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Description of Late Pennsylvanian Strata from Deep Diamond Drill Cores in the Southern Part of the Illinois Basin

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DESCRIPTION OF LATE PENNSYLVANIAN STRATA FROM DEEP DIAMOND DRILL CORES IN THE SOUTHERN PART OF THE ILLINOIS BASIN

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ABSTRACT

The combined log of two deep diamond drill cores in the western Kentucky coal field provides a basis for Kentucky-Illinois interstate correlation of late Pennsylvanian strata. Cores representing 1588 feet of strata above the Danville (No. 7) Coal (Illinois) are in permanent storage at the Illinois State Geological Survey where they have provided a basis for spore analysis and for paleontological and stratigraphic studies. Within the interval of strata represented in the cores, there are 28 coals or coal horizons, 21 marine limestone or shale members, and 11 nonmarine limestones. Sandstone and siltstone constitute 43 percent of the interval cored, shale 36 percent, limestone and fossiliferous shale 12 percent, clay and claystone 8 percent, and coal 1 percent.

The stratigraphic interval represented in the cores includes all of the Henshaw Formation and all but the lowermost part of the Lisman Formation of Kentucky, and the entire McLeansboro Group of Illinois. Many of the individual rock units described in the cores can be correlated from western Kentucky to adjacent parts of Illinois.

A composite graphic log shows lithologies in the cores to the scale of 1 inch = 50 feet. Key members are named and are correlated into a nearby electric log of the same scale. Comprehensive logs of the cores are included to provide a detailed description of the stratigraphic succession.

INTRODUCTION

Diamond drill cores recovered from Peabody Coal Company drill holes 47 and 49 near Sturgis, Kentucky (fig. 1), encountered 1588 feet of late Pennsylva-

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nian strata. The region is extensively faulted and the locality from which these cores came is located in a downfaulted block where post-Pennsylvanian faulting has preserved from erosion a small area of the youngest Pennsylvanian rocks yet recognized in the Illinois Basin. Rocks of equivalent age undoubtedly were deposited throughout the region but have been eroded from the surrounding area, except in deeper portions of this graben or in others that have not been discovered. Recent study of spore assemblages (R. A. Peppers, personal communication) from outcrops in the Rock Creek Graben (Baxter, Potter, and Doyle, 1963) in northern Hardin County, Illinois, indicates that coals at least as high stratigraphically as

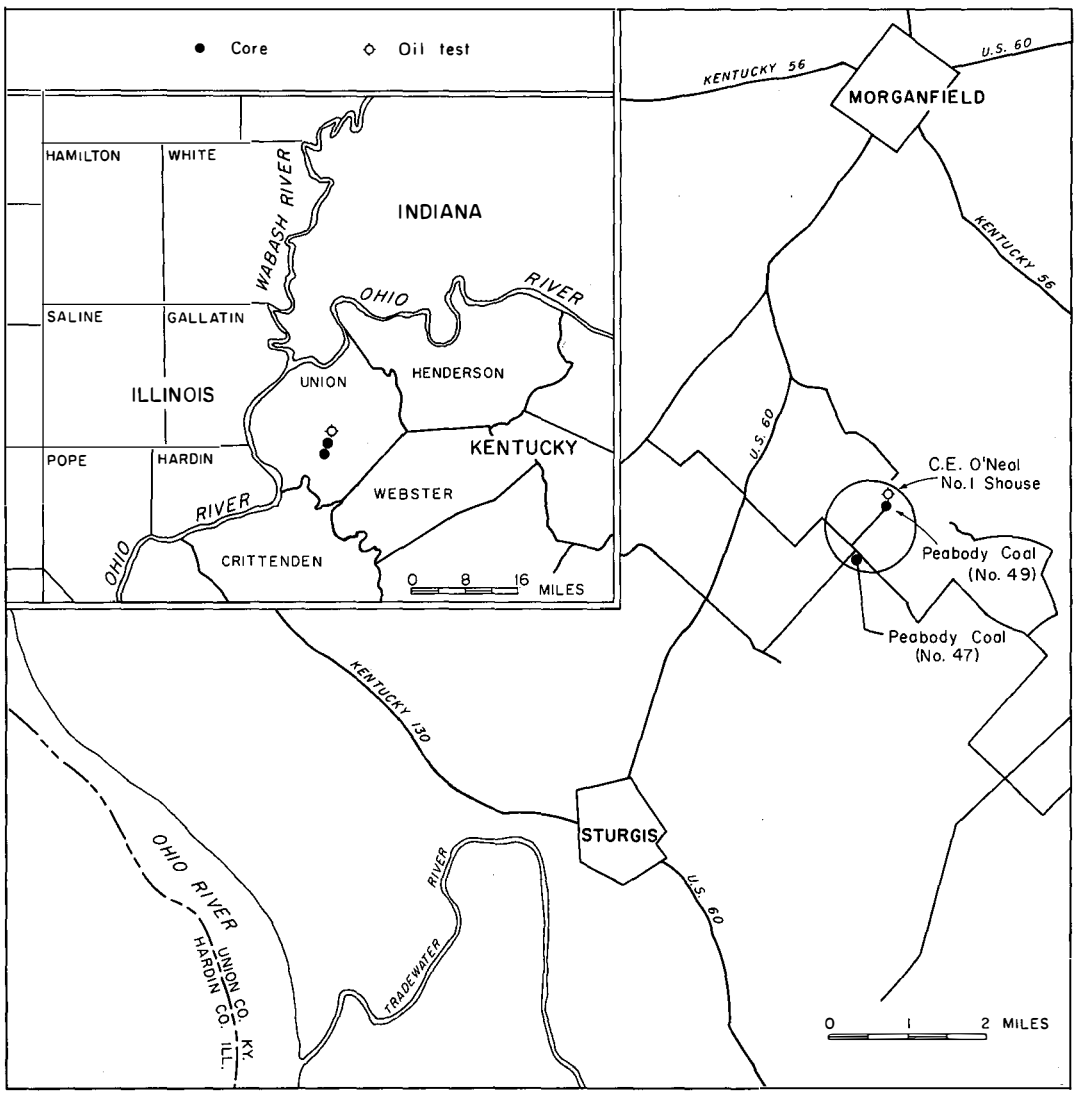

Figure 1 - Location of diamond drill holes and reference oil test hole.

the youngest coal members encountered in hole 47 (fig. 1) are locally present in downfaulted areas of Illinois near the Kentucky-Illinois boundary.

The C. E. O'Neal Company #1 H. M. Shouse oil test in Carter grid section 20-N-19, Union County, Kentucky (fig. 1), is located very close to hole 49, which is the deeper of the two core tests. Because the core hole is nearby the oil test, it is possible to make good correlations between the core and the electric log of the oil test (plate 1, in pocket). The region has been drilled extensively for oil and gas, which makes possible correlation of the Pennsylvanian section described in these cores over rather wide areas of western Kentucky and adjacent parts of southern Illinois. Also, comparison of the electric log of the Shouse test with the electric log of the Oilfield Contractors, Inc., #1 Timmons test, located about 6000 feet east of the Shouse test in Carter grid section 17-N-20 (fig. 1), shows that the Timmons test encountered approximately 180 feet of stratigraphically higher sediments than is shown in either of the cores.

It appears that the uppermost strata in the cores are younger than the youngest sediments known in the Fairfield Basin in Illinois. Thus, it is interesting to speculate whether or not downfaulted remnants of the Pennsylvanian section may be yet undiscovered in western Kentucky or adjacent parts of southern Illinois that may record the transition from Pennsylvanian to Permian age and extend the stratigraphic column for the Eastern Interior Coal Province to include sediments as young as the Dunkard Group of the Appalachian Coal Province.

Peppers (1964) studied plant spores in three coals, and in associated sediments, from the uppermost 300 feet of the core from hole 49 in order to investigate the possibility of using the spores from lithologies other than coal to correlate Pennsylvanian strata. A large variety, but relatively small number, of bisaccate pollen grains were found in the shales. These appear to have been produced in upland areas by plants undergoing major transitions in evolution. These plants became an important element of the Permian flora. Peppers also has made macerations and preliminary studies of all coals from both cores. Detailed study and comparison of spore assemblages in the coals from these cores with those from equivalent age strata in Illinois should permit correlation of late Pennsylvanian strata in Illinois with those in western Kentucky.

This paper concerns one set of data that shows the thickest unfaulted late Pennsylvanian section now known. It is being used to establish and correlate the uppermost 1588 feet of a section of Pennsylvanian rocks now known to exceed 3200 feet in total thickness in western Kentucky. It is our hope that through the use of this log as a reference section, other workers will be better able to recognize and correlate strata of late Pennsylvanian age elsewhere in western Kentucky and in adjacent areas of Illinois.

Acknowledgements

The cores on which these studies are based were drilled by the Peabody Coal Company. We are indebted to them for their interest and cooperation in making the cores available to the Illinois and Kentucky Geological Surveys for detailed examination and for their permission to publish the portion of the record described in this publication.

Previous Work

Studies of Pennsylvanian sediments in the western Kentucky coal field by David Dale Owen between 1854 and 1859 are among the earliest investigations of the sequence of Pennsylvanian strata in the Eastern Interior Coal Province. The earliest geologic report to classify the Pennsylvanian strata of the region in a stratigraphic column was that of Owen (1857). The upper part of Owen's column is shown in figure 2. In it he numbered each of the recognized coals in ascending order from the base of the Pennsylvanian System. Included within the upper Pennsylvanian portion of Owen's column were coals 12 to 18, the Anvil Rock Sandstone, the Providence Limestone, and the Carthage Limestone Members, to which Owen assigned names.

In the earliest classification of Pennsylvanian sediments in Illinois, A. H. Worthen (1866, p. 50) recognized the continuity of the sedimentary sequence between western Kentucky and southern Illinois and followed Owen's classification. The stratigraphic section first adopted by the Geological Survey of Illinois (Lesquereux, 1866, p. 213) was based on a section at Shawneetown, Illinois, which Owen had published in 1856. Worthen and his assistants used the classification that had been established by Owen in their first report and correctly extended the correlations of Coals 9 and 11 of Kentucky and the position of the Anvil Rock Sandstone of Owen's section as far north as Peoria, Illinois (Worthen, 1866, p. 53). However, in his second report, Worthen was unable to account for the thinning and disappearance of many of the lower Pennsylvanian Members of Owen's section in his northern Illinois sections and thus assumed that Owen, through some miscorrelation in the lower portion of his Kentucky section, had duplicated about 300 feet of strata (Worthen, 1868, p. 7). Therefore, Worthen based the revised general section for Illinois on the sequence exposed along the Illinois River Valley in northern Illinois and renumbered the coals, assigning them numbers from 1 to 10 in ascending order from the base of the Pennsylvanian. At that time, Worthen recognized that correlations in the earlier report (Worthen, 1866, p. 53) for coals in the upper part of the section near Peoria and in northern Illinois (including Coals 9 and 11 and the position of the Anvil Rock Sandstone) were unchanged, except that in renumbering the coals of the Illinois section his No. 5 Coal became equivalent to Owen's No. 9 Coal in the Kentucky section. Likewise, No. 6 Coal of the new Illinois section became equivalent to the No. 11 Coal of Kentucky (Worthen, 1866, p. 53; 1868, p. 9, 13).

L. C. Glenn (1912) described the Pennsylvanian sequence in western Kentucky. He added to the section described by Owen, bringing the total thickness of the Pennsylvanian to over 2065 feet. The Lisman, Geiger Lake, and Polly Coals in the upper part of the section were named at that time by Glenn.

The next major study in the western Kentucky area was made by Wallace Lee (1916), who recognized the earlier work of Owen and Glenn, but designated a total composite thickness of 2650 feet for the Pennsylvanian sequence. The establishment of the position of Owen's Carthage (Grundy Knob) Limestone in the section was a major contribution by Lee. Glenn (1922) further described the upper part of the section that Lee had described and, in addition, described additional members in the Henshaw Formation (Dixon Formation of Glenn), which extended the recognized total composite thickness of Pennsylvanian strata to 2880 feet (fig. 2).

In the adjacent region of southern Illinois, Butts (1925) utilized the section that Lee (1916) had compiled from outcrops and drill holes near Henshaw, Ken-

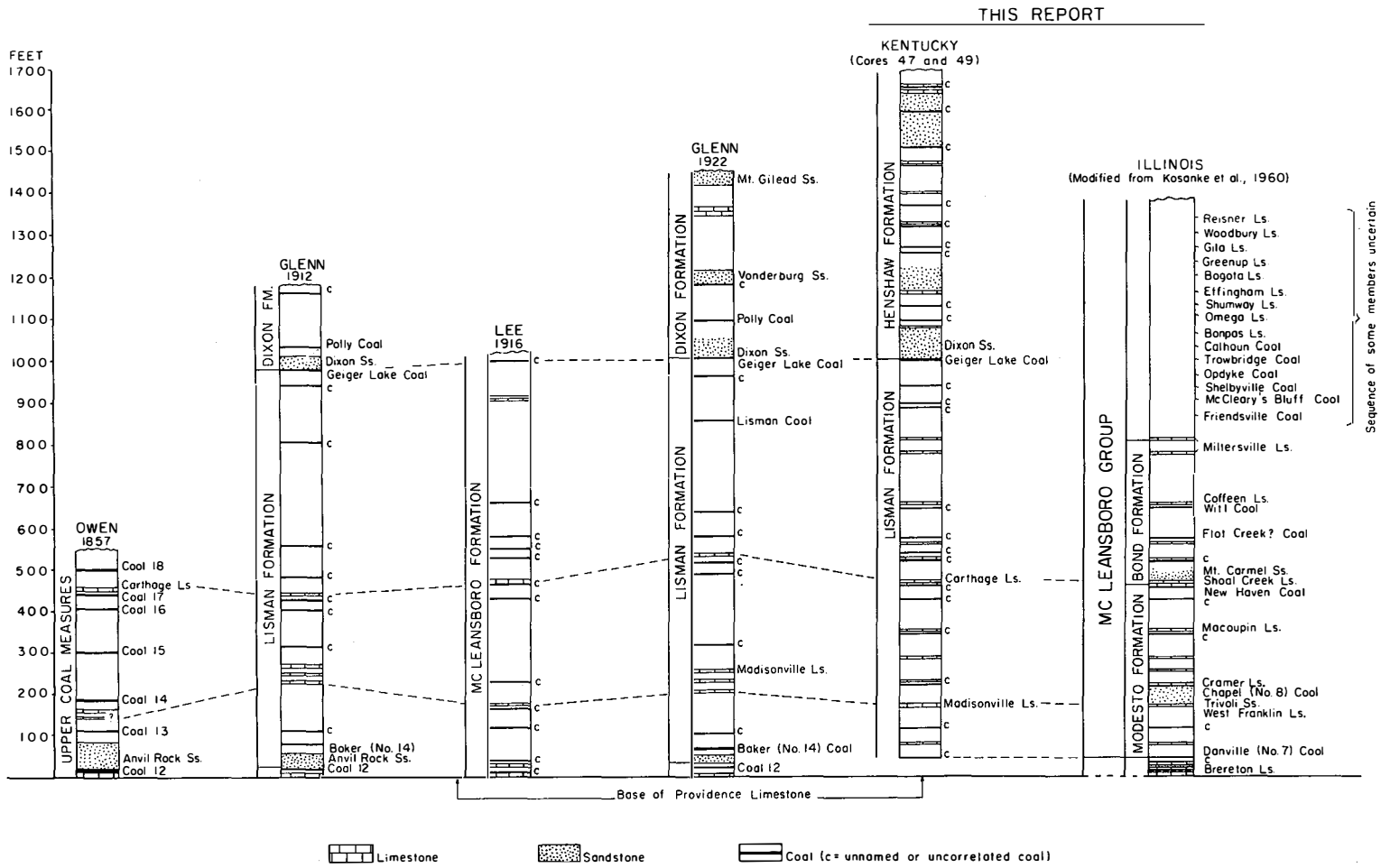

Figure 2 - Nomenclature of late Pennsylvanian strata in western Kentucky and adjacent parts of Illinois.

tucky, to describe the McLeansboro Formation in the Equality-Shawneetown area. Wanless (1955, 1962) described the Pennsylvanian sequence in the Eastern Interior Basin and commented on interstate and interbasin correlations. Kosanke et al. (1960) presented a new rock-stratigraphic classification of the Pennsylvanian strata of Illinois in which the late Pennsylvanian strata described in this report are classified in the McLeansboro Group, composed of the Modesto, Bond, and Mattoon Formations.

Mullins, Lounsbury, and Hodgson (1965) utilized the logs of the cores described in this report in compiling a generalized stratigraphic section for northwestern Kentucky. Until the present, however, study of the upper Pennsylvanian rocks of western Kentucky has been limited. The lack of good outcrops and the complicated fault pattern found near the area have made field observations and correlations in the upper section difficult.

Correlation

On plate 1, a graphic log of the cores from holes 47 and 49 is shown. Rock members that have formalized names in Kentucky are named to the right of the graphic column, and Illinois correlations are shown to the left. Correlation of key members in the core with their corresponding deflections on the electric log of a nearby oil test is also shown on plate 1.

The exact order of some named members in the Mattoon Formation in Illinois is uncertain, but undoubtedly the Kentucky equivalents of most of the named coal and limestone members of the Mattoon Formation of Illinois, listed on plate 1, are represented in these cores. Studies now in progress at the Illinois State Geological Survey, relating to details of the petrology and palynology of late Pennsylvanian rocks both in Illinois and Kentucky, will undoubtedly lead to a much more accurate correlation of the key members of the Mattoon Formation in Illinois and the Henshaw Formation in Kentucky.

A greater thickness of late Pennsylvanian sediments exists in western Kentucky and adjacent areas of southern Illinois than had been realized prior to the drilling of the deep core tests described here. Glenn (1922) recognized a composite total of 2650 feet for the Pennsylvanian System in western Kentucky, and Butts (1925) confirmed the presence of all or nearly all of these sediments in Gallatin County, Illinois. Wanless (1955, 1962) gave a total thickness of 2500 feet for the Pennsylvanian rocks of the Eastern Interior Basin. He placed the point of maximum thickness of the late Pennsylvanian strata in central western Jasper County. The maximum thickness of Pennsylvanian strata compiled by Kosanke et al. (1960) was nearly 3000 feet.

The composite thickness of strata in the core holes described in this paper is 1588 feet, to which can be added 1490 feet of sediments between the base of the Pennsylvanian and the base of the McLeansboro Group in the log of the Shouse test (fig. 1) and other nearby wells. Thus, at the locality of the core holes shown in figure 1, the total measured thickness of Pennsylvanian strata is 3078 feet. As previously stated, the Timmons test, located about 6000 feet east of the cores, records an additional 180 feet of strata stratigraphically higher than those of the cores. This would make the maximum known thickness of Pennsylvanian strata in this area 3258 feet.

Lithology

Specific lithologic groupings of the 1588-foot interval sediments described in cores 47 and 49 are summarized graphically in figure 3. Each of the 28 coals or coal horizons is shown by a line extending across the graph annotated with the measured thickness of the coal. The interval between coals is divided, according to the portion of the interval actually represented in the cores, into seven major lithologic components. These are (1) black shale, generally fissile and commonly bearing inarticulate brachiopods, conodonts, and fish remains; (2) fossiliferous limestone or shale, generally containing abundant marine fossils; (3) sandstone and siltstone; (4) gray shale, typically silty or containing thin siltstone interlaminations; (5) claystone, including sediments composed dominantly of clay-sized particles that are not laminated (includes underclay); (6) unfossiliferous limestone, occurring as beds, nodules, or pellets (normally associated with claystone), commonly referred to as underclay limestone, in some occurrences containing structures that may be of algal origin; and (7) fossiliferous limestone, in which the only identified fossils are ostracodes and Spirorbis and which are generally regarded as being of freshwater origin.

Coals and Claystones

There are 21 coals in the cores described in this paper, but only one, the coal at a depth of 459 feet, 0 inches (hole 47), exceeds 18 inches in thickness. In addition to the coals mentioned above, six coal horizons are marked by fissile carbonaceous shale directly overlying soft, crumbly, slickensided claystone (underclay) that is nearly identical with the claystones beneath most of the other coals.

Coal commonly occurs at intervals of 25 to 50 feet, interspersed with other sediments, to form repetitive or cyclic sequences. The coals most commonly rest on claystone (underclay) that is light gray and in many instances soft and very crumbly. These claystones generally are calcareous, except in their uppermost few inches. In many occurrences they contain limestone nodules that typically grade downward into a bed of nodular limestone of the type commonly referred to as freshwater or underclay limestone. The coals constitute about 1 percent of the total interval and claystones about 8 percent. Their distribution in the core is shown in figure 3.

The absence of Stigmaria root impressions in the claystones beneath any of the coals above 1215 feet (hole 47) is a notable feature of these cores. Faintly preserved root traces are visible in many of the claystones above 1215 feet, but they do not resemble the typical Stigmaria appendages or their attached rootlets commonly observed in most of the claystones (underclays) associated with coals in the Carbondale Formation or in lower coals. Robert M. Kosanke (personal communication) attributes the lack of Stigmaria in these late Pennsylvanian rocks to the dying out of Lepidodendron and Sigillaria, the Pennsylvanian trees to which the straplike Stigmaria were attached.

Limestones

The limestones encountered in the 1588 feet of strata described in these cores have been divided into three main types. These are shown in columns 2, 6, and 7 of figure 3. Column 2 shows the distribution of marine limestones, column

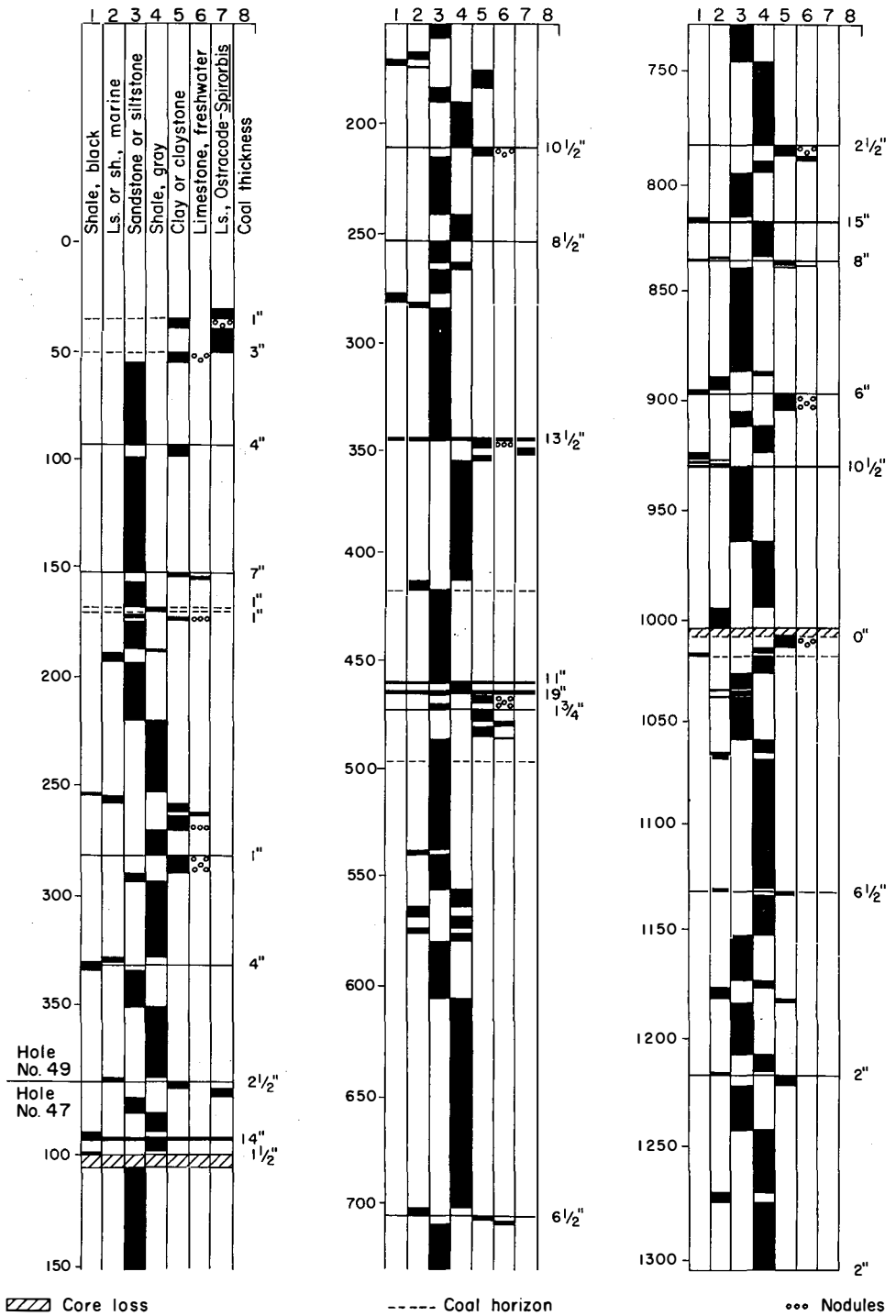

Figure 3 - Distribution of specific lithologic components in the cores.

6 shows the underclay limestones, and column 7 shows the limestones in which the only fossils observed are ostracodes and Spirorbis.

Marine Limestones.—Marine members occur at 21 positions in the core (fig. 3). Eleven of the members are found within a few feet above coal or carbonaceous horizons, and 8 of the 11 have black, hard, fissile shale between the marine units and the coal. The sequences conform to the order of successive lithologic units exhibited in cyclic sequences of Pennsylvanian sediments first described by Udden (1912) and later by Weller (1930), Wanless (1931), and Wanless and Weller (1932). The name cyclothem was applied to these sequences.

In the cores, 10 of the marine members are not closely associated with coal. Study of the distribution of major lithologic units shown in figure 3 illustrates that in some instances the marine limestones not closely associated with coal occur as single limestone beds within thick sequences of sandstone, siltstone, or shale. In other instances, the limestone occurs in several beds or benches and may be directly overlain by black shale or underlain by claystone, but with no associated coal. In a few of the cyclothems, the fossil content of the shale or limestone overlying coals indicates brackish water conditions rather than marine waters, because the fauna appears to consist entirely of inarticulate brachiopods of the genus Lingula. The most prominent marine limestone members in the core are, in ascending order, the Madisonville, Carthage, Millersville, an uncorrelated limestone at a depth of 168 feet in hole 47, and another uncorrelated limestone at a depth of 188 feet in hole 49. Most of these limestones contain large and diverse faunas consisting of brachiopods, pelecypods, crinoids, and corals, with less numerous bryozoa and other forms.

Freshwater Limestones.—The group of limestones shown in column 6 of figure 3 comprises the more or less impure, typically nodular underclay limestones or freshwater limestones that commonly occur in, or just below, the claystone (underclay) underlying coal members.

Small nodular masses, commonly incorporated in or associated with the limestone nodules, are frequently associated with the underclay limestones encountered in these cores. These nodular masses are commonly slightly darker gray than the limestone in which they are incorporated and are generally characterized by a network of very thin synaeresis cracks filled with white calcite. Norman (1959) studied similar-appearing nodules from underclays and limestones beneath a number of different coals in Illinois and concluded that the nodules were formed by a colonial form of algae, Botryococcus braunii Kützing, which lives as an extant species in freshwater and brackish lakes and is considered to be the algal species associated with boghead coals (Blackburn and Temperly, 1936).

Ostracode-Spirorbis Limestones.—A third type of limestone is shown in column 7 of figure 3. This is encountered only in the top of the Lisman Formation and in the Henshaw Formation. It is a light gray, very fine-grained limestone in which the only fossils observed are ostracodes and Spirorbis. In hole 47, limestone of this type occurs beneath the Geiger Lake Coal, at a depth of 350 feet, 5 inches, and beneath a thin coal, at a depth of 69 feet, 7 inches. In the highest part of core 49, a prominent development of limestones of this type occurs in a 3-foot, 9-inch zone at a depth of 30 feet, $8\frac{1}{2}$ inches and in a 9-foot, 11-inch zone at a depth of 39 feet, 6 inches. On the basis of general stratigraphic relationships and similarity of lithology and fauna, these limestones resemble limestones containing os-

tracode and Spirorbis faunas found in the Dunkard Group of the Appalachian Coal Province (Cross and Arkle, 1951; Cross and Schemel, 1956).

Sandstone, Siltstone, and Shale

Sandstone and siltstone constitute 43 percent of the total interval cored, and shale constitutes about 36 percent. Thus, taken together, the sandstone, siltstone, and shale comprise nearly 80 percent of the sediments in the sequence represented in the cores, but they generally do not exhibit any distinguishing features by which they can be conveniently grouped or classified. No marked changes in the ratio of sandstone to shale appear within the sediments described in these cores. Moreover, no significant differences are evident between these rocks and older Pennsylvanian rocks in this area.

STRATIGRAPHY

McLeansboro Group of Illinois
(Henshaw and Lisman Formations of Kentucky)

Mattoon Formation (Illinois), Henshaw and Lisman Formations (Kentucky)

The Mattoon Formation, the youngest Pennsylvanian formation of Illinois, includes strata above the top of the Millersville Limestone Member (Kosanke et al., 1960). Equivalent strata in Kentucky include all of the Henshaw Formation and the uppermost part of the underlying Lisman Formation.

In Illinois, the Mattoon Formation is characterized by a greater abundance of sandstone than is found in the immediately underlying formations; this relationship is also true for the cores described in this report (fig. 3).

In the uppermost 50 feet of core 49 two limestone members contain individual limestone beds up to 4 feet thick. These limestone members differ from most of the limestones at greater depths in the core as they appear to contain only ostracode and Spirorbis fossil remains.

The stratigraphically highest limestone in which abundant marine fossils were observed is a member 5 feet, 3 inches thick at a depth of 188 feet, 4 inches. This limestone is light olive-gray, fairly hard, compact, and contains brachiopods, crinoid fragments, and other marine fossils. It is overlain and underlain by siltstone and shale and is not closely associated with a coal.

The stratigraphic tie between holes 47 and 49 is made at a conspicuous sequence of beds easily recognized in both cores. The sequence consists of an 11-inch fossiliferous, calcareous shale containing abundant shells of pectenoid pelecypods overlying a thin, black, fissile shale and a $2\frac{1}{2}$-inch bony coal. Beneath the thin coal, in both cores, occurs a prominent light olive-gray to yellowish gray, very fine-grained limestone containing abundant ostracodes. In hole 49, this limestone is 5 feet thick and in hole 47 it is 3 feet, 5 inches thick, including several shale partings that contain abundant ostracode remains.

Named Members (Illinois).—Although at least 15 members have been named in the Mattoon Formation in Illinois, the area where these units are identified is somewhat removed from the area of this study and their exact relationships are uncertain, even in Illinois. For this reason, it has not been practical to correlate

these in the core record described here. The 15 named members of the Mattoon Formation of Illinois listed on plate 1 are probably represented in the cores described here, however, and future interstate studies may permit their correlation into western Kentucky.

Weller (1920) called attention to a conspicuous yellow limestone overlying a coal about 2 feet thick in the Rock Creek Graben in northern Hardin County, Illinois, which he correlated with the Bell Coal of Tradewater age in Kentucky (Abbott Formation in Illinois). On the basis of similarity of spore assemblages, R. A. Peppers (personal communication) has tentatively correlated samples from an abandoned local mine and nearby coal outcrops (Cen. NE$\frac{1}{4}$, sec. 2, T. 11 S., R. 9 E.) near the locality described by Weller with the coal at a depth of 254 feet, 8 inches in hole 47. Thus it appears that in adjacent areas of Illinois local outcrops of beds are at least as high in the stratigraphic column as those in the lower part of the Henshaw Formation.

A few drill holes in the Rock Creek Graben in the southeasternmost corner of Gallatin County, Illinois, are believed to have encountered Pennsylvanian strata at least as young as those in the lower part of the Henshaw Formation of Kentucky.

Named Members (Kentucky).—The highest named unit in the Pennsylvanian sequence in Kentucky is the Mt. Gilead Sandstone (Glenn, 1922, p. 120). The Dixon Sandstone, the base of which defines the base of the Henshaw Formation (plate 1), lies about 350 feet below the Mt. Gilead Sandstone. Because the usage of most of the names applied by Glenn (1922) to members in the Henshaw Formation has become confused, only the Dixon Sandstone is named in this report. Geologic mapping in the area is under way at the time of this writing.

The Geiger Lake Coal, which immediately underlies the Dixon Sandstone in the study area, lies at or near the top of the Lisman Formation. Lee (1916) named the Dixon Sandstone, which was described as massive, medium- to coarse-grained sandstone about 25 feet thick, that was widely traceable in the vicinity of Henshaw. The Dixon Sandstone consists of 60 feet of siltstone and sandstone in hole 47 between depths of 285 and 346 feet and overlies 13$\frac{1}{2}$ inches of Geiger Lake Coal. No other members in strata equivalent to the Mattoon Formation of Illinois have been named in Kentucky. In Illinois, Kosanke et al. (1960) estimated a maximum thickness of 500 to 600 feet for the Mattoon Formation. In the cores described here, the highest strata are 820 feet above the base of the Mattoon Formation. It is probable, therefore, that strata younger than any previously named or recognized in Illinois are represented in these cores.

Bond Formation (Illinois), Lisman Formation (Kentucky)

The Bond Formation of Illinois includes strata between the top of the Millersville Limestone Member and the base of the Shoal Creek Limestone Member (Kosanke et al., 1960). Equivalent strata in Kentucky lie within the upper part of the Lisman Formation, although the highest part of the Lisman Formation is included in the Mattoon Formation of Illinois.

Named Members (Illinois).—The following five members have been named in the Bond Formation of the central and southwestern part of Illinois (Kosanke et al., 1960): Millersville Limestone, Coffeen Limestone, Witt Coal, Flat Creek Coal, Mt. Carmel Sandstone, and Shoal Creek Limestone. Correlation of the Shoal Creek Limestone, which marks the base of the Bond Formation, with the Carthage

Limestone of western Kentucky has long been established. The Millersville Limestone is the stratigraphically highest member in Illinois for which widespread correlation has been established. It is widely recognized west of the LaSalle Anticlinal Belt in Illinois, and the equivalent Livingston Limestone is recognized east of the anticlinal belt (Kosanke et al., 1960). The Millersville is the thickest Pennsylvanian limestone in the Illinois Basin, having attained known thicknesses locally of 50 feet. Wanless (1962) correlated the Millersville Limestone with strata of late Missourian age in the Midcontinent and possibly with the Ames Limestone of Conemaugh age in Ohio. The widespread correlation of this limestone is based largely on fusulinid faunas. In southern and southeastern Illinois, and the adjacent area in western Kentucky, the Millersville Limestone is interbedded with shale or sandstone and generally occurs in two or more beds separated by shale or sandstone. In such instances, the boundary between the Bond Formation and the overlying Mattoon Formation is commonly placed at the top of the uppermost bed of limestone.

Named Members (Kentucky).— In Kentucky, the only named member in strata equivalent to the Bond Formation of Illinois is the Carthage Limestone, which has been widely traced in western Kentucky. In the core of hole 47 (plate 1), several beds of limestone in the interval between 537 and 574 feet are probably equivalent to the Millersville Limestone of Illinois. In the interval between these limestone beds and the Carthage Limestone in hole 47, four thin coals occur, three of which are overlain by marine limestone. Two of these coals are tentatively correlated with the Flat Creek and Witt Coals of Illinois (pl. 1).

Modesto Formation (Illinois), Lisman Formation (Kentucky)

The Modesto Formation of Illinois includes all strata from the top of the Danville (No. 7) Coal Member to the base of the Shoal Creek Limestone Member (Kosanke et al., 1960). These strata roughly correspond to the lower part of the Lisman Formation of Kentucky, although the actual lower boundary of the Lisman is placed at the base of the Providence Limestone, which is equivalent to the Brereton Limestone Member in the upper part of the underlying Carbondale Formation of the Kewanee Group in Illinois.

Named Members (Illinois).— Correlations in this core section have been made for the following named members recognized in Illinois (pl. 1): New Haven Coal, Macoupin Limestone, Cramer Limestone, Chapel (No. 8) Coal, Trivoli Sandstone, and West Franklin Limestone.

Named Members (Kentucky).—The only named member recognized in strata in Kentucky equivalent to the Modesto Formation is the Madisonville Limestone. This limestone is correlated with the West Franklin Limestone of Indiana and Illinois.

Carbondale Formation (Kentucky, Illinois)

The detailed log of the core in the Carbondale Formation is not included in this report, as the sequence of late Pennsylvanian strata is the principal subject of the report. Coals 9 and 11 have been worked extensively in western Kentucky, and the stratigraphic sequence and interstate correlation of most of the named members of the Carbondale Formation are fairly well established. Named members below the described portion of the cores are indicated on plate 1, in order to provide

a guide to their relationship to the described section. The named members in the upper part of the Carbondale Formation of Illinois and in western Kentucky are listed below. Detailed core descriptions for holes 47 and 49 follow.

Illinois	Western Kentucky
Danville (No. 7) Coal	No. 14 Coal?
Allenby Coal	Baker (or No. 14 ?) Coal
Bankston Fork Limestone	
Anvil Rock Sandstone	Anvil Rock Sandstone
Conant Limestone	
Jamestown Coal	No. 12 Coal
Brereton Limestone	Providence Limestone
Herrin (No. 6) Coal	No. 11 Coal
Vermilionville Sandstone	
Briar Hill (No. 5A) Coal	No. 10 Coal
St. David Limestone	
Harrisburg (No. 5) Coal	No. 9 Coal

CORE DESCRIPTIONS

The combined log of diamond drill cores is taken from drill holes located approximately 5 miles northeast of Sturgis, Union County, Kentucky (fig. 1). Hole 47 is located 260 feet from N line and 2375 feet from W line of Carter Grid, section 21-N-19. Hole 49 is located 2675 feet from N line and 1250 feet from E line of Carter Grid, section 20-N-19. Coordinates of the hole locations, derived from the Kentucky coordinate system 10,000-foot grid lines, shown on the Sturgis, Kentucky, 1:24,000 topographic map, are as follows: hole 47, X = 1,369,750 and Y = 468,200; hole 49, X = 1,371,700 and Y = 472,400.

Markers noted in the log are driller's depth markers at which cumulative errors in core measurements are adjusted. Color designations conform to the National Research Council rock color chart. Grain size designations for sandstone and siltstone are based on the Wentworth scale. The log of hole 49 is given only to a depth of 387 feet, 1½ inches. The interval 386 feet, 0 inches to 387 feet, 1½ inches overlaps the interval 66 feet, 0 inches to 67 feet, 9½ inches in the core from hole 47. The log of hole 47 is given to a depth of 1298 feet, 10 inches, which together with the partial log of hole 49 makes a continuous record through 1588 feet of core.

Cores are permanently stored in core reference files of the Illinois Geological Survey, and were described by William H. Smith, 1959, and restudied by W. H. Smith and G. E. Smith, 1966.

Core Description – Hole No. 49

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
PENNSYLVANIAN SYSTEM				
MC LEANSBORO GROUP (ILL.) MATTOON FORMATION (ILL.), HENSHAW FORMATION (KY.)				
Marker 30'0" (started to core)..			30	0
Shale, slightly silty, calcareous, medium gray, relatively hard, well laminated; ostracodes, carbonized plant fragments; grades into.....	0	8½	30	8½
Limestone zone, consisting of...	3	9	34	5½
(a) 1½" shale, medium gray, similar to shale above but contains abundant shells and ostracodes				
(b) 3½" limestone, medium gray; very similar to the 2'3" limestone bed below; contains abundant ostracodes				
(c) 1'1" shale, silty, medium gray, bottom 4" contains ostracodes and other shells; grades into				
(d) 2'3" limestone, light olive gray; single dense bed containing abundant ostracodes				
Shale, very carbonaceous, dark gray, fissile; core broken and badly disturbed.....	0	1	34	6½
Claystone, silty, medium gray, crumbly.....	0	10	35	4½
Shale, carbonaceous, dark gray..	0	1½	35	6
Claystone, slightly silty, medium gray, relatively hard but crumbly; occasional limestone nodules and nodular beds up to 2" thick that contain minute fossils, probably ostracodes; contains ¾" very carbonaceous shale 1'2" above base; grades into.....	4	0	39	6
Limestone zone, consisting of...	9	11	49	5
(a) 9" limestone, light olive gray, very dense; abundant minute fossil shells				
(b) 3'7" limestone, very argillaceous, light olive gray and medium gray; grades into				
(c) 4'1" limestone, similar to above but very nodular; contains 15 to 20 percent greenish clay matrix; nodular masses may be of algal origin				
(d) 1'6" claystone, greenish gray, very crumbly, many limestone nodules; top 5" contains several conspicuous grayish orange limestone nodules; bottom 1' contains dark pyritic nodules				
Driller's depth marker.....			50	0
Claystone, carbonaceous, dark gray, very soft.....	0	3	50	3
Claystone, light greenish gray, very soft, crumbly; abundant limestone nodules.....	1	6	51	9
Core loss; probably claystone similar to above and below....	0	8	52	5
Claystone, silty, greenish gray; weakly laminated but crumbles readily into small angular fragments; contains limestone nodules and pyritic nodules; grades into.....	3	6	55	11
Siltstone, slightly argillaceous, light greenish gray; bottom 4" interlaminated with sandstone, as below; contains occasional calcareous nodules and a prominent nodular zone 3' below top; nodular masses may be of algal origin.....	7	1	63	0
Sandstone, light gray, fine grained, massive; beds predominantly 6" - 2' thick; bottom 10' becomes coarser and contains carbonaceous micaceous laminae on bedding planes; sharp contact to coal below.....	30	0	93	0
Coal, normally brightly banded; core intact.....	0	4	93	4
Claystone, medium gray, very friable; crumbles into thin flaky fragments.....	0	8	94	0
Claystone, silty, medium gray; crumbles into small angular fragments; grades into.....	0	10	94	10
Siltstone, very clayey, crumbly; grades into.....	1	0	95	10
Siltstone, medium light gray; interbedded with about 50 percent sandstone, as below; grades into.....	2	9	98	7
Sandstone, light gray, fine to medium grained, fairly massive, in beds up to 2' thick; contains occasional laminae and zones of thin laminae that contain abundant carbonaceous micaceous material; grades into.....	43	2	141	9
Sandstone, light gray, medium grained, massive; top 1" and				

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
bottom 5'6" contain numerous thin irregular coaly laminae and occasional coaly bands up to ¾" thick; several pieces of silicified wood in the bottom 6'; abundant pyrite nodules in bottom 1"; abrupt contact to coal below	10	5	152	2
Coal, normally brightly banded; core broken in bottom 2"; bottom 1" bony	0	7	152	9
Claystone, medium gray, relatively hard; prominent hackly fracture; grades into	0	6	153	3
Claystone, similar to above but more silty; occasional small dark limestone nodules that become more numerous in lower 18"; grades into	2	9	156	0
Siltstone, very argillaceous, medium gray, rather hackly fracture; contains occasional limestone nodules, as in clay above	4	0	160	0
Siltstone, similar to above; grades into	4	6	164	6
Sandstone, light gray, fine grained; irregularly interlaminated and interbedded with about 30 percent siltstone similar to siltstone above	2	9	167	3
Shale, silty, medium gray	0	5	167	8
Shale, faintly carbonaceous, medium dark gray, very smooth, fissile; relationships suggest a weakly developed coal horizon	0	1	167	9
Shale, silty, medium gray, poorly bedded; brownish orange sideritic veinlets and crack fillings	1	4	169	1
Shale, faintly carbonaceous, medium dark gray, fissile; very similar to 1" shale at 167'8"	0	1	169	2
Shale, silty, poorly bedded; brownish orange, sideritic veinlets and crack fillings; grades into	0	8	169	10
Sandstone, light gray, thinly laminated; contains occasional calcareous nodules	1	5	171	3
Siltstone, medium gray, fairly well laminated; grades into	1	0	172	3
Claystone, very silty, medium gray, hackly fracture; crumbles into small angular fragments	1	6	173	9
Claystone, medium gray, very soft; contains abundant small limestone pellets, granular siderite, and occasional dark sideritic masses that may be of algal origin; grades into	2	5	176	2
Siltstone, very argillaceous, medium gray, slight greenish cast, poorly bedded; fractures and crumbles readily; limestone nodules moderately numerous throughout	7	7	183	9
Sandstone, argillaceous, light gray, fine grained; thinly and irregularly interlaminated with about 30 percent siltstone, as above; grades into	1	11	185	8
Shale, medium gray, thinly laminated, soft; crumbles readily into small fragments	2	0	187	8
Siltstone, very argillaceous, medium gray, soft, crumbly	0	8	188	4
Limestone, light olive gray, wavy bedded with about 25 percent greenish claystone matrix, fossiliferous; contains brachiopods and pelecypods	2	6	190	10
Driller's depth marker			190	0
Limestone, as above, but more massively bedded, hard, dense; wavy bedded interlaminations of greenish claystone form about 10 percent of total	2	6	192	6
Limestone, argillaceous, medium dark gray, abundant crinoids; limestone forms a 1½" nodular bed in silty claystone matrix; sharp contact to	0	3	192	9
Shale, very silty, medium dark gray, well laminated; grades into	0	10	193	7
Siltstone, medium dark gray; contains laminae and lenses of light gray, fine-grained sandstone	7	0	200	7
Driller's depth marker			200	0
Siltstone, as above; grades into	8	4	208	4
Siltstone, medium gray, and shale, medium dark gray; thinly interbedded and interlaminated; occasional interlaminations of light gray, fine-grained sandstone; grades into	11	8	220	0
Shale, silty, medium gray; interbedded with shaly siltstone and occasional interlaminations of fine-grained, light gray sandstone; less silty and more uniform in lower part; grades into	24	0	244	0
Shale, medium gray, fissile, uniform, darker downward; grades into	10	4	254	4
Shale, dark gray, fissile	1	2	255	6
Limestone zone, consisting of...	2	10	258	4
(a) 9½" limestone, argillaceous, medium gray, very fossiliferous; contains brachiopods, crinoids				
(b) 10½" shale, dark gray; abundant fossils and fossil fragments				
(c) 7" shale, grayish black, fissile, hard				
(d) 7" limestone, argillaceous, medium gray, very fossiliferous; contains abundant brachiopods, crinoids, and other unidentified fossils				
Claystone, medium gray, very crumbly; small limestone nodules in lower 1'	4	2	262	6
Limestone, medium gray, finely brecciated; void spaces filled with a lacy network of calcite veinlets	1	1	263	7
Claystone, medium gray, occasional limestone and sideritic nodules, weakly bedded; crumbles readily into small angular fragments; bottom 3" contains nodular beds of argillaceous limestone and siderite nodules	6	5	270	0
Shale, medium gray, fissile, weak; crumbles readily into small chips;				

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
several dark gray carbonaceous laminae in bottom 1'; grades into	2	4	272	4
Shale, medium gray, thinly laminated to fissile; less crumbly than shale above; grades into	5	8	278	0
Shale, medium gray, well laminated, relatively fissile	1	4	279	4
Driller's depth marker			280	0
Shale, as above	1	0	281	0
Shale, carbonaceous, and coaly zone, consisting of	0	5	281	5
(a) 3½" shale, black, fissile, hard				
(b) 1" coal, normally brightly banded				
(c) ½" shale, dark gray, almost bony coal				
Claystone, pyritic, slightly silty, medium dark gray, hard; contains poorly preserved plant rootlets	0	2	281	7
Claystone, medium gray; contains small limestone pellets; very weak; crumbles readily	1	1	282	8
Claystone, calcareous, greenish gray; top 1' well indurated and approaches a very argillaceous limestone; bottom part has hackly fracture and breaks into large angular fragments; contains numerous small granules and occasional nodules of light to medium gray, hard limestone; grades into	4	0	286	8
Siltstone, very argillaceous, medium gray, crumbly at top, better laminated below; contains irregular nodules, masses, and veinlets of brownish limestone and siderite; some nodules may be of algal origin	3	6	290	2
Sandstone, light gray, fine grained; contains about 35 percent thinly laminated shale, as below	4	9	294	11
Shale, very silty, medium gray near top, medium dark gray below; contains laminae and thin beds of fine-grained sandstone	5	8	300	7
Shale, very silty, medium dark gray; some thin siltstone beds in top 5'; lower part becomes finer grained and better laminated; grades into	19	5	320	0
Shale, medium dark gray, well laminated, uniform	8	0	328	0
Shale, dark gray, fissile; occasional siderite nodules; grades into	1	1	329	1
Limestone, argillaceous to shaly, medium gray, very fossiliferous; brachiopods, crinoids, corals noted	1	10	330	11
Shale, black, fissile, hard; fossils in top few inches; sharp contact at base	1	4	332	3
Coal, very bony	0	4	332	7
Shale, dark gray, fissile; contains abundant carbonized plant impressions, some of which constitute thin vitrain bands	0	2	332	9
Shale, medium gray, with abundant carbonized plant stem impressions; plant rootlets not observed; relatively weak; breaks readily	1	2	333	11
Shale, medium gray, similar to above; contains less plant fossils and becomes more silty downward; grades into	1	2	335	1
Sandstone, light gray, fine grained; about 10 percent siltstone, as below, interlaminated and thinly interbedded; contains a ¼" coaly shale at base and a 1/8" coaly band 8" above base	12	0	347	1
Siltstone, medium gray; thin, feathery interlaminations of sandstone	3	1	350	2
Siltstone, similar to above; becomes shaly at base	2	0	352	2
Driller's depth marker			350	0
Shale, medium dark gray, well laminated, uniform; occasional siderite nodules and lenses; finer grained, and very thinly laminated in lower part	20	0	370	0
Shale, medium dark gray, smooth, very fissile; abundant siderite bands and nodules	16	0	386	0
NOTE: Bottom 3'6" of the 16' shale above and the 11" fossiliferous zone below overlap the interval from 63 - 68' in the log of hole 47				
Fossiliferous zone, consisting of	0	11	386	11
(a) 2" shale, similar to above, but containing occasional shells of gastropods and Pecten				
(b) 9" shale, very fossiliferous, almost limestone, medium dark gray; contains numerous Pecten				
Coal, normally brightly banded, bony	0	2½	387	1½
Claystone, very silty, medium gray; crumbles into small angular fragments	0	10½	388	0

Core Description - Hole No. 47

The drill hole is located one mile south of hole 49, described in the preceding core description. The limestone zone and thin coal in the interval from 386 feet, 0 inches to 387 feet, 1½ inches in hole 49 overlaps the interval from 66 feet, 0 inches to 67 feet, 9½ inches in this core.

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
Marker 63'0" (started to core)			63	0
Siderite, light brownish gray	0	1	63	1
Shale, medium gray, thinly laminated, fissile, rather soft; contains an occasional Pecten and a 1" siderite band in lower part; becomes moderately fossiliferous in lower part; grades into	3	5	66	6
Fossiliferous zone, consisting of	0	11	67	5
(a) 4" shale, medium gray, similar to above, fossiliferous; contains abundant Pecten; also fossiliferous				

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
siderite nodules				
(b) 4" siltstone, calcareous, medium dark gray; contains abundant fossils, some pyritized; (fossils may all be pelecypods)				
(c) 3" shale, silty, medium dark gray; abundant small fossils and fossil fragments				
Shale, dark gray, hard, fissile; abundant carbonized plant impressions and very thin vitrain bands	0	1¾	67	6¾
Coaly zone, consisting of	0	2¾	67	9½
(a) ¾" coal, bony				
(b) 1½" claystone, brownish gray, hard, with abundant carbonized plant impressions throughout				
(c) ½" coal, bright				
Claystone, somewhat carbonaceous, very silty in part, medium dark gray; plant rootlets not observed	0	2	67	11½
Claystone, silty, medium light gray	0	6	68	5½
Siltstone, argillaceous, medium light gray, soft, poorly bedded; grades into	0	4½	68	10
Shale, argillaceous, medium gray, soft, poorly bedded; sharp contact to	0	9	69	7
Limestone zone, consisting of	3	5	73	0
(a) 1'7½" limestone, light olive gray to yellowish gray, dense, lithographic; becomes light brownish gray in zone near middle; abundant ostracodes throughout; no other fossils observed				
(b) 7½" shale, silty, very clayey, calcareous, medium gray				
(c) 5" limestone, light olive gray; similar to the 1'7½" limestone above				
(d) 3½" claystone, silty, very calcareous				
(e) 5½" limestone, light olive gray to brownish gray, dense, lithographic				
Claystone, calcareous, medium gray, soft, weak; shaly bedding in part	1	1	74	1
Driller's depth marker			75	0
Shale, clayey, somewhat silty, medium light gray, rather soft	0	9	75	9
Siltstone, very calcareous throughout, light gray, relatively thinly laminated; thin partings and laminations of shale, as above; grades into	4	6	80	3
Shale, very silty in top 1'0", slightly silty downward, medium gray, well laminated; carbonized plant fragments throughout	4	4	84	7
Shale, as above, becoming slightly finer grained and darker downward; an occasional pelecypod cast observed	6	0	90	7
Shale, medium dark gray, similar to above except smooth, fissile	1	3	91	10
Coaly zone, consisting of	1	2¾	93	¾
(a) ¼" shale, carbonaceous				
(b) ½" shale, coaly				
(c) 1'2" coal, normally brightly banded				
Siltstone, somewhat carbonaceous, dark gray; carbonized plant stem impressions	0	4	93	4¾
Shale, clayey, medium dark gray, soft, finely slickensided; occasional large plant stem impressions	1	1¼	94	6
Shale, medium gray, harder than above; contains plant impressions	0	7	95	1
Driller's depth marker			95	0
Shale, medium dark gray, similar to above, relatively firm; becomes silty downward; grades into	1	3	96	3
Siltstone, light gray and medium gray interbanded; some small scale slump structure	1	3	97	6
Shale, medium dark gray; core spin at base; abrupt change to underlying shale	1	0	98	6
Driller's depth marker			98	0
NOTE: Only 2' of core recovered between 98 and 108'; order of core in this interval is uncertain				
Shale, medium dark gray, relatively hard, contact to units below disturbed; undetermined amount of core loss below this unit	0	6		
Coaly zone, consisting of	0	2¼		
(a) 3/8" coal				
(b) 1 1/8" shale, medium gray, with prominent carbonized plant impressions				
(c) ¾" shale, argillaceous, slickensided and with weak rootlike impressions; contact to unit below is uncertain				
Shale, medium dark gray, relatively hard; contains numerous ostracodes	0	3¼		
Claystone, calcareous, medium gray and light olive gray; contains Spirorbis and unidentified broken shell fragments	0	5½		
Broken zone, consisting of	0	6½		
(a) 4¼" shale, medium and dark gray; pieces worn and disturbed in coring				
(b) ¾" coal, in broken zone; core worn by tumbling in barrel; probably considerable loss				
(c) 1½" siltstone, as below; core badly broken				
Core loss	8	½	108	0
Siltstone, light gray; about 20 percent thin interlaminations of medium and dark gray silty shale or siltstone; core has prominent striped appearance; sharp contact to	4	3	112	3
Sandstone, light gray, fine grained, thick bedded, cross-bedded in zones; has abundant coarse mica and carbonaceous debris on bedding planes; a few ½ – 3" interbeds of siltstone, as above, in top 5'	12	5	124	8
Driller's depth marker			125	0
Sandstone, light gray, fine grained, thick bedded, uniform	6	4½	131	4½

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
Coaly band, in sandstone; rather marked change in apparent grain size below this point...	0	½	131	5
Sandstone, coarsely micaceous, medium to fine grained; carbonaceous films on most bedding planes.....	3	7	135	0
Sandstone, fine grained, similar to sandstone above and below marker at 125'; top 1' contains a few sideritic lenses and pebbles.....	5	4½	140	4½
Core removed prior to detailed logging; not available for examination; probably sandstone, as above and below.....	4	7½	145	0
Sandstone, fine grained, thick bedded, rather uniform; prominent ½" coaly band at base; several ½" shale lenses scattered throughout.....	7	1	152	1
Sandstone, as above, but containing siderite nodules and small shale lenses; a 3" zone of conglomeratic sandstone in the lower part; grades into...	1	2	153	3
Sandstone, light gray, fine grained, very thinly and irregularly interlaminated; about 15 percent medium dark gray shale and siltstone laminations; bedding very contorted in some zones..	2	0	155	3
Driller's depth marker.....			155	0
Sandstone, as above marker.....	7	3	162	3
Shale, very silty, medium dark gray, hard; thin interlaminations of light gray siltstone gives the core a striped appearance.....	2	9	165	0
Shale, as above, becoming darker; thinner laminated and slightly less silty downward; sharp contact at base.....	3	8	168	8
Fossiliferous zone, consisting of.....	2	6	171	2
(a) 9½" shale, dark gray, very fossiliferous; abundant well preserved fauna; brachiopods, pelecypods, and other forms noted; contains two 1" limestone lenses				
(b) 1'7" shale, medium dark gray, smooth, hard; pyritic trail-like markings and moderately numerous fossils; several fossiliferous siderite bands				
(c) 1½" limestone, very argillaceous, highly fossiliferous; almost a coquina				
Shale, dark gray, fissile, hard; occasional marine fossils.....	1	6	172	8
Shale, dark gray, fissile, hard; no fossils observed; sharp contact to.....	2	8	175	4
Limestone, very argillaceous, light gray; a few 1/16" wavy interlaminations of dark shale; very fossiliferous; contains brachiopods, crinoid stems, and much small fossil shell debris.....	0	2½	175	6½
Shale, very calcareous, clayey, medium gray, very soft; numerous shell fragments; grades into.....	0	4	175	10½
Claystone, highly calcareous, medium gray, very soft; contains abundant pellets and small nodules of very light gray limestone; bottom 5' somewhat lighter in color and very crumbly.....	10	2	186	½
Driller's depth marker.....			185	0
Claystone, similar to above; grades into.....	0	10	185	10
Siltstone, calcareous, light gray, fine grained, thinly laminated; about 15 percent medium gray shale interlaminated and interbedded; becomes more shaly downward and grades into.....	6	4½	192	2½
Shale, medium gray, with interlaminations and thin beds of siltstone similar to above....	3	0	195	2½
Shale, slightly silty, medium gray, well laminated, moderately hard; occasional thin beds of siltstone (up to 2"), as above.....	9	7	204	9½
Driller's depth marker.....			205	0
Shale, as above; grades into....	1	5	206	5
Shale, dark gray, smooth, well laminated to fissile; abundant thin lenses and nodules of siderite; lower 3' or more contains scattered, well preserved pelecypods and ostracodes; pelecypods abundant in the bottom 3"; sharp contact to.....	5	1	211	6
Coal, normally brightly banded, core intact; no visible partings except a ¼" carbonaceous shale band 1 3/8 - 1 5/8" below top.....	0	10½	212	4½
Claystone, medium dark gray, very soft and crumbly; a few faint traces of plant rootlets present; all except top 6" is highly calcareous and contains limestone pellets.....	3	3	215	7½
Driller's depth marker.....			215	0
Siltstone, clayey and calcareous, light gray, moderately hard, thinly laminated to shaly; some shale interbedded in the lower part.....	5	0	220	0
Claystone, silty, light gray, faintly laminated; abundant siderite in veinlets and a lacelike network of crack fillings.....	1	6	221	6
Shale, light gray; contains carbonaceous material and plant fragments in moderate amounts.....	0	2	221	8
Shale, carbonaceous, dark gray, disturbed; probably some loss.....	0	¾	221	8¾
Siltstone, light gray; 10 to 20 percent medium gray shale interlaminated and thinly interbedded; siderite nodules and irregular sideritic veinlets throughout but particularly abundant in upper part.....	1	10	223	6¾
Driller's depth marker.....			225	0
Siltstone, as above marker.....	7	2½	232	2½
Siltstone, as above, and sandstone, as below, interbedded; about 50 percent each.....	2	9½	235	0
Sandstone, light gray, fine grained; top 5' thick bedded and massive; lower part interbedded with thin beds of				

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
siltstone, as below; grades into	7	8	242	8
Siltstone, medium gray, coarse grained, massive; almost sandstone	7	9	250	5
Shale, medium dark gray, silty at top; becoming smooth downward; moderately hard, well laminated, uniform; siderite streaks in lower part; lower 2' contains occasional pelecypods, ostracodes, and fish scales; sharp contact to	4	3	254	8
Coal, normally banded and bright; no prominent partings; core moderately intact; sharp contacts at top and bottom	0	8½	255	4½
Shale, silty, medium dark gray, with interlaminations of siltstone, as below; top 4" contains minor amounts of carbonaceous debris but rootlets not found	1	5½	256	10
Siltstone, medium gray, and sandstone, light gray, fine grained; interlaminated and interbedded; some small scale slump structures; also disturbed and contorted bedding	4	8	261	6
Shale, medium gray, siltstone, medium gray, and sandstone, light gray; irregularly interlaminated and thinly interbedded in about equal amounts	5	6	267	0
Siltstone, medium gray, and sandstone, light gray; irregularly interbedded and interlaminated; slump structures and contorted bedding in several places	3	4	270	4
Siltstone, medium gray, relatively massive; minor amounts of light gray fine-grained sandstone interbedded; contains slump structures, as in siltstone above	3	9	274	1
Driller's depth marker			275	0
Siltstone, medium gray, similar to above; relatively thick bedded, uniform; grades into	3	6	278	6
Shale, slightly silty, medium dark gray, relatively hard, well laminated, uniform; sharp contact at base	5	4	283	10
Limestone pellet conglomerate; consisting of abundant white limestone pellets and irregular limestone masses in dark gray claystone matrix; fossiliferous; fossils not well preserved and difficult to identify; appears to be a pelecypod fauna	0	11	284	9
Claystone, medium gray, soft, crumbly	0	5½	285	2½
Claystone, greenish gray; white limestone nodules	0	4	285	6½
Driller's depth marker			285	0
Siltstone, light gray, rather soft; very argillaceous and calcareous in top 3'6"; becomes well bedded, thinly laminated, and more uniform below; lower part contains a few fine-grained sandstone interlaminations, as in unit below	11	9½	296	9½
Siltstone, as above, interlaminated and thinly interbedded with about 50 percent fine-grained, light gray sandstone; unit shows considerable lenticular and wavy bedding	8	8½	305	6
Driller's depth marker			305	0
Siltstone, medium gray, with about 10 percent thin feathery interlaminations of light gray fine-grained sandstone; lower 3' has sandstone increasing in abundance to about 40 percent; 2½" sandstone bed at base	10	0	315	0
Siltstone, medium gray, and sandstone, light gray, as above; thinly laminated; gives striped appearance to core; about 50 percent sandstone and 50 percent siltstone	20	0	335	0
Siltstone, and sandstone, similar to above, but with sandstone increasing in abundance downward to about 80 percent below 338' depth	7	0	342	0
Sandstone, fine grained, medium bedded; in beds 3 - 8" thick	3	0	345	0
Sandstone, as above, with very minor amounts of carbonaceous laminations in bottom 3"; sharp contact to coal with no evidence of basal conglomerate or reworked material in basal part of sandstone	1	5½	346	5½
LISMAN FORMATION (KENTUCKY)				
Coal, Geiger Lake, Kentucky, bright, somewhat bony to shaly	1	1½	347	7
Claystone, medium gray; top 3" dark gray, moderately hard, slickensided; a few carbonized plant impressions evident; grades into	1	0	348	7
Clay, silty, medium gray; contains small white limestone nodules; grades into	1	10	350	5
Limestone, light gray, hard, dense; sublithographic to finely crystalline texture; contains minute fossil forms that appear to include Spirorbis only; bottom 10" contains a few clay bands and grades into	2	4½	352	9½
Claystone, medium gray with greenish cast, very crumbly	1	3	354	½
Claystone, similar to above but weak shaly bedding; contains much siderite as granules and in a fine network of veinlets	2	0	356	½
Driller's depth marker			355	0
Claystone, similar to above; grading to shale, as below	1	0	356	0
Shale, slightly silty, medium gray, relatively hard; contains a few thin beds of siltstone	9	0	365	0
Shale, medium dark gray; similar to above except slightly darker and less silty; well laminated and very uniform	10	0	375	0
Shale, slightly silty throughout, medium gray, well laminated, uniform; from 385 - 389' silty beds up to 8" thick, containing slump structures; shale examined in fairly close detail for fossil zones or possible obscure lithologic breaks, but appears to be a single lithic unit	33	10	408	10

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
Shale, dark gray, with occasional sideritic bands and an occasional marine fossil; grades into....	3	0	411	10
Fossiliferous and coaly zone, consisting of.....	2	6¾	414	4¾
(a) 7" shale, dark gray, similar to above but with moderately abundant marine fossils				
(b) 3" shale, dark gray, fissile, hard, fossiliferous				
(c) 2½" shale, calcareous, almost a shaly limestone, dark gray				
(d) 9½" shale, black, fissile, hard				
(e) 1¾" coal and coaly shale				
(f) 2" apatite? and calcite; nodules up to 1" thick imbedded in black fissile shale				
(g) 5" shale, dark gray; a coquina of small shell fragments in a dark shale matrix; bottom 1½" contains lenses of coal 1/8-½" thick				
NOTE: Contact with unit below obscure; upper part of clay unit below is somewhat broken and disturbed; the broken zone contains carbonaceous shale pieces up to 5/8" thick				
Claystone, medium gray, very smooth, slickensided; contains abundant well preserved plant impressions; faint shaly bedding; an irregular ½ – ¾" bed of calcareous sandstone in middle.....	0	8	415	¾
Carbonaceous shale; discontinuity of core below marker at 415' suggests possibility of some loss here.....	0	1	415	1¾
Driller's depth marker.....			415	0
Siltstone (seat rock), medium gray; similar to siltstone below except contains poorly preserved root impressions, coprolites, and other organic remains; not as well bedded as siltstone below; grades into.....	1	3	416	3
Siltstone, medium gray, in beds, ½ – 2" thick, fairly uniform.....	3	3	419	6
Sandstone, light gray, fine grained, in beds up to 2' thick; occasional zones of sandstone containing feathery interlaminations of medium gray shale or siltstone; sharp contact at base.....	31	8½	451	2½
Siltstone, shaly, medium gray; several 1 – 3" zones of sandstone, as above, interbedded and irregularly interlaminated; bedding shows much variability; bedding is highly angular in places and shows complex slump structure at other places; unit contains occasional very minor sandstone and shale pebble conglomerates that contain coaly bands and vitrain streaks.....	4	6	455	8½
Driller's depth marker.....			455	0
Shale, medium gray, relatively smooth, fairly soft; bedding inclined about 30°; angular contact at base.....	1	10	456	10
Sandstone, light gray, fine grained; numerous thin lenses of darker gray sandstone or shale, as below.....	1	2	458	0
Sandstone, medium gray; a 1" zone at base contains pebbles and lenses of shale, as below.....	0	6	458	6
Shale, medium dark gray, smooth slickensided joint faces, sharp contact at base.....	0	6	459	0
NOTE: All of the units between the base of the sandstone at 451' 2½" and the top of the 2" shale below indicate a zone of irregular bedding and perhaps intermixing due to penecontemporaneous slumping or cut and fill features				
Shale, carbonaceous, black, fissile, hard.....	0	2	459	2
Coaly zone, consisting of.....	5	3	464	5
(a) 11" coal, normally brightly banded; occasional hard shaly partings				
(b) 2'9" shale, medium gray, moderately fissile, hard, smooth; abundant moderately well preserved plant stem and leaf impressions				
(c) 1'7" coal, brightly banded, rather impure; contains several 1/8 – ½" shale partings and lenses				
Sandstone (seat rock), carbonaceous, argillaceous, dark gray, fine grained; becomes light gray and calcareous in bottom 4"; grades into.....	1	1	465	6
Claystone, and underclay limestone, consisting of very weakly laminated, relatively soft, silty claystone that contains abundant pellets and irregular masses (up to 1" diameter) of light to dark gray limestone; grades into.....	3	0	468	6
Siltstone, very argillaceous, calcareous; pellets and irregular masses of limestone, similar to the limestone in unit above, constitute about 10 percent of core.....	3	2	471	8
Shale, medium gray, relatively soft, smooth, fissile.....	0	4½	472	½
Shale, black, fissile, coaly, hard; prominent slickensided joint surfaces; core broken and disturbed.....	0	1	472	1½
Coal, bony; upper and lower contacts somewhat obscure; relationships suggest possibility of some loss.....	0	1¾	472	3¼
Claystone, gray with slight brownish cast, soft; contains very weak shaly laminations.....	1	3	473	6¼
Driller's depth marker.....			475	0
Claystone, very calcareous, medium gray, crumbly.....	3	4	478	4
Limestone, very argillaceous but relatively firm, light gray, with darker gray nodules; nodules may be of algal origin.....	0	6	478	10
Claystone, silty; or very				

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
argillaceous siltstone; moderately soft, weakly laminated; considerable granular siderite and some finely disseminated pyrite, slightly calcareous...	6	2	485	0
Shale, medium gray, smooth, soft; grades into.....	0	2½	485	2½
Limestone, light gray; very similar to limestone at 478'4"; very impure; contains abundant silty matrix especially in lower part; grades into.....	0	9½	486	0
Sandstone, calcareous, light gray, very fine grained; and siltstone, medium gray; very irregularly interlaminated and thinly interbedded; grades into.....	3	3	489	3
Siltstone, and sandstone, as above, interlaminated with about 50 percent medium gray shale; essentially a medium dark gray shale in basal 6"; grades into.....	4	2	493	5
Siltstone, rather shaly, medium dark gray; contains moderately abundant plant impressions, carbonaceous debris, and numerous vitrain bands (1/32-1/16" thick) in bottom 8" suggesting possibility of a poorly developed coal.....	1	7	495	0
Claystone, silty, or very fine-grained siltstone, medium gray, poorly bedded; prominent slip fractures throughout; grades into.....	0	9	495	9
Siltstone, medium dark gray, and shale, medium dark gray; interbedded and interlaminated; occasional zones contain feathery interlaminations of light gray siltstone.....	9	6	505	3
Shale, silty at top, medium dark gray, moderately smooth downward, relatively hard, well laminated, very uniform.....	10	4	515	7
Driller's depth marker.....			515	0
Shale, similar to above, becoming darker, smoother, and better laminated downward; very uniform except for a darker zone between 518 and 522' containing siderite bands up to 3" thick and occasional widely scattered pelecypod shell fossils in the shale and in the siderite bands; bottom 4" becomes softer, chippy, and is in sharp contact with the limestone below.....	21	10	536	10
BOND FORMATION (ILLINOIS)				
Limestone zone (an upper bench of the Millersville Limestone Member? of Illinois), consisting of.....	0	11½	537	9½
(a) 8" limestone, light olive gray, dense, hard, highly fossiliferous; crystalline fossils in a very fine-grained groundmass; appears to be crinoidal				
(b) 3½" limestone, silty, light olive gray, conglomeratic; small amounts of slightly carbonaceous siltstone intermixed; fossils abundant in the bottom 1"; basal contact irregular; relationships suggest considerable reworking of underlying shale and siltstone				
Shale, argillaceous, medium gray, relatively soft.....	0	2½	538	0
Siltstone, medium gray, and shale, as above, thinly interlaminated; contains abundant granular siderite; bottom 1'6" interlaminated with about 50 percent sandstone, as below; grades into.....	3	6	541	6
Sandstone, light gray, fine grained, massive, occasional shale bands and laminae; sandstone is predominantly in beds 8 - 12" thick; grades into.....	13	6	555	0
Shale, slightly silty, dark gray; bottom 2' is well laminated; top part contains about 10 percent light gray siltstone interlaminations; an occasional fossil in the bottom 1"; abrupt irregular contact to the limestone below.....	8	4	563	4
Limestone (a bench of Millersville Limestone Member? of Illinois), light olive gray, very fossiliferous, crinoidal, massive; quite similar to the limestone at 536'10" except somewhat sandy; a single massive bed with sharp contact to shale below.....	3	2	566	6
Shale, slightly silty, dark gray, well laminated; contains thin feathery interlaminations of light gray siltstone; similar to shale overlying the limestone above.....	6	8	573	2
Fossiliferous zone, consisting of.....	0	8	573	10
(a) 4" shale, similar to above, with occasional fossils (crinoids, etc.); occasional siderite nodules				
(b) 4" fossiliferous conglomerate, consisting of siderite nodules, shale pebbles, and abundant crinoid stems in a very sandy matrix				
NOTE: Relationships suggest a poorly developed bench of the Millersville Limestone Member, Illinois				
Shale, medium gray, similar to shale unit overlying the 8" fossiliferous zone above; contains interlaminations and thin beds of siltstone increasing to 50 percent in lower 1'0"; grades into.....	4	5	578	3
Sandstone, light gray, fine grained, irregularly interbedded with about 25 percent siltstone, as below.....	6	1	584	4
Driller's depth marker.....			585	0
Sandstone, as above, grading into siltstone, as below.....	5	6	590	6
Siltstone, medium gray, massive, in beds 6" - 2'0" thick.....	4	6	595	0
Siltstone, similar to above; containing zones of shale, as below, 4" - 1'0" thick.....	10	0	605	0
Shale, medium dark gray; some feathery interlaminations of light gray siltstone; medium				

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
gray siltstone, as above (in 4 – 18" beds), constitutes about 25 percent of the interval; occasional minor slump structures are present throughout	20	0	625	0
Shale, medium dark gray, with thin interlaminations of light gray siltstone (10 to 20 percent); quite similar to shale above except lacking medium gray siltstone interbeds; very uniform lithology	70	10	695	10
Shale, grayish black, smooth, hard, fissile; occasional siderite nodules; fossiliferous, contains Pecten and ostracodes?	2	6	698	4
Shale, similar to above, except becomes more fissile and harder	3	9	702	1
Fossiliferous shale zone (Coffeen Limestone Member, Illinois), consisting of	1	9½	703	10½
(a) 2½" shale, with abundant shell fragments; almost a coquina				
(b) 1'3" shale, dark gray, fossiliferous throughout				
(c) 4" shale, dark gray, many shells; almost a coquina; contains numerous crinoids				
Coal (Witt Coal Member, Illinois), normally brightly banded; core perfectly intact with a ¼" shell zone ½ – ¾" below top	0	6¼	704	4¾
Claystone, light gray, very soft, crumbly; contains small limestone pellets in lower 1'0"; grades into	1	9¾	706	2
Limestone zone, consisting of	1	8	707	10
(a) 8" claystone, similar to above; contains up to 50 percent grayish yellow limestone in conspicuous lacelike or honeycomb network				
(b) 6" limestone, very argillaceous, medium gray, with darker gray pellets and nodules that may be of algal origin; conspicuously interlaced with approximately 50 percent grayish yellow limestone, as above and below				
(c) 6" limestone, consisting of medium gray limestone nodules, as in above, in clay matrix; interlaced with 50 to 75 percent of grayish yellow limestone				
Claystone, medium gray, soft, crumbly; contains limestone pellets and nodules; grades into	0	8	708	6
Siltstone, very clayey, calcareous, sideritic, medium gray; grades into	2	9	711	3
Sandstone, calcareous, light gray, very fine grained; contains about 10 percent interlaminations of siltstone, as below	2	6	713	9
Sandstone, siltstone and shale, irregularly interlaminated and interbedded; sandstone, light gray, very fine grained; siltstone, medium gray; shale, medium dark gray; bedding throughout is irregular, wavy to contorted; contains numerous zones of small scale slump structures; upper part is principally sandstone and siltstone gradually becoming more shaly downward; grades into	31	3	745	0
Shale, very silty, medium dark gray; interlaminations of siltstone and light gray sandstone, as in above unit, constitute about 20 percent of the unit; sharp contact to coal below	37	0	782	0
NOTE: The above shale is quite uniform in character and remains silty downward to top of coal with almost total absence of fossils, carbonaceous content, or other evidences of coal roof lithology; only fossil evidence seen was small fragment of bryozoa? and a fish scale? 3" above coal				
Coal (Flat Creek Coal Member?, Illinois), normally brightly banded; core intact	0	2½	782	2½
Claystone, medium gray, extremely soft, crumbly, and grainy; occasional very small limestone knots and pellets	3	2	785	4½
Driller's depth marker			785	0
Claystone, similar to above; weakly laminated in bottom 6"; grades into	2	3	787	3
Shale, argillaceous, silty, medium gray, soft	0	3	787	6
Limestone zone, consisting of	1	0	788	6
(a) 8" limestone, grayish yellow; quite similar to limestone at 706'2" except more bedded; nodular masses in lower part may be of algal origin				
(b) 4" shale, as below, with approximately 50 percent limestone similar to above but composed mainly of small nodules that may be of algal origin; grades into				
Shale, silty, medium gray, relatively soft; contains several thin beds of siltstone and sandstone, light gray, calcareous, fine grained; grades into	4	5	792	11
Shale, medium dark gray, smooth, fissile; contains a few siderite bands	1	5	794	4
Shale, siltstone, and sandstone, interlaminated; consists predominantly of medium dark gray shale, with feathery interlaminations, lenses, and thin beds of light gray, very fine-grained sandstone and medium gray siltstone; similar to the 36'11" unit at 745'; sharp contact to shale below	20	8	815	0
Shale, dark gray, fairly smooth, fissile; fossils not observed; sharp contact to coal below	1	8	816	8
Coal, normally brightly banded; core broken in a few zones;				

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
rather shaly zone 2 – 4" below top	1	3	817	11
Claystone, medium gray, very soft, chippy, and crumbly	0	9	818	8
Shale, silty, medium gray, with feathery interlaminations and thin beds of siltstone; top 1'0" very soft and clayey; contains siderite bands and lenses; grades into	8	4	827	0
Shale, slightly silty, medium dark gray, fissile, strongly jointed; contains a prominent 2" fossiliferous clay or ironstone band containing crinoids and shell fossils 11" from base; occasional minute fossils were observed in the shale above and below the more fossiliferous band	7	4	834	4
Coal, normally brightly banded; core intact	0	8	835	0
Claystone, medium gray, very soft, grainy; occasional limestone nodules in bottom 6"; grades into	1	1	836	1
Limestone in claystone matrix; top 6" about 25 percent limestone; bottom 2" very argillaceous limestone; medium gray and grayish yellow; much lacelike network of calcite similar to that seen in limestones below several of the higher coals	0	8	836	9
Claystone, silty, medium gray; contains nodules of limestone, as above	1	2	837	11
Siltstone, medium gray; feathery interlaminations and occasional thin beds of light gray, very fine-grained sandstone; top 5'0" contains a few shaly zones and is increasingly argillaceous and soft toward top; a few limy nodules and crack fillings in top 3'0"; sharp contact at base	18	10	856	9
Sandstone (Mt. Carmel Sandstone Member, Illinois), light gray, fine grained, in beds predominantly 2 – 6" thick; minor amounts of shale in streaks and thin laminae; contains a ¾" coaly band at 864' and carbonaceous and coaly laminations in a 3" zone at 878'; sharp contact to shale below	29	6	886	3
Shale, silty, medium gray, well laminated to fissile; no fossils observed; sharp contact to limestone below	1	2	887	5
Limestone zone (Carthage Limestone, Kentucky; Shoal Creek Limestone Member, Illinois), consisting of	6	10	894	3
(a) 3" shale, dark gray; a conglomerate of shells and siderite nodules in a dark matrix				
(b) 6'7" limestone, light olive gray; top 6" very argillaceous; fossiliferous; abundant conspicuous crinoid stem segments; very dense; has wavy bedding and contains occasional stylolitic partings; basal 2'0" is about equally dense but slightly darker and more abundantly fossiliferous; sharp contact to shale below				
MODESTO FORMATION (ILLINOIS)				
Shale, dark gray, dense, fissile	1	0	895	3
Driller's depth marker			895	0
Shale, as above	1	5	896	5
Coal zone (New Haven Coal Member, Illinois), consisting of	0	7	897	0
(a) 1" pyrite band, fossiliferous at contact with shale above				
(b) 6" coal; driller reports that coal was ground out during coring but estimates it might have been about 6"; several bit-worn pieces of normally brightly banded coal up to ½" thick were recovered				
Claystone, medium gray, very soft, crumbly; contains limestone pellets and nodules up to 1" diameter beginning about 2'0" below top; nodules may be of algal origin	3	0	900	0
Limestone, and silty claystone; top 4", a 4" zone near the middle, and the bottom 3" are composed of medium gray to grayish yellow nodular limestone containing a lacelike network of calcite crack fillings with about 25 percent claystone matrix; somewhat resembles the limestones associated with claystones below the next three overlying coals; the remainder of the member is composed of claystone and siltstone with minor amounts of the described limestone beds	3	6	903	6
Driller's depth marker			905	0
Siltstone and sandstone, light gray, and shale, medium gray; interbedded and interlaminated; upper 6'0" is about 50 percent sandstone and 50 percent siltstone; lower part is 30 percent sandstone and 70 percent shale; grades into	10	0	915	0
Shale, silty at top, medium gray; abundant feathery interlaminations of light gray siltstone; becomes finer and more fissile downward; grades into	6	6	921	6
Shale, medium dark gray, relatively smooth, thinly laminated; numerous siderite bands and nodules	3	6	925	0
Shale, similar to above except darker and very thinly laminated; contains occasional pelecypod and ostracode fossils throughout; bottom 2" contains abundant broken shell fragments	6	0	931	0
Coal, somewhat shaly, normally brightly banded; core fairly well preserved but has several broken zones; relationships at base of coal are somewhat obscure but no underclay or seat earth zone appears at top of				

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
underlying unit	0	10½	931	10½
Sandstone, light gray, very fine grained, thinly interlaminated with about 50 percent medium gray siltstone and medium dark gray shale, as below; core has conspicuous striped appearance; grades into	11	1½	943	0
Siltstone, medium gray, and shale, medium dark gray; interbedded with about 5 to 10 percent light gray sandstone in feathery interlaminations decreasing in prominence downward; becomes more shaly at base and grades into	22	0	965	0
Shale, silty in upper part, medium dark gray, well laminated; becomes finer grained and darker downward; occasional fossils in the lower part; grades into	30	6	995	6
Fossiliferous zone (Macoupin Limestone Member, Illinois), consisting of	9	4	1004	10
(a) 9" shale, dark gray, very fossiliferous, marine; middle 4" is medium gray, dense, almost a limestone				
(b) 2'2" shale, dark gray, abundant small fossils, some pyritized				
(c) 2'5" shale, black, dense, fissile, sparingly fossiliferous; sharp contact to				
(d) 4'0" shale, silty, medium gray, moderately fossiliferous throughout; becomes medium dark gray in lower part				
Driller's depth marker			1005	0
Shale, similar to above, medium dark gray, relatively smooth, sparingly fossiliferous	1	10	1006	10
NOTE: 5' core loss reported by driller; uncertain of position; lithologies suggest the loss of a coal horizon; fauna in the above unit appears to be mostly pelecypod; however, identification is uncertain				
Core loss noted by driller	5	0	1011	10
Claystone, medium gray, soft, crumbly; small limestone pellets	1	3	1013	1
Limestone and claystone, medium gray; claystone contains nodules and nodular beds up to 2" thick of medium dark gray limestone and grayish yellow lacelike crack fillings	1	11	1015	0
Shale, medium gray, smooth, rather fissile; no fossils observed; occasional siderite nodules	3	7	1018	7
Carbonaceous shale (possible coal horizon), medium gray clayey shale; laminated but microslickensided; contains very abundant finely disseminated carbonaceous debris; sharp contact to underlying claystone; lithology is strongly suggestive of weakly developed coal horizon	1	1	1019	8
Claystone, silty, medium dark gray, relatively hard; lithology suggestive of underclay siltstone but Stigmaria not observed; grades into	0	6	1020	2
Shale, medium gray; about 25 percent interlaminations of light gray siltstone or very fine-grained sandstone	3	4	1023	6
Driller's depth marker			1025	0
Shale, as above; sharp basal contact	8	0	1033	0
Fossiliferous zone, including conglomeratic sandstone and shale	6	9	1039	9
(a) 11" siltstone, very argillaceous, medium gray; approaches a very silty claystone; sharp contact to				
(b) 3'0" shale, medium gray, siltstone, medium gray, and sandstone, light gray; irregularly interbedded and interlaminated; contorted bedding in some zones				
(c) 2'10" sandstone, calcareous, light gray, conglomeratic, fossiliferous; consists of shale and siderite in irregular tongues and lenses; contorted bedding; upper part contains occasional brachiopods and broken fossil fragments				
Sandstone, light gray, and siltstone, medium gray; numerous siderite nodules; very irregularly interbedded and interlaminated (contorted bedding) with about 25 percent of shale, as in unit below	10	0	1049	9
Shale, very similar to the 3'4" shale at 1020'2" except that it contains a moderate amount of siderite bands and lenses; abrupt basal contact	14	9	1064	6
Limestone, medium gray, dense, fine grained; abundant carbonized plant fragments; no fossils discernible; sharp contacts at top and bottom to shale of uniform lithology, i.e. the limestone appears as a parting in the shale	1	4	1065	10
Shale, medium gray; 15 percent light gray siltstone interlaminations in top 10'; becomes medium dark gray, less silty, and with siderite nodules in middle parts; bottom 10 – 15' becomes slightly darker, thinner laminated, and relatively smooth, with occasional small pelecypods and trail-like pyritic markings	60	8	1126	6
Limestone and fossiliferous shale zone (Cramer Limestone Member, Illinois), consisting of	1	2½	1127	8½
(a) 5" limestone, very argillaceous, medium dark gray, very fossiliferous; contains brachiopods, corals, crinoids				
(b) 6" shale, black, fissile, hard, moderately fossiliferous				
(c) 3½" limestone, very similar to 5" limestone above; sharp contact to coal				

	Thickness (ft)	Thickness (in)	Depth to base (ft)	Depth to base (in)
Coal (Chapel (No. 8) Coal Member, Illinois), normally brightly banded; contains shale lenses and marine fossils in top 2"; bottom 2" considerably broken	0	6½	1128	3
Claystone, silty, medium gray, medium hard; grades into	1	4	1129	7
Siltstone, very argillaceous, soft, crumbly; contains nodules of freshwater limestone; essentially unbedded in top 2'0"; grades into	3	8	1133	3
Shale, medium dark gray, and siltstone, medium gray, interlaminated; occasional nodules of limestone, as in siltstone above	2	1	1135	4
Driller's depth marker			1135	0
Shale, silty, medium dark gray, minor interlaminations of light gray sandstone; conspicuous 1'0" bed of sandstone, as below, 5'0" above base; very sharp contact to sandstone below	12	10	1147	10
Sandstone (Trivoli Sandstone Member, Illinois), light gray, medium fine grained; in beds ½ - 3" thick parted by dark, shaly interlaminations	7	2	1155	0
Sandstone (Trivoli Sandstone Member, Illinois), as above, except thicker bedded; predominantly in beds 4" - 2'0" thick; sharp angular contact at base with some carbonaceous debris; occasional vitrain streaks and other thin coaly bands in bottom 5'0" becoming more prominent in bottom 18"	14	0	1169	0
Shale, slightly silty, medium dark gray, relatively hard, well laminated; becomes less silty and thinner laminated downward with pyritic trail-like markings and occasional fossils in bottom 3'0"; numerous fossils in bottom 3"; sharp basal contact	4	2	1173	2
Limestone (Madisonville Limestone, Kentucky; West Franklin Limestone Member, Illinois), medium gray; a single massive bed; dense; abundant fossils; calcite-filled vertical fractures	4	7	1177	9
Claystone, very carbonaceous in top 2", medium gray, relatively hard, slickensided; contains finely disseminated pyrite and siderite granules; broken zone at bottom contact, but appears to grade into	1	7	1179	4
Siltstone, medium gray, interlaminated with about 25 percent sandstone, as below; grades into	1	6	1180	10
Sandstone, light gray, fine grained, thinly laminated; shaly partings; grades into	6	0	1186	10
Sandstone, light gray; shale and siltstone, medium gray; regularly interlaminated giving striped appearance to core	6	4	1193	2
Sandstone, light gray above, medium gray below; grades into	1	10	1195	0
Siltstone, medium gray, relatively massive	10	0	1205	0
Shale, silty in top 3'6", medium gray, becoming medium dark gray, smooth, well laminated in bottom 4'0" with occasional fossils in bottom part; grades into	8	3	1213	3
Shale, dark gray, fissile; occasional brachiopods throughout; moderately numerous fossils near top; sharp contact to coal	1	6	1214	9
Coal, normally brightly banded; shaly partings	0	2	1214	11
Claystone, slightly silty, medium gray, relatively firm; Stigmaria present	2	5	1217	4
NOTE: The underclay above is the highest in the core in which Stigmaria were well developed				
Claystone, medium gray, very soft, crumbly	1	4	1218	8
Claystone, very silty, medium gray, much granular siderite; grades into	0	5	1219	1
Sandstone, light gray, fine grained	5	4	1224	5
Driller's depth marker			1225	0
Sandstone, similar to above, interbedded with about 50 percent medium gray coarse siltstone; grades into	14	4	1239	4
Shale, silty, medium gray, relatively hard	5	8	1245	0
Shale, silty, medium gray, and siltstone, medium gray; about 50 percent each; bottom 4'0" mostly shale; becomes slightly fossiliferous and nonsilty in bottom part; grades into	23	6	1268	6
Fossiliferous zone, consisting of	4	7	1273	1
(a) 1'2" shale, dark gray, with sideritic bands and lenses, very fossiliferous; brachiopods, gastropods, crinoids observed				
(b) 3'5" shale, grayish black, fissile, moderately numerous fossils throughout; contact to shale below is fairly sharp with no evidence of a coal horizon other than the fissile shale; shale below is fossiliferous in upper part suggesting a transitional contact				
Shale, medium dark gray, relatively smooth, well laminated; sparingly fossiliferous throughout; moderately fossiliferous in upper part; contains a dark fissile zone from 1281 - 1286' but otherwise is very uniform relatively smooth shale with siderite nodules and is somewhat unique in containing fossils throughout its entire length; fossil content does not seem to increase near top of coal	25	7	1298	8
Coal (Danville (No. 7) Coal Member, Illinois), normally brightly banded; core somewhat broken	0	2½	1298	10½

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