also recommend that the alternate type section (Peppers, 1970) for the Summum be retained as a reference section.

Survant Coal

The Survant is a widespread coal in the Illinois Basin. It commonly ranges from 1 to 4 feet (0.3 to 1.2 m) thick, but in places it is as thick as 8 feet (2.4 m). It is generally underlain by a thin underclay and overlain by a dark shale. The coal commonly has a shale parting no more than a few feet thick, but the parting increases to as much as 30 feet (9 m) thick in the northern part of the coal field in Indiana and in southeastern Illinois.

Fuller and Ashley (1902) introduced the term Survant for exposures in the SW1/4 NE1/4 Section 2, T. 2 S., R. 7 W., near the now abandoned town of Survant in Pike County, Indiana. Present designation in Indiana is the Survant Coal Member (IV) of the Linton Formation (Fig. 2). Many workers have correlated the Survant with the Well coal (W. Ky. No. 8) of Kentucky and the upper bench of the Survant with the Shawneetown Coal Member of Illinois.

We have correlated the Survant and Well coals using subsurface geophysical logs. We have also correlated these coals with two benches of coal formerly called the No. 2A Coal in eastern and southeastern Illinois. The upper bench is presently designated Shawneetown Coal Member and the lower bench is unnamed. Peppers

(1970) has also correlated these coals based on palynology. *Laevigatosporites globosus*, *Schopfites*, and *Alatisporites* are abundant in the Survant and equivalent coals. A large number of species that are not present in the Houchin Creek or Springfield have been recorded from the Survant (Peppers, 1983, personal communication).

We recommend Survant as the name for this coal throughout the Illinois Basin. In addition to the Survant's being the oldest of three terms, Kosanki et al (1960, p. 34-35), when naming the Shawneetown coal, indicated the Shawneetown to be the lower of two coals called 2A but gave a depth in the core which subsequently was found to correspond with the Colchester coal. Peppers (1970) redefined the Shawneetown as the upper bench of coal. The Well coal has no type section, and was named for its having been encountered in water wells. Type section for the Survant is that designated by Fuller and Ashley in Pike County, Indiana. A reference core for the Survant was taken from near the type exposure by the Indiana Geological Survey (SDH 306, 83.3-85.2 feet) in 1980).

Colchester Coal

The Colchester is a relatively thin, highly persistent coal widely used in the Illinois Basin as a stratigraphic marker. It was considered by Wanless (1962, p. 36) to be ". . . probably the most uniform stratum in the entire basin." It is 2 to 3-1/2 feet (0.6 to 1.1 m) thick in western and northern Illinois, where it has been extensively mined; however, the coal in southern and eastern Illinois and in Indiana is thinner, ranging from a fraction of an inch to as much as 3 feet (0.9 m). Except in the northern part of the Illinois Basin, the Colchester is overlain by a distinctive black shale that is easily identified on geophysical logs of subsurface strata.

Worthen (1866, p. 59) applied Coal No. 2 to this coal in Madison County, Illinois. The Colchester was named by Worthen (1868, p. 11) from exposures in McDonough County, western Illinois. Wanless (1939) combined Worthen's terms and named it the Colchester (No. 2) coal and later (1956, p. 10) designated as the type section exposures near Colchester (Secs. 12 and 13, T. 5 N., R. 4 W., McDonough County). Kosanke et al. (1960) elevated the coal to member status in the Carbondale Formation of Illinois. It is currently known in Illinois as the Colchester (No. 2) Coal Member (Fig. 2).

In Indiana Wier and Gray (1961) adopted the term Colchester Coal Member (IIIa) of the Linton Formation for this coal, which previously had been designated Coal IIIa by Ashley (1909, p. 55-57). The name Colchester has not been used in the western Kentucky part of the Illinois Basin. However, the Colchester of southern Indiana and southeastern Illinois can be traced in the subsurface directly into northwestern Kentucky, where the unit was formerly identified by various authors as the "Schultztown," the "S," or the "No. 7" coal bed. The correlation of the Colchester from the subsurface in western Kentucky with surface exposures is controversial and has not been definitely established. Consequently the term is currently restricted to designation of the subsurface coal in western Kentucky.

The committee used geophysical logs from oil-and-gas test holes to confirm correlation of the Colchester coal throughout its known occurrence in the Illinois Basin. About 160 species of miospores have been recorded from the Colchester coal (Peppers, 1983, personal communication). The spore assemblage is dominated by *Lycospora*. *Florinites* is less abundant in this and higher coals than in

coals below. *Laevegatosporites globosus* is less abundant in the Colchester than in the Survant, Houchin Creek, or Springfield coals. *Schopfites* is rare in coals immediately below the Colchester but is common in the Colchester.

We recommend the use of the name Colchester for this coal throughout the Illinois Basin. We also recommend that the type section established by Wanless (1956, p 10) be retained. A reference core (SDII 306) taken by the Indiana Geological Survey from Pike County, Indiana, contains Colchester coal at 140.6-141.6 feet. In Kentucky the Colchester occurs at the interval 88.52 to 88.85 feet in Kentucky Geological Survey reference core hole, W. Ky. DD15.

CONCLUSIONS

The Committee has extensively reviewed the usage of 15 stratigraphic names in the tri-state region of the Illinois Basin. We find ample and convincing evidence that warrants the formal adoption of seven names: Carthage limestone, West Franklin limestone, Herrin coal, Springfield coal, Houchin Creek coal, Survant coal, and Colchester coal.

The Committee continues to meet twice a year. We also hold occasional informal field trips to examine type localities and critical exposures. We will continue to work toward the achievement of a standardized stratigraphic nomenclature for the Pennsylvanian System for use throughout the Illinois Basin.

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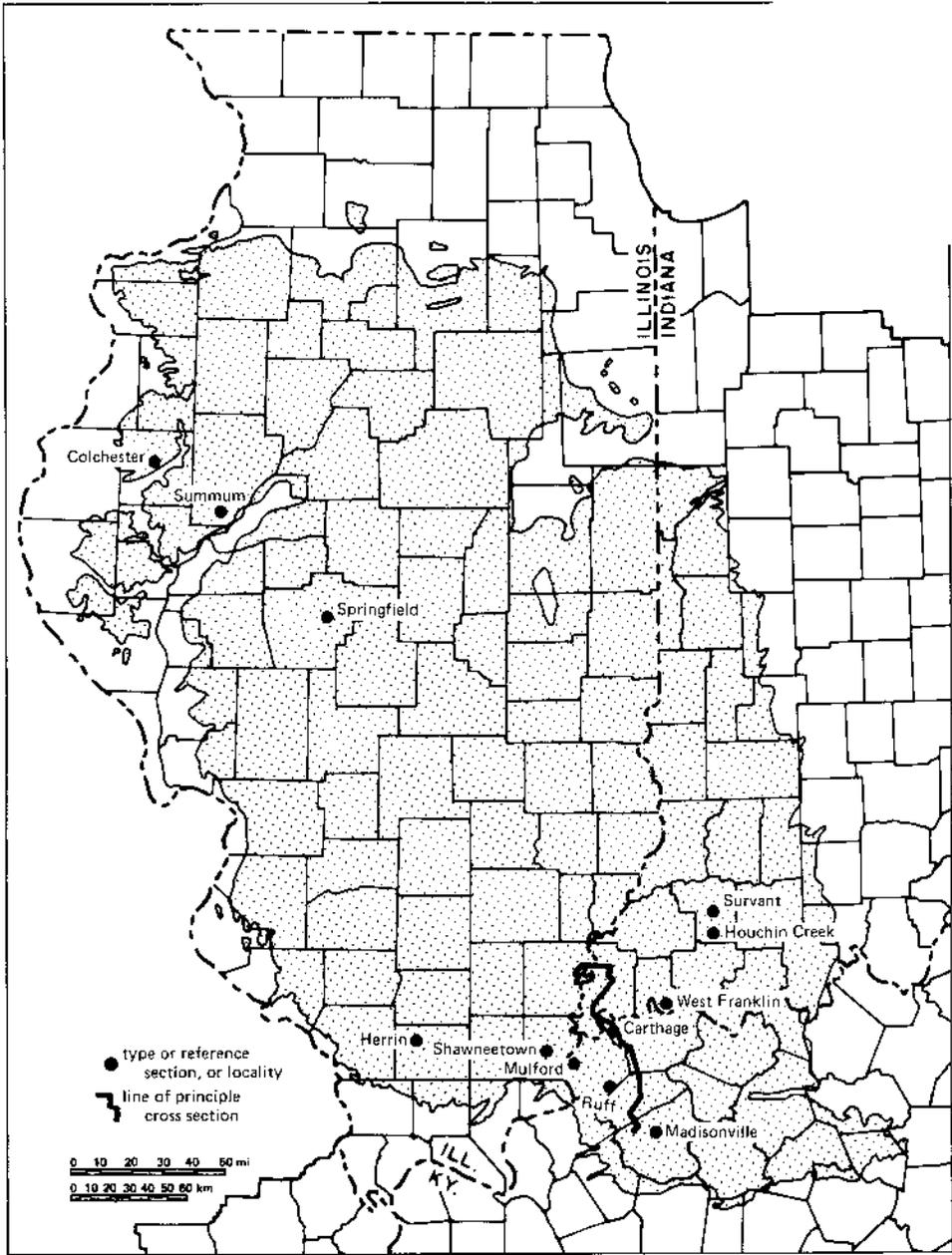


Fig. 1. Map of the Illinois Basin showing extent of Pennsylvanian rocks and locations of type and reference sections used in this report.

