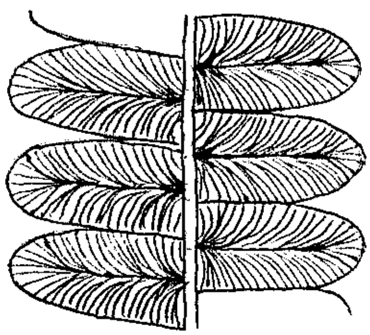
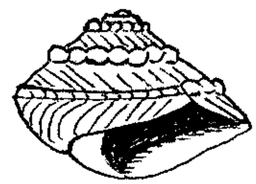
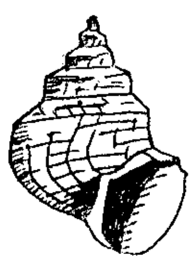
A.M.A.T.E.U.R.

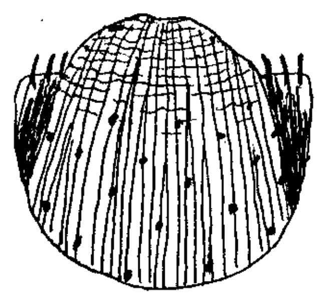
A Marmaton, Amateur-led Trek to Exposures Unexplored
near the
Raccoon River (Southeast Dallas County)

Robert Wolf • John Pope • Arsen Chantooni









Geological Society of Iowa

April 22, 1990 **Guidebook 52**

System	Series	Group	Formation	Member	Adapted from Swade 1985 Fig. 1
Pennsylvanian	Missourian (lower upper)	Bronson	Swope	Bethany Falls LS Hushpuckney SH Middle Creek LS	
			Ladore SH		
			Hertha LS		
			Pleasanton	unnamed SH Exline LS unnamed SH	
	Desmoinesian (upper middle)	Marmaton	'Lost Branch'	Cooper Creek LS unnamed SH Sni Mills LS	
			unnamed SH		
			Lenapah LS		
			Nowata SH		
			Altamont	Worland LS Lake Neosho SH Amoret LS	
			Bandera SH		
			Pawnee	Coal City LS Mine Crk SH Myrick Station LS Anna SH	field trip
			Labette SH	Mystic Coal Marshall Coal	
			Stephens Forest	Higgensville LS unnamed SH Houx LS Little Osage SH	
			Morgan School SH	Summit Coal	
			Mouse Creek	Blackjack Crk LS Excello SH	
		Cherokee	Swede Hollow	Mulky Coal	

Relationship of field trip strata to other South Central Iowa associated strata

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GSI Spring Fieldtrip
April 22nd, 1990

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INTRODUCTION

by Robert Wolf

When first approached about leading a GSI field trip last autumn, my first reaction was uncertainty. It seems that the trend in GSI field trips in recent years has been to try to outdo the previous fieldtrip. This has resulted in highly technical guidebooks. There is nothing wrong with this. However, I thought it would be nice to have a less technical trip, and to show other amateur members of the GSI that they too can lead such trips. Perhaps we could even see who could come up with the least technical trip.

I decided upon the Van Meter-Booneville area because of the numerous exposures there and because the area has been little explored by professionals. Also, there has never been a GSI trip to this area. To assist me, I called upon John Pope and Arson Chantooni, two serious and knowledgeable amateurs who have extensively studied the area and who introduced me to the exposures about five years ago.

A GSI trip in 1980 examined Pennsylvanian Kansas City and Lansing Group exposures in Madison County (P. Heckel, 1980). Another GSI trip in 1982 explored Pennsylvanian Marmaton Group and Cretaceous exposures to the west in Guthrie County (B. J. Witzke and G. A. Ludvigson, 1982). In 1985 a GSI trip went to Cherokee exposures at the Saylorville spillway in Polk County to the northeast of this area (E. A. Bettis, T. J. Kemmis, B. J. Witzke, 1985). E. R. Landis and O. J VanEck (1965) mentioned Marmaton Group and Cherokee Group coals in Dallas County. M. P. Stark (1973) in his unpublished M.S. thesis describes exposures in Madison County, including some sites that are near the sequence of stops in this trip.

I, myself mentioned an exposure at DeSoto (1983), although I was mistaken about the stratigraphy. As far as the immediate Van Meter-Booneville area is concerned, we have found very little previous work. For this reason, we hope that this trip will encourage other amateurs as well as provide professionals with something new.

We wish to thank the Geological Society of Iowa and the Geological Survey Bureau staff for answering our questions and for printing the guidebook. We also thank the owners of the Texaco Truck Stop in DeSoto for permitting us to "invade" their establishment, and to Mrs. Baker who allowed us onto her property (last stop of the trip).

CYCLIC SEQUENCE PATTERNS OF SEDIMENTATION

by John Pope

Alternating periods of shallow seas transgressing and regressing on a wide scale and over long periods of time, produced distinctive sediments in a definite vetical sequence. These sediments extend hundreds of kilometers from Iowa, into Nebraska, Kansas, and Oklahoma to the south and Illinois to Pennsylvania to the east. The sediments form a pattern of inundation and withdrawal repreated over and over, and left a record of the earth's geologic history in the material of their layers. One such sequential pattern is known as a cyclothem. A cyclothem is made up of basically four vertically ascending units: usually a thick shale, which is also the top of the underlying formation; a thin transgressive limestone; a thin core shale; a thick regressive limestone; and, again, a thick shale which continues upwards as the bottom of the overlying formation (Fig. 1).

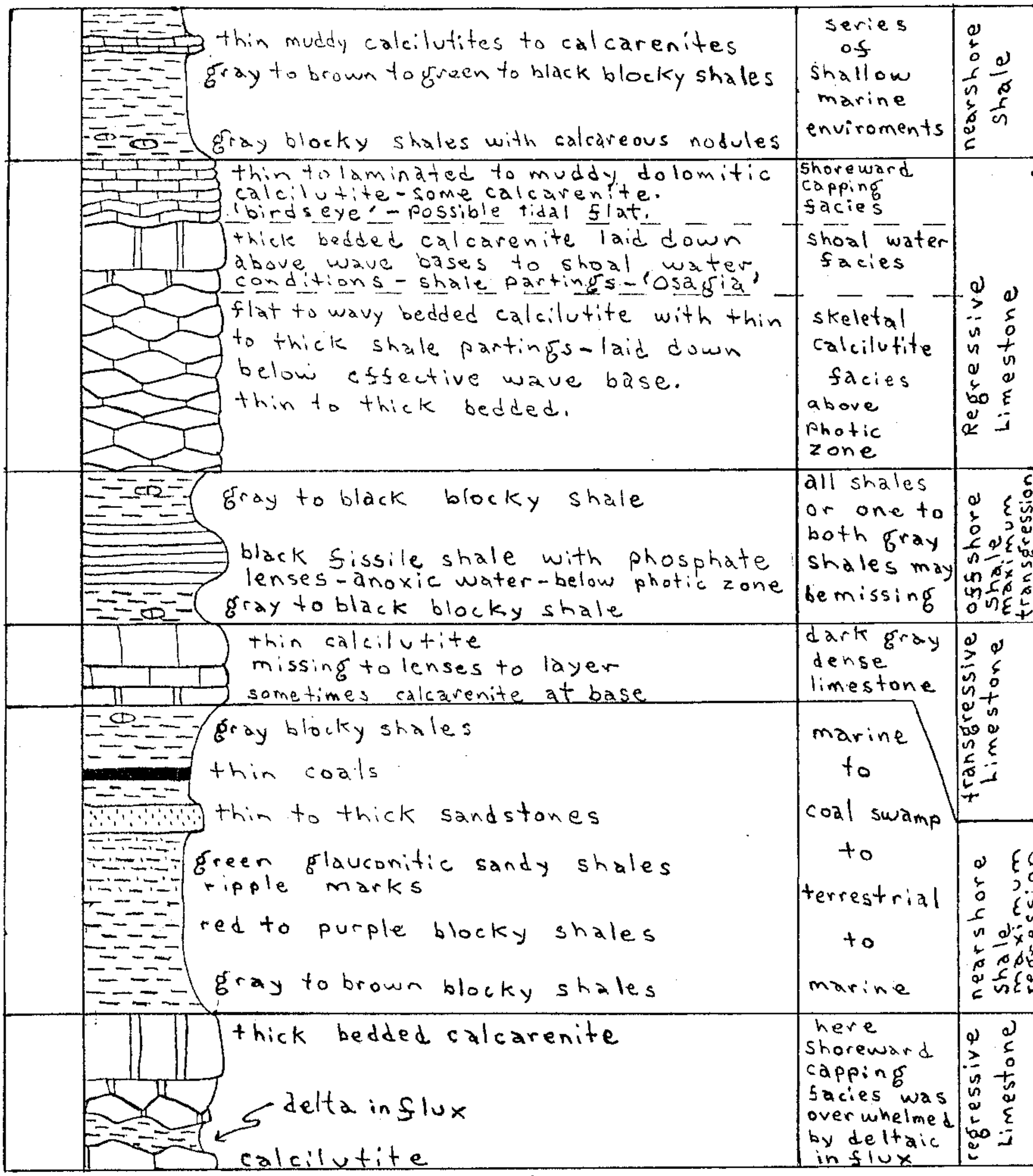
A cyclothem starts at a fairly shallow sea level, with delta influx forming sediment in submerged areas and soil forming in emerged areas. This is called a nearshore shale. Often a coal is formed on these emergent surfaces ahead of the transgression that formed the cycle above. As the water deepened because of sea level rise, delta material settled out further and further from shore. Eventually, benthic algal growth produced a thin carbonate mud, known as a transgressive limestone. Sometimes this forms as a thin calcarenite, deposited in shallow agitated water with a calcilutite above, deposted in quieter water, below effective wave base, during later transgression (unnamed limestone below Little Osage shale at Hanley, Madison Co., Iowa). Others were deposited as merely calcilutites. In some situations (e.g., base of Excello Shale) the transgressive limestone did not form. This can be explained as rapid transgression which did not allow benthic algal growth to happen before the base of the photic zone was reached, prodelta mud inhibiting benthic algal growth, or pH and salinity of water adjacent to the overlying a submerged coal swamp inhibiting benthic algal growth (Excello Shale lying atop Mulky Coal at Stops #4 and #5). When well formed, usually these limestones are very dark and dense with many fossils. Because of their physical characteristics, fossils seem rare or are hard to extract. One exception to this is the unnamed limestone below the Little Osage Shale at stop #1. As the water deepened further, below the photic zone, benthic algal growth and carbonate production stopped.

Southern Dallas County was in what is known as the trade wind belt at approximately 8-10 degrees north latitude. As hot air, which rose from near the equator in the doldrums, spread north and south, part of it descended at about thirty degrees latitude and returned to the equator as the trade winds. Because of the earth's rotation, this air mass flows toward the equator and is deflected to the west. This is known as the Coriolis Effect which produces the trade winds.

Large air masses (trade winds) moving over the sea, move surface waters vast distances. This accounts, to a large extent, for the circulation patters of the epicontinental sea. As the surface water was forced westward toward the open ocean, deeper cold water, low in oxygen, flowed in from the ocean floor to replace the loss. This set up a large circulation cell thousands of kilometers across (Fig. 2). This cell produced an upwelling effect near the shore line, and the cold water, which was rich in nutrients entered the photic zone. This produced high concentrations of plankton and algal growth. The biomass eventually settled back down to the sea floor. As it decayed it further depleted the bottom of oxygen. Certain heavy metals were also deposited, which these organisms tended to concentrate when alive.

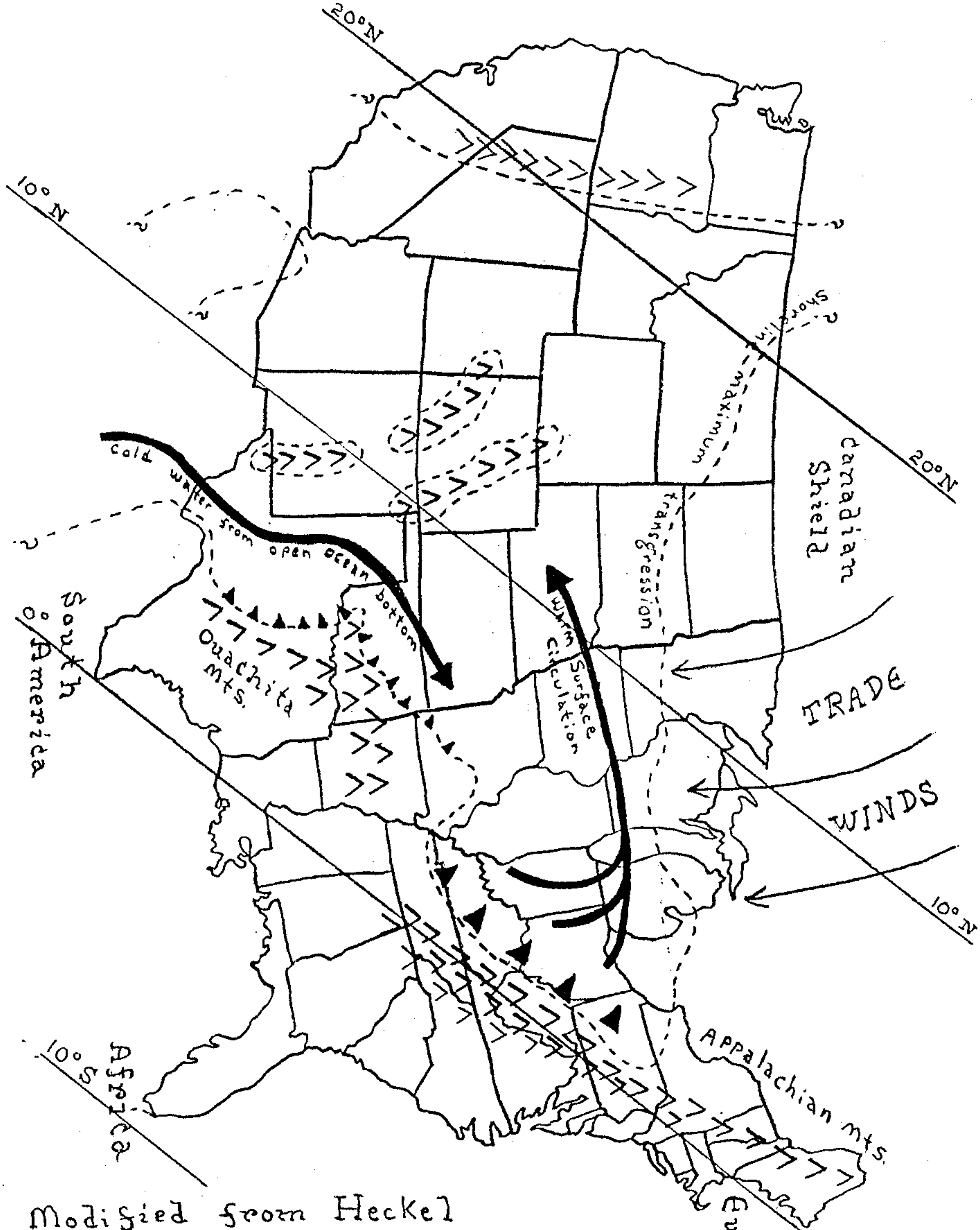
Meanwhile, more oxygen was prevented from reaching the deeper water because land locked seas tend to become stratified. Warm sea water on top and cold ocean water on the bottom produced a thermocline which prevented vertical wave circulation from reaching the bottom; this caused anoxic conditions in the lower regions of the sea. The settling organic materials, thusly un-oxidized, formed a black core shale, usually rich in phosphate granules, lenses, and laminae (Fig. 3).

Analysis (by Arsen Chantooni) of a phosphate nodule from the Little Osage Shale at stop #1 is as follows:



Modified from Heckel (1977 fig 2)

Fig. 1.



Modified from Heckel
(1977 fig. 6)

Fig. 2

Analysis of a phosphate nodule from Little Osage Shale Northwest of Van Meter. A. Chantooni, June 1984. Sample #1; all percents are by weight, as is basis.

	% by weight	Equivalents
Phosphate	38.95% as PO_4	1.24
Sulfate	0.90% as SO_4	0.02
Iron	1.60% as FE	0.09
Aluminum	0.08% as Al	0.01
Magnesium	absent	absent
Calcium	30.00% Ca	1.50
Copper	0.02% as Cu	0.00
Zinc	6.40% as Zn	0.20
Silica	0.40% as such	----

Unaccounted for: sulfide, carbon, carbonate, organic matter (21.65%) (Assumed carbon & organic matter: 10%)

Sulfide present: mostly tightly bound, calculated as 4.6% as S
Carbonate: present, calculated as 7.5% as CO_3

Most Probable Combinations

$Ca3(PO)_2$:	63.6%
$CaCO_3$	12.5%
$CaSO_4$	1.3%
Al_2O_3	0.16%
FeS_2	3.4%
ZnS	9.5%
CaS	0.03%
SiO_2	0.4%
Carbon & Organic matter	9.5%
Total	100.39%

Sedimentation was very slow. Most aragonitic fossils were dissolved and replaced by pyrite or marcasite. Although, at a location 17 kilometers to the northeast of Stop #4, an ammonite was found preserved in a phosphate lens. Most fossils in the black facies are normally pelagic or epipelagic. These include fish remains, orbiculoid brachiopods, pectin clams and abundant conodonts. Here the maximum depth of the transgression was reached and regression began. As the water shallowed from the black facies and destroyed the thermocline, some oxygenation of the bottom occurred allowing a gray shale facies with abundant fossils to form (e.g., upper Excello Shale at stops #4 and #5) (Fig. 4). As the water level continued falling to the photic zone, benthic, carbonate-producing algal-growth resumed. This is evidenced by increasing numbers and size of calcilutite nodules in the upper Excello Shale at stops #4 and #5. Eventually thin wavy beds of calcilutite with thin shale partings were deposited, forming the regressive limestone. These layers were laid down below the effective wave base. Although more work needs to be done here, it seems that the regressive limestones (Blackjack Creek, Houx, Myrick Station) in this area consist entirely of calcilutites and are missing the shoal water calcarenites and capping facies of similar limestones in the Missourian Series, in Madison County, to the south. These limestones were probably overwhelmed by delta

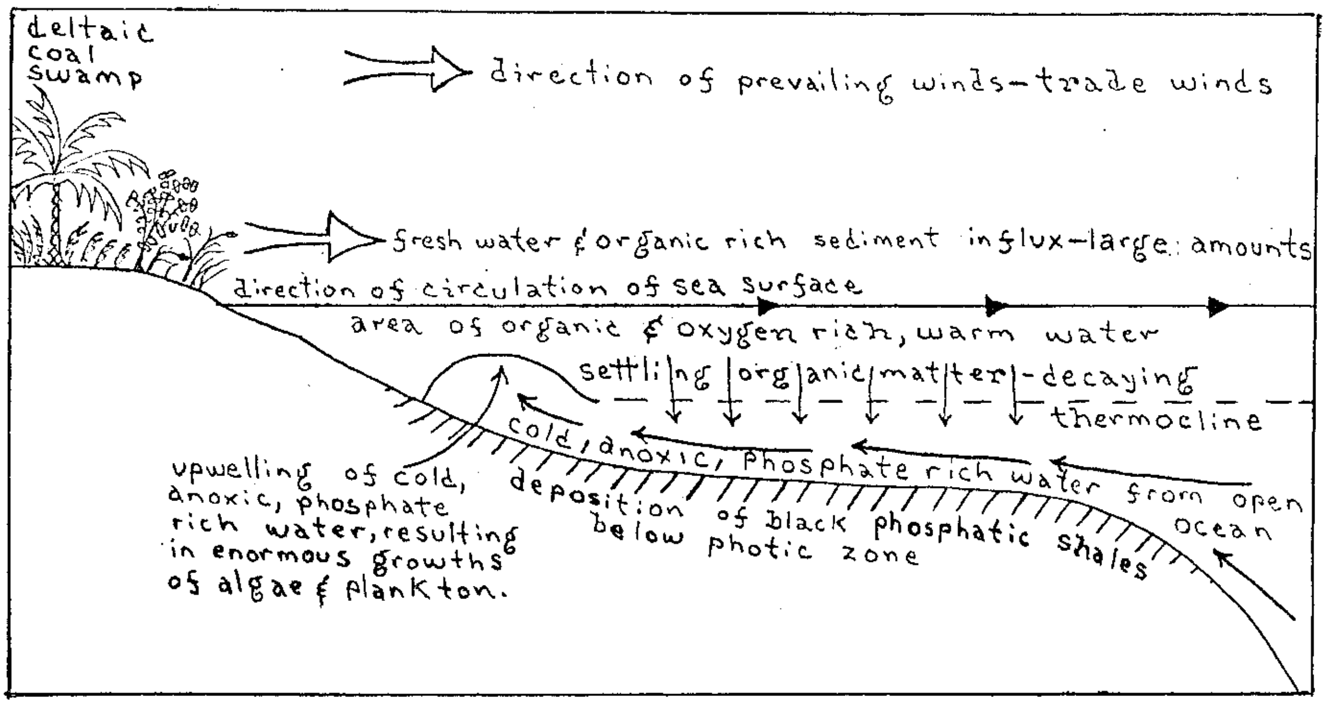
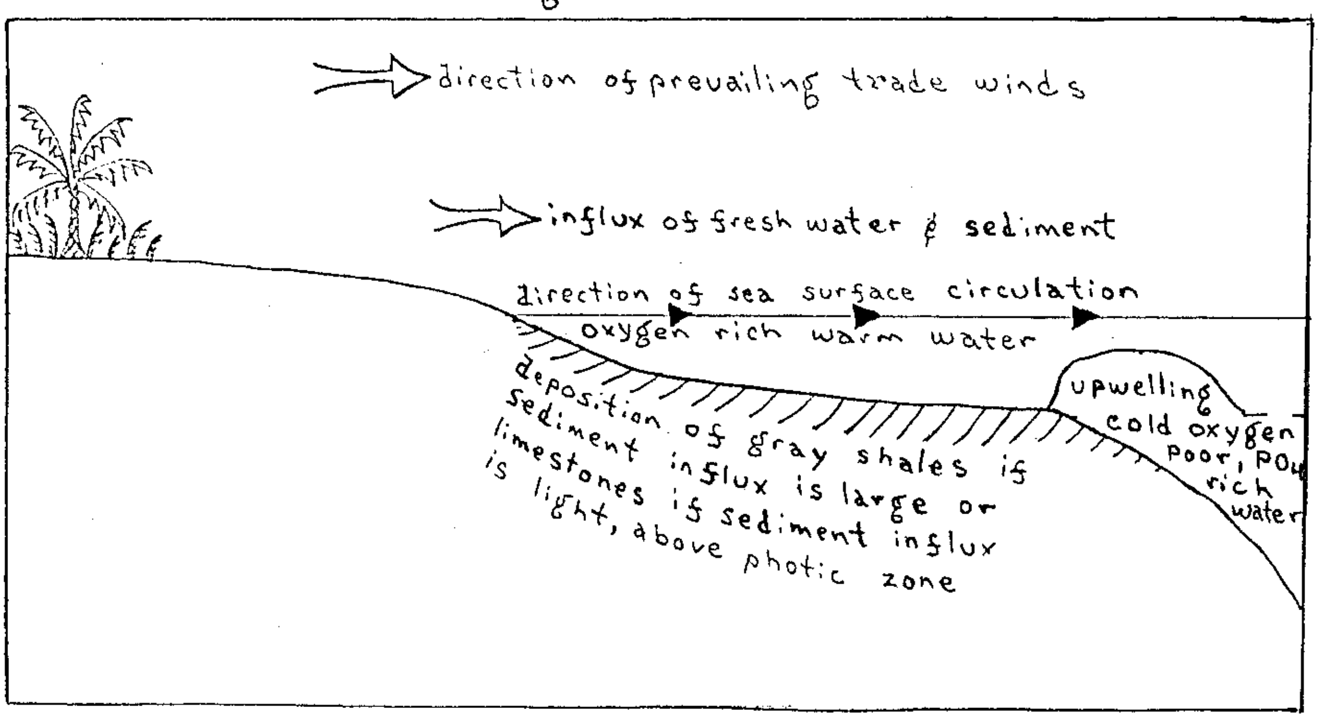


Fig. 3.

Modified from Heckel (1977 fig 5a-b) & M. Howes

Fig. 4.



influx. At stop #1, the Houx Limestone is overlain by a red shale. Where the limestone is not present, the red shale is in abrupt contact with the underlying green-gray facies of the Little Osage Shale.

The nearshore shales above the regressive limestones can indicate prodelta mud or a paleosol (unnamed red shale above the Houx limestone at stop #1). Most contain thin to thick layers of sandstone, some with ripple marks (Mine Creek Shale at stop #1), crossbedding, possibly due to channel fill sand deposits (Labette Shale at stop #2), and coal and plant material (Marshall Coal and Labette Shale at stops #1, #2, and #3).

It must also be kept in mind that some cyclic sedimentation in this area was directly due to nearness of the northern limit of sedimentation. Here local delta building could account for minor deposits of localized black shales such as the black fissile facies of the Labette Shale at stop #3. This shale could be the product of a restricted and localized interdelta bay, lagoon, or marsh. Such a shallow water black shale usually has few conodonts and is adjacent to other shoreline to shallow water deposits. This is seen in the thick sandstones, with plant material and crossbedding, lying above the black shale and clay shales and sandstones lying laterally adjacent to it, at stops #1 and #2 to the north and west. Exposures between stops #2 and #3 reveal intermediate deposits of the black shale. Other inconsistencies in sedimentation could be due to uneveness of the sea floor, caused by basins and uplifts.

The Higginsville Limestone Member and Coal City Limestone Member probably represent minor cycles that did not complete the entire cycle of deposition of a major cyclothem.

Wanless and Weller (1932) first applied the name "Cyclothem" to sequences in Illinois, and Moore adopted the term for the midcontinent in 1936. Wanless and Shepard (1936) proposed that these cyclic alternations resulted from the raising and lowering of sea level, brought about the formation and melting of Gondwanian ice sheets. Heckel (1986) has estimated ranges of 44,000 to 400,000 years for minor to major cyclothems. These estimates are comparable to theories of Pleistocene ice ages.

PALEONTOLOGY

By John Pope

Articulate brachiopods of at least 21 genera are found at Van Meter and Booneville. Spirifers are represented in this area by seven genera. Athyrididina are *Composita* and *Cleiothyridina*. *Composita ovata* is usually small to medium in size, biconvex, with a low dorsal fold and a shallow ventral sinus. The concentric growth lines are smooth.

Cleiothyridina is distinguished from *Composita* by the broad flat spines projecting from the growth lines. On weathered specimens they can only be seen if magnified. The shell is usually wider than long.

Hustedia mormoni is a very small brachiopod of the suborder Retziidina. It has an elongate-oval shell with no fold or sulcus., but with strong costae.

Crurithyris, Neospirifer, Punctospirifer, and *Phricodothyris* are all in the suborder Spiriferidina. *Crurithyris planoconvexa* is small, with the pedicle valve highly convex. The brachial valve is almost flat and sometimes both valves have a shallow sulcus.

Phricodothyris perplexa looks similar to *Composita,* has spines on the growth lines like *Cleiothyridina,* but the beak of the pedicle valve is not tightly incurved agains the brachial valve, as it is in the latter two. Also, unlike *Cleiothyridina,* the spines are double-barreled and hollow instead of flat and single.

Neospirifer cameratus can be a rather large brachipod. The cardinal extremities are normally rounded. The fold and sulcus are low and wide and have plications. There are distinct concentric growth lines and the lateral surfaces are covered with fasiculate plications. It does not occur above the Desmoinesian Series.

Punctospirifer kentuckyensis is a much smaller version of *Neospirifer,* but the fold and sulcus have no plications. The lateral plications are not fasiculate and look rough because of strong growth lines. Juvenile Neospirifers are often confused with *Punctospirifer,* but *Punctospirifer* is readily distinguished by the smooth fold and sulcus and the rough plications.

Strophomenid Productidina include *Desmoinesia, Reticulatia, Kozlowskia, Linoproductus, Juresania, Echinaria,* and *Leptolosia. Desmoinesia muricata* is finely costate, rugose and abundantly covered with fine spines. The pedicle valve is convex with a slight sinus. The brachial valve is concave and is usually spineless, while its interior is somewhat similar to *Kozlowskia splendens.*

Reticulatia portlockianus is a large brachiopod. The pedicle valve is highly convex, while the brachial valve is concave. It has costae and rugae and is prominently reticulate. Both valves are geniculated and the brachial valve is without spines, while the pedicle valve has numerous large spines. The interior of the brachial valve has numerous large spines. The interior of the brachial valve has a median septum, fairly well defined brachial ridges, and many endospines. It is usually the principal host for *Crania, Leptalosia,* and encrusting bryozoans.

Kozlowskia splendens looks like a miniature *Reticulatia.* The pedicle valve is both costate and rugose with slight reticulation. It has few spines, with a row along the hinge line, and a row of symmetrical spines across the pedical valve. The brachial valve has no spines on the exterior but resembles *Reticulatia* on the interior with an additional anterior rim. Both valves are geniculated. It is usually distinguished from other species by its thickened anterior rim, and from *Desmoinesia* by its larger costae, fewer spines, and spineless brachial valve. *Kozlowskia wabashensis* also occurs here.

Linoproductus is somewhat similar to *Reticulatia,* but the costae and spines are much finer and it is not reticulate. There are usually two rows of spines along the hinge line.

Juresania nebrascensis is a very spiny brachiopod with two sizes of spines in concentric rows. Spines occur on both valves. The pedicle valve is highly convex, while the brachial valve is concave to nearly flat.

Echinaria semipunctatus is similar to *Juresania* in the fact that both valves are covered with spines. *Echinaria* has fine spines only, in concentric rows, that lie close to the shell. It has a very narrow hinge line and is much larger than *Juresania.*

Leptalosia ovalis is an extremely small brachiopod. As a commensual it attached to other organisms for a place to live, but it was not a parasite. The pedicle valve was not only cemented to the host, long spines also helped anchor it in place. It is quite variable in shape because it conforms to the surface to which it is attached. The brachial valve is rarely seen as it is extremely fragile.

Strophomenid brachiopods of the suborder Strophomenidina include *Derbyia* and *Meekella. Derbyia crassa* is suboval in outline, biconvex, and costellate. The interior of the pedicle valve has a median septum and prominent hinge teeth. Usually the cardinal area is wider than it is high.

Meekella striatocostata is highly biconvex with fine costellae and large costae. The large cardinal area is about equal in width and height. On some species in this area, the costae tend to die out some distance from the beak and anterior margin. These tend to grade more toward the non-costate genus *Orthothetina.*

Strophomenid Chonetindina include *Neochonetes, Chonetinella,* and *Mesolobus. Neochonetes* is slightly concavo-convex and may have a very shallow median sulcus on the pedicle valve or may be smoothly rounded. It is finely costellate.

Chonetinella flemingi crassiradiata is highly concavo-convex and the pedicle valve has a deep sulcus between two lobes. The brachial valve has a corresponding fold. The variety found here has very coarse costellae compared to species of the Missourian Series.

Mesolobus mesolobus has a fold in the sulcus of the pedicle valve and a sulcus in the fold of the brachial valve. This extra median pedicle fold is highly variable, and can be quite strong to almost absent or narrow to wide. The surface is usually finely costellate, but in some species the costellae are very weak to absent. *Mesolobus* is the most common of the three described Chonetidian and is confined to below the top of the Desmoinesian Series. All three genera have a row of spines along the hinge line.

Rhynchonellid brachiopods are *Wellerella* and *Leiorhynchoidea. Wellerella osagensis* is small, subpentagonal in outline, with a well developed fold and sulcus. The fold has three to five costae, the flanks four, but none reach the beak.

Leiorhynchoidea rockymontanus is similar to *Wellerella,* but is larger in size. Usually the fold and sulcus is not as prominent as in the latter and the flanks are not costate.

Inarticulate brachiopods *Crania, Lingula,* and *Orbiculoidea* occur. *Crania* was a commensual like *Leptalosia* with which it's associated. While most inarticulates have shells that are chitino-phosphatic, *Crania* has a calcareous shell. When present the brachial valve is seen as a subconical, suboval, with concentric growth lines. The brachial valve is often missing so the interior of the pedicle valve is seen. Cementing to the host causes some irregularities, but the pedicle valve normally shows as a thickened ring surrounding three muscle scars. These scars are arranged in a triangle at one side of the ring.

Lingula carbonaria is chitino-phosphatic in shell structure. It is elongate with a pointed end and much resembles a kernel of corn. It is ornamented by fine concentric growth line.

Orbiculoidea missouriensis is also chitino-phosphatic, but it is suboval in outline like *Crania.* The valves are subconical with fine concentric growth lines. Many times a narrow pedicle slit is observed. Both *Lingula* and *Orbiculoidea,* when found in the black shales, may appear blue or brown. Neither brachiopod attached itself like *Crania.*

Ameura is the most common trilobite of the Pennsylvanian in this area. The head or cephalon has a brim, and the segments of the tail or pygidium do not reach the margin. It is not ornamented and has nine thoracic segments.

Bryozoans include branching, encrusting, and fennestrate types. *Rhombopora* usually occurs as branches less than three millimeters in diameter. The zooecia are arranged in rows with a large acanthostyle at the intersection and smaller paurostyler in between.

Cyclotrypa occurs as encrusting and branching forms. The zooecia are partially covered by a crescent shaped hood or lunule. Spots or monticles free of zooecia occur scattered over the surface between the zooecia. *Cyclotrypa zonata,* in the drawing, shows a section just below the surface where rings of vesicles surround the zooecia.

Tabulipora is similar to *Cyclotrypa* in form but the zooecia vary in size and are close together, sharing dividing walls. A large stylet occurs at the intersection of most of the walls. *Prismopora* is very unusual in shape, in that the branches are triangular instead of round. The edges are wavy and the faces have widely spaced zooecia. Branching off a main branch occurs in threes.

Streblotrypa is a very tiny branching type with branches about one millimeter in diameter. Zooecia occur in vertical parallel rows with a double row of metapores below each zooecia.

The fennestellidae are lacy branching forms with fennestrules or windows formed between the rows of branches. Zooecia are in various arrangements on the main branches and some have them on the tranverse crossbars between the branches. Most common forms are *Polypora, Septapora, Fennestralina* and *Synocladia.*

At least five gastropod genera occur at these locations and probably several more. *Platyceras* is a horn shaped form where the whorls do not touch. It is very often associated as being attached to the anal area of crinoids.

Euphemites is in a planispiral coiled shape. It has several prominent spiral cords that die out before reaching the aperture.

Trepospira has a lenticular shaped shell with a low spire. It has a single row of nodes just below the sture.

Ianthinopsis is a medium spired gastropod. It has a globular shell with a pointed spire and very faint spiral ornamentation.

Baylea has a turbonate shell with spiral and collabral threads.

Polytaxis is a foraminfer with a low, conical trochospiral test. The walls are calcareous with numerous crescent shaped chambers to a whorl.

Endothyranella is enrolled and planispiral in later whorls, with chambers that make it look like a miniature cephalopod. It too is calcareous.

Climacammina is biserial in early stages and uniserial in later stages. The walls are calcareous and the aperture is terminal with two or more openings.

The larger fusiform foraminifer is *Fusulina girtyi.* It is small, short, with bluntly pointed poles. The center is finflated. The septa are fluted throughout the shell and usually do not reach to the next volution. The chomata that border the tunnel are very irregular near the outer volutions. *Fusulina pumila* and *Fusulina stookeyi* may also occur with *Fusulina girtyi.*

Wilkingia is a large clam. It is oval in outline with a short anterior end. The concentric growth lines are prominent and very well preserved specimans are studded with very fine spines. The posterior end may or may not gape.

Stereostylus is usually a fairly small, solitary, rugose coral with a prominent columella. It is usually round and cone shaped with a slight curve, but attachment may distort its shape. The epithecal surface is covered with septal ridges and grooves, crossed by transverse growth lines.

Spirorbis is a calcareous worm tube often attached to brachs or clams. It is coiled in a flat sprial and usually bears concentric ridges.

Parametacoceras is moderately small and very like *Metaoceras.* It does not bear a row of lobes along the ventro-lateral shoulder as does the latter, but the lateral sides are ornamented by transverse ribs. *Pseudorthoceras* is long, slender, tapered, and circular in cross section. The surface of the conch is thin and smooth, and the sutures are circular.

Poterioceras is a large cone shaped cephalopod with closely spaced sutures. It is sub-circular in cross section. The nature of the siphuncle has not been determined in this specimen. A large ammonitic cephalopod was found associated with *Poterioceras.* It has not yet been identified.

Ostracods are very tiny, hinged, bivalved arthropods. They are often bean-shaped shells either smooth or with various bumps, nodes, keels, pits, and sinuses. The tiny animal has all the appendages, segments, and antennae of a typical arthropod.

Occasional echinoid plates and spines are found. The spines were attached to the plates by a ball and socket joint that allowed the spine to move. They are possibly of the genus *Archeocidaris,* a regular echinoid, or sea urchin.

Crinoids are only found as isolated plates and stem segments. One distorted stem has two tiny chitino-phosphatic rings of the genus *Phosphannulus.* These are assigned to the Order Hyolithelminthes but are of unknown affinity. Other boring may be ascribed to myzostomes or gastropods.

Vertebrate teeth include *Petalodus,* a large wide crusher tooth of a skate-like petalodontid. It has serrated edges.

Cladodus has a large sharply pointed central spire with two smaller ones on either side.

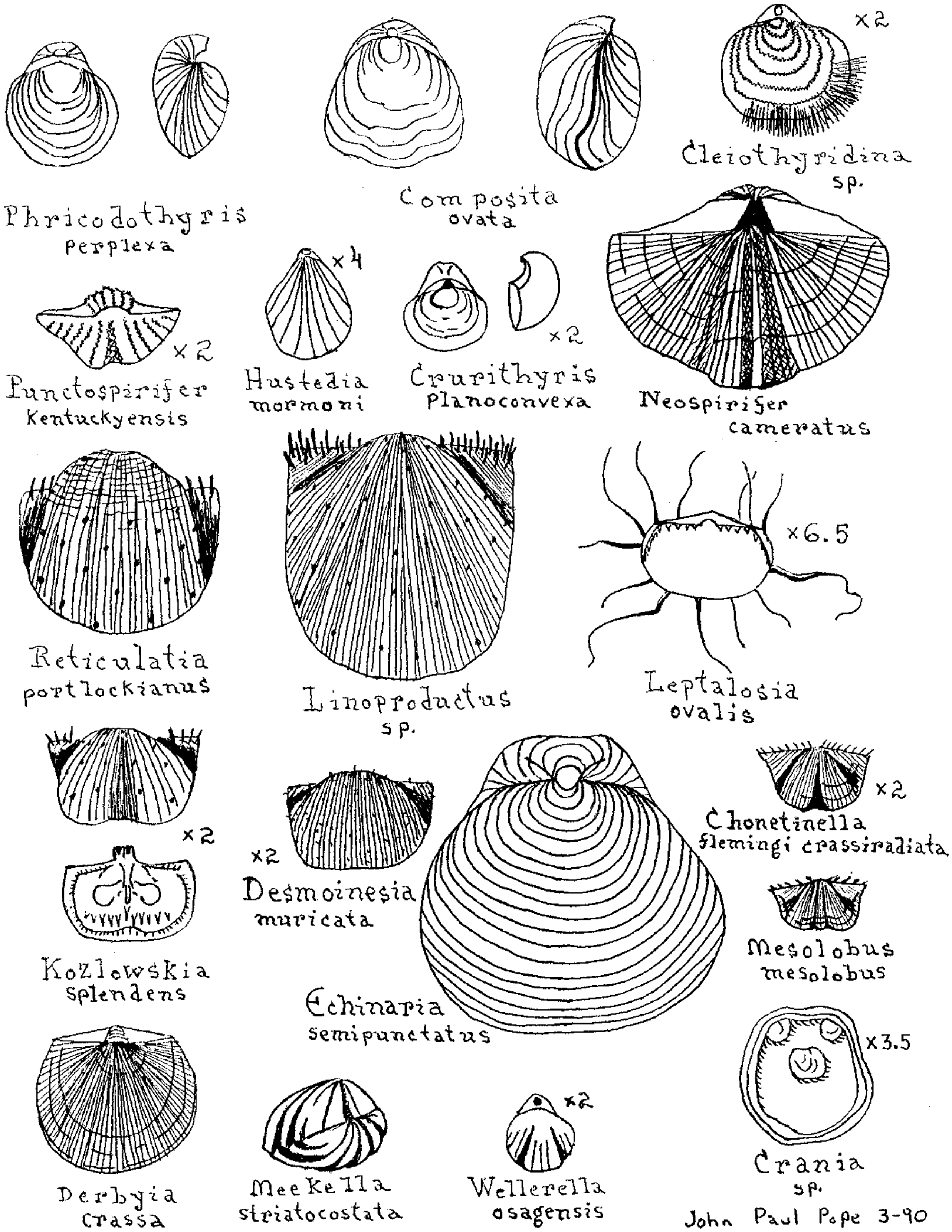
Demal denticles of the species *Petrodus patelliformis* look like chocolate drops with ridges on the sides of the cone. Most are blueish white in color and many are found in the calcium-phosphate lenses.

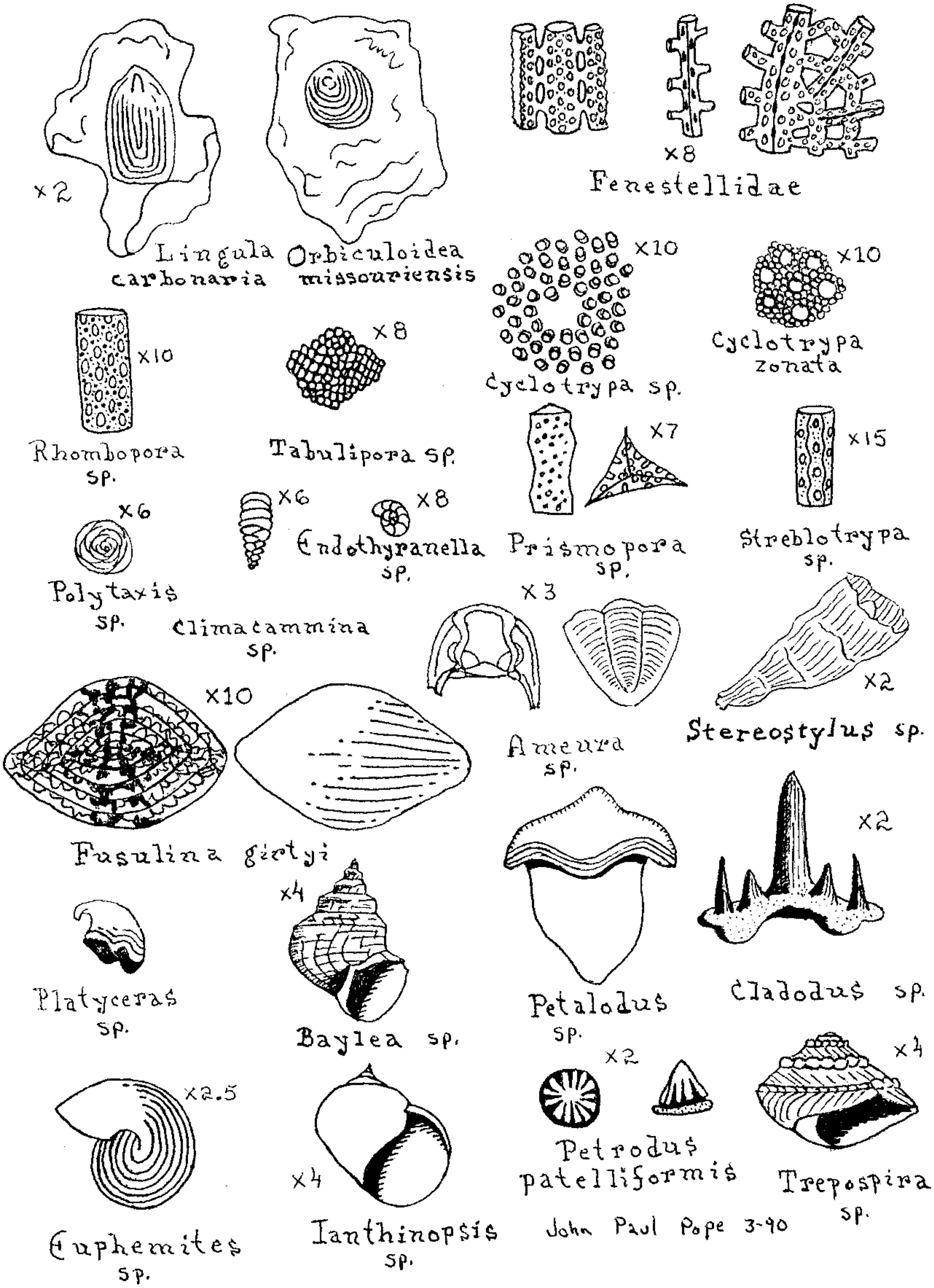
Several other unidentified tooth fragments have been found as well as what might be part of a fin. Skin, scales, and spines are also associated with the phosphate lenses.

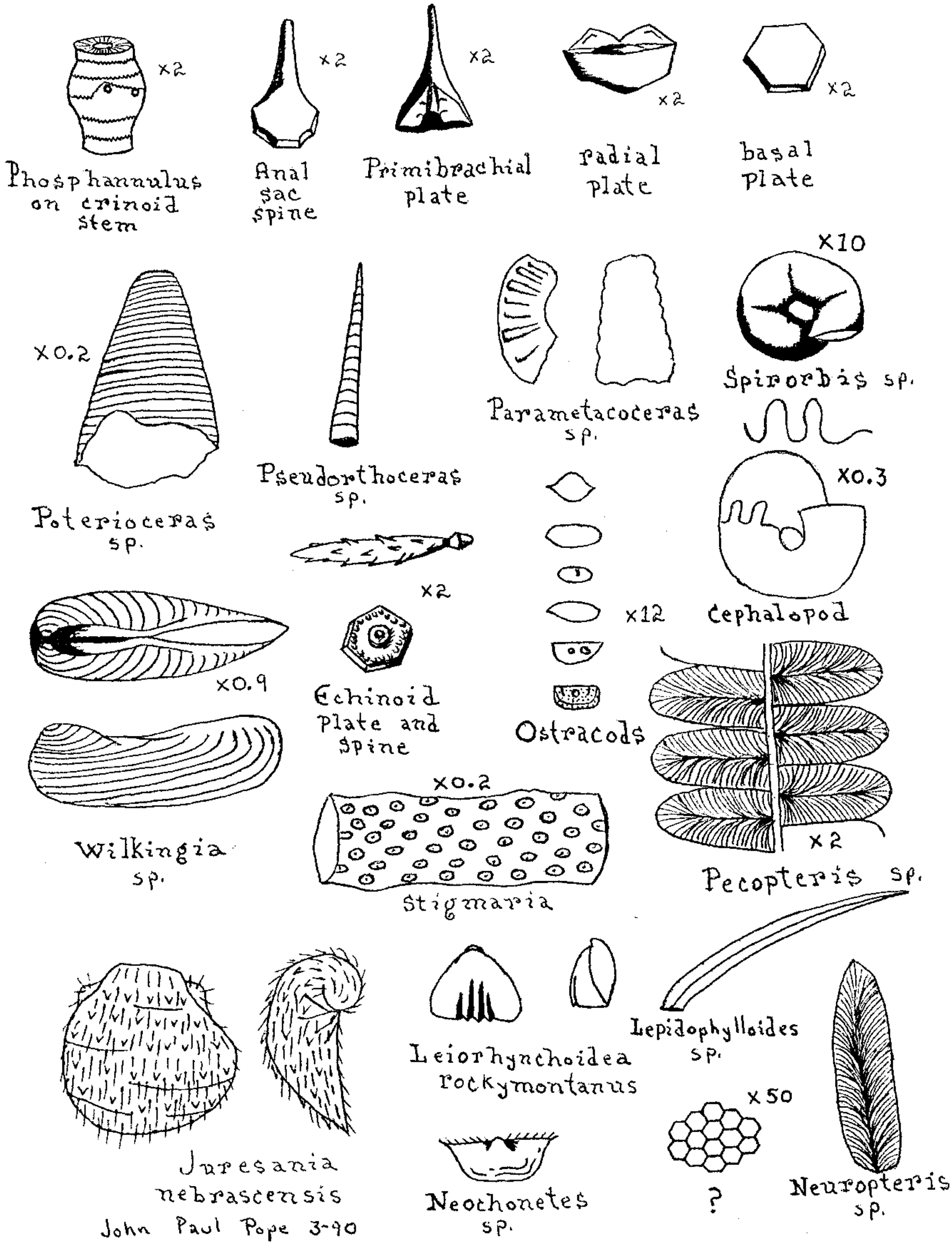
Stigmaria are the roots of *Lepidodendron* trees. The scars are left where smaller "rootlets" have broken off. *Lepidophylloides* are the strap-like leaves of these trees.

Pecopteris and *Neuropteris* are fern leaves. *Pecopteris* is fastered to the stem by the entire base, where *Neuropteris* is attached by a single central point. Both are usually found as thin carbonaceous films in the shale or sandstone.

Adetognathus is a conodont that is associated with shallow water, nearshore environments. A single platform element was found in a marine sandstone in a red shale. Conodonts are usually very common in black facies of "core shales."


Phricodothyris perplexa
Composita ovata
x2
Cleiothyridina sp.
x 2
Punctospirifer kentuckyensis
x 4
Hustedia mormoni
x 2
Crurithyris planoconvexa
Neospirifer cameratus
Reticulatia portlockianus
Linoproductus sp.
x 6.5
Leptalosia ovalis
x 2
Kozlowskia splendens
x 2
Desmoinesia muricata
Echinaria semipunctatus
x 2
Chonetinella flemingi crassiradiata
Mesolobus mesolobus
x 3.5
Crania sp.
Derbyia crassa
Meekella striatocostata
x 2
Wellerella osagensis
John Paul Pope 3-90


x2
Lingula carbonaria
Orbiculoidea missouriensis
x8
Fenestellidae
x10
Cyclotrypa sp.
x10
Cyclotrypa zonata
x10
Rhombopora sp.
x8
Tabulipora sp.
x7
Prismopora sp.
x15
Streblotrypa sp.
x6
Polytaxis sp.
x6
Climacammina sp.
x8
Endothyranella sp.
x3
Ameura sp.
x2
Stereostylus sp.
x10
Fusulina girtyi
x2
Petalodus sp.
Cladodus sp.
Platyceras sp.
x4
Baylea sp.
x2.5
Euphemites sp.
x4
Ianthinopsis sp.
x2
Petrodus patelliformis
x4
Trepospira sp.
John Paul Pope 3-90


Phosphannulus on crinoid stem
x2
Anal sac spine
x2
Primibrachial plate
x2
radial plate
x2
basal plate
x2
Poterioceras sp.
x0.2
Pseudorthoceras sp.
Parametacoceras sp.
Spirorbis sp.
x10
cephalopod
x0.3
x0.9
Echinoid Plate and Spine
x2
Ostracods
x12
Wilkingia sp.
x0.2
Stigmaria
Pecopteris sp.
x2
Juresania nebrascensis
Leiorhynchoidea rockymontanus
Lepidophylloides sp.
Neochonetes sp.
x50
?
Neuropteris sp.
John Paul Pope 3-90

Northwest of Van Meter	Bandera Shale	Labette Shale	Myrick Station Limestone	Higginsville Limestone	Houx Limestone	Little Osage Shale	unnamed limestone
Linoproductus			5	C			VC
Juresania				1			3
Kozlowskia	5			1	5		20
Reticulatia			7	C			C
Desmoinesia			C	VC			10K+
Leptalosia				4			15
Derbyia	15			C			VC
Meekella				5			
Composita	C		C	VC			VC
Phricodothyris			2	5			
Cleiothyridina				1			
Neospirifer	1		8	12			C
Crurithyris			3	25	50		10
Hustedia				1			
Wellerella				2	20		
Punctospirifer				3	7		5
Leiorhynchoidea							2
Chonetinella	25			8	2		12
Neochonetes	5		2	2			25
Mesolobus	VC		35	VC	55		8K+
Crania				10			2
Lingula						3	
Orbiculoidea						2	3
Parametacoceras							1

Northwest of Van Meter	Bandera Shale	Labette Shale	Myrick Station Limestone	Higginsville Limestone	Houx Limestone	Little Osage Shale	unnamed limestone
Pseudorthoceras	15						2
Poterioceras			1				
Ammonite			1				
Wilkingia			1	2			
Cladodus	1					3	
Petalodus	3					2	
Petrodus			5			400+	
ostrocods				x			x
Euphemites	15						3
Trepospira	4						
Ianthinopsis	6						
Baylea			2				
Polytaxis				1			3
Ameura				x			
Rhombopora							20
Cyclotrypa				10			3
crinoid stems	x		x	x	x		
Pecopteris		x					
Neuropteris		x					
Lepidophylloides		x					
Stigmaria		x					

East of Booneville #2 & #3	Little Osage Shale	unnamed limestone	Blackjack Creek Limestone	upper Excello Shale	black facies Excello Shale
Linoproductus		C	30	15	
Reticulatia		3	C	VC	
Juresania			1	3	
Echinaria			C	VC	
Kozlowskia			5	20	
Desmoinesia		VC	C	C	
Leptalosia			10	30	
Derbyia		C	7	12	
Meekella			2	25	
Composita		C	C	VC	
Phricodothyris			8	28	
Cleiothyridina			2	50	
Cruirithyris		2	4	C	
Hustedia				2	
Neospirifer		2	15	VC	
Punctospirifer			1	VC	
Wellerella				VC	
Mesolobus		VC	C	VC	
Neochonetes		2	3	15	
Chonetinella				21	
Crania			5	82	
Orbiculoidea	1			1	10
Lingula	1				2

East of Booneville #2 & #3	Little Osage Shale	unnamed limestone	Blackjack Creek Limestone	upper Excello Shale	black facies Excello Shale
Spirorbis			2	75	
Rhombopora		2	3	C	
Tabulipora				C	
Prismopora				25	
Streblotrypa				8	
Cyclotrypa			5	C	
Fennestellidae				C	
Polytaxis			x	30	
Endothyranella			x	200+	
Climacammina			x	25	
Fusulina			x	4000+	
Platyceras				3	
Wilkingia			1	3	
ostracods			x	VC	
Ameura				3	
Cladodus				1	
Petalodus				1	
Petrodus	2				23
Stereostylus			1	30	
Phosphannulus				2	
echinoid				x	
crinoid				VC	

	North of Booneville		1 mi north of I-80, north of Van Meter	
	Labette Shale	Higginsville		
	Labette Shale	Higginsville LS		
plant material	x		x	
Neochonetes		x		x
Linoproductus				VC
Derbyia		x		x
Desmoinesia		x		x
Mesolobus		x		x
Composita				x
Reticulatia				x
Neospirifer				x
Kozlowskia				x
crinoid		x		x

	Swede Hollow Formation	sandstone lenses in red shale
Composita		1
Linoproductus		VC
Derbyia		5
Adetognathus		1
gastropods		C
clams		C

Number of fossils represent amounts collected in several trips over a number of years. Macrofossils were acquired by surface collection, while microfossils were collected by screening bulk shale samples.

Some fossils are common to an area or fragmented, so numbers were not counted.

C - commonly found.
VC - very commonly found.
x - occurs, but no attempt was made to determine numbers.

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FIELD TRIP LOG

* Meet at the Texaco Truck Stop in DeSoto, south of Interstate 80, west side of Highway 169.

* Begin trip at the junction of Highway 169 and County Road F-90 (paved), south of DeSoto. Strata poorly exposed in slopes north of the intersection probably expose the Hertha Formation to Cooper Creek Limestone Member, "Lost Branch" Formation interval.

* Turn east (left) on F-90. Use caution when turning off Highway 169. Proceed for two miles.

* Turn north (left) on a gravel road. Continue north for 1.5 miles to Stop One.

STOP ONE: Roadcut south of the South Raccoon River. Interstate 80 is visible to the north. This is the most complete section of the trip. Youngest beds are exposed to the south, older beds to the north. Best exposures occur west of the road. Site will be very muddy.

* CAUTION: Make U-turn here and head south for 0.5 miles then turn east (left) on DeSoto Road. Continue into Van Meter (0.3 miles).

* At junction of DeSoto Road and Hazel Street in Van Meter, turn north (left). Continue for 0.3 miles.

* Curve to the east (right) on Main Street. Continue for 0.2 miles.

* At stop sign, continue east (straight ahead) on Main for 0.2 miles.

* At junction with Mill Street, turn north (left) and cross railroad tracks and the Raccoon River. This is County Road R-16 (paved). Continue north for one mile to Interstate 80, noting exposures east of the road, including Labette sandstone and coal, and Higginsville Limestone, especially in the vicinity of the Interstate.

* Cross Interstate 80 and continue north for a mile to Stop Two along the east side of R-16.

STOP TWO: We will park along the east shoulder of the road. Overflow vehicles can park along the private drive immediately north of the cut. Pull as far to the right side of the drive as possible.

* CAUTION: We will need to turn around here. Proceed to the end of the drive where it makes a circle. Watch carefully for cross-traffic on the county road.

* Head south on R-16 for about 3.5 miles, crossing I-80 and passing through Van Meter, to F-90.

* At junction with F-90, turn east (left). Continue for two miles to gravel road intersection.

* At junction with Badger Creek corner, turn south (right). Continue for 2.8 miles to Badger Creek State Recreational Area, on the west side (right).

LUNCH at Badger Creek State Recreational Area.

* Return to F-90 via gravel road for 2.8 miles, noting an exposure of Labette sandstone and shale along the east side of the road.

* At junction with F-90, turn east (right). Continue for 1.5 miles to Booneville.

* At junction with County road R-22 (paved) in Booneville, turn north (left) on R-22 and then immediately east (right) on High Street. Park here and proceed on foot along R-22 up hill to Stop 3.

STOP THREE: Roadcut on the north edge of Booneville.

* Continue east on High Street to Walnut Street and turn left. Continue easterly on the gravel road for 0.5 miles to Stop 4.

STOP FOUR: Second roadcut east of Booneville.

* Continue east on the gravel road for one mile to next stop.

STOP FIVE: Third roadcut east of Booneville.

* Continue east on gravel road (which becomes a mud road) for about three miles to the last stop.

STOP SIX: Field exposure north of gravel road. This is about a mile west of Interstate 35. The site will be muddy.

CAUTION: The road is fairly heavily travelled, pull off as far as possible.

* End of trip. Interstate 35 can be reached to the east.

STOP ONE
Northwest of Van Meter
gravel road cut
SE 1/4, SE 1/4, Sec. 20 and SW 1/4, SW 1/4, Sec. 21, T78N, R27W

Pennsylvanian System

Desmoinesian Series

Marmaton Group

Bandera Shale

at least 12' of greenish-gray shale, reddish at base, some fossils, brachiopods, crinoid columns, gastropods, nautiloids.

Pawnee Formation

Coal City Limestone Member

3' of highly weathered sandy limestone, brown at top, gray toward base, some small fossils.

Mine Creek Shale Member

3.5' red to gray shale.

10" brown sandstone.

3.75' greenish shale.

8" brown sandstone, ripple marks, plant fossils.

16.3' gray to green shale, red in places.

Myrick Station Limestone Member

10" brown to dark gray sandy limestone, massive bedded, fossils.

Anna Shale Member

5" black shale, dark gray at top and base, conodonts.

Labette Shale

1.25" greenish gray shale.

9" brown sandstone, plant fossils.

6' gray to brown shale, septarian nodules.

1.25' of brown sandstone, plant fragments.

4.1' gray to brown shale with coal smuts in middle.

8" brown sandstone, plant fossils.

2' gray-brown shale, plant fossils.

1' brown sandstone, plant fossils.

4' thin brown sandstone and brown sandy shale, good plant fossils.

1.5' thin bedded brown sandstone, plant fossils.

3.5' gray-brown shale.

Marshall Coal Member

1' coal, selenite crystals.

4.5' brown shale, plant fossils, grayish near top, sandy at base.

Stephens Forest Formation

Higginsville Limestone Member

3' brown to gray limestone, nodular at top, massive at base, abundant brachiopods.

Unnamed Shale Member

5' gray-brown shale, fossils.

4.5' red shale.

Houx Limestone Member

6" maximum, brown limestone, discontinuous, brachiopods.

Little Osage Shale Member

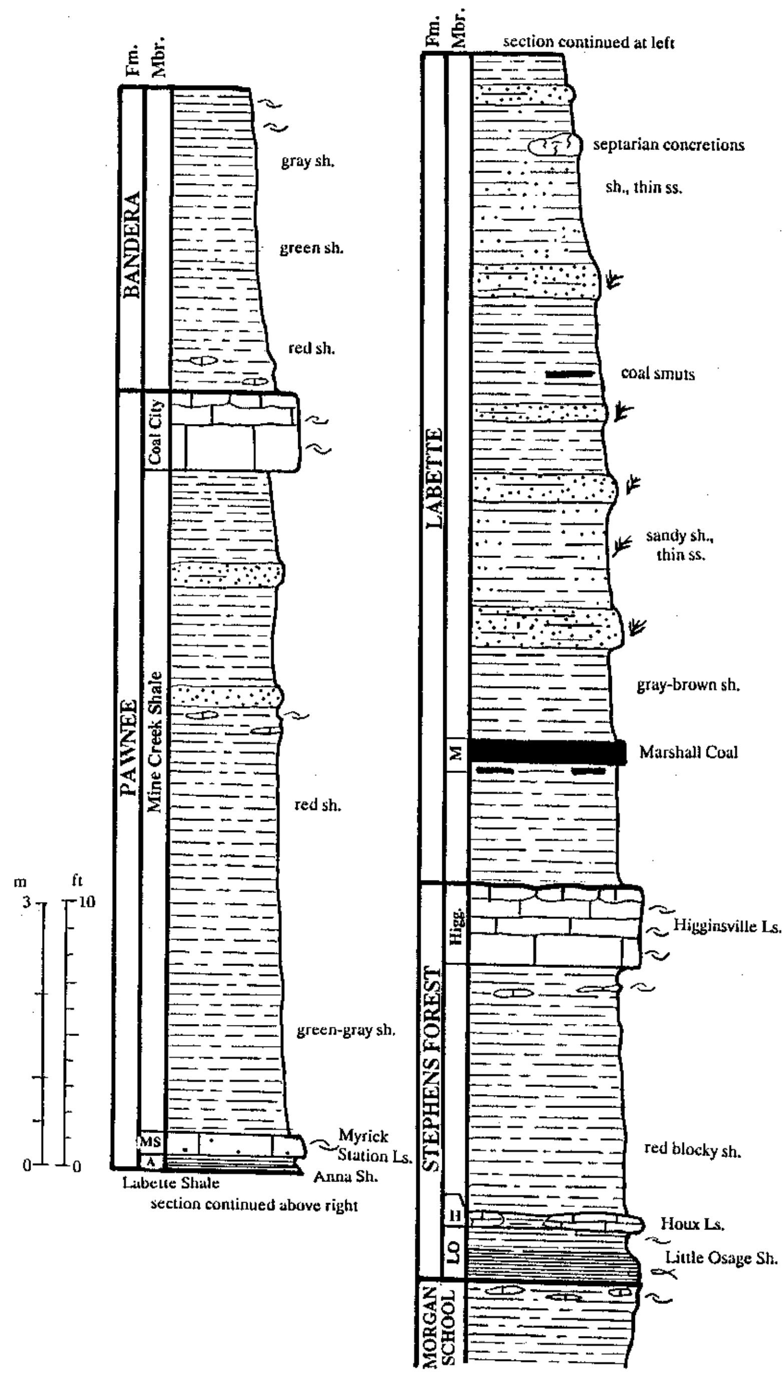
1' gray green shale, brachiopods.

1' black shale, fish fragments, calcium phosphate nodules.

Morgan School Shale

3' at least, gray green shale, red toward base, fossiliferous, very abundant brachiopods in upper part.

STOP 1


Fm.
Mbr.
BANDERA
gray sh.
green sh.
red sh.
Coal City
PAWNEE
Mine Creek Shale
red sh.
green-gray sh.
MS
A
Myrick Station Ls.
Anna Sh.
Labette Shale
section continued above right
m
ft
3
10
0
0
Fm.
Mbr.
section continued at left
septarian concretions
sh., thin ss.
coal smuts
LABETTE
sandy sh., thin ss.
gray-brown sh.
M
Marshall Coal
STEPHENS FOREST
Higg.
Higginsville Ls.
red blocky sh.
H
Houx Ls.
LO
Little Osage Sh.
MORGAN SCHOOL

STOP TWO
Roadcut two miles north of Van Meter
on County Road R-16
SE 1/4, SW 1/4, Sec. 10, T78N, R27W

Pennsylvanian System

Desmoinesian Series

Marmaton Group

Labette Shale

3.5' brown sandstone, plant fossils.

3' brown shaley sandstone.

2.3' brown sandstone, plant fossils.

1' brown shaley sandstone.

10" brown sandstone, plant fossils, cross-bedded in upper part.

6" brown shaley sandstone.

10" brown sandstone, plant fossils, cross-bedded in upper part.

5" brown shaley sandstone.

6" brown sandy shale.

2.5' dark gray to black to brown shale.

3" brown sandstone, shale, coal, plant fossils.

5' gray brown shale.

Marshall Coal Member

6" gray brown shale, coal smuts.

1.5' brown shale.

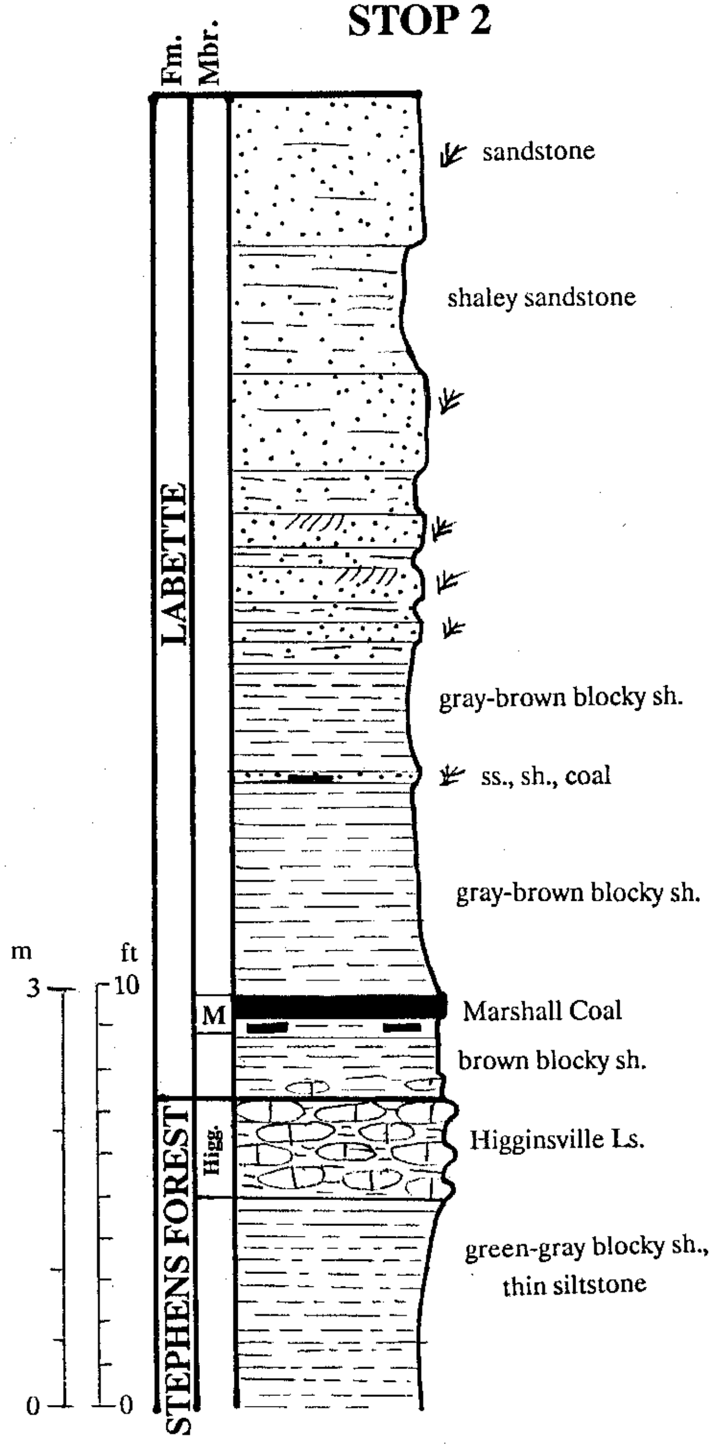
Stephens Forest Formation

Higginsville Limestone Member

2.1' nodular brown limestone and shale, brachiopod fragments.

5' greenish gray shale, thin siltstones.

STOP 2


Fm.
Mbr.
sandstone
shaley sandstone
gray-brown blocky sh.
ss., sh., coal
gray-brown blocky sh.
Marshall Coal
brown blocky sh.
Higginsville Ls.
green-gray blocky sh.,
thin siltstone
LABETTE
STEPHENS FOREST
M
Higg.
m
ft
3
10
0
0

STOP THREE
Roadcut north edge of Booneville
SW 1/4, NW 1/4, Sec. 29, T78N, R26W

Pennsylvanian Period

Desmoinesian Series

Marmaton Group

Labette Shale

10' at least, brown sandstone, some layers more resistant to weathering than others, cross bedding, middle part of roadcut.

3" gray shale, brachiopods, crinoid columns.

8.5' black, fissile shale.

4" gray shale.

1.4' black fissile shale.

2' gray brown shale.

Marshall Coal Member

5" coal.

5.5' dark gray shale.

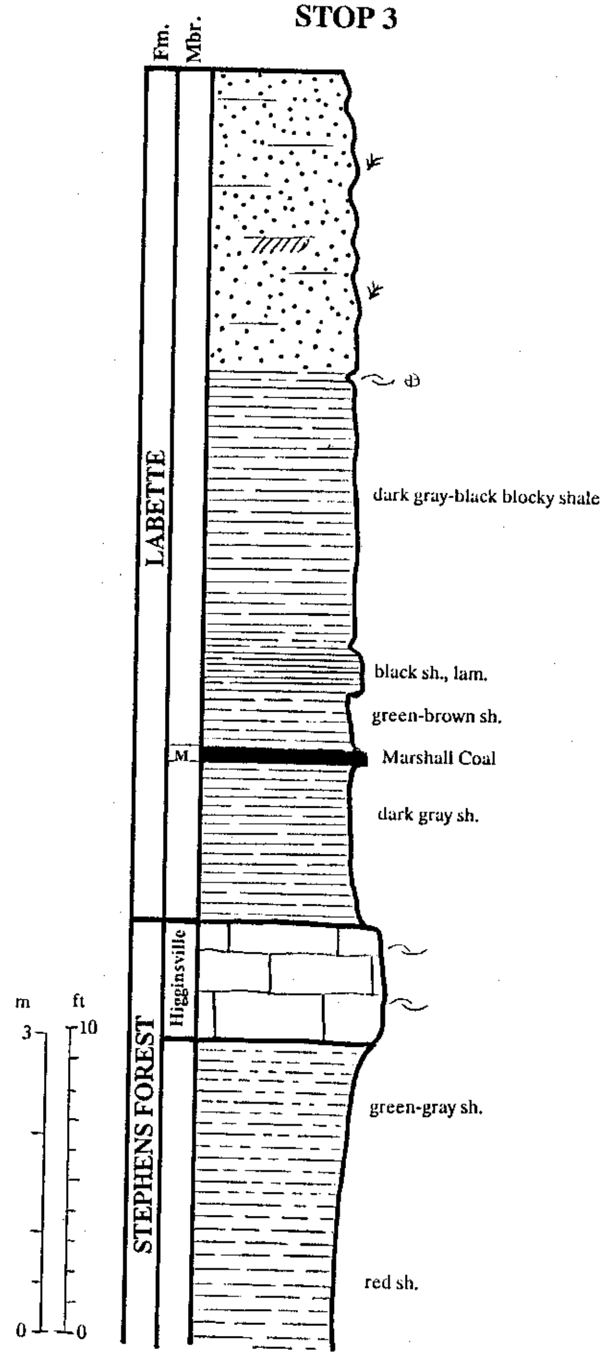
Stephens Forest Formation

Higgensville Limestone Member

4' of bedded to massive limestone, gray to brown, abundant brachiopods.

10' shale, upper half gray-green, lower half red, exposed at south end of cut, east side of road.

STOP 3



Fm.
Mbr.
LABETTE
STEPHENS FOREST
Higginsville
M
dark gray-black blocky shale
black sh., lam.
green-brown sh.
Marshall Coal
dark gray sh.
green-gray sh.
red sh.
m
ft
3
10
0
0

STOP FOUR
Second roadcut east of Booneville
NW 1/4, NE 1/4, Sec. 29, T78N, R26W

Pennsylvanian Period

Desmoinesian Series

Marmaton Group

Stephens Forest Formation

Unnamed Shale Member

2' or so red shale, not well exposed, upper part of cut, east end.

Little Osage Shale Member

1' or so black shale, upper part of cut, east end.

Morgan School Shale

3' gray shale with limestone lenses, highly fossiliferous, brachiopods.

Mouse Creek Formation

Blackjack Creek Limestone Member

2.5' brown limestone, highly eroded, base is grayish, quite fossiliferous in places, nodular.

Excello Shale Member

3' gray-green shale, with calcareous nodules, quite fossiliferous, brachiopods, bryozoans, foraminifers.

1.5' black fissile shale with calareous lenses at base, calcium phosphate nodules.

Cherokee Group

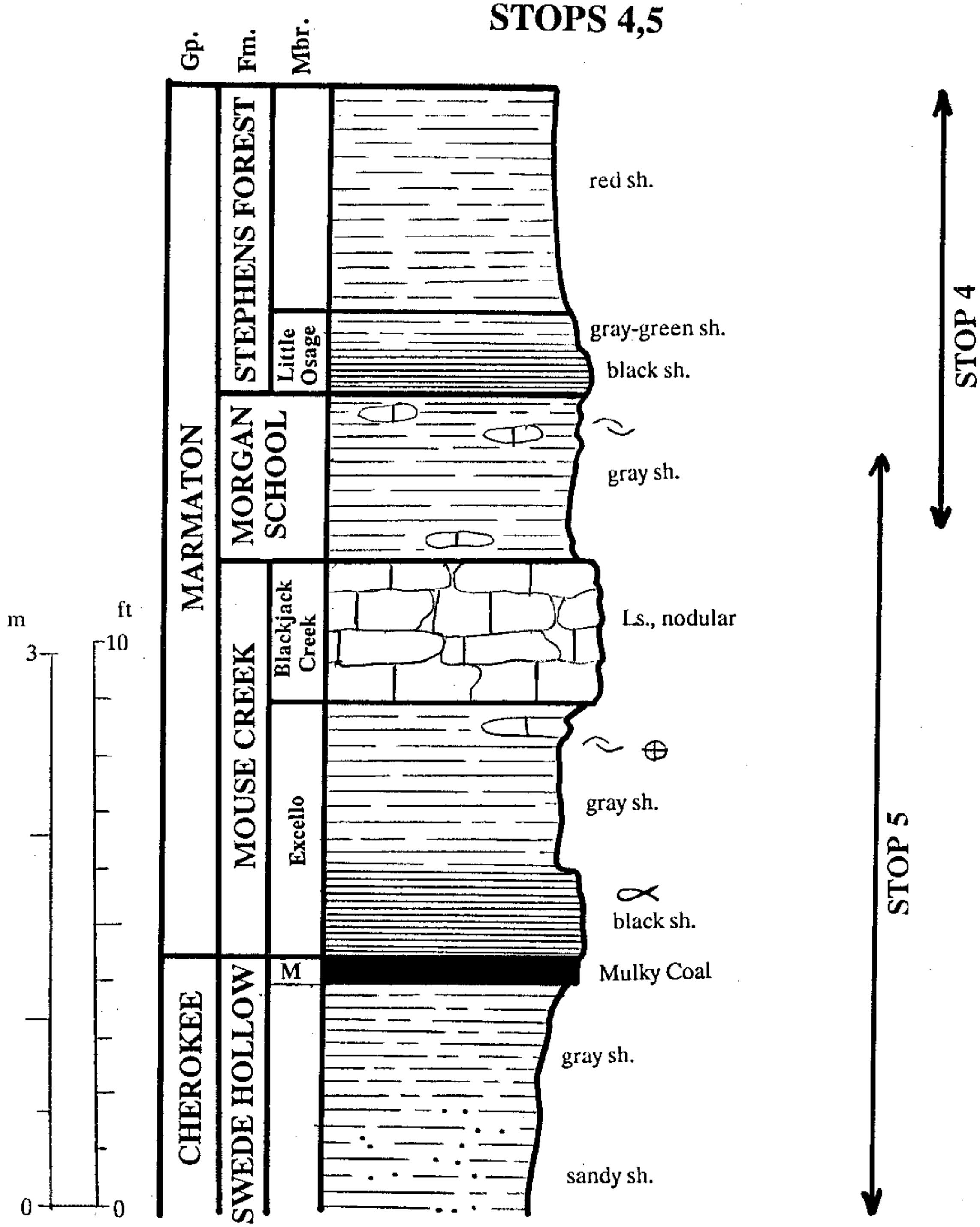
Swede Hollow Formation

Mulky Coal

6" coal.

4' gray shale, sandy toward base, septarian nodules.

STOPS 4,5


Gp.
Fm.
Mbr.
MARMATON
CHEROKEE
STEPHENS FOREST
MORGAN SCHOOL
MOUSE CREEK
SWEDE HOLLOW
Little Osage
Blackjack Creek
Excello
M
red sh.
gray-green sh.
black sh.
gray sh.
Ls., nodular
gray sh.
black sh.
Mulky Coal
gray sh.
sandy sh.
m
ft
3
10
0
0
STOP 4
STOP 5

STOP FIVE
Third roadcut east of Booneville
SW 1/4, Sec. 21, T78N, R26W

Pennsylvanian Period

Desmoinesian Series

Marmaton Group

Morgan School Shale

a few feet of grayish shale, poorly exposed.

Mouse Creek Formation

Blackjack Creek Limestone Member

2.5' highly eroded limestone, nodular, brown at top, gray toward base, quite fossiliferous in places including ostracods.

Excello Shale Member

3' gray shale, not well exposed, quite fossiliferous, brachiopods, crinoid columns, occasional trilobite fragments.

1.5' black shale, fissile in places, with limestone nodules at base, nodules occasionally have fish fragments and inarticulated brachiopods.

Cherokee Group

Swede Hollow Formation

Mulky Coal

6" coal.

4' gray shale, sandy toward base.

STOP SIX
Field exposure 1 mile west of Interstate 35
east of Booneville
east center of E 1/2, SE 1/2, Sec 24, T78N, R26W

Pennsylvanian Period

Desmoinesian Series

Marmaton Group

Mouse Creek Formation

Blackjack Creek Limestone Member

3' of gray to brown limestone, nodular, top of exposure to the north.

Excello Shale Member

1.5' gray shale.

6" black fissile shale.

Cherokee Group

Swede Hollow Formation

Mulky Coal Member

6" coal.

12' gray sandy shale, limonitic concretions.

4' gray green shale, limonitic concretions.

4' red shale.

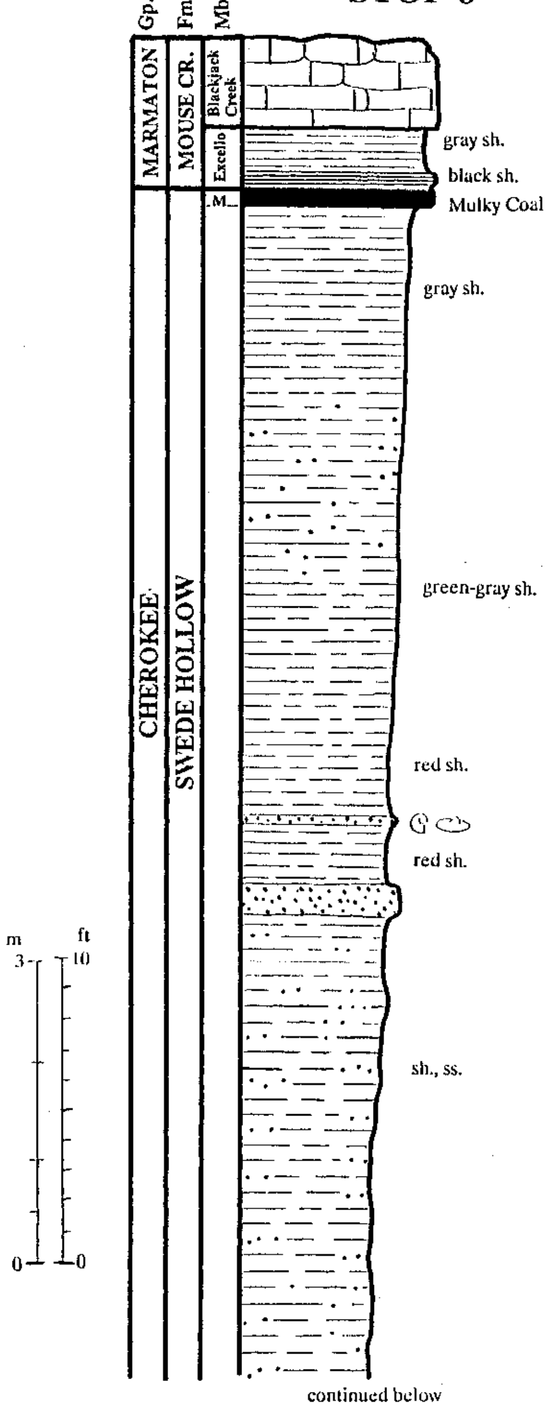
2" red brown muddy sandstone, gastropods, pelecypods, abundant burrows.

2' red shale.

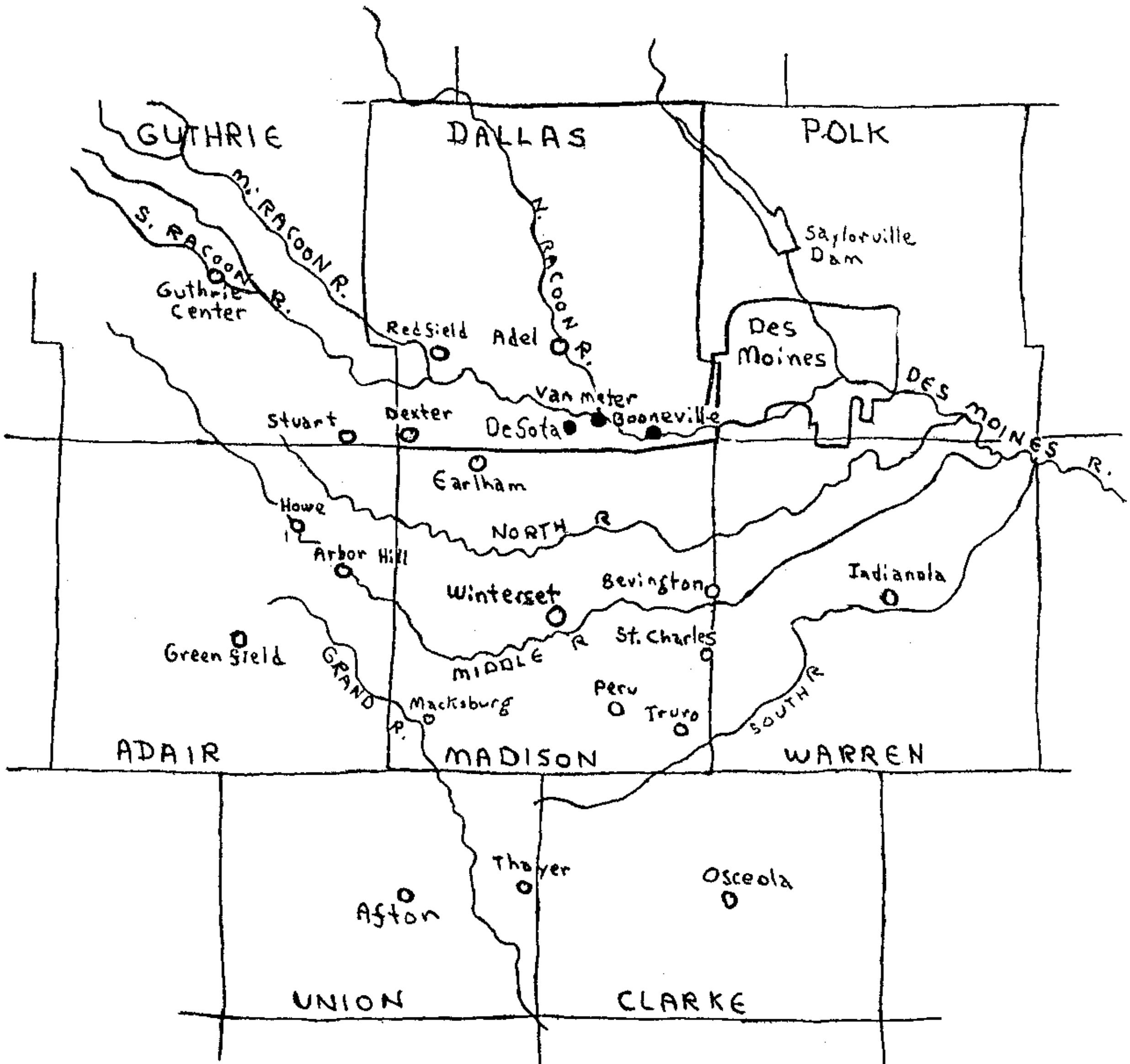
1' brown to gray, dense, massive sandstone.

25' gray to green shale, sandstone, and limestone nodules.

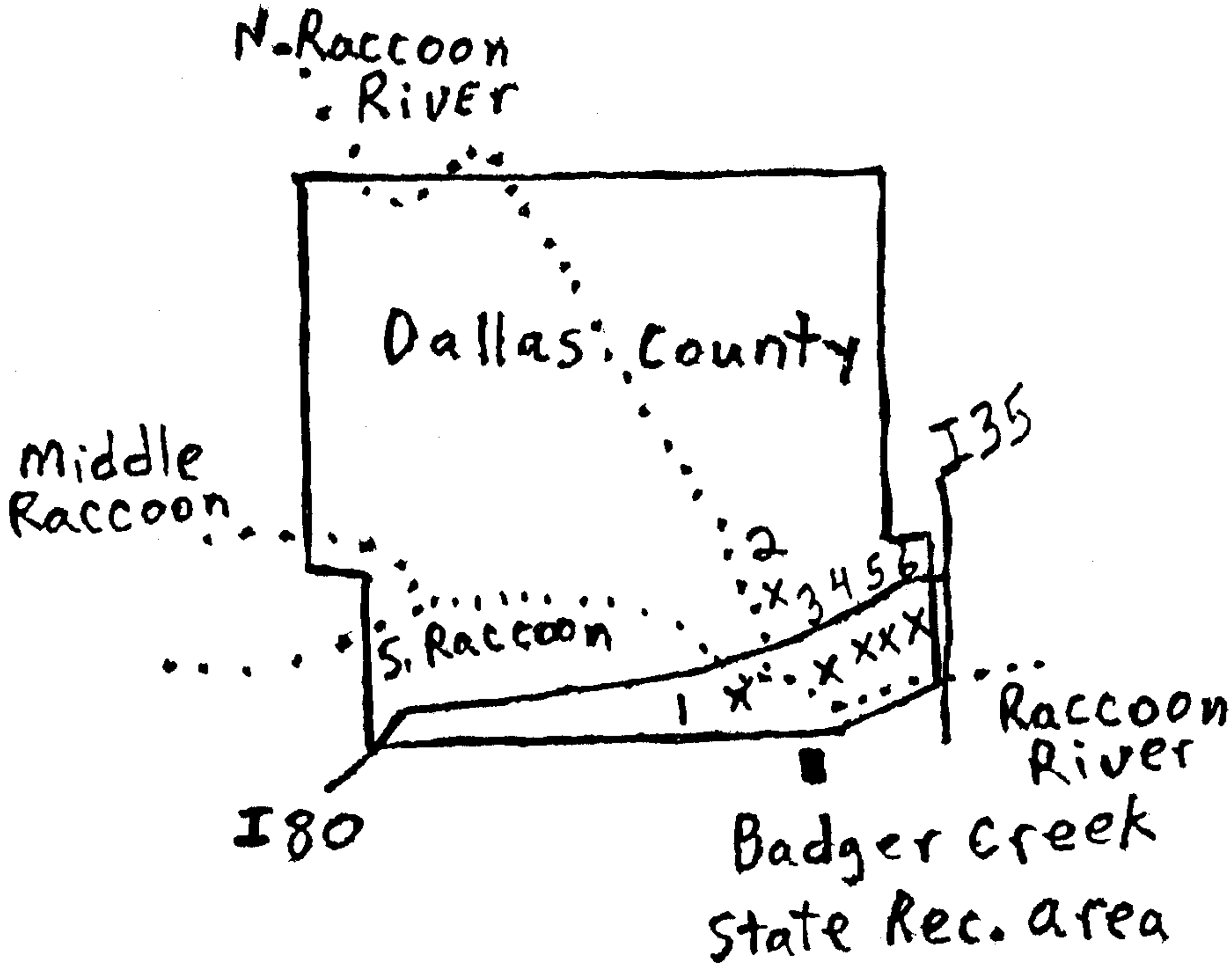
STOP 6



Gp.
Fm.
Mbr.
MARMATON
MOUSE CR.
Blackjack Creek
Excello
M
CHEROKEE
SWEDE HOLLOW
gray sh.
black sh.
Mulky Coal
gray sh.
green-gray sh.
red sh.
red sh.
sh., ss.
m
ft
3
10
0
0
continued below



Relationship of field guide area to other South-Central Iowa Pennsylvanian exposures.



Geological Society of Iowa
%Iowa Department of Natural Resources
Geological Survey Bureau
123 North Capitol Street
Iowa City, Iowa 52242