STATE OF ILLINOIS William G. Stratton, Governor
DEPARTMENT OF REGISTRATION AND EDUCATION
Vera M. Binks, Director

1958

PENNSYLVANIAN FAUNAS of the Beardstown, Glasford, Havana, and Vermont Quadrangles

Harold R. Wanless

REPORT OF INVESTIGATIONS 205

ILLINOIS STATE GEOLOGICAL SURVEY
JOHN C. FRYE, *Chief* URBANA, ILLINOIS

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Urbana, Illinois 1958

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PENNSYLVANIAN FAUNAS OF THE BEARDSTOWN, GLASFORD, HAVANA, AND VERMONT QUADRANGLES, ILLINOIS

HAROLD R. WANLESS

ABSTRACT

This report lists more than 500 species of invertebrate fossils collected from the Pennsylvanian rocks of western Illinois. The study is based on 399 collections from 49 fossiliferous beds. The faunas are dominantly marine, although a few beds contain fresh-water or brackish-water fossils.

The report interprets the environmental relations of the faunas, relating them to probable depths of water, which are believed to express many eustatic changes in sea level.

The value of the faunas as stratigraphic markers is discussed and the usefulness of some forms as index fossils is indicated.

INTRODUCTION

Pennsylvanian rocks exposed in Fulton County, Illinois, were selected by Worthen (1870) as the type for coals numbered 1 through 7 in the lower and middle Pennsylvanian. In the geologic mapping of the Beardstown, Glasford, Havana, and Vermont quadrangles (Wanless, 1957), which include most of Fulton County, the column of outcropping Pennsylvanian rocks is classified into 154 numbered members. These in turn are grouped into 21 cyclothems, most of which contain some beds deposited when the area was submerged beneath marine waters and others deposited in fresh or brackish waters. Marine fossils are found in 12 of the cyclothems, and the others may contain nonfossiliferous marine beds. Of the 154 numbered members, 49 contain marine fossils.

The faunas are exceedingly diverse. More than 500 species or varieties have been identified, so that this is probably the richest fauna thus far recorded from Pennsylvanian rocks. The fauna of some beds, as well as the total fauna, would be enlarged by further collecting. In particular the Francis Creek shale (member 64), Hanover limestone (member 92), and the Exline limestone (member 142) are not adequately represented in the collections.

The faunas are found in shales and limestones of several types. Most of the fossil-bearing beds are from a few inches to three feet thick, and where two fossiliferous beds of different lithology are adjacent, it is not uncommon to find their faunas strikingly different. The slight thickness of most fossiliferous beds indicates relatively frequent changes in sedimentation conditions and in environments.

In all, 399 collections, which probably contain more than 100,000 specimens of macrofossils, have been made from these beds by J. M. Weller, H. R. Wanless, C. L. Cooper, W. V. Searight, A. C. Bevan, L. J. Henbest, T. E. Savage, E. C. Dapples, H. B. Willman, and H. L. Geis. The larger fossils were identified by H. R. Wanless in 1944 and were checked by J. M. Weller in the same year. The microfossils also were identified by C. L. Cooper in 1944. The fossil names were checked and a few changes made by C. W. Collinson in 1956.

The lists of fossils in individual collections are too lengthy to publish in this report, but they may be consulted at the State Geological Survey in Urbana. The composite fauna of each member (table 3) and the list of collecting localities (table 4) follow the text.

Appreciation is expressed to J. M. Weller for help in identification of the fossils, for the use of his excellent paleontological library, and for careful checking of all fossil identifications except microfossils; to C. L. Cooper for identifying the foraminifera, conodonts, and ostracodes, and to C. W. Collinson and Alan Scott for modernizing the nomenclature to reflect changes made between 1944 and 1956 and for checking identifications of additional collections made during 1956.

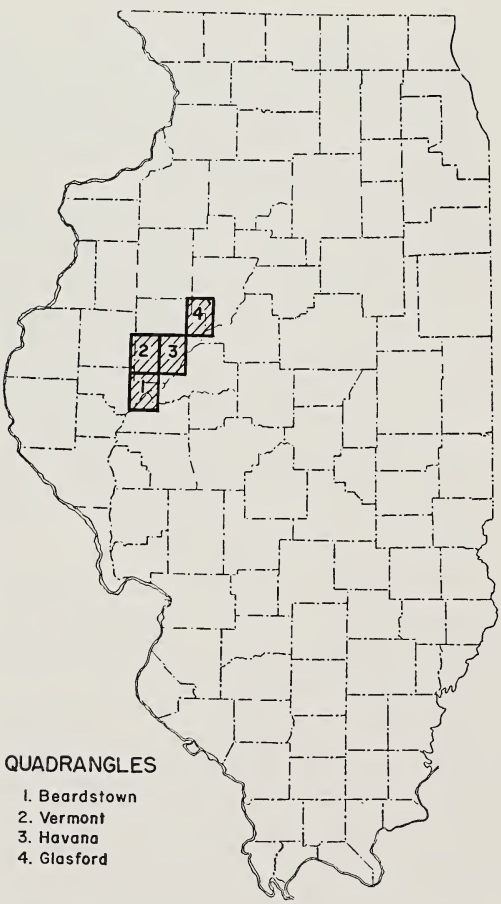

Fig. 1.—Location of the Beardstown, Glasford, Havana, and Vermont quadrangles.

STRATIGRAPHIC RELATIONS OF FAUNAS

The sequence of cyclothems and members in the Beardstown, Glasford, Havana, and Vermont quadrangles is shown in figure 2, which is summarized from the detailed descriptions in Illinois Geological Survey Bulletin 82 (Wanless, 1957). The regional correlations of the cyclothems are shown in table 1. Correlations of the members with other named units in Illinois and throughout the Eastern Interior coal basin are discussed in Bulletin 82 and Circular 217 (Wanless, 1956).

The typical western Illinois cyclothem contains ten lithologic units named in descending order as follows:

10. Gray shale, locally with ironstone nodules or beds
9. Limestone and calcareous shale
8. Black sheety shale
7. Limestone (local)
6. Gray shale (local)
5. Coal
4. Underclay
3. Underclay limestone
2. Sandy shale
1. Sandstone with unconformity at base

Each unit of the typical cyclothem may be a member, such as most of the coals, underclays, and sandstones, but some units consist of several members, such as the distinctive limestone and shale members that comprise unit 9 in the Liverpool cyclothem.

TABLE 1.—REGIONAL CORRELATIONS

This Area*	Appalachian Region	Northern Midcontinent Region
McLeansboro Group	Conemaugh Group	Missouri Group
Trivoli	Brush Creek?	Hertha?
		Des Moines Group
Exline		Exline
Gimlet		Cooper Creek
Sparland		Worland
Carbondale Group	Allegheny Group	
Pokeberry		Below Coal Creek
Brereton	Washingtonville	Myrick Station
St. David		Houx
Summum		Blackjack Creek, Lower Fort Scott, Oswego
Liverpool	Hamden	Ardmore, Verdigris
Tradewater Group		
Greenbush		Roof of Fleming coal?
Seahorne	Vanport?	Pink limestone, Tiawah
	Pottsville Group	
Seville	Lower Mercer	Seville

*Units named in first column are cyclothems. Units named in second and third columns are fossiliferous limestones and shales.

Units 1 to 6 are believed to be nonmarine, although 6 is marine in places. Units 7 to 10 are marine. In this area nearly all the fossils are found in units 6 to 10. However, unit 3, the underclay limestone, contains freshwater fossils in the Greenbush cyclothem and marine fossils in the Brereton cyclothem. Distribution by cyclothems of fossiliferous units, number of fossiliferous members, and total species or varieties are shown in table 2.

Because each of the several marine inundations of western Illinois during Pennsylvanian time had unique outlines, depths, durations, and climates, the marine strata of the cyclothems differ in lithology, fauna, thickness, and sequence. Thus the St. David limestone thins and disappears north of this area, but the Seville limestone is thicker and purer to the north. The Hanover limestone thickens southwestward and is very widespread in Missouri, Kansas, and Oklahoma but wedges out in the Havana quadrangle. The Lonsdale limestone has nearly optimum development in the Glasford quadrangle. The major marine limestone of the Sparland cyclothem, the Piasa or Cutler, is widespread to the south but wedges out before reaching this area, so that the black sheety shale

TABLE 2.—DISTRIBUTION OF FOSSILS BY UNITS, MEMBERS AND CYCLOTHEMS

Cyclothem	Units that are fossiliferous	Number of fossiliferous members	Species or varieties
Trivoli	7, 8, 9	5	108
Exline	9, 10?	2	51
Gimlet	7, 8, 9	4	223
Sparland	7, 8	2	82
Pokeberry	9	1	36
Brereton	3, 8, 9	4	98
St. David	5, 8, 9, 10	7	223
Summum	8, 9	4	21
Liverpool	6, 7?, 8, 9, 10	15	198
Abingdon		0	0
Greenbush	3, 9	2	8
Wiley		0	0
Seahorne	9	1	112
Upper DeLong		0	0
Middle DeLong		0	0
Lower DeLong		0	0
Seville	8, 9	2	97
Pope Creek		0	0
Tarter		0	0
Babylon		0	0
Pre-Babylon		0	0

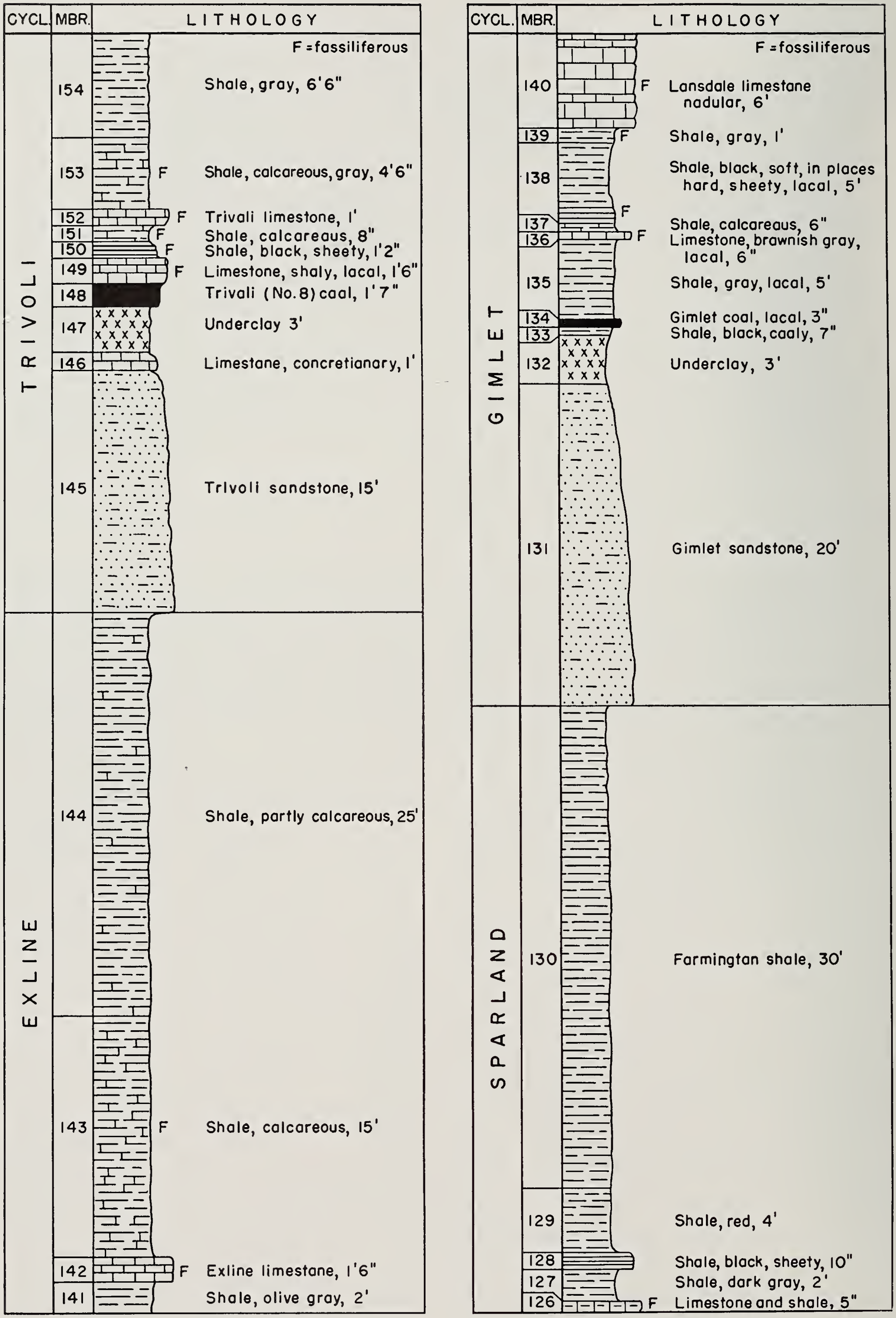

FIG. 2.—Columnar section of Pennsylvanian strata in the Beardstown, Glasford, Havana, and Vermont quadrangles.

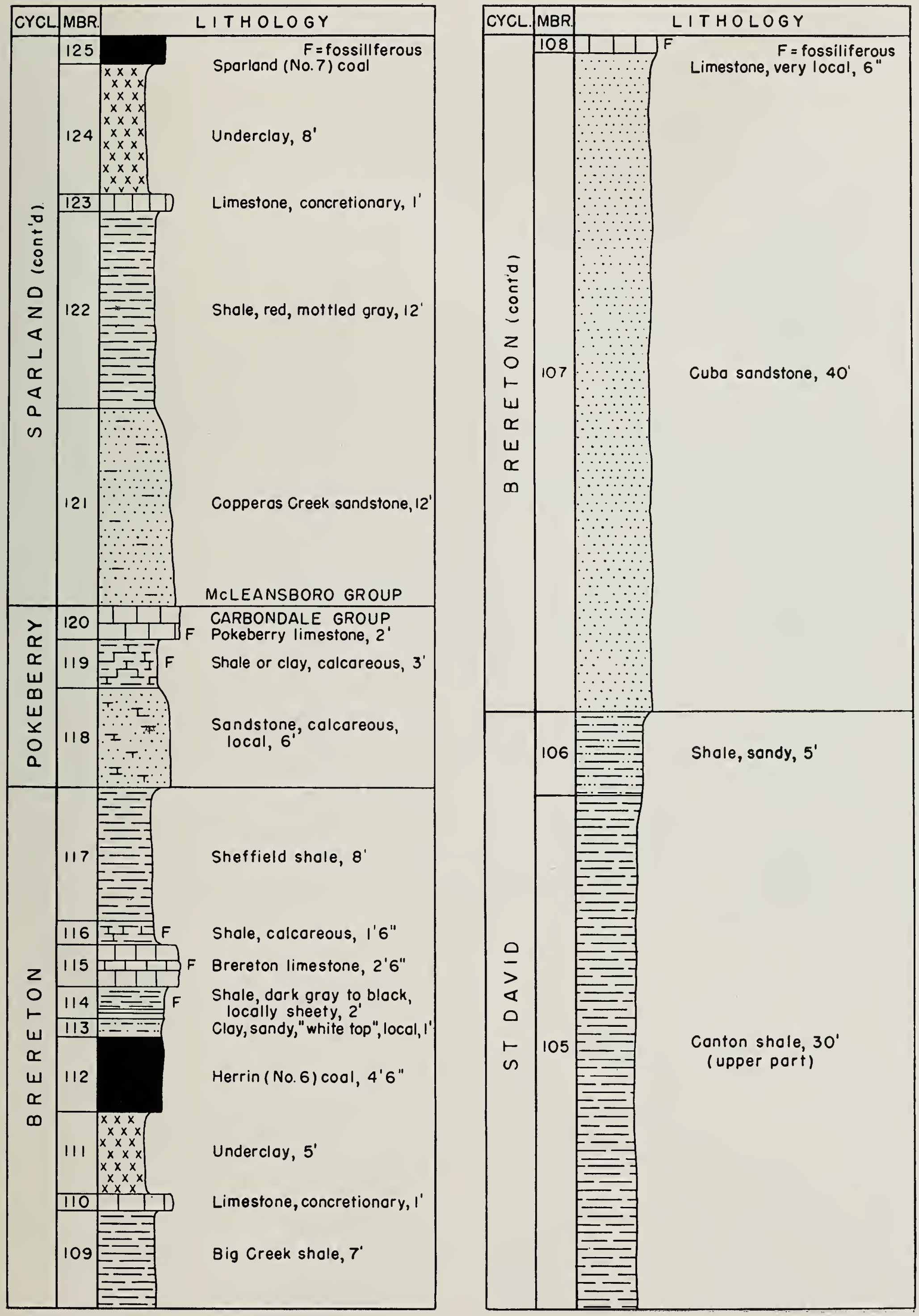

FIG. 2.—continued.

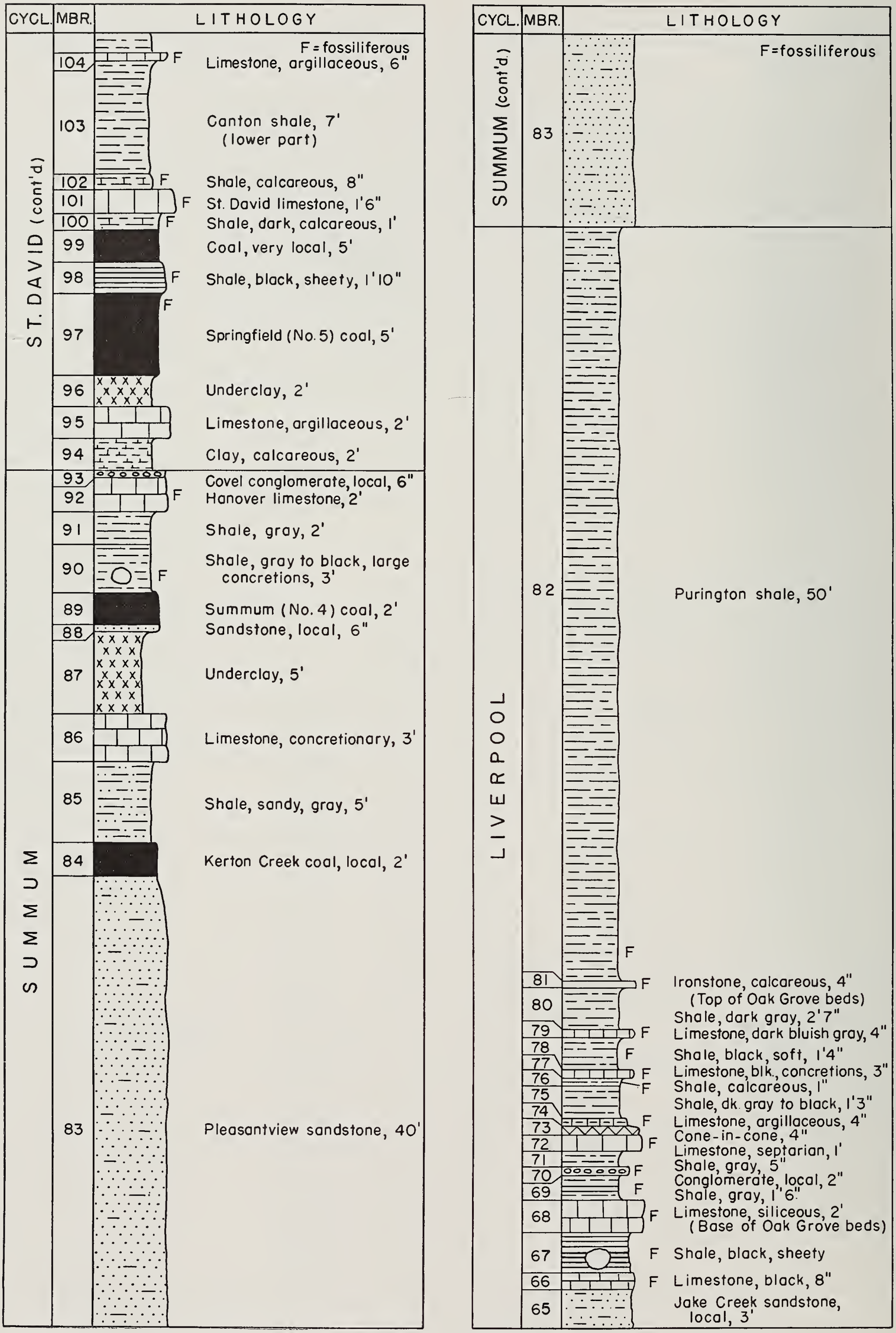

FIG. 2.—continued.

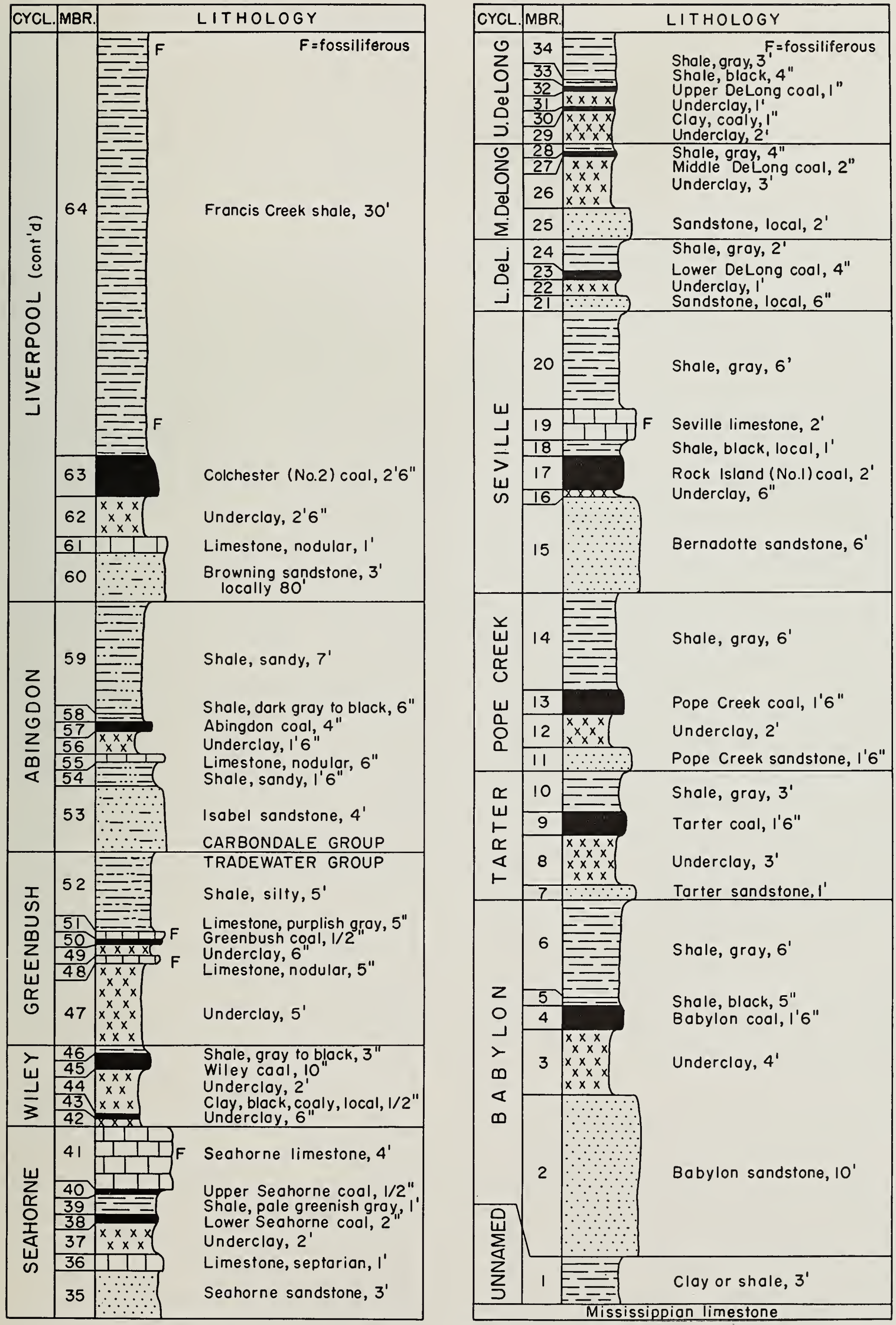

FIG. 2.—concluded.

and a thin local marine limestone beneath it record only the marginal deposits of the Sparland inundation.

Marine fossils were found locally in the top of the Springfield (No. 5) coal, in the gray shale (unit 6) in one cyclothem, in limestone (unit 7) below the black shale in three or four cyclothems, in the black sheety shale (unit 8) and enclosed concretions in 8 cyclothems, in the principal marine limestone and associated calcareous shales (unit 9) in 11 cyclothems, and in the upper gray shales (unit 10) and their ironstone or limestone concretions in two or three cyclothems.

The black sheety shale (unit 8) quite commonly has a characteristic fauna and, in addition, contains large black calcareous or pyritic concretions with a distinctive fauna strikingly different from that of the enclosing black shale. The principal marine limestone of the cyclothem (unit 9) is generally overlain by a few inches to two feet of very calcareous shale with embedded fossils which become concentrated on the surface as the shale weathers. Locally a similar shale occurs below the limestone and grades down into the black sheety shale. In the Liverpool cyclothem the limestone unit, called the Oak Grove beds, consists of generally less than 10 feet of interbedded fossiliferous shales and limestones. It is divided into 14 members, ten of which have very distinctive faunas.

ENVIRONMENTAL INTERPRETATION OF MARINE FAUNAS

Elias (1937) compared the present faunal zones of a shallow sea to faunal and lithologic zones which mark progressive and regressive stages of marine invasions in the Lower Permian Big Blue series in Kansas. Although none of the Permian marine forms survive today, Elias attempted to match them with what appear to be comparable faunal associations of modern seas, and established a series of lithologic and faunal types into which marine Big Blue strata may be divided, as follows:

	Depth
(1) red shale, no fauna . .	. Emergent
(2) green shale	0-30 feet
(3) *Lingula* facies . . .	30-60 feet
(4) molluscan facies . .	60-90 feet
(5) mixed facies . . .	90-110 feet
(6) brachiopod facies . .	110-160 feet
(7) fusulinid facies . .	160-180 feet

In some places he found lithologies and faunas in this order (1-7) from the base upward to a fusulinid zone, and in reverse order (7-1) farther upward to the junction with overlying nonmarine strata. In other places a molluscan fauna would mark the climax of the inundation, and Elias concluded that at the particular locality the sea reached a maximum depth of 60 to 90 feet. These faunal variations may also be interpreted as resulting from progressively increasing distances from shore with a diminishing amount of clastic terrigenous sediment and that maximum depths were much smaller than suggested by Elias. Study of the stratigraphic relations of faunas in the Beardstown-Glasford-Havana-Vermont area indicates that most of the lithologic and faunal zones of Elias are recognizable, but that they probably show depth fluctuations of smaller magnitude.

The Seville, Seahorne, Liverpool, Summum, St. David, Brereton, Pokeberry, and Gimlet cyclothems reach the fusulinid facies—at least, they have yielded fusulinids. In the Seahorne, Liverpool, Summum, St. David, and Pokeberry cyclothems this facies is recognized only in the Beardstown quadrangle within the four-quadrangle area. Only the Seville, Brereton, and Gimlet cyclothems contain the fusulinid facies throughout the area. As fusulinids are common in the Seville and Brereton cyclothems within a foot above the coals of these cyclothems, it is very doubtful that the sea attained a depth of 160 to 180 feet while only a foot of sediment accumulated after the drowning of a coal swamp. Maxima of inundations would be the brachiopod facies in the Trivoli, Liverpool, and St. David cyclothems (except in the Beardstown quadrangle), mixed facies in the Greenbush and Sparland cyclothems, molluscan facies in the Exline cyclothem, *Lingula* facies in the Summum cyclothem (except in the Beardstown quadrangle). No marine record of the Pokeberry cyclothem is known in this area outside the Beardstown quadrangle, and the Seahorne has a distinctive lithology, which has been called algal, and a fauna mostly of minute gastropods that is unlike any other fauna in the area, except locally that of the Lonsdale limestone above its fusulinid zone. Classification as mixed facies would probably describe it best.

Rich (1951) has proposed classification of subaqueous environments according to their position 1) on relatively flat surfaces above wave base (undaform) or below wave base (fondoform), and 2) on more steeply sloping surfaces (clinoform). In undaform areas with water bottoms above wave base, sedimentary particles, both organic and inorganic, are shifted about, abraded, and sorted before final deposition. In the clinoform environment there may be sufficient slope to permit the creep, flow, or sliding of newly deposited particles, in places distorting the sedimentary structures. In fondoform areas organic or inorganic particles settle to the bottom, remain essentially where they fall, and lack the wear and sorting characteristic of the undaform sediments. Broken, abraded, and sorted shelly matter is thus a clue to deposition in shallow bottoms above wave base.

Most limestones and shales in the area include much fragmental shelly material, so they may be properly called clastic limestones. Exceptions are some of the black concretions in black sheety shales, such as those in the Liverpool, Summum, and St. David cyclothems. Also, in some calcareous shales little abrasion is evident, and some productid shells show attached spines. The original slope of depositional surfaces must have been very low, for most of the marine shales and limestones are widespread sheet deposits that show no evidences of post-depositional slumping or other distortion. The undaform of Rich is therefore the principal marine environment.

It has been proposed (Wanless and Merrill, 1951) that the widespread distribution of numerous thin records of brief marine inundations resulted from eustatic rise and fall of sea level and that the marine layers are of virtually similar age through large areas.

FOSSILS AS STRATIGRAPHIC INDICES

Faunal variations from member to member and cyclothem to cyclothem in the Beardstown-Glasford-Havana-Vermont area may be related to two causes: 1) changes in environment and attendant changes in faunal association; and 2) the substitution of newly evolved species for older ones in similar environmental situations.

The first cause would explain variations between faunas in successive laminae of the same cyclothem, and the second would explain faunal differences in some lithologically similar beds in different cyclothems. Variation in the fauna of a particular bed from place to place in the area is a result of a contemporaneous pattern of environment distribution and may serve to point toward a shore in one direction and deeper water in another.

COMPOSITION OF THE FAUNA

The faunal associations of 50 members in 12 cyclothems include representatives of most of the prominent phyla and orders of later Paleozoic time. Each biological group is briefly discussed.

Protozoa

Foraminifera are common in the faunas, and 33 species and varieties are listed. Illinois fusulinids have been studied by Dunbar and Henbest (1942). The varieties listed from the Seville, Seahorne, Liverpool, Summum, St. David, Brereton, and Gimlet marine zones aid in correlation with equivalents in other parts of the country. Generally a particular species of fusulinid does not survive more than two, or at the most three, cycles, and some varieties seem restricted to a single cyclothem. They are most abundant in the Brereton and Lonsdale limestones. At localities 149 (table 4) in the Glasford quadrangle and 148 in the Peoria quadrangle lenticular masses of a cemented coquina of fusulinids occur in calcareous shale at the base of the Lonsdale limestone.

Smaller foraminifera are represented by 17 genera, none of which are identified specifically. They are most abundant in the Gimlet and Brereton cyclothems. The encrusting genus *Apterrinella* is found commonly in limestone in which sedimentation was slow, so that shells on the sea bottom could be bored into and encrusted before burial by sediment. *Apterrinella* is associated with sponge borings, the bryozoan *Fistulipora carbonaria* Ulrich, and questionable worm borings.

Sponges

Sponges are known from siliceous spicules, which are common only in insoluble residues from the Seville limestone, and the questionable sponge borings referred to above.

Corals

Horn corals are widespread and common, ranging from the Seville to the Trivoli cyclothem. In older literature they have mostly been referred to as *Lophophyllidium profundum* (Milne-Edwards and Haime) and *L. proliferum* (McChesney). Five of the six listed genera of corals are found in the Lonsdale limestone. *Chaetetes milleporaceus* Milne-Edwards and Haime, a widely distributed colonial coral that formed biostromes in the Mid-continent and Southwest, was found only in the Pokeberry limestone of the Beardstown quadrangle. The seas here probably received too much influx of mud for *Chaetetes,* which is generally found in relatively pure limestones.

Crinoids

Crinoid stems and plates have been listed from 30 of the 48 members that yield marine faunas. In many members they are abundant and varied in size and structure. Plates of *Ethelocrinus tuberculatus* (Meek and Worthen) are abundant in the St. David calcareous shale (member 102) and are at least locally good index fossils for that bed. Entire crinoid calyces are very uncommon; less than half a dozen have been discovered in all the collections.

Ophiuroids

Ophiuroid plates and ossicles are common in calcareous shales of the Sparland cyclothem and are present but uncommon in calcareous shales of the Brereton cyclothem. They are of microscopic size and may have escaped detection in limestones or in other shales.

Echinoids

Echinoid spines and plates, quite common in a few collections from the Lonsdale limestone and a few other members, have been referred tentatively to five species, four of which occur in the Gimlet cyclothem.

Holothuroidea

Holothurian plates and spicules are quite abundant in the Liverpool cyclothem at the base of the Purington shale (member 82) and in the underlying ironstone bed (member 81). They are of microscopic size and may occur in some other shales which were not carefully searched. They are associated with a molluscan fauna and the brachiopod *Crurithyris planoconvexa* (Shumard).

Annelids

Spirorbis anthracosia Whitfield, a marine or brackish-water worm, is found in several members, both in association with marine faunas and with supposed freshwater or brackish-water forms, especially in the underclay limestone in the Greenbush cyclothem. Worm tubes or castings (*Serpulopsis insita*? White) on brachiopod or molluscan shells are apparently common in several beds, although difficult to distinguish from the foraminifer *Apterrinella*.

Bryozoa

Bryozoa are very common in the Seville limestone where 22 of the 34 listed varieties are found. Ulrich (1890) described several species of fenestellids from the Seville limestone at its type locality. Fenestellids are uncommon in most of the other marine zones.

The branching bryozoan referred to *Rhombopora lepidodendroides* Meek is common and is listed from 21 members. *Prismopora* is represented by *P. sereata* (Meek) in the Seville and Seahorne limestones and by *P. triangulata* (White) in the St. David and Brereton limestones. This appears to be an evolutionary development. Most strata younger than the Seville yield bryozoa too few or too poorly preserved to be of much use in correlation. Encrusting bryozoa (*Fistulipora carbonaria* Ulrich) are common in the St. David, Brereton, Gimlet, and Trivoli calcareous shales.

Brachiopods

Brachiopods are abundant in most members and 54 species or varieties were identified. Several species are so common and restricted in stratigraphic distribution that they are excellent guide fossils. Among the chonetids the genus *Mesolobus* has a sequence of four forms with limited range (Weller and McGehee, 1933). These include *Mesolobus striatus* Weller and McGehee in the Seville, *M. mesolobus* s.s. (Norwood and Pratten) in the Seahorne and Liverpool cyclothems, especially in member 66, *M. mesolobus* var. *decipiens* (Girty) and *M. mesolobus* var. *euampygus* (Girty) in the St. David, Brereton, and Sparland cyclothems, both being especially common in the calcareous shale (member 102) of the St. David cyclothem, and *Mesolobus* n. sp. in the Lonsdale limestone. *Me-*

solobus is absent from the Trivoli cyclothem and is considered to die out at the end of Des Moines time in the Mid-continent region and Allegheny time in the Appalachian basin.

Chonetes granulifer Owen, *Chonetina,* and *Lissochonetes* are also common, but do not appear to be as useful index fossils as *Mesolobus. Chonetes granulifer* Owen is the most common fossil in the calcareous shale (member 153) in the Trivoli cyclothem. Muscle scar attachments on the inside of the brachial valve of the chonetids seem to form patterns which may be unique for each cyclothem. Shells with detached brachial valves are not common, so the extent of pattern variation in a particular cyclothem is not well known.

The genus *Marginifera* is likewise abundant and includes forms that have restricted stratigraphic range. *Marginifera haydenensis* Girty and *M. nana* (Meek and Worthen) are restricted to the Seville limestone and comparable beds in the Appalachian, Mid-continent, and Rocky Mountain regions. *Marginifera muricatina* Dunbar and Condra occurs in the Seahorne, Liverpool, Summum, St. David, and Brereton cyclothems, with a maximum development in the gray septarian limestone (member 72) of the Liverpool cyclothem, where it is the most common fossil. *M. splendens* (Norwood and Pratten) occurs in the Summum and higher beds to the top of the column. It is most abundant in the St. David limestone and calcareous shale (members 101 and 102) where it is the most common fossil and greatly exceeds *M. muricatina* in abundance. *Marginifera* (?) *lasallensis* (Worthen) is restricted to the Lonsdale limestone in this area. Muscle scar patterns in the genus *Marginifera* may also be significant for closer stratigraphic zonation.

Other productids are common in certain beds. A variety of *Linoproductus "cora"* (d'Orbigny), which is common in the Seville limestone, is characterized by much finer radial striae than the *Linoproductus* which is the most conspicuous fossil in the brown *Linoproductus* limestone (member 79) in the Oak Grove beds. Other variations may be characteristic of higher zones. *Dictyoclostus* n. sp. aff. *americanus* Dunbar and Condra is common in the St. David limestone, whereas *D. portlockianus* (Norwood and Pratten) is the most abundant species in the Pokeberry limestone. *Juresania nebrascensis* (Owen) is widespread but is most common in large concretions in the black sheety shale (member 98) of the St. David cyclothem. *Linoproductus* and *Juresania* seem more common in argillaceous or ferruginous limestones associated with dominantly molluscan faunas, whereas *Dictyoclostus* is more common in purer limestones in association with more typical brachiopod facies. *Cancrinella boonensis* (Swallow) and *Teguliferina armata* (Girty) appear in the Lonsdale limestone and are probably diagnostic middle or later Pennsylvanian species.

Composita, perhaps as common as any brachiopod, seems divisible into two species, *C. argentea* (Shepard) and *C. subtilita* (Hall), neither of which seems to be stratigraphically restricted. Although generally typical of brachiopod facies, well preserved uncrushed shells of *C. argentea* (Shepard) are abundant in some large concretions in the black sheety shale of the St. David cyclothem, but wholly absent in others, which have only molluscan faunas.

In numbers, *Neospirifer cameratus* (Morton) of the lower Pennsylvanian is gradually replaced upward by *N. triplicatus* (Hall). *Spirifer occidentalis* Girty is common in the Seville cyclothem and extends up to the Liverpool, with a questionable identification in the St. David. *Neospirifer, Spirifer,* and *Punctospirifer* are all characteristic of the brachiopod facies in lighter colored limestones and calcareous shales. *Derbya crassa* (Meek and Hayden), *Hustedia mormoni* (Marcou), and *Cleiothyridina orbicularis* (McChesney) all have similar associations in lighter colored limestones and shales and seem to lack value as diagnostic fossils. *Phricodothyris perplexa* (McChesney) is generally limited to purer limestones of fusulinid facies such as the Seville, Brereton, and Lonsdale. *Crurithyris planoconvexa* (Shumard) is especially abundant in argillaceous or ferruginous limestones in which it is associated with a largely molluscan fauna. It is most abundant in the *Linoproductus* limestone (member 79) of the Oak Grove beds but seems to have little value for stratigraphic correlation.

The *Lingula* facies is well developed in the black sheety shales and enclosed concretions. *Orbiculoidea missouriensis* (Shumard) is as abundant in these beds as is *Lingula.* Associated with these forms are *Trigonoglossa,* another inarticulate brachiopod which is uncommon, conodonts, fish remains, and the pelecypod genus *Dunbarella.*

Brachiopods which first appear high in the column are *Meekella striatocostata* (Cox), first in the St. David limestone, and *Rhipidomella carbonaria* (Swallow), *Schizophoria texana* Girty, and *Cryptacanthia compacta* (White and St. John), all of which appear first in the Lonsdale limestone.

Pelecypods

Pelecypods are very diverse, and a total of 90 kinds is listed. The rich pelecypod faunas are concentrated in a few beds, of which the large concretions in the St. David black sheety shale (member 98) with 39 species, the Lonsdale limestone (member 140) with 37 species, the *Cardiomorpha* limestone (member 77) with 23 species, and the *Linoproductus* limestone (member 79) with 27 species, have the richest assemblages. The Lonsdale limestone has several local facies, in some of which pelecypods are almost wholly absent, whereas in others they are dominant.

Dunbarella is common in black sheety shales. *D. knighti* Newell occurs in the Seville and Liverpool cyclothems and *D. rectalaterarea* (Cox) in the St. David cyclothem. Among the large concretions in the St. David black sheety shale the more pyritic concretions commonly contain a limited fauna with the brachiopod *Orbiculoidea missouriensis* (Shumard) and the pelecypods *Solemya parallela* Beede and Rogers, *S. trapezoides* Meek, and *Clinopistha radiata* var. *laevis* Meek and Worthen. More calcareous and less pyritic concretions contain the brachiopods *Linoproductus* and *Composita* along with a rich pelecypod fauna including several species each of *Edmondia, Schizodus,* and *Pleurophorus.*

The very thin *Cardiomorpha* limestone (member 77) consists almost wholly of closely packed *C. missouriensis* Shumard, *Sedgwickia topekaensis* (Shumard), and *Myalina lepta* Newell, none of which is conspicuous in adjacent beds. Light-colored calcareous shales at several positions commonly contain *Astartella concentrica* (Conrad) and *Nuculopsis girtyi* Schenck.

Some pelecypods are generally found in the brachiopod facies in purer limestones. These include among others *Parallelodon tenuistriatus* (Meek and Worthen) and *Annuliconcha interlineata* (Meek and Worthen). *Euchondria pellucida* (Meek and Worthen) along with the brachiopod *Crurithyris planoconvexa* (Shumard) is most characteristic of the calcareous ironstone band (member 81) at the top of the Oak Grove beds. Among species which are only locally common but are restricted to the Lonsdale limestone are *Nuculana arata* (Hall), *Annuliconcha interlineata* (Meek and Worthen), and *Clavicosta echinata* Newell.

Although pelecypod faunas are very diverse, most forms seem to be adjusted to special environmental situations which commonly are not regularly repeated in vertical sequence, so it is difficult to use pelecypods as index fossils in the sense of stages in evolutionary development. Thus there are no ecologic counterparts in other parts of the column for the large black concretions in the St. David black sheety shale with *Solemya, Clinopistha,* and *Pleurophorus,* for the "*Cardiomorpha*" limestone with *Cardiomorpha, Sedgwickia,* and *Myalina,* or for the Lonsdale limestone with *Annuliconcha, Clavicosta,* and *Nuculana. Dunbarella* reappears in black shales of several cyclothems and shows evolutionary development in that *D. knighti* below is replaced by *D. rectalaterarea* above in similar environmental situations. Somewhat the same is true for *Astartella* and *Nuculopsis* in successive calcareous shales overlying marine limestones. The pelecypods are most useful, however, as indicators of environment by their characteristic associations, generally influenced markedly by the argillaceous, ferruginous, or carbonaceous content of the beds.

Gastropods

Gastropods are also common and diverse, and 88 species are listed. Minute gastropods, nearly as small as microfossils, are especially common in the Seahorne limestone in which 52 kinds of gastropods are found. A similar facies was described by Knight (1930-1934) from the St. Louis, Missouri, Pennsylvanian outlier from the Labette shale of Sparland age. The larger gastropod genera *Naticopsis* and *Trachydomia* are found with the minute forms in the Seahorne limestone.

The Lonsdale limestone has gastropod facies locally similar to the Seahorne, although minute gastropods are much less common in it. *Naticopsis ventricosa* (Norwood and Pratten) of the Seahorne is replaced by *N. meeki* Knight in the Lonsdale, and *Trachydomia oweni* Knight of the Seahorne is replaced by *T. nodulosa* Worthen of the Lonsdale. Minute ornate gastropods of the Pseudozygopleuridae are especially conspicuous in the Seahorne, and many species of this family were described by Knight from the Labette shale. Although some of Knight's names were applied to Seahorne forms, the Seahorne shells seem different enough from the much younger Labette forms to indicate evolutionary change. The Labette forms occur in calcareous shale from which they can be extracted in perfect condition, but the Seahorne forms are firmly embedded in limestone and are more difficult to extract.

In some places the Lonsdale limestone displays a strongly gastropod facies. Several forms which are unknown in other beds in the area are common.

These include *Gosseletina spironema* (Meek and Worthen), *Baylea adamsi* (Worthen), *B. giffordi* (Worthen), *Porcellia gillanus* White and St. John, and *Mourlonia* cf. *beckwithana* (McChesney). Bellerophontid gastropods are common in the Liverpool calcareous shale (member 74), especially *Bucanopsis* aff. *marcouiana* (Geinitz), *B. tenuilineata* (Gurley), and *Euphemites carbonarius* (Cox). *Pharkidonotus percarinatus* (Conrad) is very common at one Lonsdale locality. The Exline calcareous shale (member 143) has an abundant though small gastropod fauna. Various species of *Strobeus* are especially characteristic of the *Linoproductus* limestone (member 79).

Like the pelecypods, many gastropod species seem to be associated with environments sufficiently distinctive that they did not recur commonly in this area. The curious minute gastropod fauna with plentiful pseudozygopleurids has also been observed by the writer at Knight's St. Louis locality in the Labette shale, at an outcrop of the Keechi Creek shale of Canyon (Lower Missouri) age near Mineral Wells, Texas, and in the La Tuna member of the Magdalena group near El Paso, Texas. The rocks are of different age in each place and critical comparative study of these faunas should reveal evolutionary tendencies. The genus *Trepospira* is represented by *T. illinoisensis* (Worthen) in the Seville, Seahorne, Liverpool, and St. David cyclothems and by *T. discoidalis* Newell in the Lonsdale. This is probably an evolutionary change.

The following gastropods are more tolerant of environmental variations and therefore recur most frequently in the faunas of the Beardstown-Glasford-Havana-Vermont area: *Bucanopsis tenuilineata* (Gurley), *Pharkidonotus percarinatus* (Conrad), *Euphemites carbonarius* (Cox), *Cymatospira montfortianus* (Norwood and Pratten), *Glabrocingulum grayvillense* (Norwood and Pratten), *Donaldina robusta* (Stevens), *Meekospira choctawensis* Girty, and various species of *Strobeus*. Detailed study of variations in these forms within and between cyclothems is needed to determine their potential usefulness as index fossils.

Scaphopods

Scaphopods are uncommon, and only two species are listed from seven different members.

Amphineura

The amphineura are represented only by *Glaphurochiton carbonarius* (Stevens), of which only two specimens were found, both in the St. David cyclothem.

Cephalopods

Straight tubular nautiloid cephalopods referred to *Pseudorthoceras knoxense* (McChesney) are widespread and are listed from 22 beds. Most of the other nautiloid genera are uncommon, but a total of 26 kinds of nautiloids are listed. Several species of *Metacoceras* are fairly widespread, though nowhere common. Nautiloids are most common in the large black concretions in the black sheety shale of the St. David cyclothem (member 98) with ten species and the Lonsdale limestone (member 140) with 11 species, mostly from one locality. Only two species of ammonoid cephalopods are known, but they are the most abundant fossils in the Liverpool cyclothem black limestone (member 66), in concretions in the black sheety shale (member 67), and also in large concretions in the Summum cyclothem black shale (member 90).

It is curious that the large concretions in the black sheety shale of the St. David cyclothem have a rich diverse fauna whereas those in the Liverpool and Summum cyclothems have a very small fauna with ammonoids dominant. Large concretions were not found in the Seville cyclothem black sheety shale in these quadrangles, but in the Alexis quadrangle (Wanless, 1929, p. 158-163) they contain a rich fauna similar to that of the St. David of this area.

Trilobites

Trilobites are uncommon, but they are found in most of the cyclothems, and six species are listed. *Sevillia sevillensis* Weller is restricted to the Seville limestone. *Ditomopyge* n. sp. (included under *Ditomopyge* sp. in table 3) is restricted to the Seahorne, *D. parvulus* (Girty) is found in the St. David, Brereton, and Pokeberry cyclothems, and *D. scitula* (Meek and Worthen) in Lonsdale limestone. Thus the trilobites are useful index fossils, though infrequent.

Crustacea

Crustacean remains are uncommon. *Estheria ortoni* Clarke, the most common of three listed, is found in three members of the Liverpool cyclothem.

Ostracodes

Ostracodes are represented by 111 species and are thus the most diverse group. They were identified by C. L. Cooper (1946). Ostracodes are rather scant in the Seville, Seahorne, and Liverpool cyclothems in this area, but the higher cyclothems have more plentiful faunas, and 35 species are listed from the Gimlet cyclothem. The most abundant ostracode collecting zone is probably the Exline cyclothem calcareous shale (member 143) with 24 species. This fauna was studied by Bean (1938). Several species of ostracodes seem to be restricted to limited parts of the column, although it is not certain that this restriction is controlled by environment rather than by evolutionary change.

Conodonts

Conodonts are common and characteristic fossils of some of the black sheety shales, especially that of the St. David cyclothem which contains 10 of the 26 conodont species listed. Light gray calcareous shales yield conodonts when washed and screened, and shales below and in the Lonsdale limestone have yielded a good fauna of conodonts. The limestones of this area have not been tested for their conodont faunas. The genus *Gondolella* is found only in the Gimlet cyclothem and is believed to be absent from older conodont-bearing beds. Several natural assemblages of conodonts have been found on bedding surfaces of the St. David black sheety shale (Rhodes, 1952).

Vertebrates

Vertebrate remains are limited to fish scales, spines, tubercles, teeth, and bone fragments. They are most plentiful in the St. David cyclothem black slaty shale, but are not generally common or diverse enough to be useful index fossils. Eleven varieties are listed.

Plants

Although this report deals with animal remains, it is worthy of comment that the large black concretions in the St. David cyclothem black sheety shale contain impressions of logs along with mollusks and brachiopods. The Exline limestone (member 142) contains well preserved stems and fern leaves (*Neuropteris*) along with some invertebrates. In both cases the sites of deposition were evidently close to a supply of land vegetation. In one locality in the Glasford quadrangle erect silicified stumps were observed rooted in the top of the Lonsdale limestone, and fragments of silicified wood are common at the top of the Lonsdale limestone at several places. This is interpreted as showing that the sea drained away shortly after the Lonsdale limestone was formed and the emerged limestone provided a "soil" that supported forest vegetation.

FAUNAL CHARACTERISTICS OF MEMBERS

Although the several faunas can be characterized generally as *Lingula*, molluscan, mixed, brachiopod, and fusulinid facies, following Elias's terminology, variable factors such as depth, distance from shore, temperature, salinity, bottom material, rate of sediment influx, frequency of scavengers, hydrogen ion concentration, and oxidation-reduction potential must have given each fossiliferous bed some unique faunal characteristics not shared by other beds.

In the following discussion, the general composition in terms of dominant major groups is described for each bed. Species that are especially common or dominant are listed; relations between fauna, lithology, and sedimentary environment are discussed; and in those cases where the fauna in a bed varies regularly or irregularly in composition within the four quadrangle area, the pattern of this variation is discussed. Locality references are to the list of fossil collecting localities (table 4).

Seville Cyclothem

Seville Limestone (Member 19)

Nearly all the collections from the Seville limestone are from a small area in the north part of the Vermont quadrangle and the south part of the Avon quadrangle near Seville. The fauna of 97 species is distinguished by the richest bryozoan concentration of any member and includes 22 of the 39 species listed. Although *Fusulinella iowensis* Thompson is present at several localities it is not abundant enough to consider the fauna as fusulinid facies. Brachiopods are most abundant, and *Marginifera haydenensis* Girty and *M. nana* (Meek and Worthen) are the most common species. They occur in no other members in the area.

Other species: *Derbya crassa* (Meek and Hayden), *Mesolobus striatus* Weller and McGehee, *Juresania nebrascensis* (Owen), *Dictyoclostus gallatinensis* (Girty), *D.* n. sp. aff. *americanus* Dunbar and Condra, *Linoproductus "cora"* (d'Orbigny), *Phricodothyris perplexa* (McChesney), *Spirifer occidentalis* Girty, *Neospirifer cameratus* (Morton), and *Composita argentea* (Shepard). It is the only member with common siliceous sponge spicules, and smaller foraminifera are fairly common. The fauna includes 23 brachiopods, 12 pelecypods, and 7 gastropods. It would be called a brachiopod facies. It is one of the most siliceous of the limestones.

Seahorne Cyclothem

Seahorne Limestone (Member 41)

The Seahorne limestone is much more widespread than the Seville, and collections are well distributed through all the quadrangles except in the Glasford where the limestone is below drainage. The total fauna is 112 species, one of the largest faunas from a single member. It is dominated by gastropods, of which 52 species are listed, but includes 17 brachiopods and 16 pelecypods. All but a few of the gastropods are of nearly microscopic size, a feature in which the Seahorne differs from all other beds of the region. At most places three larger gastropods, *Trachydomia oweni* Knight, *Naticopsis ventricosa* (Norwood and Pratten), and *Natiria americana* (Girty), are common. The rich gastropod fauna is present at only a few localities, especially 12, 18, and 22 (table 4). Elsewhere only a few common brachiopods and rare gastropods are generally seen.

The distinctive Seahorne fauna was described first from the limestone roof of the Tebo coal in Henry County, Missouri (Girty, 1915). Many of the minute gastropods have not been described and would constitute new species. The Pseudozygopleuridae with 14 species are the most abundant group of minute gastropods. Fusulinids are present but uncommon at several localities in the Beardstown quadrangle and the southwest part of the Havana quadrangle, but are absent elsewhere. The Seahorne might be considered molluscan facies but is not much like other members with molluscan facies. If the nodular structure is produced by algae, it may be considered a special algal limestone facies.

At locality 22 a limestone a foot or so below the Seahorne limestone, and apparently separated from it by a thin coal horizon and underclay, has abundant *Spirorbis anthracosia* Whitfield but apparently no other fossils.

Greenbush Cyclothem

Underclay Limestone (Member 48)

This member has yielded a distinctive and unique fauna of one species each of gastropods, pelecypods, crustaceans, ostracodes, and worms, all believed to be freshwater forms. The limestone is fairly widespread, but the fauna was collected only near Marietta in the Vermont quadrangle. This is the only member in the area that has yielded a freshwater fauna.

Limestone (Member 51)

This bed is very discontinuous and was seen at only a few outcrops. A small fauna of crinoid stems and two common brachiopods suggests a brachiopod facies.

Liverpool Cyclothem

Francis Creek Shale (Member 64)

The lower part of the Francis Creek shale over the Colchester (No. 2) coal commonly contains compressions of plants. The major part of the shale is wholly nonfossiliferous, but where the shale is more than 40 feet thick the upper 3 or 4 feet contain *Marginifera muricatina* Dunbar and Condra. Thus the environment changed from freshwater to marine during the deposition of this shale.

Black Limestone (Member 66)

The fauna of the black limestone consists of 21 species: 2 inarticulate brachiopods, 4 articulate brachiopods, 8 pelecypods, 3 gastropods, 2 nautiloids, and 2 ammonoids. The most common fossils are the two ammonoids and the pelecypod *Dunbarella knighti* Newell. In fauna and lithology this member resembles that of large concretions in the overlying black sheety shale. The fauna seems largely pelagic.

Black Sheety Shale (Member 67)

This widespread and typical black sheety shale has yielded a small fauna of 6 species: 2 inarticulate brachiopods—*Lingula* and *Orbiculoidea*, 1 ammonoid, fish remains, and 2 conodonts. It is a *Lingula* facies. The small phosphatic concretions which give bedding surfaces a pimply appearance have yielded a few whole impressions of ganoid fish in the Galesburg area northwest of here. A rich fish fauna has been collected from this bed near Mecca, Parke County, Indiana (Zangerl and Richardson, 1955).

Black Concretions in Member 67

The large concretions in the black sheety shale are wholly barren of fauna at most places, but in and near Mill Creek in the Beardstown quadrangle they have yielded a fauna of 21 species: 2 inarticulate brachiopods—*Lingula* and *Orbiculoidea,* 1 articulate brachiopod, 11 pelecypods, 3 nautiloids of which *Pseudometacoceras sculptile* (Girty) is common, 1 abundant ammonoid *Beyrichoceras wanlessi* (Plummer and Scott), and fish remains. The fauna resembles closely that of member 66. It is a molluscan facies, although it contains *Lingula* which is more characteristic of shallower water.

Oak Grove Beds (Members 68 to 81)

Siliceous Limestone (Member 68)

The basal member of the Oak Grove beds is a local accumulation of dark blue-gray siliceous limestone which is flinty in some places (locality 16) and shelly in others (localities 39 and 40). This member has a fauna of 32 species: 14 brachiopods, 5 pelecypods, 3 bryozoa, and 3 gastropods are the most abundant. Fusulinids occur in the flinty limestone at Mill Creek. Common *Phricodothyris perplexa* (McChesney) in the flinty limestone suggests that the water was deeper and clearer than in the shelly facies.

Shale and Limestone (Member 69)

This shale member contains thin beds of limestone which have not been traced as widely as those higher in the Oak Grove beds. The fauna of 69 species from two localities includes 23 species of ostracodes, 10 brachiopods, 12 pelecypods, and 14 gastropods. This is the lowest zone rich in ostracodes. The large faunal list results from mixing smaller faunules of both shale and limestone from a 2-foot interval. The gross fauna would be considered a mixed facies between molluscan and brachiopod facies.

Conglomerate (Member 70)

Fragments of crinoid columnals are the most conspicuous fossils in this local thin conglomerate of dark gray limestone pebbles. The fauna of 12 species is largely molluscan with 6 gastropods, 1 pelecypod, and 1 scaphopod. Only 2 brachiopods are present. The fossils are fragments of shells, and they show sorting by waves and currents in shallow water.

Septarian Limestone (Member 72)

The widespread septarian limestone has a fauna of 74 species, but at virtually every outcrop it is dominated by one brachiopod species, *Marginifera muricatina* Dunbar and Condra, which is about ten times as abundant as all other species combined. Although 23 collections were studied, 40 of the species are found at only locality 46. The fauna at most places is a brachiopod facies with *Marginifera, Mesolobus,* and *Derbya* most common, but at locality 46 it is strongly molluscan with 43 species of mollusks among the total fauna of 66 species at that place. Pelecypod species outnumber gastropods 19 to 15. A few fusulinids were found in the limestone at locality 46.

Argillaceous Limestone (Member 74)

Above the gray septarian limestone a thin argillaceous limestone or calcareous shale contains abundant somewhat crushed shells which weather out to litter the outcrop surface. Although the most abundant species are *Marginifera muricatina* Dunbar and Condra, *Mesolobus mesolobus,* s. s. (Norwood and Pratten), and *Derbya crassa*

(Meek and Hayden), the member has a fauna of 63 species. Although a few brachiopods are most numerous, bellerophont gastropods are unusually plentiful and characteristic of the bed. These include *Bucanopsis tenuilineata* (Gurley), *B.* aff. *marcouiana* (Geinitz), *Cymatospira montfortianus* (Norwood and Pratten), *Pharkidonotus percarinatus* (Conrad), and *Euphemites carbonarius* (Cox), all of which are common. The fauna also includes 11 pelecypods, 19 gastropods, and 14 brachiopods. Only a few ostracodes were found, in contrast to their abundance in the calcareous shale (member 69) below the gray septarian limestone.

Mesolobus Shale (Member 76)

About a foot above the preceding member a bed about one inch thick is largely made up of white generally uncrushed shells of *Mesolobus mesolobus* s. s. (Norwood and Pratten). It has a fauna of 12 species of which *Marginifera muricatina* Dunbar and Condra and *Composita argentea* (Shepard) are other common forms.

Cardiomorpha Limestone (Member (77)

The thin discontinuous bed of ferruginous black limestone or calcareous ironstone is nearly a coquina of uncrushed pelecypod shells in such a dense matrix that it is almost impossible to extract whole shells. It is easier to obtain internal molds. The dominant species is a variety of *Cardiomorpha missouriensis* Shumard, but *Sedgwickia topekaensis* (Shumard) is also very abundant. The fauna of 39 species has 23 pelecypods. The only common gastropod of 6 species present is tentatively identified as *Bucanopsis marcouiana* (Geinitz). *Lingula* and *Orbiculoidea* are the only common brachiopods. This is a typical molluscan facies fauna.

Dunbarella Shale (Member 78)

Just above the *Cardiomorpha* limestone, dark gray to black shale is crowded with flattened impressions of the pectenoid pelecypod *Dunbarella knighti* Newell. It contains a few other fossils: *Lingula,* 2 kinds of *Myalina,* a crustacean *Estheria,* and an annelid *Spirorbis.* The fauna suggests very shallow water, marine to brackish. In many ways it resembles that of the St. David cyclothem black sheety shale (member 98), but lacks conodonts and fish remains.

Linoproductus Limestone (Member 79)

Above the *Dunbarella* dark shale, a very widespread thin bed of dark gray argillaceous limestone that weathers deep rusty brown is crowded with well preserved, uncrushed and unworn, fossils of large variety. The two most abundant species, visible on nearly every broken surface, are *Linoproductus "cora"* (d'Orbigny) and small pale blue shells of *Crurithyris planoconvexa* (Shumard). Although the two most abundant forms are brachiopods, the fauna as a whole has a molluscan aspect. The 74 species include 17 brachiopods, 17 pelecypods, 21 gastropods, and 7 nautiloid cephalopods. Several mollusks common in this member are virtually unknown in other members. These include the pectenoid pelecypods *Pernopecten ohioense* Newell, *Aviculopecten flabellum* (Price), and the gastropod *Donaldina robusta* (Stevens). *Strobeus primogenius* (Conrad) is the most common of five species of *Strobeus. Dunbarella knighti* Newell, the dominant species of the underlying shale is not present, although 8 species of pectenoid pelecypods are listed.

Ironstone (Member 81)

About 2 feet above the *Linoproductus* limestone is a persistent bed of calcareous ironstone which is the top member of the Oak Grove beds. It has a well preserved fauna that consists almost entirely of external molds and internal casts of fossils. The fine texture of the ironstone permits good preservation of shell ornamentation in the casts and molds. A fauna of 42 species was listed from five collections, but nearly every species was found at locality 42, the type outcrop of the Oak Grove beds. The most abundant and characteristic species is an ornate pectenoid pelecypod *Euchondria pellucida* (Meek and Worthen). The fauna includes 5 brachiopod species of which only *Crurithyris planoconvexa* (Shumard) is common, 15 pelecypods, and 12 gastropods. An unusual element is abundant plates and spicules of holothurians, *Protocaudina kansasensis* (Hanna) and *Ancistrum* sp.

Purington Shale (Member 82)

Immediately above the ironstone bed the lower foot of the gray Purington shale contains flattened impressions of an essentially similar fauna. One collection lists 29 species. *Euchondria,* holothurian plates and spicules, and *Crurithyris* are as common as in the ironstone band. An ostracode *Cavellina* sp. is also common. Above this basal zone the Purington shale is quite barren of fauna, although a few poorly preserved molluscan impressions were found in ironstone nodules in the lower 10 feet. They are all forms listed from the Oak Grove ironstone band.

Summum Cyclothem

Shale over Kerton Creek Coal (Member 85)

A small marine fauna was found at two localities in black shale which overlies the Kerton Creek coal. The coal itself is a local deposit in partially filled "channel" areas of the Pleasantview sandstone. The fauna of 7 species includes *Lingula* and *Orbiculoidea,* 3 pelecypods, fish spines, and the straight tubular nautiloid *Pseudorthoceras knoxense* (McChesney). It is a shallow-water marine fauna similar to that found in other black shales above coal beds.

Concretions in Dark Shale (Member 90)

The large spherical concretions in the dark shale overlying the Summum (No. 4) coal are not very fossiliferous as compared with similar concretions in the black shale of the St. David cyclothem. Three collections contain 11 species of which the most abundant species is the small ammonoid *Beyrichoceras wanlessi* (Plummer and Scott). The rest of the fauna is made up of 5 pelecypods, 3 brachiopods, 1 other ammonoid, and a fish spine, a typical assemblage for large concretions in dark shales. The abundant small ammonoid is probably pelagic. No fossils were found in the enclosing dark shale.

Hanover Limestone (Member 92)

The Hanover limestone is very hard near Pleasantview in the Beardstown quadrangle and probably has not been adequately collected as the only species listed are *Marginifera splendens* (Norwood and Pratten) and a fusulinid, probably *Fusulina haworthi* (Beede). Near Cuba it yields a very different fauna of three types of fish remains and the inarticulate brachiopod *Orbiculoidea missouriensis* (Shumard), which is the most abundant form. Thus within about 40 miles between Cuba and Pleasantview the Hanover limestone grades from the *Lingula* facies at Cuba to the brachiopod or fusulinid facies near Pleasantview.

St. David Cyclothem

Springfield (No. 5) coal (Member 97)

In strip mines near Cuba the uppermost inch of No. 5 coal has several thin laminae of dull bony matter containing impressions of marine fossils alternating with nonfossiliferous bright coal laminae. The dull laminae in the coal yield 6 brachiopod species and a conodont. The most abundant is the inarticulate brachiopod *Orbiculoidea missouriensis* (Shumard). These species were evidently adapted to the extremely shallow marine waters of the initial stage of flooding which ended the coal swamp.

Black Sheety Shale (Member 98)

This is the most fossiliferous of the black sheety shales of the area. It contains large black concretions whose fauna is separately discussed. The shale has yielded a fauna of 49 species of which *Dunbarella rectalaterarea* (Cox), *Lingula carbonaria* Shumard, *Orbiculoidea missouriensis,* and several kinds of fish remains are most characteristic. Conodont remains are common and seven species are listed. Some conodont assemblages were found. The lower part of the shale is hard and sheety and has the limited fauna described above, but the upper part is somewhat softer, and contains a more diverse fauna including *Marginifera* and other productids, *Leiorhynchus, Derbya, Composita,* and chonetids. The fauna of the two parts is not differentiated in the collections. It consists of 13 species of brachiopods, 10 pelecypods, 9 gastropods, and 3 annelids. The upper part of the black shale has abundant curved bands of lighter shale which appear to be the fillings of worm burrows.

Concretions in Black Shale (Member 98)

Most of the large spheroidal to discoidal concretions in the black shale have a very limited fauna, of which *Orbiculoidea missouriensis* (Shumard) is most common. Near Cuba some of the concretions are largely replaced with pyrite or marcasite and contain an abundance of pyritized shells, mostly the large pelecypod *Solemya trapezoides* Meek, but including the smaller pelecypods *Solemya parallela* Beede and Rogers and *Clinopistha radiata* var. *laevis* Meek and Worthen, and the brachiopod *Orbiculoidea.*

A much smaller number of concretions, especially in the vicinity of locality 85, are not pyritized and contain a rich assemblage of uncrushed fossils. Preservation is better in these concretions than in any other member in the area. The fauna includes *Solemya* and *Clinopistha* along with a rich variety of brachiopods, of which the following are most abundant: *Orbiculoidea,* a different variety of *Linoproductus "cora"* (d'Orbigny) than in either the Seville or Oak Grove limestones, *Marginifera muricatina* Dunbar and Condra, *Juresania nebrascensis* (Owen), and *Composita argentea* (Shepard). More than 500 uncrushed shells of *Composita* have been found in a single concretion.

The fauna of 90 species includes 13 brachiopods, 39 pelecypods, 19 gastropods, and 10 nautiloid and 2 ammonoid cephalopods. Among the dominant pelecypods are several species each of *Edmondia, Schizodus,* and *Pleurophorus,* as well as the aberrant form *Placunopsis carbonaria* Meek and Worthen which is generally attached to other shells and is impressed on striations of the host shell in a random manner wholly unrelated to the symmetry of the pelecypod. Concretions which have weathered on waste piles of strip mines for several years shatter with a light tap of the hammer and break away cleanly from the enclosed uncrushed shells. None of the shells show evidence of breakage, abrasion, or sorting.

Calcareous Shale (Member 100)

The dark calcareous shale below the St. David limestone at some places contains very large nautiloids at least 6 inches in diameter which are partly in the shale and partly in the overlying limestone. The shale has a fauna of 39 species including 13 ostracodes and 5 conodonts. Among 12 brachiopods, 4 chonetids are most prominent.

St. David Limestone (Member 101)

The St. David limestone is hard, and although highly fossiliferous it is difficult to extract good whole shells. Blocks of the limestone are abundant on strip mine waste piles.

In the Havana quadrangle the most abundant and distinctive fossils are *Mesolobus mesolobus* var. *euampygus* (Girty) and *Marginifera splendens* (Norwood and Pratten). Neither form is prominent in a comparable member, the gray septarian limestone (member 72) of the Liverpool cyclothem. *Marginifera muricatina* Dunbar and Condra is present in the St. David limestone but is much less abundant than *M. splendens*. In the large black concretions in the black slaty shale only about 2 feet below the St. David limestone, *M. muricatina* is common but *M. splendens* is absent. Thus difference in distribution of the species is partly ecological, *M. splendens* favoring clearer seas in which limestone forms and *M. muricatina* the muddier bottoms with reducing conditions.

The St. David limestone has a fauna of 98 species including 27 brachiopods, 20 pelecypods, 12 gastropods, and 6 nautiloid cephalopods. Crinoid stems and plates are quite common. Near Pleasantview in the Beardstown quadrangle *Fusulina girtyi* (Dunbar and Condra) is conspicuous along with the bryozoan *Prismopora triangulata* (White). In the Vermont and Havana quadrangles these forms are absent and molluscan shells are uncommon, the fauna being of a typical brachiopod or brachiopod-crinoid facies. In the Glasford and Canton quadrangle collections there are 13 molluscan species not found to the south. Thus the St. David grades from a brachiopod-fusulinid facies near Pleasantview through a brachiopod-crinoid facies near Cuba to a brachiopod-molluscan facies near Canton and Glasford. Molluscan genera common to the north and northeast include *Pteria, Astartella, Nuculopsis, Nuculana,* and *Yoldia* among the pelecypods and *Donaldina, Bucanopsis,* and *Orestes* among the gastropods.

Calcareous Shale (Member 102)

Immediately above the St. David limestone is about a foot of very calcareous shale filled with loose but generally crushed fossils. This is a counterpart of member 74 in the Liverpool cyclothem, member 116 in the Brereton, and member 153 in the Trivoli. It has yielded a fauna of 118 species. The fossils weather out loose. The shale generally adheres to blocks of the St. David limestone on strip-mine waste-piles and these blocks afford almost unlimited opportunities to collect this fauna.

Brachiopods such as *Marginifera splendens* (Norwood and Pratten), *Mesolobus mesolobus* var. *euampygus* (Girty), *M. mesolobus* var. *decipiens* (Girty), and *Dictyoclostus* n. sp. aff.

americanus Dunbar and Condra are most conspicuous. Fragmentary crinoid remains are common and the distinctive plates of *Ethelocrinus tuberculatus* (Meek and Worthen) and *Delocrinus* sp. are especially conspicuous. The fauna includes 10 bryozoa, 28 brachiopods, 15 pelecypods, 20 gastropods, and 6 nautiloid cephalopods. Microfossils include 5 smaller foraminifera, 1 conodont, and 20 ostracodes. Fusulinids and *Prismopora* are present near Pleasantview and collections from the Glasford quadrangle have the greatest variety of mollusks along with abundant brachiopods.

Argillaceous Limestone (Member 104) in Canton Shale

A bed of impure limestone or a band of limestone concretions 9 to 12 feet above the base of the Canton shale contains a fauna of 17 species: 7 brachiopods, 4 pelecypods, 3 gastropods, 2 nautiloids, and crinoid stems. The brachiopods *Chonetes granulifer* Owen and *Linoproductus "cora"* (d'Orbigny) are most common.

Brereton Cyclothem

Limestone (Member 108)

The Herrin (No. 6) coal generally has a nonfossiliferous underclay limestone below its underclay and above the Cuba sandstone, but in one outcrop just east of Cuba a marine limestone is present a few feet below the underclay limestone. The limestone has a fauna of 39 species, including 12 ostracodes concentrated from the associated shale. The most abundant forms are *Linoproductus "cora"* (d'Orbigny), *Mesolobus mesolobus* var. *euampygus* (Girty), *Marginifera muricatina* Dunbar and Condra, *Rhombopora lepidodendroides* Meek, and crinoid stems. *Fusulina girtyi* (Dunbar and Condra) is present. There are only three gastropods and one pelecypod as opposed to 16 brachiopods and 3 bryozoa. The fauna is a brachiopod facies.

Dark Shale (Member 114)

The No. 6 coal is locally overlain by black sheety shale, but more commonly the shale is soft and dark gray. The latter has no macrofauna but contains 26 species of ostracodes.

Brereton Limestone (Member 115)

The Brereton limestone is widely distributed in Illinois and surrounding states. It is best known for its fusulinids and has been called "Fusulina limestone." *Fusulina girtyi* (Dunbar and Condra), though present in other beds, is most characteristic of the Brereton. The fauna of 46 species includes 19 brachiopods, 7 bryozoa, 4 pelecypods, and 3 gastropods. Smaller foraminifera are common, especially *Textularia* sp. Among the brachiopods *Phricodothyris perplexa* (McChesney), *Marginifera splendens* (Norwood and Pratten), *Composita argentea* (Shepard), and *C. subtilita* (Hall) are most plentiful. The fauna is characteristic of clearer and slightly deeper water than most other limestones.

Calcareous Shale (Member 116)

About a foot of fossiliferous calcareous shale overlying the Brereton limestone has a fauna of 53 species, including 18 ostracodes, 3 foraminifera, 5 bryozoa, 2 crinoids, 19 brachiopods, one pelecypod and no gastropods or cephalopods. The fauna is generally similar to that of the Brereton limestone beneath it, with the addition of the ostracodes.

Pokeberry Cyclothem

Pokeberry Calcareous Shale (Member 119) and Limestone (Member 120)

The Pokeberry limestone and associated calcareous shale have a fauna of 36 species including 6 bryozoa, 13 brachiopods, no pelecypods, 4 gastropods, and 7 ostracodes. The most abundant fossil is *Dictyoclostus portlockianus* (Norwood and Pratten), which is also the dominant species in the Jamestown limestone of southwestern Illinois, a probable correlative. Other common and conspicuous brachiopods are *Composita subtilita* (Hall) and *Echinoconchus semipunctatus* var. *knighti* Dunbar and Condra. Fusulinids are present, although uncommon. It is the only bed in the area that yields *Chaetetes milleporaceous* Milne-Edwards and Haime. The fauna is a typical brachiopod facies, but the dominant brachiopod species is not dominant in any other bed.

Sparland Cyclothem

Calcareous Shale and Limestone (Member 126)

A thin earthy limestone and calcareous shale above the Sparland (No. 7) coal and below the black sheety roof shale has a fauna of 68 species, including the following microfossils: 15 ostracodes, 7 conodonts, and 8 foraminifera but no fusulinids. This is the only zone in which ophiuroid plates and ossicles are common. Among the 17 brachiopod species the most common are *Chonetes granulifer* Owen, *Mesolobus mesolobus* var. *decipiens* (Girty), *Marginifera splendens* (Norwood and Pratten), *Wellerella tetrahedra* Dunbar and Condra, *Crurithyris planoconvexa* (Shumard), and *Composita subtilita* (Hall). No one species is dominant. There are four pelecypods and six gastropods.

Black Sheety Shale (Member 128)

The black sheety shale of the Sparland cyclothem (locality 171) has a typical black shale fauna with *Orbiculoidea missouriensis* (Shumard) the most common fossil. Conodonts are also common and there are 7 pelecypods, of which 3 are pectenoids. Ostracodes of the genus *Hollinella* are common and holothurian plates have been observed.

Gimlet Cyclothem

Limestone (Member 136)

A thin limestone bed was found below the black shale of the Gimlet cyclothem at a single locality (154) where it yields a fauna of 20 species, of which *Chonetes granulifer* Owen is most common. The fauna includes 9 brachiopods and only 3 mollusks, and is a brachiopod facies. *Fusulina megista* Thompson is present but uncommon.

Black Shale (Member 138)

The Gimlet cyclothem black shale is also very local, and was collected at only locality 154. Fossils are uncommon but 19 species were found. Unidentified small brownish-yellow plates or shell fragments are most common. Otherwise it is a typical black shale fauna with *Orbiculoidea missouriensis* (Shumard), conodonts, fish scales and teeth, and a few ostracodes.

Shale (Member 139)

At two places where the Lonsdale limestone is underlain by calcareous fossiliferous shale (localities 148 and 149), fusulinids are abundant in the shale and a cemented coquina of fusulinids occurs locally. Locality 148 is the type locality for Dunbar and Henbest's *Fusulina acme* and *F. lonsdalensis*. The fauna of 58 species is most largely microfossils and includes 27 ostracodes, 10 conodonts, and 13 foraminifera of which 3 are fusulinids. There are 4 common brachiopods.

Lonsdale Limestone (Member 140)

The Lonsdale limestone has the most varied fauna of any member in the area

(Waldo, 1928). The fauna of 194 species consists of 14 foraminifera, 1 sponge, 5 corals, 5 crinoids, 3 echinoids, 2 annelids, 11 conodonts, 4 bryozoa, 30 brachiopods, 39 pelecypods, 39 gastropods, 1 scaphopod, 11 nautiloid cephalopods, 2 trilobites, 25 ostracodes, and 1 fish tooth. This extraordinary diversity results from facies variations within small distances so that several of the larger collections have almost wholly different faunas. The species most abundant at some localities are absent at others.

At locality 154, abundant and distinctive species are *Cancrinella boonensis* (Swallow), *Conocardium missouriensis* Roundy, many common brachiopods, as *Mesolobus* n. sp., and *Caninia* sp. At locality 155, abundant species are *Marginifera splendens* (Norwood and Pratten), *Nuculana bellistriata* (Stevens), *Linoproductus "cora"* (d'Orbigny), *Pharkidonotus percarinatus* (Conrad) (which is found at no other Lonsdale locality), and *Marginifera? lasallensis* (Worthen).

At locality 156, abundant species are *Baylea adamsi* (Worthen), *B. giffordi* (Worthen), *Porcellia gillanus* White and St. John, and various other small gastropods suggestive of the Seahorne fauna.

At locality 157, abundant species are *Marginifera splendens* (Norwood and Pratten), *Dielasma bovidens* (Morton), *Composita subtilita* (Hall), *Cleiothyridina orbicularis* (McChesney), *Hustedia mormoni* (Marcou), *Derbya crassa* (Meek and Hayden), *Gosseletina spironema* (Meek and Worthen) and *Cryptacanthia compacta* (White and St. John). Each of these localities yielded more than 40 species, with about 70 species from locality 155.

The Lonsdale limestone includes many species unknown in older beds in the area, some of which become common in the Upper Pennsylvanian of the Illinois basin, as *Teguliferina armata* (Girty), *Rhipidomella carbonaria* (McChesney), and *Caninia* sp. On the other hand, it marks the last appearance of the common early Pennsylvanian brachiopod genus *Mesolobus*. The varied sedimentation, petrology, and ecology of the Lonsdale limestone would well repay careful study.

Exline Cyclothem

Exline Limestone (Member 142)

The most conspicuous fossils on bedding surfaces of the dark brownish-gray impure Exline limestone are leaves and stems of fossil ferns. Associated with this flora are annelids (*Spirorbis anthracosia* Whitfield) and a few pelecypods which were noted in the field but not found in the collections. This is a brackish-water fauna, probably near land as the fern leaves are well preserved. In Iowa the Exline has a normal marine fauna (Cline and Burma, 1949).

Exline Calcareous Shale (Member 143)

The thickest fossiliferous shale in the area overlies the dark Exline limestone. Typical marine fossils are found through 25 feet of shale. The larger fossils weather out abundantly on the slopes. Fifty species are listed and ostracodes are especially common with 24 (Bean, 1938). The fauna includes 5 pelecypods, 12 gastropods, and only 3 brachiopods. The most common large fossils are *Nuculopsis girtyi* Schenck, *Astartella concentrica* (Conrad), *Euphemites carbonarius* (Cox), and *Glabrocingulum grayvillense* (Norwood and Pratten). It is quite a typical molluscan fauna.

Trivoli Cyclothem

Shaly Limestone (Member 149)

A discontinuous shaly limestone overlies the Trivoli (No. 8) coal at the type outcrop of the cyclothem (locality 168). It is a coquina of worn, flattened, distorted, leached shells from which it is difficult to extract good specimens. Some of the 28 species listed are recognized only from fragments. The fauna includes 11 brachiopods, of which 3 chonetids and *Crurithyris planoconvexa* (Shumard) are most abundant. Productids are uncommon. Other common forms are crinoid stems and plates, *Rhombopora lepidodendroides* Meek, and other bryozoa. Trilobite remains are more conspicuous than in any other bed but are mostly detached genal spines. There are only 4 mollusks, none of which is common. Fragments of fusain are fairly common.

Black Sheety Shale (Member 150)

Fossils were collected from the black sheety shale member at only the type locality of the cyclothem (locality 168). The fauna of 37 species represents two facies, a lower one in which the shale is dark brownish gray, soft, and grades into the underlying limestone, and an upper facies of hard black sheety shale.

The lower shale yields an abundance of brachiopod shells, especially *Composita argentea* (Shepard), *Meekella striatocostata* (Cox), *and Crurithyris planoconvexa* (Shumard), and pectenoid pelecypods, especially *Euchondria levicula* Newell. The upper shale is only a few inches thick and contains *Lingula, Orbiculoidea,* conodonts, and teeth. The two faunules from this member are not differentiated in the table of fossils. The lower faunule represents the brachiopod facies and the upper the *Lingula* facies.

Calcareous Shale Below Trivoli Limestone (Member 151)

The calcareous shale below the Trivoli limestone has a fauna of 50 species from three collections, mostly from locality 168, the type outcrop of the Trivoli cyclothem. The fauna includes 15 ostracodes, 6 bryozoa, 10 brachiopods, and 5 gastropods. Crinoid stems and plates are very common. The fauna might be considered a mixed facies.

Trivoli Limestone (Member 152)

The Trivoli limestone is represented by a single collection of 14 species from locality 168. With more numerous collections a large fauna could be obtained. The limestone resembles the St. David limestone in lithology, and *Marginifera splendens* (Norwood and Pratten) is the most common fossil as it is in the St. David. Ten brachiopods dominate the fauna. The only molluscan species is the gastropod *Strobeus medialis* (Meek and Worthen).

Calcareous Shale (Member 153)

The lower 4½ feet of the calcareous shale overlying the Trivoli limestone is fossiliferous. A collection from the only exposure, locality 168, contains 51 species, including 6 bryozoa, 13 brachiopods, 2 pelecypods, 7 gastropods, and 13 ostracodes. The most abundant fossils are crinoid stems and plates and the brachiopods *Chonetes granulifer* Owen, *Chonetina flemingi* var. *plebeia* Dunbar and Condra, *Crurithyris planoconvexa* (Shumard), *Neospirifer triplicatus* (Hall), and *Composita subtilita* (Hall). *Chonetes* and *Chonetina* have taken the place of *Mesolobus* as the most abundant fossils in a chonetid-rich zone. The fauna is of mixed-to-brachiopod facies.

TABLE 3.—PENNSYLVANIAN FOSSILS IN THE BEARDSTOWN,

CYCLOTHEM	Seville	Seahorne	Greenbush		Liverpool													
MEMBER	Seville ls.	Seahorne ls.	Nodular ls.	Massive ls.	Black ls.	Black sh.	Concretions	Siliceous ls.	Conglomerate	Shale + ls. (68)	Septarian ls.	Argillaceous ls.	*Mesolobus* sh.	*Cardiomorpha* ls.	*Dunbarella* sh.	*Linoproductus* ls.	Fossil-cast ls.	Purington sh.
MEMBER NUMBER	19	41	48	51	66	67	67	68	70	71	72	74	76	77	78	79	81	82
NUMBER OF COLLECTIONS	19	23	2	2	7	3	3	8	2	2	23	18	4	10	1	23	5	1
Plants																		
Wood impressions and petrified wood																		
Foraminifera																		
Apterrinella sp.		X5									C4	X1					X2	
Bradyina sp.																		
Climacammina sp.	X1																	
Cribrospira sp.	X1																	
Cribrostomum sp.																		
Deckerella sp.																		
Earlandia sp.																		X1
Endothyra sp.											X1							X1
Endothyronella sp.																		
Fusulina acme Dunbar & Henbest																		
Fusulina eximia Thompson																		
Fusulina girtyi (Dunbar & Condra)																		
Fusulina haworthi Beede																		
Fusulina illinoisensis Dunbar & Henbest																		
Fusulina lonsdalensis Dunbar & Henbest																		
Fusulina megista Thompson																		
Fusulina mysticensis Thompson																		
Fusulina pumila Thompson		X6																
Fusulina sp.																		
Fusulinella gephyrea Dunbar & Henbest	X1																	
Fusulinella iowensis Thompson	X4																	
Fusulinella iowensis var. stouti Thompson	X1																	
Fusulinid, genus and species																		
Glyphostomella sp.																		
Globivalvulina sp.																		
Involutina sp.	X1							X1		C2	X2					X1		X1
Nummulostegina sp.																		
Polytaxis sp.	X1																	
Tetrataxis sp.	X1	X2										X1						
Textularia sp.	X1																	
Tolypammina sp.											X1							
Wedekindellina euthysepta (Henbest)	X1																	
Wedekindellina sp.								X1			X1							
Sponges																		
Sponge borings																		
Sponge spicules	C4																	
Corals																		
Arachnolasma sp.																		
Axophyllum rude? White & St. John																		
Caninia sp.																		
Chaetetes milleporaceus Milne-Edwards & Haime																		
Coral resembling Heliolites																		
Lophophyllid corals, several species	X2	X1						X1	X1	X1	X4	C8				X2		
Syringopora sp.																		
Bryozoa																		
Allonema? sp.																		
Bascomella sp.	X1																	
Bryozoa, genus and species																		
Chainodictyon laxum Foerste								X1										
Diploporaria biserialis (Ulrich)	C6																	
Fenestrellina mimica (Ulrich)	X3																	
Fenestrellina modesta (Ulrich)	C4																	
Fenestrellina perminuta (Ulrich)	X1																	
Fenestrellina sevillensis (Ulrich)	X3																	
Fenestrellina wortheni (Ulrich)	X3																	
Fenestrellina sp.	X4							X1		X1		X1						

A=abundant; C=common; X=present; number=number of collections in which fossil was present.

GLASFORD, HAVANA, AND VERMONT QUADRANGLES

Summum			St. David							Brereton				Poke-berry	Spar-land		Gimlet				Ex-line	Trivoli				
Black sh.	Concretions	Hanover ls.	No. 5 coal	Black sh.	Concretions	Calcareous sh.	St. David ls.	Calcareous sh.	Ls. in Canton sh.	Local ls.	Dark sh.	Brereton ls.	Calcareous sh.	Pokeberry ls.-sh.	Limestone + sh.	Black sh.	Limestone	Dark sh.	Calcareous sh.	Lonsdale ls.	Calcareous sh.	Shaly ls.	Black sh.	Calcareous sh.	Trivoli ls.	Calcareous sh.
85	90	92	97	98	98	100	101	102	104	108	114	115	116	120	126	128	136	138	139	140	143	149	150	151	152	153
2	3	2	1	15	22	4	33	41	2	2	3	19	12	11	8	1	1	1	12	28	7	1	1	3	1	3
					C8										X1	X1						X1				
					X4			C6				X2					X1					X1				
																				X1						
																			X7	X1						
												X1														
																			X4	X2						
																					X1					
								X1											X7	X2						
															X2				X6	X1						
																			X1	X1						
																				X1						
		X7	X8		X1		A12	C4	X2																	
													?1	X1												
								X2				X5														
																			A7	X5						
																	X1			X1						
																				X1						
		X1																	X1							
															X1											
																			?2							
															X1				X5	X1						
							X1	X5		X1		X1			X2						X4		X1			
																			X4	X1						
							X1	X1							X2				X5	X4						X1
							X1	X2				X1	X1		X2				X4	X2						
															X1				?1		X1					
								X1												X1						
																				X1						
																				X1						
							X1					X1								C2						
														X1												
																				X1						
						X1	X5	C13				C8	C6	X3	X2		X1			C13		X1	X1	X1	X1	X1
																X1										
																					X1					
							X1																C1			
												X1														
														X3												
												X1														
							X2	X5				X3	X1							X4				X1		X1

TABLE 3.—

CYCLOTHEM	Seville	Seahorne	Greenbush		Liverpool													
MEMBER	Seville ls.	Seahorne ls.	Nodular ls.	Massive ls.	Black ls.	Black sh.	Concretions	Siliceous ls.	Conglomerate	Shale + ls. (68)	Septarian ls.	Argillaceous ls.	*Mesolobus* sh.	*Cardiomorpha* ls.	*Dunbarella* sh.	*Linoproductus* ls.	Fossil-cast ls.	Purington sh.
MEMBER NUMBER	19	41	48	51	66	67	67	68	70	71	72	74	76	77	78	79	81	82
NUMBER OF COLLECTIONS	19	23	2	2	7	3	3	8	2	2	23	18	4	10	1	23	5	1
Bryozoa—Cont.																		
Fistulipora carbonaria Ulrich	C4											X1						
Penniretepora bellula (Ulrich)	X4																	
Polypora fastuosa (DeKoninck)	X3																	
Polypora whitei Ulrich	X1																	
Polypora sp.										X1								
Prismopora sereata (Meek)	X3	X3																
Prismopora triangulata (White)																		
Rhombocladia delicata Rogers	X3	X1																
Rhombopora lepidodendroides Meek	C8	X4						X2		X2	X2	X1	X1			X1		
Septopora biserialis var. nervata Ulrich																		
Septopora delicatula Ulrich	X5																	
Septopora multipora ? Rogers																		
Septopora sp.	X1																	
Streblotrypa prisca (Gabb & Horn)																		
Streblotrypa sp.	X1																	
Sulcoretepora carbonaria (Meek)	X4																	
Tabulipora carbonaria (Worthen)																		
Tabulipora heteropora (Condra)	X2										X1							
Thamniscus octonarius Ulrich																		
Thamniscus sevillensis Ulrich	X4																	
Vinella? sp.																		
Inarticulate Brachiopods																		
Lingula carbonaria Shumard	X1					X1	X1			X1	X1			C4	X1	X3		X1
Lingula kanawhensis Price																X1		
Orbiculoidea missouriensis (Shumard)	X5	X1			X1	X1	X2	X2		X1				X3		X1	X2	
Orbiculoidea munda (Miller & Gurley)																X1		
Petrocrania modesta (White & St. John)																X3		
Petrocrania sp.																		
Trigonoglossa sp.	X1				X1													X2
Articulate Brachiopods																		
Cancrinella boonensis (Swallow)																		
Chonetes granulifer Owen several var.		X1		X1				X2			X1							
Chonetina flemingi var. crassiradiata Dunbar & Condra																		
Chonetina flemingi var. plebeia Dunbar & Condra																		
Chonetina n. sp.		X6																
Cleiothyridina orbicularis (McChesney)		X2																
Composita argentea (Shepard)	C12	X3								X2	C7	C9	C1					
Composita elongata? Dunbar & Condra																		
Composita subtilita (Hall)	X3	C6			X1			X2		X2	X3	X4	C1			X3		
Crurithyris planoconvexa (Shumard)		X2		X1				X1			C2	C6				A14	C4	C1
Cryptacanthia compacta (White & St. John)																		
Derbya bennetti Hall & Clarke																		
Derbya crassa (Meek & Hayden)	C7							X1		X2	C9	C9	X2			X6		
Derbya robusta? Hall	X1																	
Dictyoclostus gallatinensis (Girty)	C5																	
Dictyoclostus portlockianus (Norwood & Pratten)		X3									X1	X1						
Dictyoclostus n. sp. aff. americanus Dunbar & Condra	C8	X2						X3		X1		X1				X1		
Dielasma bovidens (Morton)	X1																	
Echinoconchus semipunctatus var. knighti Dunbar & Condra	X1																	
Hustedia mormoni (Marcou)	X5							X1				X1						
Juresania nebrascensis (Owen)	C4	X2														X5		
Leiorhynchus rockymontanus (Marcou)																		
Linoproductus "cora" (d'Orbigny), several var.	C12	X1					X1	X3			X1	X1	X1	X1		A20	X1	
Lissochonetes geinitzianus (Waagen)											X1	X4						

A=abundant; C=common; X=present; number=number of collections in which fossil was present.

Continued

Summum			St. David							Brereton				Poke-berry	Spar-land		Gimlet				Ex-line	Trivoli				
Black sh.	Concretions	Hanover ls.	No. 5 coal	Black sh.	Concretions	Calcareous sh.	St. David ls.	Calcareous sh.	Ls. in Canton sh.	Local ls.	Dark sh.	Brereton ls.	Calcareous sh.	Pokeberry ls.–sh.	Limestone + sh.	Black sh.	Limestone	Dark sh.	Calcareous sh.	Lonsdale ls.	Calcareous sh.	Shaly ls.	Black sh.	Calcareous sh.	Trivoli ls.	Calcareous sh.
85	90	92	97	98	98	100	101	102	104	108	114	115	116	120	126	128	136	138	139	140	143	149	150	151	152	153
2	3	2	1	15	22	4	33	41	2	2	3	19	12	11	8	1	1	1	12	28	7	1	1	3	1	3
							X5	C9		X1			X2	X4					X1	X5						X1
								X1														X1				
														X1								?1		X1		X1
							X2	X1				X1	X1	X3												
							X5	X1				X1														
						X1	C11	X6		X1		X4	X3	X4					X1	X2		C1	X1	X1		A2
				X1																						
																								X1		X1
								X1																		
																								X1		X1
								X3						X5						C6				X1		
							X3			X1			X1													
								X1																		
X1				C5	X3		X1									C1							X1			
				X3																						
C1	C2	A1	A1	A9	C17	X1		X1		X1					X1	C1	X1	C1		X2			X1			
								X1		X1																
				X1								X1														
					X1											X?1	X1			X3		X1	X1		X1	
						X1	C6	C14	C1	X1		X2	X5		C3	X1	C1	X1		X11	X1	A1	C1	A1		A2
						X1	C10	C13	X1	X1		X6	X2		X2					X2						
																			X1			A1		X1		C2
							X1	X6				X1	X4	X1	?1					C9						
			X1	X2	A8	X1	C7	C12				C7	X3	X4	X1	X1	X1			X6			C1	X1	X1	X1
																							?1			
	X1			X4	C4	X1	C16	C20	X1	X1		C6	X5	C8	C3					C12				X1	X1	X1
	X1		X1	X2	X3	X2	X7	C13		X1		X3	X1		C2	X1	X1	X1		X5		A1	C1	X1	X1	X1
																				X2						
														X1	X2					X3						
			X1	C2	X5	X2	C13	C17		X1		X3	X6	X7				X1		X10	X1	?1	X1	X1	X1	X2
							X1																			
							X8	X8				X3	X1	A9	X3					X5				X1	X1	X1
							C9	X5																		
																				C7						X1
							X1	X5		X1		X1	X1	X2	X1					X3				X1		
						X1	X5	C11				X1	X6		X1		X1			C10						X1
				X2	A2	X1	X9	X7		X2			X2		X1					X5			X1	X1		
				X2			X1	X1																		
				C3	C5		C15	C10	C1	A1		X1		C6			X1			C6		X1	?1	X1	X1	X1
							X1	X2	X1													C1	X1			

Table 3.—

CYCLOTHEM	Seville	Seahorne	Greenbush		Liverpool													
MEMBER	Seville ls.	Seahorne ls.	Nodular ls.	Massive ls.	Black ls.	Black sh.	Concretions	Siliceous ls.	Conglomerate	Shale + ls. (68)	Septarian ls.	Argillaceous ls.	*Mesolobus* sh.	*Cardiomorpha* ls.	*Dunbarella* sh.	*Linoproductus* ls.	Fossil-cast ls.	Purington sh.
MEMBER NUMBER	19	41	48	51	66	67	67	68	70	71	72	74	76	77	78	79	81	82
NUMBER OF COLLECTIONS	19	23	2	2	7	3	3	8	2	2	23	18	4	10	1	23	5	1
Articulate Brachiopods—Cont.																		
Marginifera haydenensis Girty	A11																	
Marginifera? lasallensis (Worthen)																		
Marginifera muricatina Dunbar & Condra		C7			X1			X3	X1	C2	A13	A10	C2			C6	X2	
Marginifera nana (Meek & Worthen)	A12																	
Marginifera splendens (Norwood & Pratten)																		
Meekella striatocostata (Cox)																		
Mesolobus mesolobus (Norwood & Pratten)		X6			X1			C4		C2	C12	A12	A4	X3		C1	X1	X1
Mesolobus mesolobus var. decipiens (Girty)																		
Mesolobus mesolobus var. euampygus (Girty)												?2				?1		
Mesolobus striatus Weller & McGehee	C7																	
Mesolobus n. sp.																		
Neospirifer cameratus (Morton)	C12	C11								X1	X5	C6				C7		
Neospirifer triplicatus (Hall)	X1																	
Phricodothyris perplexa (McChesney)	C11	C14						C4			X2	X2						
Productid genus and species	X1																	
Punctospirifer kentuckyensis (Shumard)	X6	X1						X1	X1	X1	X2	X2						
Rhipidomella carbonaria (Swallow)																		
Rhynchopora carbonaria (McChesney)																		
Rhynchopora n. sp.																X1		
Schizophoria texana Girty																		
Spirifer occidentalis Girty	C10	X4			X1			X1										
Teguliferina armata (Girty)																		
Wellerella tetrahedra Dunbar & Condra								X1		X1	X4	X5				X1		
Wellerella n. sp.																		
Amphineurans																		
Glaphurochiton carbonarius (Stevens)																		
Scaphopods																		
Dentalium indianum? Girty		X1									X1							
Plagioglypta annulistriata Meek & Worthen		X1							X1		X1							
Gastropods																		
Anomphalus umbilicatus? Knight		X2																
Anthracopupa sp.			X2															
Baylea adamsi (Worthen)																		
Baylea giffordi (Worthen)									X1									
Baylea inclinata (Weller)		X4														?1		
Baylea subconstricta (Meek & Worthen)																		
Baylea supercrenata (Weller)		X5																
Baylea? sp.		X4									X1							
Bellerophon crassus Meek & Worthen																X1		
Bucanopsis elliptica? (McChesney)																X1		
Bucanopsis aff. marcouiana (Geinitz)											X2	C4		X5		X2		
Bucanopsis nodocostatus (Gurley)		X1																
Bucanopsis tenuilineata (Gurley)										X1	X1	C5				X2	X2	
Bucanopsis aff. textiliformis (Gurley)																		
Ceraunocochlis cf. fulminula Knight		X7																
Ceraunocochlis? n. sp.																		
Cymatospira montfortianus (Norwood & Pratten)	X1	X2								X1	X2	C6		X1		C6	X3	X1
Donaldina robusta (Stevens)								X1		X2	X3	X1		X1		C7	X3	X1
Donaldina stevensana? (Meek & Worthen)		X1			X2													
Eoptichia cf. rothi (Knight)		X1																
Eucochlis perminuta Knight		X2																
Euconospira turbiniformis (Meek & Worthen)		X1																
Euphemites carbonarius (Cox)	X1	X3								X1	X1	C5	X2	X2		C7	X1	
Gastropod genus and species?		X4														X1		
Glabrocingulum grayvillense (Norwood & Pratten)		X3						X1		X2	X2	C7	X1			C7	X3	X1
Glabrocingulum welleri (Newell)												cf. 2						
Glabrocingulum sp.																		
Gosseletina spironema (Meek & Worthen)		C6																

A=abundant; C=common; X=present; number=number of collections in which fossil was present.

Continued

Summum			St. David							Brereton				Poke-berry	Spar-land		Gimlet				Ex-line	Trivoli				
Black sh.	Concretions	Hanover ls.	No. 5 coal	Black sh.	Concretions	Calcareous sh.	St. David ls.	Calcareous sh.	Ls. in Canton sh.	Local ls.	Dark sh.	Brereton ls.	Calcareous sh.	Pokeberry ls.–sh.	Limestone + sh.	Black sh.	Limestone	Dark sh.	Calcareous sh.	Lonsdale ls.	Calcareous sh.	Shaly ls.	Black sh.	Calcareous sh.	Trivoli ls.	Calcareous sh.
85	90	92	97	98	98	100	101	102	104	108	114	115	116	120	126	128	136	138	139	140	143	149	150	151	152	153
2	3	2	1	15	22	4	33	41	2	2	3	19	12	11	8	1	1	1	12	28	7	1	1	3	1	3
																				X1						
			X1	C6	C15	X1	C14	A17	X1	X1																
		X1					A17	A20		X1		C8	C8	X2	C3		X1		X1	C12		X1		C1	X1	X2
							X1								X1					X4			X1			
			X1	X3	X4	C2	C14	C14		X1			X5	X2	C3											
						X1	A16	A18		A1		X6	X5													
																			X1	X7						
							C10	C18													X1	X1	X1			
								X2				X7	C6	X5					X1	C10				X1	X1	C1
				X1	X3		X9	X9	X2			C8	X1	X4	X2		X1			C15					X1	
						X1	X8	C15		X1		X1	X6	X6						X5		X1		X1		X2
																				X3						
																				C4						
							X3	X6					X1													
																				X2						
								X2?																		
												X1								C7						
					X1		X1	X5				X6	X6		C2					X3			?1			
																				X2						
				X1			X1																			
							X1													X2						
								X1																		
								X1												X1						
																				C6				X1		
					X2										X1					C5				X1		
																				X3						
				X1						X1																
								X1												X4						
							?1																			
																				?1						
						X1	X1	X2	X1											X3	X2					
																				X1						
															X1											
																				X1						
					X1			X5	X1	X1										X1				X1		
				X1	X5		X1	X1										X1		X4						X1
																				X1	X2					
																				X1						
																				X3						
				X1	X3	X2		C7	X1						X1	?1	X1			X2	C3			X1		X1
					X1		X1										X1									
				X2	C5		X1	C11		X1		X1			C2			X1		X3	A5		X1	X1		X1
																				X3						
														X1												
																				C7	X1					

Table 3.—

CYCLOTHEM	Seville	Seahorne	Greenbush		Liverpool													
MEMBER	Seville ls.	Seahorne ls.	Nodular ls.	Massive ls.	Black ls.	Black sh.	Concretions	Siliceous ls.	Conglomerate	Shale + ls. (68)	Septarian ls.	Argillaceous ls.	*Mesolobus* sh.	*Cardiomorpha* ls.	*Dunbarella* sh.	*Linoproductus* ls.	Fossil-cast ls.	Purington sh.
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NUMBER OF COLLECTIONS	19	23	2	2	7	3	3	8	2	2	23	18	4	10	1	23	5	1
Gastropods—Cont.																		
Hemizyga cf. corbis Knight		X1								X1								
Hemizyga illineata Knight																		
Hemizyga sp.		X1																
Meekospira choctawensis Girty		C4			X1			X1	X1	X1	X2	C6				X4	X3	X1
Microdoma sp.		X1																
Mourlonia cf. beckwithana (McChesney)																		
Mourlonia? sp.		X1																
Murchisonia sp.		X2									X1							
Naticopsis meeki Knight																		
Naticopsis ventricosa (Norwood & Pratten)		C10														X1		
Natiria americana (Girty)		C5																
Orthonema carbonarium Worthen																		
Orthonychia parva (Swallow)	X1	X1																
Pharkidonotus percarinatus (Conrad)		X5								X1	X1	X4				X3	X1	
Phymatopleura nodosus (Girty)										X1		X1				X1		
Phymatopleura pratteni? (Meek & Worthen)		X1																
Phymatopleura scitula? (Meek & Worthen)																		
"Pleurotomaria" conoformis Worthen		X4																
"Pleurotomaria" granulostriata Meek & Worthen		X2																
"Pleurotomaria" spp.		X2															X1	
Plocezyga angularis Knight		X1																
Plocezyga percostata Knight		X1																
Plocezyga cf. tenuilirata Knight																		
Porcellia gillanus White & St. John		X1																
Pseudozygopleura assertonsoris Knight		X1																
Pseudozygopleura cf. conica Knight		X2						X1										
Pseudozygopleura cf. girtyi (Knight)																		
Pseudozygopleura cf. pagoda Knight		X1																
Pseudozygopleura cf. plummeri Knight		X1																
Pseudozygopleura cf. pluricostata Knight									X1									
Pseudozygopleura cf. pulchra Knight		X1																
Pseudozygopleura cf. recticostata Knight		X1																
Pseudozygopleura cf. semicostata (Meek)		X1																
Pseudozygopleura sinuosior Knight											X1							
Pseudozygopleura cf. tenuivirga Knight		X3																
Pseudozygopleura, several species		X3							X1	X1	X1					X2		
Pyrgozyga cf. macra (Knight)		X3								X1								
Rhabdotocochlis rugata Knight		X1																
Rhabdotocochlis? sp.																		
Shansiella carbonaria (Norwood & Pratten)												X1						
Soleniscus typicus Meek & Worthen																		
Straparolus (Amphiscapha) catilloides (Conrad)		X1								X1	X1	X3					X1	X1
Streptacis? spp.										X1								
Strobeus brevis White	X2	X6									X1	X4				X1		
Strobeus intercalaris (Meek & Worthen)		X1										X1		X1		X3		
Strobeus medialis (Meek & Worthen)									X1		X2	X2				X4		
Strobeus paludinaeformis (Hall)										X1	X1	X1						
Strobeus primogenius (Conrad)	X1	X3									X1					C7		
Strobeus regularis (Cox)		X4									X1	X1				X2	X1	
Strobeus welleri Knight		X1																
Strobeus sp.	X1				X1									X1				
Strophostylus minutissimus? Knight		X2																
Trachydomia nodulosa Worthen																		
Trachydomia oweni Knight		C8																
Trepospira discoidalis Newell																		
Trepospira illinoisensis (Worthen)	X1	X1										X3				X4	X3	
Worthenia speciosa (Meek & Worthen)												X2						
Worthenia tabulata (Conrad)												X1						
Worthenia sp.																		
Yunnania subsinuata (Meek & Worthen)																		

A=abundant; C=common; X=present; number=number of collections in which fossil was present.

Continued

Summum			St. David							Brereton				Poke-berry	Spar-land		Gimlet				Ex-line	Trivoli				
Black sh.	Concretions	Hanover ls.	No. 5 coal	Black sh.	Concretions	Calcareous sh.	St. David ls.	Calcareous sh.	Ls. in Canton sh.	Local ls.	Dark sh.	Brereton ls.	Calcareous sh.	Pokeberry ls.–sh.	Limestone + sh.	Black sh.	Limestone	Dark sh.	Calcareous sh.	Lonsdale ls.	Calcareous sh.	Shaly ls.	Black sh.	Calcareous sh.	Trivoli ls.	Calcareous sh.
85	90	92	97	98	98	100	101	102	104	108	114	115	116	120	126	128	136	138	139	140	143	149	150	151	152	153
2	3	2	1	15	22	4	33	41	2	2	3	19	12	11	8	1	1	1	12	28	7	1	1	3	1	3
					X1																					
																				X1						
							X1	X4				X1								X6						
																				X1						
																				X6						
												X1								C7						
																				X1						
								X6												C7		X1				X1
								X2												A2	X3					X1
				X2			X1	X4																		X1
				X1																						
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					X1																					
				X1			X1																			
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					X2																					
								X1							X1											
				X1																						
						X1	X1	X3							X1						X2	X1				
							X1																			
					X2			X3												X2	X1					
					X4		X1	X2												X1	X2					X1
					X1		X2	X1						X1						X1	X1			X1		
				X1	X2															X2						
					X2			X1												X3						
					C3			X1												X4				X1		
																				X2						
																		X1		X1						
					X1			X3																		
								X1												X1						
																				X1						
													X1													

Table 3.—

CYCLOTHEM	Seville	Seahorne	Greenbush		Liverpool													
MEMBER	Seville ls.	Seahorne ls.	Nodular ls.	Massive ls.	Black ls.	Black sh.	Concretions	Siliceous ls.	Conglomerate	Shale + ls. (68)	Septarian ls.	Argillaceous ls.	*Mesolobus* sh.	*Cardiomorpha* ls.	*Dunbarella* sh.	*Linoproductus* ls.	Fossil-cast ls.	Purington sh.
MEMBER NUMBER	19	41	48	51	66	67	67	68	70	71	72	74	76	77	78	79	81	82
NUMBER OF COLLECTIONS	19	23	2	2	7	3	3	8	2	2	23	18	4	10	1	23	5	1
Cephalopods																		
Beyrichoceras wanlessi (Plummer & Scott)					A2	X1	A2							X1				
Brachycycloceras normale Miller, Dunbar & Condra					X1													
Cyrtoceras? aff. dilatatum Meek & Worthen											X1					X1		
Cyrtoceras? sp.																		
Domatoceras aff. moorei Miller, Dunbar & Condra																		
Domatoceras aff. toddanum (Gurley)																		
Domatoceras aff. umbilicatum Hyatt																		
Endolobus aff. depressa (Hyatt)																		
Eoasianites welleri (Smith)					A2													
Large nautiloid fragments																		
Liroceras liratum (Girty)																X2		
Liroceras obsoletum (Girty)		X1																
Megaglossoceras aff. montgomeryensis (Worthen)																X1		
Metacoceras cornutum Girty		X1									X2					C2		
Metacoceras crassus (Hyatt)							X1				X2							
Metacoceras perelegans Girty							X1			X2	X2					X2		
Metacoceras aff. sublaeve Miller, Dunbar & Condra																		
Metacoceras sp.	X1																X1	
Mooreoceras tuba (Girty)																		
Nautiloid, genus & species?	X1															X1		
Planetoceras sp.																		
Pseudometacoceras sculptile (Girty)							C3											
Pseudorthoceras knoxense (McChesney)	X2	X2			X1		X2			X1	X4	X5		X2		X5	X1	
Solenochilus sp.	X1																	
Temnocheilus aff. winslowi (Meek & Worthen)		X1																
Temnocheilus sp.																		
Titanoceras aff. illinoisense (McChesney)																		
Titanoceras sp.																		
Pelecypods																		
Acanthopecten carboniferus (Stevens)		X1									X1	X1						
Allorisma costatum Meek and Worthen		X1																
Allorisma granosum? (Shumard)																		
Allorisma subcuneata Meek & Hayden																X1		
Allorisma terminale Hall	X1																	
Annuliconcha interlineata (Meek & Worthen)																		
Anthracomya? sp.			X2															
Anthraconeilo aff. bownockeri Morningstar	X1																	
Anthraconeilo taffiana Girty										X1	X1	X3		X1		X3	X3	X1
Astartella compacta Girty	X1	X2						X1		X2		X3				X2		
Astartella concentrica (Conrad)									X1	X1		C6	X1			X2	X2	X1
Astartella concentrica var. gurleyi White																		
Astartella concentrica var. varica McChesney										X1		X1		X1				
Aviculopecten coxanus? Meek and Worthen	X1																	
Aviculopecten flabellum (Price)																X2		
Aviculopecten germanus Miller and Faber											X1					X2		
Aviculopecten, several species	X1	X2									X1			X4		X3	X2	
Aviculopinna illinoisensis Worthen																X1		
Bakevellia parva Meek and Hayden																		
Cardiomorpha missouriensis Shumard		C1			A4		X1				X2	X1	X1			X4	X1	
Cardiomorpha? sp.														A8				
Clavicosta echinata Newell																		
Clinopistha radiata var. laevis Meek and Worthen					X2													
Conocardium missouriensis Roundy																		
Cypricardinia carbonaria Meek														X1				
Dunbarella knighti Newell	X1				A3		C2							C5	A1		X1	
Dunbarella rectalaterarea (Cox)																		

A=abundant; C=common; X=present; number=number of collections in which fossil was present.

Continued

Summum			St. David							Brereton				Pokeberry	Sparland		Gimlet				Exline	Trivoli				
Black sh.	Concretions	Hanover ls.	No. 5 coal	Black sh.	Concretions	Calcareous sh.	St. David ls.	Calcareous sh.	Ls. in Canton sh.	Local ls.	Dark sh.	Brereton ls.	Calcareous sh.	Pokeberry ls.-sh.	Limestone + sh.	Black sh.	Limestone	Dark sh.	Calcareous sh.	Lonsdale ls.	Calcareous sh.	Shaly ls.	Black sh.	Calcareous sh.	Trivoli ls.	Calcareous sh.
85	90	92	97	98	98	100	101	102	104	108	114	115	116	120	126	128	136	138	139	140	143	149	150	151	152	153
2	3	2	1	15	22	4	33	41	2	2	3	19	12	11	8	1	1	1	12	28	7	1	1	3	1	3
	A3				X1																					
					X1																					
								X1												X1						
					X1																					
																				X1						
							X1													X1						
	C2				X1																					
							X1	X1																		
					X1		X1																			
					X1															X1						
				X1	X1		X3													X1						
																				X1						
				X1	X3			X3												X2						
																				X2						
															X1						X1					
					X1															X1						
							X2		X1											X3						
					X1																					
X1				X3	C9	X1	X3	X5	X1						X1					X2	X3			X1		X1
				X1																						
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							X1		X1							X1				X1		X1				
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								X3												X1						
							X2	X3							X1											
																				X3						
																				X1						
					C4		X1	X1				X2								X3						
							X1	X4				X1					X1			X1	A3		X1	X1		
										X1					X1											
									X1											X1						
					X4		X1								X1											
																				X2						
					X1																					
	X1				C15				X1						X1					X2						?1
																				X2						
					A14															X1						
								X1												X2						
	X1																									
				C4	C7											X1										

TABLE 3.—

CYCLOTHEM	Seville	Seahorne	Greenbush		Liverpool													
MEMBER	Seville ls.	Seahorne ls.	Nodular ls.	Massive ls.	Black ls.	Black sh.	Concretions	Siliceous ls.	Conglomerate	Shale + ls. (68)	Septarian ls.	Argillaceous ls.	*Mesolobus* sh.	*Cardiomorpha* ls.	*Dunbarella* sh.	*Linoproductus* ls.	Fossil-cast ls.	Purington sh.
MEMBER NUMBER	19	41	48	51	66	67	67	68	70	71	72	74	76	77	78	79	81	82
NUMBER OF COLLECTIONS	19	23	2	2	7	3	3	8	2	2	23	18	4	10	1	23	5	1
Pelecypods—Cont.																		
Edmondia meekiana? Morningstar														X1				
Edmondia nebrascensis Meek																X1		
Edmondia ovata Meek and Worthen					X1		X1							X1		X3		
Edmondia reflexa? Meek														X1		X1	X1	
Edmondia subtruncata Meek																		
Edmondia, several species										X1		X1		X3				
Euchondria levicula Newell																		
Euchondria menardi (Worthen)																		
Euchondria pellucida (Meek and Worthen)										X1	X1					X1	A4	A1
Euchondria subcancellata Newell																		
Lima retifera Shumard		X1					X1				X1			X1		X2	X2	X1
Lima n. sp.		X1					X1											
Lithophaga sp.																		
Monopteria gibbosa (Meek and Worthen)																		
Myalina lepta Newell														C6	X1			
Myalina meeki Dunbar							X1											
Myalina wyomingensis (Lea)											X1							
Myalina sp.					X1									X1	X1			X1
Nucula beyrichi Schauroth											X1						X2	
Nucula croneisi Schenck	X1	X1										X3		X1				X1
Nucula aff. elongata Morningstar										X1								
Nucula wewokana Girty											X1					X1		
Nucula sp.		X2									X1					X1		
Nuculana arata (Hall)																		
Nuculana bellistriata (Stevens)											X1	C6		C4		C4		X1
Nuculana meekana (Mark)										X1				X1			X1	
Nuculopsis girtyi Schenck											X1	X2		X1		X2	X1	
Orthomyalina ampla (Meek and Hayden)																		
Paleonucula anodontoides (Meek)											X1	X3				X1		
Parallelodon aff. sangamonensis Worthen																		
Parallelodon tenuistriatus (Meek & Worthen)		X3						X1		X2	X1							
Parallelodon sp.	X1												X1				X2	X1
Pelecypod, genus and species?										X1				C3				X1
Pernopecten ohioense Newell					X1						X1					C6	X1	
Placunopsis carbonaria Meek and Worthen		X1																
Plagiostoma acosta Cox							X2											
Plagiostoma n. sp.											X1							
Pleurophorus? costatus (Brown)																		
Pleurophorus aff. immaturus Herrick											X1			X1				
Pleurophorus aff. oblongus Meek					X1									X2		X1	X1	
Pleurophorus tropidophorus Meek		X1								X1								
Pleurophorus n. sp.																		
Pleurophorus? several species							X1				X1							
Posidonia aff. fracta Meek																		
Posidonia sp.		X1																
Pseudomonotis sp.																		
Pteria longa (Geinitz)		X3						X1		X1	X1							
Pteria ohioense (Herrick)	X1																	
Pterinopectinella? sp.																X1		
Schizodus affinis Herrick							X1			X1				X1			X1	
Schizodus cf. alpinus (Hall)							X1											
Schizodus subcircularis Herrick		X1									X1					X1		
Schizodus wheeleri (Swallow)																		
Sedgwickia topekaensis (Shumard)														C5				
Septimyalina perattenuata (Meek & Hayden)																X1		
Septimyalina sp.																		
Solemya parallela Beede & Rogers							X2											
Solemya radiata Meek & Worthen		X1												X1		X1		
Solemya trapezoides Meek	X1																	
Streblochondria hertzeri (Meek)	X3							X1								X3		
Streblochondria sculptilis (Miller)																		
Streblochondria? tenuilineata (Meek & Worthen)	X3						?1				X1					X1		
Volsellina subelliptica (Meek)																		
Yoldia glabra Beede & Rogers											X1							

A=abundant; C=common; X=present; number=number of collections in which fossil was present.

Continued

Summum			St. David							Brereton				Pokeberry	Sparland		Gimlet				Ex-line	Trivoli				
Black sh.	Concretions	Hanover ls.	No. 5 coal	Black sh.	Concretions	Calcareous sh.	St. David ls.	Calcareous sh.	Ls. in Canton sh.	Local ls.	Dark sh.	Brereton ls.	Calcareous sh.	Pokeberry ls.-sh.	Limestone + sh.	Black sh.	Limestone	Dark sh.	Calcareous sh.	Lonsdale ls.	Calcareous sh.	Shaly ls.	Black sh.	Calcareous sh.	Trivoli ls.	Calcareous sh.
85	90	92	97	98	98	100	101	102	104	108	114	115	116	120	126	128	136	138	139	140	143	149	150	151	152	153
2	3	2	1	15	22	4	33	41	2	2	3	19	12	11	8	1	1	1	12	28	7	1	1	3	1	3
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....	C2	....	....	....	A13	....	....	X1	....	....	....	....	....	....	....	X1	....	....	....	X1	....	....	....	....	....	....
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TABLE 3.—

CYCLOTHEM	Seville	Seahorne	Greenbush		Liverpool													
MEMBER	Seville ls.	Seahorne ls.	Nodular ls.	Massive ls.	Black ls.	Black sh.	Concretions	Siliceous ls.	Conglomerate	Shale + ls. (68)	Septarian ls.	Argillaceous ls.	*Mesolobus* sh.	*Cardiomorpha* ls.	*Dunbarella* sh.	*Linoproductus* ls.	Fossil-cast ls.	Purington sh.
MEMBER NUMBER	19	41	48	51	66	67	67	68	70	71	72	74	76	77	78	79	81	82
NUMBER OF COLLECTIONS	19	23	2	2	7	3	3	8	2	2	23	18	4	10	1	23	5	1
Annelids																		
Spirorbis anthracosia Whitfield		X2	X1					X2					X1	X4	X1	X1		
Worm, genus and species																		
Worm tubes (Serpulopsis insita? White)										X1				X1		X4	X1	
Trilobites																		
Ameura sangamonensis (Meek and Worthen)																		
Ditomopyge parvulus (Girty)																		
Ditomopyge olsoni Williams	X1																	
Ditomopyge scitula (Meek and Worthen)																		
Ditomopyge sp.		X2						X1								X2	X1	
Sevillia sevillensis Weller	X4																	
Crustaceans																		
Crustacean, genus and species			X1															
Estheria ortoni Clarke												X1		X4	X1			
Leaia sp.	X1																	
Ostracodes																		
Amphissites alticostatus Bradfield										X1								
Amphissites centronotus (Ulrich and Bassler)	X1																	
Amphissites girtyi Knight										X1		X1						
Amphissites robustus Cooper																		
Amphissites rothi Bradfield																		
Amphissites roundyi Knight																		
Bairdia altifrons Knight																		
Bairdia ampla Reuss																		
Bairdia beedei Ulrich and Bassler																		
Bairdia coryelli Roth and Skinner		X1																
Bairdia crassa Harlton																		
Bairdia hoxbarensis Harlton																		
Bairdia menardensis Harlton																		
Bairdia menardvillensis Harlton																		
Bairdia oklahomaensis Harlton	X2	X2																
Bairdia peracuta Warthin																		
Bairdia pompiloides Harlton																		
Bairdia seminalis Knight																		
Bairdia whitesidei Bradfield																		
Bairdia sp.	X1																	
Bairdiacypris nebraskensis (Upson)																		
Bairdiacypris trojana (Wilson)																		
Carbonita cf. tenuis Cooper		X1																
Carbonita sp.			X1															
Cavellina angusta Cooper										X1								
Cavellina bisecta Bradfield										X1								
Cavellina cavellinoides (Bradfield)																		
Cavellina cummingsi Payne																		
Cavellina daubeana (Bradfield)																		
Cavellina jejuna Coryell & Sample																		
Cavellina minuta Bradfield																		
Cavellina rotunda Cooper																		
Cavellina sp.											C1					X1	C3	C1
Coryellites centralis (Coryell & Billings)																		
Coryellites contracta Cooper																		
Coryellites elongata Cooper																		
Coryellites firma Kellett																		
Coryellites johnsoni (Upson)																		
Coryellites ovata Cooper																		X1
Coryellites palopintoensis (Coryell & Sample)																		
Coryellites parallela (Knight)																		
Coryellites pediformis (Knight)																		
Coryellites subelliptica (Upson)												X1						X1
Coryellites tomlinsonella Cooper																		

A=abundant; C=common; X=present; number=number of collections in which fossil was present.

Continued

Summum			St. David							Brereton				Pokeberry	Sparland		Gimlet				Exline	Trivoli				
Black sh.	Concretions	Hanover ls.	No. 5 coal	Black sh.	Concretions	Calcareous sh.	St. David ls.	Calcareous sh.	Ls. in Canton sh.	Local ls.	Dark sh.	Brereton ls.	Calcareous sh.	Pokeberry ls.-sh.	Limestone + sh.	Black sh.	Limestone	Dark sh.	Calcareous sh.	Lonsdale ls.	Calcareous sh.	Shaly ls.	Black sh.	Calcareous sh.	Trivoli ls.	Calcareous sh.
85	90	92	97	98	98	100	101	102	104	108	114	115	116	120	126	128	136	138	139	140	143	149	150	151	152	153
2	3	2	1	15	22	4	33	41	2	2	3	19	12	11	8	1	1	1	12	28	7	1	1	3	1	3
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....	....	....	....	....	....	X1	....	....	....	....	X2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

Table 3.—

CYCLOTHEM	Seville	Seahorne	Greenbush		Liverpool													
MEMBER	Seville ls.	Seahorne ls.	Nodular ls.	Massive ls.	Black ls.	Black sh.	Concretions	Siliceous ls.	Conglomerate	Shale + ls. (68)	Septarian ls.	Argillaceous ls.	*Mesolobus* sh.	*Cardiomorpha* ls.	*Dunbarella* sh.	*Linoproductus* ls.	Fossil-cast ls.	Purington sh.
MEMBER NUMBER	19	41	48	51	66	67	67	68	70	71	72	74	76	77	78	79	81	82
NUMBER OF COLLECTIONS	19	23	2	2	7	3	3	8	2	2	23	18	4	10	1	23	5	1
Ostracodes—Cont.																		
Ectodomites dattonensis (Harlton)																		
Ectodomites sp.																		
Fabalicypris acuminata Cooper										X1								
Fabalicypris dispar Cooper										X1								
Fabalicypris plana Cooper										X1								
Fabalicypris sp.																		
Fabalicypris wetumkaensis Cooper																		
Fabalicypris wileyensis Cooper										X1								
Healdia asper Cooper																		
Healdia aspinosa Cooper																		
Healdia carterensis Bradfield																		
Healdia cincta Coryell & Billings																		
Healdia colonyi Coryell & Booth																		
Healdia elegans Warthin																		
Healdia formosa Harlton																		
Healdia granosa Cooper																		
Healdia limacoidea Knight																		
Healdia marginata Harlton										X1								
Healdia oblonga Bradfield										X1								
Healdia oklahomaensis Harlton																		
Healdia rectis Cooper																		
Healdia spinosa Cooper										X1								
Healdia usitata Cooper																		
Healdiacypris acuminatus Cooper												X1						
Hollinella cushmani Kellett																		
Hollinella dentata Coryell										X1								
Hollinella kellettae Knight										X1								
Hollinella levis Cooper																		
Hollinella limata (Moore)																		
Hollinella minuta Cooper										X1								
Hollinella oklahomaensis (Harlton)																		
Hollinella pulchra (Moore)																		
Hollinella shawneensis Kellett																		
Hollinella sp.																		
Hollinella warthini Cooper																		
Jonesina bradyana (Jones)																		
Jonesina deesensis Bradfield																		
Jonesina infrequens (Bradfield)																		
Jonesina subquadrata Delo																		
Jonesina trisulcata Bradfield																		
Kellettina montosa (Knight)																		
Kellettina robusta (Kellett)																		
Kirkbya firma Kellett																		
Kirkbya magna Roth																		
Kirkbya n. sp.																		
Lochriella angusta Cooper																		
Macrocypris menardensis Harlton																		
Macrocypris? sp.		X1															X1	
Microcheilinella bicornuta Cooper																		
Microparaparchites brazoensis (Coryell & Sample)																		
Microparaparchites cuneatus (Warthin)																		
Microparaparchites ovatus Cooper										X1								
Microparaparchites wapanuckaensis (Harlton)																		
Moorites elongatus (Jones & Kirkby)																		
Moorites knighti (Wilson)																		
Moorites minutus (Warthin)																		
Moorites punctus (Wilson)										X1								
Moorites spiciferus (Wilson)																		

A=abundant; C=common; X=present; number=number of collections in which fossil was present.

Continued

Summum			St. David							Brereton				Poke-berry	Spar-land		Gimlet				Ex-line	Trivoli				
Black sh.	Concretions	Hanover ls.	No. 5 coal	Black sh.	Concretions	Calcareous sh.	St. David ls.	Calcareous sh.	Ls. in Canton sh.	Local ls.	Dark sh.	Brereton ls.	Calcareous sh.	Pokeberry ls.-sh.	Limestone + sh.	Black sh.	Limestone	Dark sh.	Calcareous sh.	Lonsdale ls.	Calcareous sh.	Shaly ls.	Black sh.	Calcareous sh.	Trivoli ls.	Calcareous sh.
85	90	92	97	98	98	100	101	102	104	108	114	115	116	120	126	128	136	138	139	140	143	149	150	151	152	153
2	3	2	1	15	22	4	33	41	2	2	3	19	12	11	8	1	1	1	12	28	7	1	1	3	1	3
								X1			X3															
																							X1			
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						X1	X1	X1		X1	X3		X1		X2				X4	X2	X2			X1		X1
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Table 3.—

CYCLOTHEM	Se-ville	Sea-horne	Green-bush		Liverpool													
MEMBER	Seville ls.	Seahorne ls.	Nodular ls.	Massive ls.	Black ls.	Black sh.	Concretions	Siliceous ls.	Conglomerate	Shale + ls. (68)	Septarian ls.	Argillaceous ls.	*Mesolobus* sh.	*Cardiomorpha* ls.	*Dunbarella* sh.	*Linoproductus* ls.	Fossil-cast ls.	Purington sh.
MEMBER NUMBER	19	41	48	51	66	67	67	68	70	71	72	74	76	77	78	79	81	82
NUMBER OF COLLECTIONS	19	23	2	2	7	3	3	8	2	2	23	18	4	10	1	23	5	1
Ostracodes—Cont.																		
Paraparchites sp.												X1					X1	
Roundyella simplicissima (Knight)										X1								
Sansabella amplectans Roundy										X1								
Sansabella carbonaria Cooper																		
Sansabella exilis Cooper										X1								
Sansabella laevis (Warthin)										X1								
Sansabella sulcata Roundy																		
Silenites lenticularis (Knight)																		
Sulcella sulcata Coryell & Sample										X1								
Waylandella bythocyproidea (Warthin)										X1								
Waylandella obesa Cooper																		
Waylandella regularis Cooper										X1								
Waylandella sp.																		
Crinoids																		
Allagecrinus sp.	X1																	
Crinoid, genus and species?	X4																	
Crinoid stems and plates	C7	C9		X1				X3	X1	X1	X2	X3				X2	X2	X1
Delocrinus sp.												X2						
Ethelocrinus tuberculatus (Meek & Worthen)												X1						
Ethelocrinus sp.	X1																	
"Hoplarthrum tenue" Moore																		
Hydreionocrinus sp.																		
Stereobrachicrinus sp.	X1																	
Holothuroids																		
Ancistrum sp.																	X2	X1
Miscellaneous plates																		
Protocaudina kansasensis (Hanna)																	X2	X1
Ophiuroids																		
Ophiuroid plates and ossicles																		
Echinoids																		
Echinocrinus aff. aculeata (Shumard & Swallow)																		
Echinocrinus aff. biangulata (Shumard & Swallow)																		
Echinocrinus aff. cratis White																		
Echinocrinus aff. megastylus (Shumard & Swallow)	X1																	
Echinocrinus sp.		X1														X1		
Conodonts																		
Ctenognathus minutus (Ellison)		X1																
Gnathodus roundyi Gunnell	X1																	
Gondollela curvata Stauffer & Plummer																		
Gondollela merrilli Gunnell																		
Hibbardella sp.																		
Hindeodella sp.	X1					X1												
Idiognathodus acutus Ellison	X1	X1																
Idiognathodus delicatus Gunnell		X1																
Idiognathodus tersus Ellison																		
Ligonodina lexingtonensis (Gunnell)																		
Ligonodina typa (Gunnell)	X?1																	
Ligonodina sp.																		
Lonchodina clarki (Gunnell)																		
Lonchodina sp.						X1												
Metalonchodina bidentata (Gunnell)																		
Metalonchodina sp.																		
Neoprioniodus cacti (Gunnell)																		
Neoprioniodus conjunctus (Gunnell)	X1																	
Neoprioniodus sp.																		
Ozarkodina delicatula (Stauffer & Plummer)																		
Prioniodina? camerata (Gunnell)																		

A=abundant; C=common; X=present; number=number of collections in which fossil was present.

Continued

Summum			St. David							Brereton				Poke-berry	Spar-land		Gimlet				Ex-line	Trivoli				
Black sh.	Concretions	Hanover ls.	No. 5 coal	Black sh.	Concretions	Calcareous sh.	St. David ls.	Calcareous sh.	Ls. in Canton sh.	Local ls.	Dark sh.	Brereton ls.	Calcareous sh.	Pokeberry ls.-sh.	Limestone + sh.	Black sh.	Limestone	Dark sh.	Calcareous sh.	Lonsdale ls.	Calcareous sh.	Shaly ls.	Black sh.	Calcareous sh.	Trivoli ls.	Calcareous sh.
85	90	92	97	98	98	100	101	102	104	108	114	115	116	120	126	128	136	138	139	140	143	149	150	151	152	153
2	3	2	1	15	22	4	33	41	2	2	3	19	12	11	8	1	1	1	12	28	7	1	1	3	1	3
											X3		X1						X1	X2				X1		
																								X1		
																					X1					
							X1			X1	X2									X1						
								X2																X1		
																							X1			
					X1	X1	C14	C17	X2	X1		X6	A5	C7	C1		X1		C1	C12	X1	X1	X1	C1	X1	C2
								X6				X1	X5							X1		X1				
								C11		X1										X1						
																				X1						
							X1	X10												X1				X1		
																										X1
																X1		X1								
																		C1								
															X1	X1										
													X1		C1							X1				
																			X1					X1		X1
																				X1	X1					
																				X1						
							X2								X1		X1			X1		X1				
				X3											X2				X1	X1						
																				X1						
																				X1						
				X1																						
			X1	X3											X1	C1		X1	X1	X1			X1			
						X1									X2	C1		X1	X2	X1						
						X1																				
						X1													X1							
																X1			X1							
																		X1								
				X3											X1				X1							
				X2																X1			X1			
				X2																						
																							X1			
				X1																						
						X1									X1	X1			X1							
				X1																						
				C6														X1	X1	X1			X1			
															X1					X1						

TABLE 3.—

CYCLOTHEM	Seville	Seahorne	Greenbush		Liverpool													
MEMBER	Seville ls.	Seahorne ls.	Nodular ls.	Massive ls.	Black ls.	Black sh.	Concretions	Siliceous ls.	Conglomerate	Shale + ls. (68)	Septarian ls.	Argillaceous ls.	*Mesolobus* sh.	*Cardiomorpha* ls.	*Dunbarella* sh.	*Linoproductus* ls.	Fossil-cast ls.	Purington sh.
MEMBER NUMBER	19	41	48	51	66	67	67	68	70	71	72	74	76	77	78	79	81	82
NUMBER OF COLLECTIONS	19	23	2	2	7	3	3	8	2	2	23	18	4	10	1	23	5	1
Conodonts—Cont.																		
Streptognathodus appletus Ellison	X1																	
Streptognathodus cancellosus (Gunnell)																		
Streptognathodus elongatus Gunnell																		
Streptognathodus excelsus Stauffer & Plummer																		
Streptognathodus gracilis Stauffer & Plummer	X1																	
Streptognathodus simulator Ellison																		
Streptognathodus wabaunseensis Gunnell																		
Vertebrates																		
Ctenacanthus sp.							X1											
Fish bone																		
Fish scale										X1			X1					X1
Fish teeth undetermined												X1						
Lystracanthus sp.							X2											X1
Orthopleurodus sp.		X1																
Petalodus sp.																		
Petrodus occidentalis Newberry & Worthen						X1	X1	X1										
Pleuracanthus sp.																		
Vaticinodus carbonarius St. John & Worthen																		
Xystrodus bellulus St. John & Worthen																		

A=abundant; C=common; X=present; number=number of collections in which fossil was present.

TABLE 4.—COLLECTING LOCALITIES

1. SE¼ SW¼ SE¼ sec. 22, T. 6 N., R. 1 E., Vermont quadrangle. Collection from Seville limestone (member 19) by C. L. Cooper (614) for microfauna.
2. SE¼ SW¼ SE¼ sec. 5, T. 2 N., R. 2 E., Beardstown quadrangle. Collection from Seville limestone (member 19) and underlying dark shale (member 18) by C. L. Cooper (476-1) for microfauna.
3. NE¼ SW¼ SE¼ sec. 24, T. 6 N., R. 1 E., Vermont quadrangle. Collection from Seville limestone (member 19) by J. M. Weller.
4. SE¼ NE¼ sec. 10, T. 7 N., R. 1 E., Avon quadrangle. Collections from Seville limestone (member 19) by T. E. Savage and J. M. Weller.
5. SE¼ NE¼ SE¼ sec. 22, T. 6 N., R. 1 E., Vermont quadrangle. Railroad cut of T. P. & W. R. R. Collections from Seville limestone (member 19) by T. E. Savage, J. M. Weller, and H. R. Wanless.
6. SE¼ SW¼ NE¼ sec. 23, T. 6 N., R. 1 E., Vermont quadrangle. Collections from Seville limestone (member 19) at type locality by J. M. Weller and L. G. Henbest (G7 - fusulinids).
7. W½ NE¼ sec. 24, T. 6 N., R. 1 E., Vermont quadrangle. Collection from Seville limestone (member 19) by J. M. Weller.
8. SE¼ SW¼ sec. 11, T. 7 N., R. 1 E., Avon quadrangle. Collection from Seville limestone (member 19) by J. M. Weller.
9. Center sec. 4, T. 6 N., R. 2 E., Avon quadrangle. Collection from Seville limestone (member 19) by J. M. Weller.
10. SW¼ sec. 22, T. 6 N., R. 1 E., Vermont quadrangle, near old Leaman station. Collection from Seville limestone (member 19) by T. E. Savage.
11. SW¼ NE¼ sec. 16, T. 4 N., R. 3 E., Havana quadrangle. Collection from Seahorne limestone (member 41) by C. L. Cooper (613-1M) and L. G. Henbest (542).
12. S½ SE¼ sec. 5, T. 3 N., R. 3 E., Havana quadrangle. Collections from Seahorne limestone (member 41) at type locality by H. R. Wanless and C. L. Cooper (616-1M).
13. SE¼ sec. 26, T. 3 N., R. 1 W., Beardstown quadrangle. Shale pit at Ray. Collection from Seahorne limestone (member 41) by W. V. Searight.
14. SE¼ SW¼ SE¼ sec. 27, T. 3 N., R. 1 W., Beardstown quadrangle. Collection from Seahorne limestone (member 41) by W. V. Searight.
15. SW¼ SE¼ NE¼ sec. 32, T. 2 N., R. 1 E., Beardstown quadrangle. Collection from Seahorne limestone (member 41) by W. V. Searight.

Concluded

Summum			St. David							Brereton				Pokeberry	Sparland		Gimlet				Ex-line	Trivoli				
Black sh.	Concretions	Hanover ls.	No. 5 coal	Black sh.	Concretions	Calcareous sh.	St. David ls.	Calcareous sh.	Ls. in Canton sh.	Local ls.	Dark sh.	Brereton ls.	Calcareous sh.	Pokeberry ls.-sh.	Limestone + sh.	Black sh.	Limestone	Dark sh.	Calcareous sh.	Lonsdale ls.	Calcareous sh.	Shaly ls.	Black sh.	Calcareous sh.	Trivoli ls.	Calcareous sh.
85	90	92	97	98	98	100	101	102	104	108	114	115	116	120	126	128	136	138	139	140	143	149	150	151	152	153
2	3	2	1	15	22	4	33	41	2	2	3	19	12	11	8	1	1	1	12	28	7	1	1	3	1	3
....	....	....	....	....	....	....	....	X1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	X1	....	....	X2	....	....	....	X1	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	X3	....	....	....	....	X1	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	X1	X1	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	X1	....	....	....	....	....	....
....	....	....	....	....	....	X1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	X1	....	....	....	....	....	....	....	....	....	....
....	....	....	....	X1	X1	....	....	X1	....	....	....	....	....	....	X1	X1	....	X1	....	....	....	....	X1	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	X1	....	X1	X1	....	....	....	X1	....	....	....	....
X1	X2	X1	....	C4	X2	....	....	....	....	....	....	....	....	....	....	....	....	X1	....	....	....	....	X1	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	X2	....	....	....	....	....	....	....	....	....	....	....	....
....	....	X1	....	C5	X1	....	X1	X1	....	....	....	X1	X1	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	X1	....	....	....	....	....	....	....	....	....	....	X1	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	X1	....	....	....	....	....	....
....	....	....	....	....	X1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

16. Sec. 31, T. 2 N., R. 1 E., Beardstown quadrangle. Mill Creek. Collections from Seahorne limestone (member 41), Liverpool cyclothem black sheety shale and large concretions (member 67), and siliceous limestone (member 68) by W. V. Searight and J. M. Weller.
17. SW¼ SW¼ NE¼ sec. 7, T. 1 N., R. 1 E., Beardstown quadrangle. Collection from Seahorne limestone (member 41) by W. V. Searight.
18. SW¼ SW¼ SW¼ sec. 26, T. 3 N., R. 2 E., Beardstown quadrangle. Collections from Seahorne limestone (member 41) by W. V. Searight and J. M. Weller.
19. SE¼ sec. 16, T. 6 N., R. 1 E., Vermont quadrangle. Road cut south of Marietta toward Marietta station. Collections from Seahorne limestone (member 41), Liverpool cyclothem black limestone (member 66), and Oak Grove septarian limestone (member 72) by J. M. Weller.
20. NE¼ NW¼ sec. 20, T. 6 N., R. 2 E., Vermont quadrangle. Collection from Seahorne limestone (member 41) by J. M. Weller.
21. NE¼ SW¼ NE¼ sec. 36, T. 4 N., R. 2 E., Havana quadrangle. Collection from Seahorne limestone (member 41) by H. R. Wanless.
22. NE¼ SE¼ sec. 30, T. 4 N., R. 3 E., Havana quadrangle. Collections from Seahorne limestone (member 41) by L. G. Henbest (498) and H. R. Wanless.
23. NW¼ SW¼ sec. 36, T. 5 N., R. 2 E., Havana quadrangle. Collection from Seahorne limestone (member 41) by H. R. Wanless.
24. SE¼ NW¼ sec. 7, T. 4 N., R. 3 E., Havana quadrangle. Collection from Seahorne limestone (member 41) by H. R. Wanless.
25. SE¼ SE¼ sec. 25, T. 4 N., R. 2 E., Havana quadrangle. Collection from Seahorne limestone (member 41) by H. R. Wanless.
26. SE¼ NE¼ sec. 36, T. 4 N., R. 2 E., Havana quadrangle. Collection from Seahorne limestone (member 41) by H. R. Wanless.
27. SW¼ SE¼ sec. 15, T. 6 N., R. 1 E., Vermont quadrangle. Collection from Greenbush cyclothem underclay limestone (member 48) by J. M. Weller.
28. Hollow east of Marietta, probably in sec. 16, T. 6 N., R. 1 E., Vermont quadrangle. Collection from Greenbush cyclothem underclay limestone (member 48).
29. Sec. 23, T. 5 N., R. 1 E., Vermont quadrangle. Collections from Greenbush cyclothem limestone (member 51) by H. R. Wanless and J. M. Weller.
30. SW¼ SW¼ sec. 28, T. 5 N., R. 3 E., Havana quadrangle. Collection from Greenbush cyclothem limestone (member 51) by H. R. Wanless.

31. SW¼ sec. 36, T. 6 N., R. 2 E., Havana quadrangle. Collection from upper part of Francis Creek shale (member 64) by H. R. Wanless.
32. SW¼ SW¼ sec. 14, T. 6 N., R. 1 E., Vermont quadrangle. Collection from Liverpool cyclothem black limestone (member 66) by J. M. Weller.
33. SW¼ SE¼ sec. 35, T. 6 N., R. 2 E., Havana quadrangle. Collection from Liverpool cyclothem black limestone (member 66).
34. SW¼ SE¼ SE¼ sec. 14, T. 1 N., R. 1 W., Beardstown quadrangle. Collection from Liverpool cyclothem black sheety shale (member 67) by W. V. Searight.
35. NW¼ SE¼ sec. 17, T. 5 N., R. 4 E., Havana quadrangle. Collections from Liverpool cyclothem black sheety shale (member 67) by H. R. Wanless; siliceous limestone (member 68) by C. L. Cooper 553b (M) argillaceous limestone (member 74) by C. L. Cooper (486aM) and *Linoproductus* limestone (member 79) by L. G. Henbest (538).
36. NW¼ NE¼ NE¼ sec. 15, T. 1 N., R. 1 W., Beardstown quadrangle. Collections from large black concretions in Liverpool cyclothem black sheety shale (member 67) and siliceous limestone (member 68) by W. V. Searight.
37. SE¼ NE¼ NE¼ sec. 16, T. 18 N., R. 11 W., Beardstown quadrangle. Collection from Liverpool cyclothem siliceous limestone (member 68) by W. V. Searight.
38. Sec. 4, T. 1 N., R. 1 E., Beardstown quadrangle. Collection from Liverpool cyclothem siliceous limestone (member 68) by W. V. Searight.
39. SE¼ NW¼ sec. 22, T. 5 N., R. 4 E., Havana quadrangle. Collection from Liverpool cyclothem siliceous limestone (member 68) by H. R. Wanless.
40. SW¼ NW¼ sec. 20, T. 5 N., R. 4 E., Havana quadrangle. Collection from Liverpool cyclothem siliceous limestone (member 68) by H. R. Wanless.
41. NW¼ NW¼ sec. 20, T. 5 N., R. 4 E., Havana quadrangle. Collection from type locality of Liverpool cyclothem from shale (member 69) below septarian limestone, *Mesolobus* bed (member 76), and *Cardiomorpha* limestone (member 77) by H. R. Wanless.
42. SW¼ SE¼ sec. 6, T. 5 N., R. 3 E., Havana quadrangle. Collections from type locality of Oak Grove beds of Liverpool cyclothem from calcareous shale (member 69), septarian limestone (member 72), calcareous shale (member 74), *Mesolobus* shale (member 76), *Cardiomorpha* limestone (member 77), *Linoproductus* limestone (member 79), calcareous ironstone (member 81), and base of Purington shale (member 82) by H. R. Wanless. Collection from member 74 by C. L. Cooper 487c(M).
43. NE¼ SW¼ sec. 34, T. 6 N., R. 3 E., Havana quadrangle. Collections from Liverpool cyclothem conglomerate (member 70), septarian limestone (member 72), *Linoproductus* limestone (member 79) by H. R. Wanless.
44. Center NW¼ sec. 35, T. 6 N., R. 3 E., Havana quadrangle. Collections from Liverpool cyclothem conglomerate (member 70), septarian limestone (member 72), calcareous shale (member 74), *Cardiomorpha* limestone (member 77), *Linoproductus* limestone (member 79), and calcareous ironstone (member 81) by T. E. Savage.
45. NW¼ NW¼ sec. 13, T. 5 N., R. 1 E., Vermont quadrangle. Collection from Liverpool cyclothem septarian limestone (member 72) by J. M. Weller.
46. SW¼ NW¼ NE¼ sec. 29, T. 5 N., R. 4 E., Havana quadrangle. Collection from Liverpool cyclothem septarian limestone (member 72) by H. R. Wanless.
47. NE¼ NE¼ sec. 7, T. 5 N., R. 3 E., Havana quadrangle. Collection from Liverpool cyclothem septarian limestone (member 72) by H. R. Wanless.
48. SW¼ SE¼ sec. 8, T. 5 N., R. 4 E., Havana quadrangle. Collections from Liverpool cyclothem septarian limestone (member 72), *Cardiomorpha* limestone (member 77), and *Linoproductus* limestone (member 79), by H. R. Wanless.
49. SE¼ NW¼ sec. 5, T. 5 N., R. 4 E., Havana quadrangle. Collection from Liverpool septarian limestone (member 72) by H. R. Wanless.
50. Center sec. 12, T. 6 N., R. 2 E., Canton quadrangle. Collections from Liverpool cyclothem septarian limestone (member 72), calcareous shale (member 74), *Mesolobus* shale (member 76), *Cardiomorpha* limestone (member 77), *Linoproductus* limestone (member 79), and ironstone (member 81) by T. E. Savage.
51. NW¼ NE¼ NE¼ sec. 29, T. 5 N., R. 1 E., Vermont quadrangle. Collection from Liverpool cyclothem calcareous shale (member 74) by J. M. Weller.
52. SE¼ NW¼ sec. 8, T. 5 N., R. 4 E., Havana quadrangle. Collection from Liverpool cyclothem calcareous shale (member 74) by H. R. Wanless.
53. NW¼ NW¼ sec. 33, T. 6 N., R. 3 E., Havana quadrangle. Collection from Liverpool cyclothem calcareous shale (member 74) and *Linoproductus* limestone (member 79) by H. R. Wanless.
54. NE¼ SW¼ sec. 36, T. 6 N., R. 3 E., Havana quadrangle. Collection from Liverpool cyclothem calcareous shale (member 74), *Linoproductus* limestone (member 79) and ironstone (member 81) by H. R. Wanless.
55. NW¼ SE¼ sec. 8, T. 5 N., R. 4 E., Havana quadrangle. Collections from *Cardiomorpha* limestone (member 77) and *Linoproductus* limestone (member 79) by H. R. Wanless.

56. NE¼ NE¼ sec. 12, T. 5 N., R. 2 E., Havana quadrangle. Collection from *Cardiomorpha* limestone (member 77) by H. R. Wanless.
57. NE¼ SE¼ sec. 33, T. 6 N., R. 3 E., Havana quadrangle. Collections from *Cardiomorpha* limestone (member 77), *Linoproductus* limestone (member 79), and ironstone (member 81) by H. R. Wanless.
58. SE¼ SE¼ sec. 17, T. 5 N., R. 4 E., Havana quadrangle. Collection from *Linoproductus* limestone (member 79) by H. R. Wanless.
59. Sec. 20, T. 5 N., R. 1 E., Vermont quadrangle. Collection from *Linoproductus* limestone (member 79) by H. R. Wanless.
60. SW¼ SW¼ sec. 8, T. 4 N., R. 2 E., Vermont quadrangle. Collection from black sheety shale over coal probably Kerton Creek coal (member 84) by L. G. Henbest (453).
61. NW¼ NE¼ sec. 29, T. 5 N., R. 4 E., Havana quadrangle. Collection from black sheety shale over coal probably Kerton Creek coal (member 84) by H. R. Wanless.
62. SW¼ NE ¼ NE¼ sec. 15, T. 3 N., R. 2 E., Beardstown quadrangle. Collection from concretions in Summum cyclothem dark shale (member 90) by W. V. Searight.
63. SW¼ SW¼ NE¼ sec. 15, T. 3 N., R. 2 E., Beardstown quadrangle. Collection from concretions in Summum cyclothem dark shale (member 90) by W. V. Searight.
64. SE¼ sec. 35, T. 6 N., R. 3 E., Havana quadrangle. Collection from concretions in Summum cyclothem dark shale (member 90) by H. R. Wanless.
65. NE¼ NE¼ SW¼ sec. 26, T. 2 N., R. 1 W., Beardstown quadrangle. Collection from Hanover limestone (member 92).
66. NW¼ SW¼ sec. 22, T. 6 N., R. 3 E., Havana quadrangle. Collection from Hanover limestone (member 92) by H. R. Wanless.
67. NE¼ NE¼ sec. 29, T. 6 N., R. 3 E., Havana quadrangle. Collections from upper 1 inch of Springfield No. 5 coal (member 97) and St. David cyclothem black sheety shale (member 98) by H. R. Wanless.
68. SE¼ NE¼ NW¼ sec. 22, T. 3 N., R. 2 E., Beardstown quadrangle. Collection from St. David black sheety shale (member 98) by W. V. Searight.
69. NE¼ NW¼ NE¼ sec. 1, T. 1 N., R. 1 W., Beardstown quadrangle. Collection from St. David cyclothem black sheety shale (member 98).
70. N½ SW¼ sec. 26, T. 2 N., R. 1 W., Beardstown quadrangle. Collections from St. David cyclothem black sheety shale (member 98) and St. David limestone (member 101) by W. V. Searight and J. M. Weller.
71. SW¼ SE¼ NW¼ sec. 23, T. 3 N., R. 1 E., Beardstown quadrangle. Collections from St. David cyclothem black sheety shale (member 98), concretions in member 98 and St. David limestone (member 101) by W. V. Searight and J. M. Weller.
72. SE¼ SW¼ sec. 27, T. 6 N., R. 3 E., Havana quadrangle. Collection from St. David cyclothem black sheety shale (member 98), by H. R. Wanless.
73. NE¼ SW¼ sec. 21, T. 6 N., R. 3 E., Havana quadrangle. Collections from St. David cyclothem black sheety shale (member 98), large black concretions in member 98, and St. David limestone (member 101) by H. R. Wanless.
74. SW¼ NW¼ sec. 28, T. 6 N., R. 3 E., Havana quadrangle. Collections from St. David cyclothem black sheety shale (member 98), calcareous shale (member 102), and limestone and calcareous shale (member 104) in Canton shale by H. R. Wanless.
75. NW¼ NE¼ sec. 30, T. 6 N., R. 3 E., Havana quadrangle. Collection from St. David cyclothem black sheety shale (member 98).
76. Sec. 1, T. 7 N., R. 5 E., Glasford quadrangle. Collection from St. David cyclothem black sheety shale (member 98) by H. R. Wanless.
77. SE¼ sec. 36, T. 1 N., R. 1 W., Beardstown quadrangle. Upper Mill Creek. Collections from St. David cyclothem black sheety shale (member 98), large black concretions in member 98, St. David limestone (member 101), and calcareous shale (member 102) by T. E. Savage, W. V. Searight and J. M. Weller.
78. Sec. 9, T. 6 N., R. 4 E., Canton quadrangle. Collections from concretions in St. David cyclothem black sheety shale (member 98), St. David limestone (member 101), and St. David calcareous shale (member 102) by J. M. Weller.
79. N½ N½ sec. 3, T. 3 N., R. 2 E., Vermont quadrangle. Collections from large concretions in St. David cyclothem black sheety shale (member 98), St. David limestone (member 101) (L. G. Henbest); and calcareous shale (member 102) by J. M. Weller, W. V. Searight, T. E. Savage, and L. G. Henbest. Station 450.
80. NW¼ sec. 15, T. 3 N., R. 2 E., Beardstown quadrangle. Collection from large concretions in St. David cyclothem black sheety shale (member 98) by W. V. Searight.
81. NE¼ NW¼ NW¼ sec. 30, T. 7 N., R. 7 E., Glasford quadrangle. Collection from large concretions in St. David cyclothem black sheety shale (member 98) by A. C. Bevan.
82. NW¼ NE¼ SW¼ sec. 23, T. 2 N., R. 1 W., Beardstown quadrangle. Collection from large concretions in St. David cyclothem black sheety shale (member 98) by W. V. Searight.

83. SE¼ sec. 19, T. 6 N., R. 3 E., Havana quadrangle. Collections from large concretions in St. David cyclothem black sheety shale (member 98) and calcareous shale (member 102) by T. E. Savage.
84. NE¼ NW¼ sec. 1, T. 5 N., R. 4 E., Havana quadrangle. Collection from large concretions in St. David cyclothem black sheety shale (member 98) by H. R. Wanless.
85. SE¼ SW¼ sec. 26, T. 6 N., R. 3 E., Havana quadrangle. Collections from large concretions in St. David cyclothem black sheety shale (member 98) and calcareous shale (member 100) by H. R. Wanless, and H. L. Geis (Cooper collection 616).
86. N. center sec. 30, T. 6 N., R. 3 E., Havana quadrangle. Collection from large concretions in St. David cyclothem black sheety shale (member 98) by H. R. Wanless.
87. NE¼ NE¼ sec. 25, T. 6 N., R. 4 E., Manito quadrangle. Collection from large concretions in St. David cyclothem black sheety shale (member 98) and St. David limestone (member 101) by H. R. Wanless.
88. SE¼ NW¼ sec. 24, T. 6 N., R. 4 E., Havana quadrangle. Collections from concretions in St. David cyclothem black sheety shale (member 98) and calcareous shale (member 102) by H. R. Wanless.
89. NW¼ SW¼ sec. 32, T. 6 N., R. 4 E., Havana quadrangle. Collection from large concretions in St. David cyclothem black sheety shale (member 98) by H. R. Wanless.
90. NW¼ SW¼ NE¼ sec. 13, T. 5 N., R. 3 E., Havana quadrangle. Collection from large concretions in St. David cyclothem black sheety shale (member 98) by H. R. Wanless.
91. NW¼ SW¼ NE¼ sec. 21, T. 6 N., R. 3 E., Havana quadrangle. Collection from calcareous shale (member 100) below St. David limestone by H. L. Geis (Cooper collection 488c).
92. NE¼ SW¼ SW¼ sec. 25, T. 2 N., R. 1 W., Beardstown quadrangle. Collections from calcareous shale (member 100) below St. David limestone and St. David limestone (member 101) by W. V. Searight.
93. SE¼ SE¼ NE¼ sec. 1, T. 6 N., R. 5 E., Glasford quadrangle. Collections from calcareous shale (member 100) below St. David limestone and St. David limestone (member 101) by A. C. Bevan.
94. Sec. 35, T. 2 N., R. 1 W., Beardstown quadrangle. Collection from shale partings in St. David limestone (member 101) for microfossils by H. R. Wanless (Cooper collection 773-1).
95. NE¼ SW¼ NE¼ sec. 26, T. 2 N., R. 1 W., Beardstown quadrangle. Collections from St. David limestone (member 101) and calcareous shale (member 102), the limestone by W. V. Searight.
96. NW¼ NE¼ NW¼ sec. 26, T. 2 N., R. 1 W., Beardstown quadrangle. Collections from St. David limestone (member 101) and calcareous shale (member 102) over the limestone by W. V. Searight and J. M. Weller.
97. NE¼ NW¼ SW¼ sec. 33, T. 7 N., R. 5 E., Glasford quadrangle. Collections from St. David limestone (member 101) by A. C. Bevan.
98. SE¼ SW¼ NE¼ sec. 26, T. 7 N., R. 5 E., Glasford quadrangle. Collections from St. David limestone (member 101) and calcareous shale (member 102) over the limestone by A. C. Bevan.
99. SW¼ SW¼ sec. 27, T. 6 N., R. 3 E., Havana quadrangle. Collections from St. David limestone (member 101) and calcareous shale (member 102) over the limestone by L. G. Henbest.
100. NE¼ SE¼ sec. 29, T. 6 N., R. 3 E., Havana quadrangle. Collections from St. David limestone (member 101) and calcareous shale (member 102) over the limestone by H. R. Wanless.
101. NE¼ SE¼ sec. 21, T. 6 N., R. 3 E., Havana quadrangle. Collections from St. David limestone (member 101) and calcareous shale (member 102) over the limestone by H. R. Wanless and C. L. Cooper (collection 617M from member 102).
102. SW¼ NW¼ sec. 23, T. 6 N., R. 3 E., Havana quadrangle. Collections from St. David limestone (member 101) and calcareous shale (member 102) over the limestone by H. R. Wanless.
103. NW¼ NE¼ sec. 30, T. 6 N., R. 3 E., Havana quadrangle. Collection from St. David limestone (member 101) by H. R. Wanless.
104. SE¼ SW¼ sec. 17, T. 6 N., R. 4 E., Havana quadrangle. Collection from St. David cyclothem calcareous shale (member 102) by C. L. Cooper (615M).
105. NW¼ SW¼ NE¼ sec. 21, T. 6 N., R. 3 E., Havana quadrangle. Collection from St. David cyclothem calcareous shale (member 102) by H. L. Geis (Cooper collection 488A).
106. Center SW¼ sec. 25, T. 2 N., R. 1 W., Beardstown quadrangle. Collections from St. David cyclothem calcareous shale (member 102) by H. R. Wanless (Cooper collection 772-2) and W. V. Searight.
107. SW¼ NW¼ SE¼ sec. 36, T. 7 N., R. 5 E., Glasford quadrangle. Collection from St. David cyclothem calcareous shale (member 102) by A. C. Bevan.
108. SW¼ SE¼ SW¼ sec. 12, T. 7 N., R. 6 E., Glasford quadrangle. Collection from St. David cyclothem calcareous shale (member 102) by A. C. Bevan.
109. SE¼ NW¼ sec. 24, T. 6 N., R. 3 E., Havana quadrangle. Collection from St. David cyclothem calcareous shale (member 102) by J. M. Weller.

110. NW¼ sec. 28, T. 6 N., R. 3 E., Havana quadrangle. Collection from St. David cyclothem calcareous shale (member 102) by J. M. Weller.
111. Sec. 24, T. 6 N., R. 4 E., Havana quadrangle. Collection from St. David cyclothem calcareous shale (member 102) by T. E. Savage.
112. SW¼ sec. 8, T. 6 N., R. 3 E., Canton quadrangle. Collection from St. David cyclothem calcareous shale (member 102) by T. E. Savage.
113. Sec. 9, T. 6 N., R. 4 E., Canton quadrangle. Collection from St. David cyclothem calcareous shale (member 102) by T. E. Savage.
114. Sec. 21, T. 6 N., R. 4 E., Havana quadrangle. Collection from St. David cyclothem calcareous shale (member 102) by T. E. Savage.
115. NW¼ NW¼ NE¼ sec. 21, T. 7 N., R. 5 E., Glasford quadrangle. Collection from limestone and calcareous shale (member 104) in Canton shale by A. C. Bevan.
116. NE¼ NW¼ sec. 21, T. 6 N., R. 3 E., Havana quadrangle. Collection from limestone (member 108) above Cuba sandstone by H. R. Wanless and C. L. Cooper (618).
117. SE¼ SW¼ NW¼ sec. 1, T. 7 N., R. 4 E., Glasford quadrangle. Collections from dark shale (member 114) over No. 6 coal, Brereton limestone (member 115), and calcareous shale (member 116) by C. L. Cooper (489B from member 114, 514a from member 116), J. M. Weller and L. G. Henbest (Station 543).
118. SW¼ NE¼ sec. 19, T. 6 N., R. 3 E., Havana quadrangle. Collections from dark shale (member 114) over No. 6 coal and Brereton limestone (member 115) by C. L. Cooper (485 from member 114), L. G. Henbest (stations 539 and 585 from member 115), and H. R. Wanless.
119. SE¼ SW¼ sec. 19, T. 6 N., R. 3 E., Havana quadrangle. Collections from dark shale (member 114) over No. 6 coal by C. L. Cooper (554).
120. Center SW¼ sec. 25, T. 2 N., R. 1 W., Beardstown quadrangle. Collections from Brereton limestone (member 115) and Pokeberry limestone (member 120), and Sparland cyclothem calcareous shale (member 127) by W. V. Searight and H. R. Wanless (Cooper collection 772-1).
121. SE¼ SE¼ NE¼ sec. 22, T. 7 N., R. 6 E., Glasford quadrangle. Collections from Brereton limestone (member 115) and calcareous shale (member 116) by A. C. Bevan.
123. SE¼ NW¼ sec. 15, T. 7 N., R. 4 E., Canton quadrangle. Collections from Brereton limestone (member 115) and calcareous shale (member 116) by J. M. Weller.
124. NE¼ sec. 1, T. 7 N., R. 4 E., Glasford quadrangle. Collections at type locality of Brereton cyclothem from Brereton limestone (member 115) and calcareous shale (member 116) by J. M. Weller, L. G. Henbest (582 and G9 from member 115); collections from bed 116 by C. L. Cooper (514a) and H. R. Wanless.
125. SE¼ SW¼ sec. 20, T. 6 N., R. 3 E., Havana quadrangle. Collection from Brereton limestone (member 115) by H. R. Wanless.
126. SW¼ SW¼ sec. 20, T. 6 N., R. 3 E., Havana quadrangle. Collection from Brereton limestone (member 115) by H. R. Wanless.
127. SW¼ sec. 4, T. 8 N., R. 4 E., Canton quadrangle. Collection from Brereton limestone (member 115) by J. M. Weller.
128. NE¼ NE¼ SW¼ sec. 11, T. 8 N., R. 7 E., Peoria quadrangle. Collection from Brereton limestone (member 115) by L. G. Henbest (546).
129. N½ NW¼ sec. 26, T. 2 N., R. 1 W., Beardstown quadrangle. Collections at locality of Pokeberry cyclothem from type Pokeberry limestone (member 120) by W. V. Searight, J. M. Weller, and H. R. Wanless (Cooper collection 456-1).
130. SE¼ NE¼ SE¼ sec. 26, T. 2 N., R. 1 W., Beardstown quadrangle. Collection from Pokeberry limestone (member 120) by W. V. Searight.
131. NW¼ NW¼ sec. 26, T. 2 N., R. 1 W., Beardstown quadrangle. Collection from Pokeberry limestone (member 120) by W. V. Searight.
132. NW¼ sec. 35, T. 2 N., R. 1 W., Beardstown quadrangle. Collection from Pokeberry limestone (member 120) by J. M. Weller.
133. SW¼ NW¼ sec. 33, T. 8 N., R. 6 E., Glasford quadrangle. Collection from Sparland cyclothem calcareous shale and limestone (member 126) by H. R. Wanless and A. C. Bevan.
134. Sec. 31, T. 9 N., R. 5 E., Glasford quadrangle. Collection from Sparland cyclothem calcareous shale and limestone (member 126) by H. R. Wanless (Cooper collection 771).
135. NE¼ NW¼ NE¼ sec. 32, T. 8 N., R. 5 E., Glasford quadrangle. Collection from Sparland cyclothem calcareous shale and limestone (member 126) by E. C. Dapples (Cooper collection 85-1).
136. NW¼ NW¼ NE¼ sec. 20, T. 8 N., R. 6 E., Glasford quadrangle. Collection from Sparland cyclothem calcareous shale and limestone (member 126) by E. C. Dapples (Cooper collection 80-1).
137. NE¼ SE¼ NE¼ sec. 25, T. 8 N., R. 6 E., Glasford quadrangle. Collection from Sparland cyclothem calcareous shale and limestone (member 126) by A. C. Bevan.
138. SW¼ SE¼ NW¼ sec. 33, T. 9 N., R. 6 E., Glasford quadrangle. Collection from Sparland cyclothem calcareous shale and limestone (member 126) by E. C. Dapples (Cooper collection 92).
139. SW¼ NW¼ SE¼ sec. 31, T. 9 N., R. 7 E., Glasford quadrangle. Collections from shale (member 139) below Lons-

dale limestone by E. C. Dapples (Cooper collection 94-1) and from Lonsdale limestone (member 140) by J. M. Weller.

140. SW¼ NE¼ SW¼ sec. 32, T. 9 N., R. 7 E., Peoria quadrangle. Collection from shale (member 139) below Lonsdale limestone by E. C. Dapples (Cooper collection 93).

141. NE¼ SW¼ NE¼ sec. 34, T. 9 N., R. 5 E., Glasford quadrangle. Collections from shale (member 139) below Lonsdale limestone by H. L. Geis (Cooper collection 481) and Exline cyclothem calcareous shale (member 143) by A. C. Bevan and J. M. Weller.

142. SW¼ SE¼ NW¼ sec. 3, T. 8 N., R. 5 E., Glasford quadrangle. Collections from shale (member 139) below Lonsdale limestone and Lonsdale limestone (member 140) by E. C. Dapples (Cooper collections 60-2 and 60-1).

143. SW¼ SW¼ NW¼ sec. 28, T. 8 N., R. 5 E., Glasford quadrangle. Collections from shale (member 139) below Lonsdale limestone and Lonsdale limestone (member 140) by E. C. Dapples (Cooper collections 81-2 and 81-1).

144. NE¼ SW¼ NW¼ sec. 28, T. 8 N., R. 5 E., Glasford quadrangle. Collection from shale (member 139) below Lonsdale limestone by H. L. Geis (Cooper collection 483).

145. NW¼ SE¼ NE¼ sec. 11, T. 8 N., R. 6 E., Glasford quadrangle. Collection from shale (member 139) below Lonsdale limestone; bed 140 Lonsdale limestone. Collections by E. C. Dapples (Cooper collections 34-1, 34-2, 79-1 and 79-2).

146. NE¼ NE¼ NW¼ sec. 20, T. 8 N., R. 6 E., Glasford quadrangle. Collection from shale (member 139) below Lonsdale limestone by E. C. Dapples (Cooper collection 78-1).

147. NW¼ NE¼ NW¼ sec. 24, T. 8 N., R. 6 E., Glasford quadrangle. Collection from shale (member 139) below Lonsdale limestone by E. C. Dapples (Cooper collection 89-1).

148. NW¼ NW¼ SE¼ sec. 7, T. 8 N., R. 7 E., Peoria quadrangle. Collection from shale (member 139) below Lonsdale limestone by E. C. Dapples (Cooper collection 96-1).

149. SW¼ NW¼ sec. 28, T. 8 N., R. 5 E., Glasford quadrangle. Collection from shale (member 139) below Lonsdale limestone by H. R. Wanless.

150. NE¼ NW¼ NW¼ sec. 35, T. 9 N., R. 5 E., Glasford quadrangle. Collection from Lonsdale limestone (member 140) by E. C. Dapples (Cooper collection 69).

151. SW¼ NW¼ NE¼ sec. 10, T. 8 N., R. 6 E., Glasford quadrangle. Collections from Lonsdale limestone (member 140) by J. M. Weller and E. C. Dapples (Cooper collections 83-1, 83-2, and 83-3).

152. NW¼ SE¼ NW¼ sec. 17, T. 8 N., R. 6 E., Glasford quadrangle. Collection from Lonsdale limestone (member 140) by E. C. Dapples (Cooper collection 82-1).

153. NW¼ sec. 3, T. 8 N., R. 5 E., Glasford quadrangle. Collections from Lonsdale limestone (member 140) by J. M. Weller and H. R. Wanless.

154. SW¼ sec. 5, T. 8 N., R. 5 E., Glasford quadrangle. Collections from Gimlet limestone (member 136), black shale (member 138), and Lonsdale limestone (member 140) by J. M. Weller, H. R. Wanless, and T. E. Savage.

155. Center S½ sec. 34, T. 9 N., R. 5 E., Glasford quadrangle. Collections from Lonsdale limestone (member 140) by J. M. Weller.

156. NW¼ sec. 34, T. 8 N., R. 6 E., Glasford quadrangle. Collection from Lonsdale limestone (member 140) by J. M. Weller.

157. Center SW¼ sec. 15, T. 8 N., R. 5 E., Glasford quadrangle. Collection from Lonsdale limestone (member 140) by J. M. Weller.

158. Center W½ SW¼ sec. 35, T. 9 N., R. 5 E., Glasford quadrangle. Collection from Lonsdale limestone (member 140) by J. M. Weller.

159. SE¼ sec. 32, T. 9 N., R 7 E., Peoria quadrangle. Collection from Lonsdale limestone (member 140) by J. M. Weller.

160. SE¼ sec. 4, T. 8 N., R. 7 E., Peoria quadrangle. Collection from Lonsdale limestone (member 140) by J. M. Weller.

161. NE¼ SW¼ SW¼ sec. 35, T. 9 N., R. 5 E., Glasford quadrangle. Collection from Lonsdale limestone (member 140) by A. C. Bevan.

162. Sec. 31, T. 6 N., R. 2 E., Vermont quadrangle. Collection from blocks of Lonsdale limestone (member 140) from glacial drift in Baughman branch by J. M. Weller.

163. NE¼ SE¼ NW¼ sec. 5, T. 8 N., R. 5 E., Glasford quadrangle. Collection from Exline black limestone (member 142) by E. C. Dapples (Cooper collection 61) and J. M. Weller.

164. NW¼ NE¼ SE¼ sec. 33, T. 9 N., R. 6 E., Glasford quadrangle. Collection from Exline cyclothem calcareous shale (member 143) by E. C. Dapples (Cooper collection 91).

165. SW¼ SE¼ NW¼ sec. 15, T. 8 N., R. 5 E., Glasford quadrangle. Collection from Exline cyclothem calcareous shale (member 143) by E. C. Dapples (Cooper collection 63-1).

166. NE¼ NE¼ SE¼ sec. 1, T. 8 N., R. 6 E., Glasford quadrangle. Collection from Exline cyclothem calcareous shale (member 143) by H. R. Wanless (Cooper collection 770).

167. SW¼ NE¼ sec. 21, T. 8 N., R. 6 E., Glasford quadrangle. Collection from Exline cyclothem calcareous shale (member 143) by H. R. Wanless.

168. NE¼ SW¼ SW¼ sec. 3, T. 8 N., R. 5 E., Glasford quadrangle. Collections at type locality of Trivoli cyclothem from shaly limestone (member 149), black sheety shale (member 150), calcareous shale (member 151) below Trivoli limestone (Cooper collection 417), Trivoli limestone (member 152), and calcareous shale (member 153) above Trivoli limestone by H. L. Geis (Cooper collection 147 from member 151), H. R. Wanless, and A. C. Bevan.
169. NW¼ SE¼ NW¼ sec. 15, T. 8 N., R. 5 E., Glasford quadrangle. Collection from calcareous shale (member 151) below Trivoli limestone by E. C. Dapples (Cooper collection 64-1).
170. NE¼ SW¼ NE¼ sec. 3, T. 8 N., R. 5 E., Glasford quadrangle. Collection from calcareous shale (member 153) above Trivoli limestone by E. C. Dapples (Cooper collection 62-1.)
171. SW¼ NW¼ NE¼ sec. 1, T. 8 N., R. 6 E., Glasford quadrangle. Collection from Sparland black shale (member 128) by H. R. Wanless.

Numerous collections made by the late T. E. Savage in the Vermont and Canton quadrangles are not listed here because the exact locations for the collections are in doubt. Most of these collections are small and include only a small variety of the more common fossils, generally included in lists from other localities.

REFERENCES

Bean, Beryl K., 1938, Ostracodes of the Gimlet cyclothem (Pennsylvanian) near Peoria: Unpublished Master of Science thesis, University of Illinois.

Cline, L. M., and Burma, B. H., 1949, Paleoecological study of the Pennsylvanian Exline limestone of Iowa and Missouri (abst.): Bull. Geol. Soc. Am., v. 60, p. 1880-1881.

Cooper, C. L., 1946, Pennsylvanian ostracodes of Illinois: Illinois Geol. Survey Bull. 70.

Dunbar, C. O., and Henbest, L. G., 1942, Pennsylvanian fusulinidae of Illinois: Illinois Geol. Survey Bull. 67.

Elias, M. K., 1937, Depth of deposition of the Big Blue (Late Paleozoic) sediments in Kansas: Bull. Geol. Soc. Am., v. 48, p. 403-432.

Girty, G. H., 1915, Paleontology: *in* Stratigraphy of the Pennsylvanian series in Missouri, by H. Hinds and F. C. Greene: Missouri Bur. Geol. & Mines, v. 13, p. 263-376.

Knight, J. B., 1930-1934, The gastropods of the St. Louis, Mo., Pennsylvanian outlier: Jour. Paleon., v. 4, supp. 1; v. 5, p. 1-15, 177-229; v. 6, p. 189-202; v. 7, p. 30-58, 359-392; v. 8, p. 139-166, 433-447.

Rhodes, F. H. T., 1952, A classification of Pennsylvanian conodont assemblages: Jour. Paleon., v. 26, p. 886-901.

Rich, J. L., 1951, Three critical environments of deposition, and criteria for recognition of rocks deposited in each of them: Bull. Geol. Soc. Amer., v. 62, p. 1-20.

Ulrich, E. O., 1890, Paleozoic bryozoa: Geol. Survey of Illinois, vol. VIII, p. 283-678.

Waldo, A. W., 1928, The Lonsdale limestone and its fauna in Illinois: Unpublished Master of Science thesis, University of Illinois.

Wanless, H. R., 1929, Geology and mineral resources of the Alexis quadrangle, Illinois: Illinois Geol. Survey Bull. 57.

Wanless, H. R., 1956, Classification of the Pennsylvanian rocks of Illinois as of 1956: Illinois Geol. Survey Circ. 217.

Wanless, H. R., 1957, Geology and mineral resources of the Beardstown, Glasford, Havana, and Vermont quadrangles, Illinois: Illinois Geol. Survey Bull. 82.

Wanless, H. R., and Merrill, W. M., 1951, Evidence of eustatic change in sea level in the Pennsylvanian of the southwestern United States (abst.): Bull. Geol. Soc. Am., v. 62, p. 1487.

Weller, J. M., and McGehee, J. R., 1933, Typical form and range of *Mesolobus mesolobus*: Jour. Paleon., v. 7, p. 109-110.

Worthen, A. H., 1870, Fulton County: Geol. Survey of Illinois, vol. IV, p. 90-110.

Zangerl, R., and Richardson, E. S., Jr., 1955, Ecologic history of a transgressing Pennsylvanian sea near Mecca, Indiana (abst.): Bull. Geol. Soc. Amer., v. 66, p. 1639.

Illinois State Geological Survey Report of Investigations 205
59 p., 2 figs., 4 tables, 1957