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GUIDE LEAFLET 1971-E

GUIDE LEAFLET

GEOLOGICAL SCIENCE FIELD TRIP

MT. STERLING AREA

Brown, Adams, Pike, and Schuyler Counties

Mt. Sterling, Meredosia, Rushville, and Augusta 15-Minute Quadrangles

David L. Reinertsen, Dwain J. Berggren,
and Myrna M. Killey

Host—Brown County Community High School *September 25, 1971*

Sponsored by the
ILLINOIS STATE GEOLOGICAL SURVEY *Urbana 61801*

TO THE PARTICIPANTS:

The Geological Science Field Trip program is designed to acquaint Illinois residents with the landscape, the rock and mineral resources, and the geological processes that have led to their origin. With this program, we hope to stimulate a general interest in the geology of Illinois and a greater appreciation of the state's vast mineral resources and their importance to the over-all economy.

We encourage you to ask the tour leaders any questions that may occur to you during the trip. Discussion often clarifies points that otherwise would remain confused to many of the participants. We also invite your written comments upon the conduct of the trips so that we might improve them as much as possible.

Additional copies of this guide leaflet, as well as itineraries for field trips that have been held in the past, may be obtained free of charge by writing to the Illinois State Geological Survey. The itinerary maps for each field trip can be purchased for 10 cents each.

Several of the stops along this itinerary are located on private property whose owners have graciously given us permission to visit their lands. Please obey the instructions of your trip leaders and conduct yourselves in a manner that will show respect for the property owners' cooperation. Please do not litter, or climb on fences, and leave all gates as found, so that we may be welcome to return on future field trips. These simple rules of courtesy also apply to public property as well. For the convenience of those persons who may use this itinerary at some future time, the names and addresses of every private property owner are listed for the respective stops on a page at the back of this guide leaflet. Whenever possible, always attempt to obtain permission when visiting private property.

We hope that you enjoy today's field trip and will attend others in the future.

THE STAFF
EDUCATIONAL EXTENSION SECTION
ILLINOIS STATE GEOLOGICAL SURVEY

MT. STERLING GEOLOGICAL SCIENCE FIELD TRIP

Introduction

The Mt. Sterling area is not one geographical province but three. The illustration "Physiographic Divisions of Illinois" at the end of the leaflet shows that the largest part of the area, that part east of the Illinoian Mendon Moraine on the itinerary map, lies along the southwestern edge of the Galesburg Plain. West of the Mendon Moraine, the area can be divided between two other physiographic provinces: the Lincoln Hills Section to the south and the Dissected Till Plains Section to the northwest--the boundary between these on the itinerary map being the dotted northern outcrop line of the Cretaceous System.

The Galesburg Plain is generally characterized by level or slightly rolling prairies developed on Illinoian drift. The Dissected Till Plains Section is a valley-cut upland formed on the older Kansan till. Most of it is west of the Mississippi River. The Lincoln Hills Section is a bedrock plateau, expressed as a stream-cut ridge in this area.

In other areas the landscape of each province is unique, but in the Mt. Sterling area they seem much alike. Although parts of the Cretaceous ridge in the southwestern portion of the area are about 100 feet higher than the area's general relief, the rather gentle slopes make this difference in elevation not readily discernible. In addition, streams cutting headward into the upland and those resulting from release of ponded glacial meltwaters have deeply dissected and obscured slight provincial surface differences and produced a land surface having a fairly uniform texture of valleys and hills.

The foundation of the present topography is a succession of Paleozoic sedimentary rocks and a single sedimentary formation of Cretaceous (Mesozoic age) (fig. 1). The Paleozoic strata are 3,200 to 3,500 feet thick in this area. The upper layers--the limestones, dolomites, shales, sandstones, and coals of the Valmeyeran Series (middle Mississippian) and the lower part of the Pennsylvanian System--crop out in almost every stream valley (fig. 2). These strata dip about 8 feet per mile southeastward from the Mississippi River Arch toward the Illinois Basin, a large shallow, spoon-shaped depression that extends into southwestern Indiana and western Kentucky (figs. 3 and 4). The deepest part of this basin is located in southeastern Illinois, where bedrock strata are nearly 14,000 feet thick. In the Mt. Sterling area, the thinner strata of the basin's western shelf are folded locally into small structures that have produced some oil and gas.

The Mt. Sterling area rose above sea level long before the Mesozoic Era, which is represented in the region by the gravel, sand and clay that compose the Baylis Formation of Cretaceous age. The Baylis Formation is probably not more than 100 feet thick and forms the top of a ridge extending northwest-southeast for about 25 miles between Liberty and Pittsfield. This Liberty-Pittsfield ridge has been a drainage divide since preglacial times, and its modest elevation seems to have been sufficient to deflect the advances of the glaciers reaching its higher southern half.

At the beginning of the Pleistocene Period a million or more years ago, the Mt. Sterling area seems to have been the southern edge of a bedrock upland cut by deep, mature valleys and flanked on the southwest by the slightly higher Liberty-Pittsfield ridge. Nebraskan outwash from the northwest has been found in the region, but the only glaciers known to have entered the area were the Kansan, advancing from the northwest between 700,000 and 500,000 years ago, and the first Illinoian glacier (the Liman), perhaps 200,000 years later. (See diagrams following page 4.) Both glaciers were

SYSTEM	SERIES	GROUP, STAGE	FORMATION, MEMBER	ROCK TYPE	MAX. THICKNESS	DESCRIPTION
QUAT.	Pleist.	Wisconsinan St.			40'	Loess, silt
		Illinoian St.			30'	Till, outwash gravel, sand, silt, clay
		Kansan St.			15'	Till, outwash gravel, sand
CRETACEOUS			Baylis Fm.		60'	Sand, basal gravel
PENNSYLVANIAN		McLeansboro Gr.	Farmington Sh Mbr.			
		Kewanee Gr.	No. 7 Coal Mbr. No. 6 Coal Mbr. No. 5 Coal Mbr. Hanover Ls. Mbr. Pleasantview Ss. Mbr. Purington Sh. Mbr. Oak Grove Ls. Mbr. No. 2 Coal Mbr.		130'	Sandstone, shale, limestone, coal, underclay
		McCormick Gr.	Babylon Ss. Mbr.			
MISSISSIPPIAN	Valmeyeran		St. Louis Fm.		25'	Limestone
			Salem Fm.		30'	Limestone, dolomite
			Sonora & Warsaw Fm.		80'	Shale, dolomite, sandstone; geodes
			Keokuk - Burlington Fm.		210'	Limestone, dolomitic, very cherty
	Kind.	New	Hannibal Fm.		100'	Shale
DEVONIAN		Albany Gr.	Saverton Fm. Grassy Creek Fm. Sweetland Crk. Fm.		120'	Shale
SILURIAN	Niag. Al.				135'	Limestone, dolomite, some chert
ORDOVICIAN	Cincinnatian	Maquoketa Gr.			175'	Shale, siltstone, some limestone and dolomite
	Champlainian	Galena Gr.			190'	Limestone, some chert
		Platteville Gr.			135'	Dolomite, limestone, some chert
		Ancell Gr.			200'	Sandstone, some shale
Older Ordovician and Cambrian strata (undifferentiated)					1850'	Dolomite, limestone, sandstone, shale, conglomerate
PRECAMBRIAN SYSTEM						Granite, other igneous and metamorphic rocks

Fig. 1 - Generalized geologic column of strata in the Mt. Sterling area.

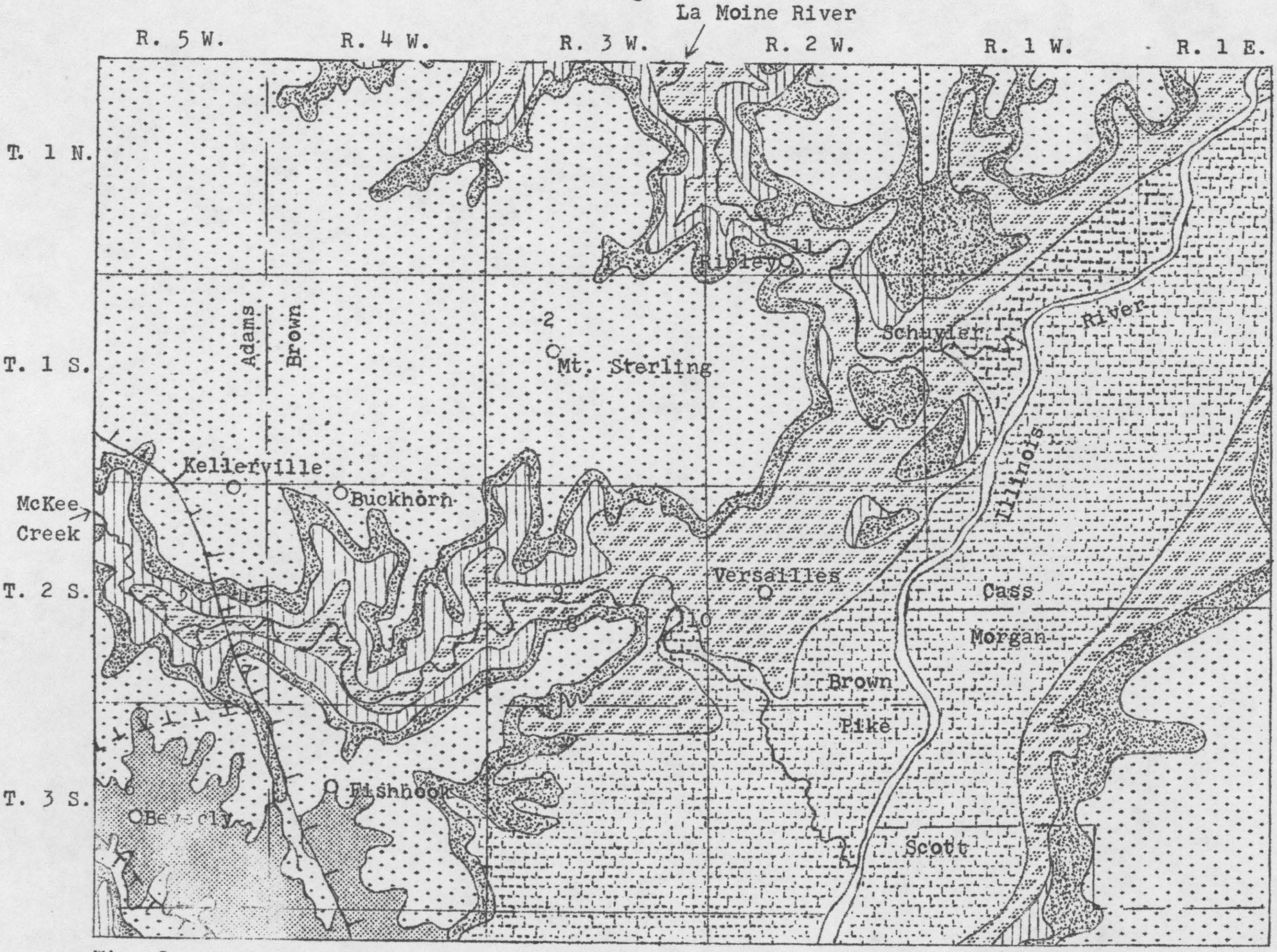


Fig. 2 - Geologic map of the bedrock formations in the Mt. Sterling area. Numbers on map refer to itinerary stops.

PLEISTOCENE

- Illinoian
- Kansan

CRETACEOUS

- Baylis

PENNSYLVANIAN

- Carbondale
- Spoon

MISSISSIPPIAN

- Upper part of Valmeyeran
- Middle part of Valmeyeran
- Lower part of Valmeyeran

Scale

0 3 6

Miles

Fig. 3 - Index map with locations of (1) Fishhook Anticline, (2) Pittsfield Anticline, (3) Mississippi River Arch, and (4) Illinois Basin.

relatively weak and both reached the limits of their advance in this area, but no evidence exists to show that they pushed up onto the higher southern part of the Liberty-Pittsfield ridge.

Although some valley fillings are more than 100 feet thick, the average thickness of glacial drift in this region probably is less than 50 feet. The original thickness of the Kansan and Illinoian drifts was probably much more. The Illinoian drift, at least, probably stood as high as the tops of the flat ridges in the area drained by McKee Creek and as the flat uplands west of Mt. Sterling, which are at nearly the same elevation. Since the Liberty-Pittsfield ridge to the southwest and the upland to the north blocked drainage in all directions except east or southeast, and since drainage in these directions was encouraged by the rather high fall from the upland to the Illinois River, it seems reasonable to think that a number of streams have rather quickly trenched their way through drift sheets several times and have fallen into old southeast-trending preglacial stream courses. However, McKee Creek flows generally eastward along a tortuous course of an alternating narrow and wide valley (see itinerary map). The valley is narrow where the stream has cut through the glacial till and into bedrock, thus forming a permanent channel. In areas where the creek has cut into preglacial channels filled with softer materials, lateral erosion produced wider valley bottoms and young flood plains.

During the Wisconsinan glaciations, 4 to 8 feet of loess was deposited on the uplands. The loesses thicken toward the Illinois River Valley, often attaining a thickness of more than 25 feet on the valley bluffs. The soils on the uplands of the Mt. Sterling area are developed on loess.

Glacial History of Illinois

In the past million or so years--during the Pleistocene Epoch--much of northern North America has been repeatedly covered by huge glaciers. These glaciers formed in eastern and central Canada at times when the climate was perhaps 4° to 7° Centigrade cooler than it is now and the winter snows did not completely melt during the summers. After many years of these conditions, masses of compressed snow and ice accumulated that were so thick their weight caused them to flow hundreds of miles outward from their snow fields, carrying with them the soil and rocks they moved over.

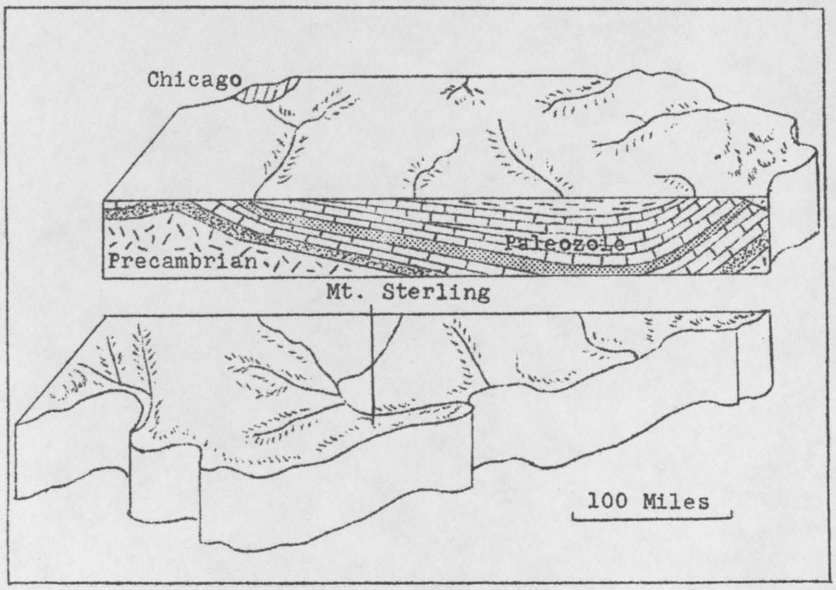
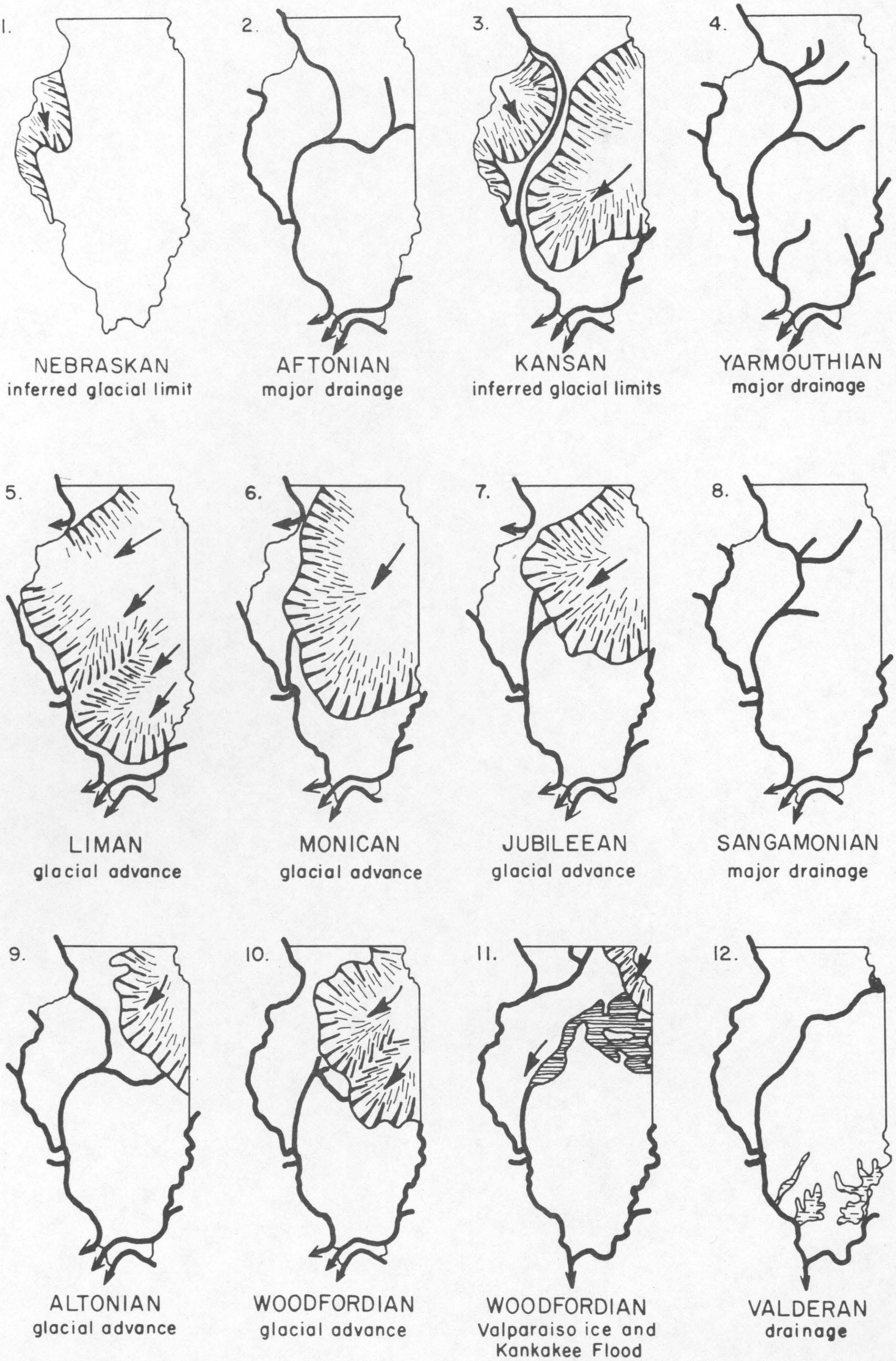


Fig. 4 - North-south cross-section through Illinois showing the Paleozoic strata in the Illinois Basin.

Figure 5 shows the maximum advance of the glaciers that entered Illinois and adjoining states from two Canadian centers. (A third center, between these two, existed later.) The glaciers

SEQUENCE OF GLACIATIONS AND INTERGLACIAL DRAINAGE IN ILLINOIS



(From Willman and Frye, "Pleistocene Stratigraphy of Illinois," ISGS Bull. 94, fig. 5, 1970.)

Fig. 5 - Maximum extent of the Laurentide Ice Sheet. The Kee-Watin (K) and the Labradorean (L) centers are shown.

from these centers converged in the central lowland between the Appalachian and Rocky Mountains. Flowing into this continental trough, which has been occupied since Paleozoic times by America's largest river systems, the glaciers made their farthest advance to the south. Because Illinois lies entirely in the central lowland, it has the distinction of having been invaded by glaciers from every center--from the first glaciation about a million years ago to the last, a mere 12,500 years ago.

Pleistocene glaciers changed the landscape they covered. They scraped and smeared, leveled and filled the landforms they overrode. They moved colossal amounts of rock and earth, for much of what they wore off the ground was kneaded into their ice and carried along, often for hundreds of miles. The continual floods shed by melting ice trenched new drainageways and washed great quantities of rock and earth materials beyond the glacier fronts. In most of Illinois, then, glaciers and their meltwaters buried the old rock-ribbed, hill-and-valley terrain, creating the gentle landforms of our prairies and the rivers that drain them.

The deposits of earth and rock materials moved by a glacier and deposited as the glacier advances or melts are called drift. If drift is found to be ice-laid, it is called till. Water-laid drift is called outwash. Pleistocene glaciations created many till and outwash forms that can still be recognized.

Ice-laid drift--till--is deposited both directly by the ice (plastering action) and by melting of the ice, which causes the rock and earth it carries to slump to the ground. Because its sediments simply drop from the ice, a till is unsorted (contains particles of different sizes and compositions) and unstratified (unlayered). A till may contain materials ranging in size from microscopic clay particles to large boulders. However, tills in Illinois generally occur as pebbly clays.

Tills may be deposited as end moraines, the arc-shaped ridges that pile up along the glacier edges that are melting as fast as the ice moves forward. Till also may be deposited as ground moraines, or till plains, gently undulating plains that occur behind the end moraines. Deposits of till identify places once covered by glaciers. Northeastern Illinois has many broad ridges alternating with level tracts, and these are a succession of end moraines and till plains deposited by the Wisconsinan glacier (see "Glacial Map of Northeastern Illinois" at the end of the leaflet).

Sorted and stratified drift carried into place by water melting off the glacier is called outwash. As a meltwater stream washes the drift sediments, it sorts them by size--lighter sands and clays tend to be carried farther downstream than heavier gravels and cobbles. Outwashes are bedded or layered because the flow of water carrying them changes. If the water flow depositing sand in a particular place increases and runs faster, it can carry heavier sediments farther and, perhaps, deposit gravel over the sand. Typically, Pleistocene outwashes in Illinois are multi-layered beds of clays, silts, sands, and gravels that look much like modern stream deposits.

Outwash deposits are found in the area covered by the ice field and sometimes far beyond it. Because meltwater streams run on top of the glacier and in crevasses that provide channels under the ice, outwash features can be found where the glacier lay. In some places, the cobble-gravel-sand filling of the bed of a stream that flowed in the ice is preserved on the till plain as a sinuous ridge called an esker. Coneshaped mounds of coarse outwash, called kames, are formed where meltwater plunged through crevasses in the ice or into ponds along the edge of the glacier.

The finest outwash sediments, the clays and silts, formed bedded deposits in the ponds and lakes that filled glacier-dammed stream valleys, the sags of the till plains, and some low, moraine-diked till plains. Meltwater streams entering a lake quickly lose speed and almost immediately drop the sands and gravels they carry, forming deltas that can often be recognized in outwash deposits. Very fine sand and silts are moved across the lake floor by wind-generated currents, and the clays slowly settle out and accumulate with them.

Beyond the edge of the ice, where a wide front of meltwater runs off in innumerable shifting and short-lived streams, outwash is laid in a thin blanket as an outwash plain. Outwash is also carried away from the glacier in rivers cut by floods of meltwater. The Mississippi, Illinois, and Ohio Rivers were major channels for meltwaters, and were greatly widened and deepened during times of the greatest meltwater floods. When the floods waned, these valleys were partly filled with outwash far beyond the ice margins. These outwash deposits, largely sand and gravel, are known as valley trains. Valley trains may be extensive and thick deposits. For instance, the valley train of the Mississippi Valley is more than 200 feet thick along much of its length.

The amount of water drawn from the sea and precipitated into ice during a glaciation was probably enough to lower sea level an estimated maximum of 450 feet below what it is today. Consequently, the volume of meltwater available from a continental glacier was enough to form vast lakes, to erode large river valleys, and to alter the land surface far beyond the margins of the ice. If all present-day ice caps were to melt, sea level might rise more than 150 feet and flood large low-lying areas of the continents.

One of the most widespread sediments associated with glaciation was carried by neither ice nor water but by wind. Loess, the name given to such deposits of windblown silt, covers the surface of most of Illinois. The silt was blown from flood plains of the valley trains. Most loess deposition occurred in the fall and winter seasons, when cold temperatures stopped the thawing and caused meltwater floods to abate, exposing the surfaces of the valley trains and permitting them to dry out. During Pleistocene time, as now, the west winds prevailed, and the loess deposits are thickest on the east sides of the source valleys. The loess thins rapidly away from the valleys.

Each Pleistocene glaciation was followed by an interglacial stage that began when the climate warmed enough to melt the glaciers and their snowfields. During these warmer intervals, when the climate was similar to that of today, drift and loess surfaces were exposed to weather and used by living things. Consequently, over most of the glaciated terrain that was above water, soils developed on the Pleistocene deposits and changes in composition, color, and texture took place in zones beneath their surfaces. Often such soils were destroyed by later glacial advances, but if they survive, they serve as keys to the identity of the covering beds and are evidence of the passage of a long interval of interglacial time. In the glaciated parts of Illinois, the sides of almost every new roadcut and ditch show soil and weathering zones as wide bands in tones of brown, red, yellow, or gray.

Depositional History of the Mississippian Sedimentary Rocks

Valmeyeran (middle Mississippian) formations form the bedrock surface in part of the Mt. Sterling area (figs. 1 and 2). These strata form part of a thick sequence of Mississippian rocks that occurs in the upper Mississippi Valley, where they have a cumulative thickness of more than 2,000 feet and form the type section for which the Mississippian System of rocks was named. These rocks are predominantly marine limestones and most of them are richly fossiliferous.

During the Mississippian Period, some 350 to 310 million years ago, the mid-continent of North America was a low-lying, stable platform. Throughout the Mississippian Period, as during most of the Paleozoic Era, the Illinois Basin was a slowly subsiding (sinking) area on this platform and in it thick marine strata accumulated. The continental platform was submerged many times by marine invasions during the Cambrian, Ordovician, Silurian, and Devonian Periods. At the close of the Devonian Period the region remained submerged, and with the beginning of the Mississippian Period the shore lay just to the north and northeast of the Illinois Basin. At this time mud was being delivered into the sea by rivers flowing from the north and northeast. As a result, the Kinderhookian formations consist mainly of shale and siltstone (fig. 1). Later, during early Valmeyeran (middle Mississippian) time, the sea on the western shelf of the basin, which includes the Mt. Sterling area, remained clear and mud-free most of the time. In this region the thick Burlington and Keokuk Limestones were deposited. These limestones accumulated in shallow water as a high bank of crinoidal carbonate debris that bordered the deeper part of the basin to the southwest where some mud continued to be deposited.

Later in Valmeyeran time, the sea in the field trip area again became muddy, and the shale and impure limestone and dolomite of the Warsaw Formation were laid down. The muddy sediments of the Warsaw were derived mainly from the east, where a great river was building a delta of sand and silt southwestward across Illinois into the deeper part of the Illinois Basin. As the delta extended westward and was built higher, muddy sediments spilled over the edge of the Burlington-Keokuk crinoidal bank onto the western shelf of the basin. Some muddy sediments were also delivered to the western shelf by rivers from the north and northwest. Near the end of Warsaw deposition these rivers transported much sand into this region, and the quartz sandstone and sandy dolomite of the Sonora Formation were deposited. This sandy formation interfingers with the upper part of the Warsaw Formation and the lower part of the younger Salem Limestone in western Illinois and eastern Iowa. The Mississippian sea then extended far to the north, and for the remainder of Valmeyeran time little mud and sand were deposited in the Mt. Sterling area. The relatively pure Salem and St. Louis Limestones were deposited over enormous areas of the continental platform.

The clear, warm sea in which the Valmeyeran limestones were deposited in the Mt. Sterling area was fairly shallow, probably only a hundred or so feet deep most of the time, and at other times only a few tens of feet and less. Marine animals found the shallow sea ideal for their development. Portions of these limestones consist almost entirely of cemented fossils and fossil fragments, limestone fragments, or oolites, which indicate shallow-water, wave-swept conditions of deposition. Mats and crusts of algal limestone, formed by microscopic, calcium carbonate-secreting algae (primitive plants) are also indicative of such shoal environments.

The Ste. Genevieve Limestone, which occurs above the St. Louis Limestone to the south and southeast, also was deposited in the Mt. Sterling area, as was a thick section of strata belonging to the Chesterian Series (upper Mississippian; see "Geologic Map of Illinois" at the end of this leaflet). However, the Chesterian strata, the Ste. Genevieve Limestone, and most of the St. Louis Limestone have been stripped away by erosion. This erosion occurred principally during an interval of emergence that followed the final withdrawal of the Mississippian sea at the end of Chesterian time and preceded the deposition of the Pennsylvanian rocks.

During the later part of the Mississippian Period (Chesterian time) the sea was less extensive than when the Valmeyeran limestones were deposited. The shoreline shifted southward, and increased amounts of sand and mud were delivered into the Illinois Basin by an ancient river system called the Michigan River. This river system drained a land area to the north and northeast in southern Canada. A great delta much like the present-day Mississippi River delta in Louisiana was built out into the sea. Under the influence of this deltaic environment the amounts of sand and mud fluctuated. As a result, the Chesterian formations consist of regular alternations of sandstone, shale, and limestone. The sandstones and shales record times when the delta extended far out into the sea, while limestones record times when the shoreline receded to the north. In many respects the Chesterian formations resemble the cyclic sediments of the Pennsylvanian System, which overlie the Mississippian strata. Thin coal seams in some of the upper Chesterian sandstones indicate times when the sea withdrew temporarily and plant debris accumulated in fresh-water swamps on the delta. These late Mississippian coal swamps were forerunners of those that occurred more extensively later in the Pennsylvanian Period.

Depositional History of the Pennsylvanian Rocks

Pennsylvanian strata form the surficial bedrock in part of the field trip area (fig. 2). These rocks belong to the Abbott, Spoon, Carbondale, and Modesto Formations. At one time these formations completely covered the field trip area, but locally they have been removed by post-Pennsylvanian erosion.

At the close of the Mississippian Period, about 310 million years ago, the Mississippian sea withdrew from the midcontinent region. A long interval of erosion took place early in Pennsylvanian time. This erosion removed hundreds of feet of the pre-Pennsylvanian strata, completely stripping them away and cutting into older rocks in large areas of the Midwest. An ancient river system cut deep channels into the bedrock surface. Erosion was interrupted by the invasion of the early Pennsylvanian sea.

Depositional conditions in the Illinois Basin during the Pennsylvanian Period were similar to those that existed during late Mississippian time. The Pennsylvanian river system flowed southwestward across a swampy lowland, carrying mud and sand from northern highlands, and a great delta was built out into the shallow sea (fig. 6). The lowland stood only a few feet above sea level, so that only slight changes in relative sea level caused great shifts in the position of the shoreline.

Throughout Pennsylvanian time the Illinois Basin continued to subside. The delta front continually shifted northward and southward due to worldwide sea-level changes, intermittent subsidence of the basin, and variations in the amounts of sediment carried seaward from the land. The areas of land and sea continually changed as the shoreline shifted northward and southward. These alternations between marine and nonmarine conditions were more drastic and frequent than those during Mississippian time, and produced striking lithologic variations in the Pennsylvanian rocks.

Conditions at various places on the shallow sea floor favored the deposition of sandstone, limestone, or shale. Sandstone was deposited near the mouths of distributary channels, where sands were reworked by waves and spread as thin sheets near the shore. The shales were deposited in quiet-water areas--in delta bays between distributaries, in lagoons behind bars, and in deeper water beyond the

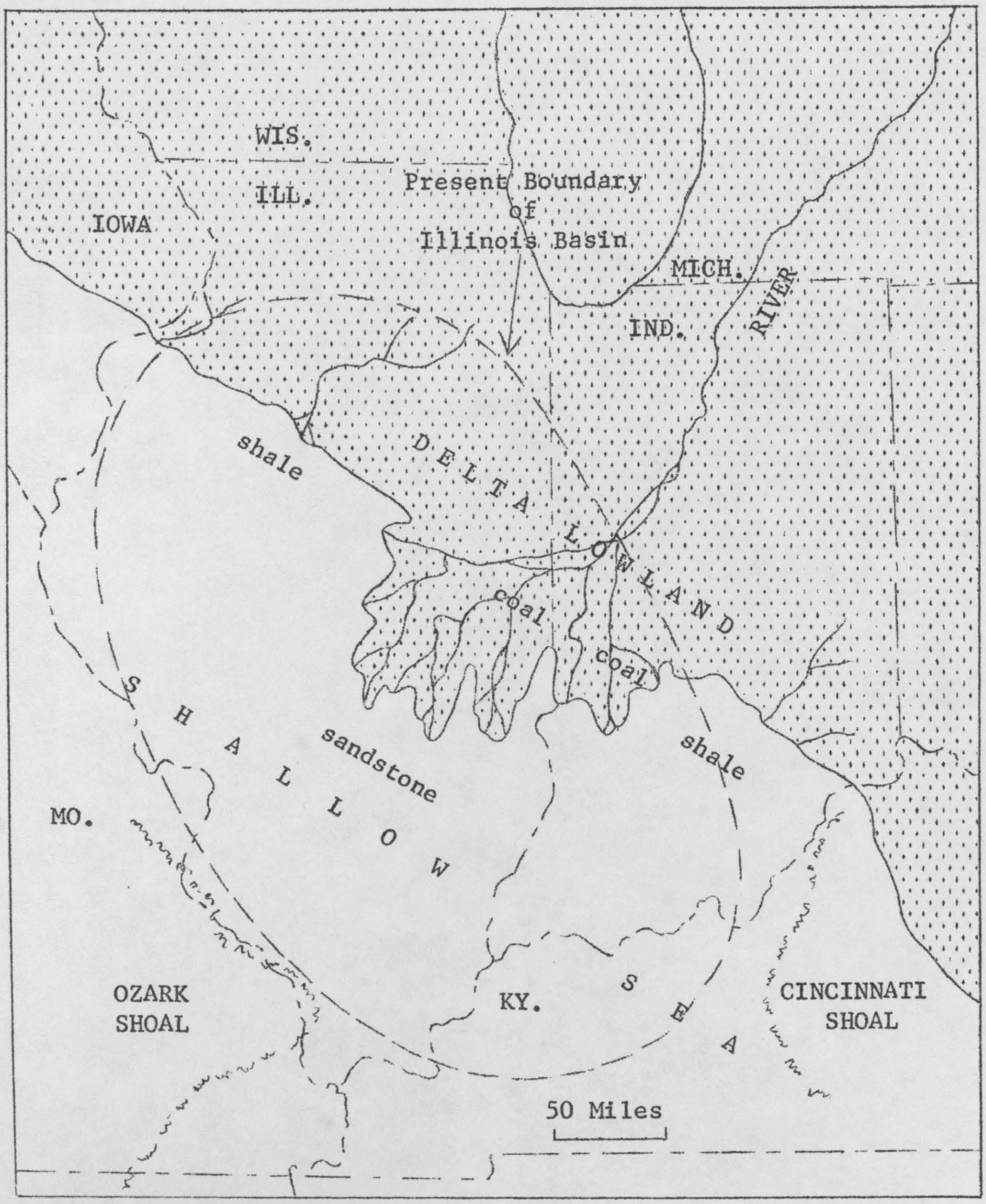


Fig. 6 - Paleogeography of Illinois-Indiana region during Pennsylvanian time. The diagram shows the Pennsylvanian river delta and the position of the shoreline and the sea at an instant of time during the Pennsylvanian Period.

nearshore zone of sand deposition. Limestone, which formed by chemical precipitation from the sea and from the accumulation of limy shells of marine animals, was usually deposited farther from shore than the sandstone and shale, but some limestone was formed in nearshore areas where little sand and mud were being deposited. The areas of sandstone, shale, and limestone deposition continually changed as the position of the shoreline changed and as the delta distributaries extended seaward or shifted their positions laterally along the shore.

Nonmarine sandstones, shales, and limestones were deposited on the deltaic lowland bordering the sea. The nonmarine sandstones were deposited in distributary channels, in river channels, and on the broad flood plains of the rivers. Some sand bodies, 100 or more feet thick, cut through many of the underlying rock units. The shales were deposited mainly on flood plains. Fresh-water limestones and some shales were deposited locally in fresh-water lakes and swamps. The coals were formed by the accumulation of plant material, usually where it grew, beneath the quiet waters of extensive swamps that prevailed for long intervals on the emergent delta lowland. Lush forest vegetation, which thrived in the warm, moist Pennsylvanian climate, covered the region. The origin of the underclays beneath the coals is not known precisely, but they were probably deposited in the swamps as slackwater muds before and during the formation of the coals. The formation of coal marked the end of the nonmarine portion of the depositional cycle. Resubmergence of the borderlands by the sea interrupted nonmarine deposition, and marine sediments were then laid down over the coal.

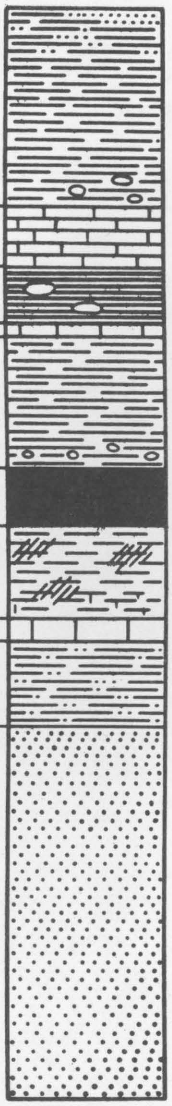
Pennsylvanian Cyclothems

Because of the extremely variable environmental conditions under which they formed, the Pennsylvanian strata exhibit extraordinary variations in thickness and composition, both laterally and vertically. Individual sedimentary units are often only a few inches thick and rarely exceed 30 feet thick. Sandstones, shales, limestones, and coals grade laterally into one another. However, a few of the coals and several of the limestones can be traced in the subsurface throughout large areas of the Midwest.

The rapid and frequent changes in depositional environments during Pennsylvanian time produced regular or cyclical alternations of sandstone, shale, limestone, and coal in response to the shifting front of the Pennsylvanian delta. Each series of alternations, called a cyclothem, consists of several marine and nonmarine rock units that record a complete cycle of marine invasion and retreat. Geologists have determined, after extensive studies of the Pennsylvanian strata in the Midwest, that an ideally complete cyclothem consists of 10 sedimentary units. The chart on the next page shows the arrangement. Approximately 50 cyclothems have been described in the Illinois Basin, but only a few contain all 10 units. Usually one or more are missing because conditions of deposition were more variable than is indicated by the ideal cyclothem. However, the order of units in every cyclothem is almost always the same. A typical cyclothem includes a basal sandstone overlain by an underclay, a coal, a black sheety shale, a marine limestone, and a gray marine shale. In general, the sandstone-underclay-coal portion (the lower 5 units) of each cyclothem is nonmarine and was deposited on the coastal lowlands from which the sea had withdrawn. However, some of the sandstones are entirely or partly marine. The units above the coal are marine sediments and were deposited when the sea advanced over the delta lowland.

Origin of Coal

It is generally accepted that the Pennsylvanian coals originated by the accumulation of vegetable matter, usually in place, beneath the waters of extensive, shallow, fresh to brackish swamps. They represent the last-formed deposits of the nonmarine portions of the cyclothems. The swamps occupied vast areas of the deltaic coastal lowland, which bordered the shallow Pennsylvanian sea. A luxuriant growth of forest plants, many quite different from the plants of today, flourished in the warm Pennsylvanian climate. Today's common deciduous trees were not present, and the flowering plants had not yet evolved. Instead, the jungle-like forests were dominated by giant ancestors of present-day club mosses, horsetails, ferns, conifers, and cycads. The undergrowth also was well developed, consisting of many ferns, fernlike plants, and small club mosses. Most of the plant fossils found in the coals and associated sedimentary rocks show no annual growth rings, suggesting rapid



10 Shale, gray, sandy at top; contains marine fossils and ironstone concretions, especially in lower part.

9 Limestone; contains marine fossils.

8 Shale, black, hard, laminated; contains large spheroidal concretions and marine fossils.

7 Limestone; contains marine fossils.

6 Shale, gray; pyritic nodules and ironstone concretions common at base; plant fossils locally common at base; marine fossils rare.

5 Coal; locally contains clay or shale partings.

4 Underclay, mostly medium to light gray except dark gray at top; upper part noncalcareous, lower part calcareous.

3 Limestone, argillaceous; occurs in nodules or discontinuous beds; usually nonfossiliferous.

2 Shale, gray, sandy.

1 Sandstone, fine-grained, micaceous, and siltstone, argillaceous; variable from massive to thin-bedded; usually with an uneven lower surface.

AN IDEALLY COMPLETE CYCLOTHEM

(Reprinted from Fig. 42, Bulletin No. 66, Geology and Mineral Resources of the Marseilles, Ottawa, and Streator Quadrangles, by H. B. Willman and J. Norman Payne)

(28197–20M–6/66)

growth rates and lack of seasonal variations in the climate. Many of the Pennsylvanian plants, such as the seed ferns, eventually became extinct.

Plant debris from the rapidly growing swamp forests--leaves, twigs, branches, and logs--accumulated as thick mats of peat on the floors of the swamps. Normally, vegetable matter rapidly decays by oxidation, forming water, nitrogen, and carbon dioxide. However, the cover of swamp waters, which were probably stagnant and low in oxygen, prevented the complete oxidation and decay of the peat deposits.

The periodic invasions of the Pennsylvanian sea across the coastal swamps killed the Pennsylvanian forests and initiated marine conditions of deposition. The peat deposits were buried by marine sediments. Following burial, the peat deposits were gradually transformed into coal by slow chemical and physical changes in which pressure (compaction by the enormous weight of overlying sedimentary layers), heat (also due to deep burial), and time were the most important factors. Water and various gaseous substances were slowly driven off during the coalification process, and the peat deposits were changed into coal.

Coals have been classified by ranks that depend on degrees of coalification. The commonly recognized coals, in order of increasing rank, are (1) brown coal or lignite, (2) sub-bituminous, (3) bituminous, (4) semibituminous, (5) semianthracite, and (6) anthracite. Each increase in rank is characterized by larger amounts of fixed carbon and lesser amounts of oxygen and other gases. Hardness of coal also increases with increasing rank. All Illinois coals are classified as bituminous.

Underclays occur beneath most of the coals in Illinois. Because underclays are generally unstratified (unlayered), are leached to a bleached appearance, and generally contain plant roots, many geologists consider that they represent the ancient soils on which the coal-forming plants grew.

The exact origin of the carbonaceous black shales that occur above many coals is uncertain. The black shales probably are deposits formed under restricted marine (lagoonal) conditions during the initial part of the invasion cycle, when the region was partly closed off from the open sea. In any case, they were deposited in quiet-water areas where very fine, iron-rich muds and finely divided plant debris were washed in from the land. The high organic content of the black shales is also in part due to the carbonaceous remains of plants and animals that lived in the lagoons. The fossil remains of animals in the black shales are sometimes depauperate (dwarf) because they were stunted by toxic conditions in the sulfide-rich waters of the lagoons. The phosphatic siderite nodules that occur in the black shales were formed by chemical precipitation of calcium carbonate, iron carbonate (siderite), and phosphate from the brackish lagoonal waters. These features suggest slow rates of shale deposition.

Mineral Production and Resources

Minerals produced in Illinois during 1969 set a record high value of $692.9 million, an increase of $22.3 million (or 3.3 percent) over the total for 1968. This was the fourteenth year that mineral production in Illinois exceeded $600 million. In mineral production, the state led the Upper Mississippi Valley region and was eighth in the nation. The value of the fossil fuels--coal and crude oil--produced in Illinois amounted to approximately $441.4 million, or 63.7 percent, of the value of all minerals produced in the state. Stone products--crushed stone, cement, and lime--form the second most valuable group of produced minerals in Illinois, accounting for $126.8 million, or 18.3 percent, of the total value. Clay products, valued at $58.4

million, represented 8.4 percent of the total value. Common sand and gravel were valued at $40.3 million and silica sand at almost $15.8 million. All types of sand and gravel together furnished 8.3 percent of the state's mineral worth. Fluorspar, lead, and zinc yielded approximately $9 million, or 1.3 percent of the total mineral value.

Pennsylvanian and Pleistocene clays in the Brown County area were used by both Indians and early settlers to make pottery. One of the earliest known potteries in the state was founded at Ripley in 1836 where stoneware was produced from clay occurring below the Colchester (No. 2) Coal Member (fig. 1). From 1882, when records were first kept, through 1963, the last year that coal was reported to have been mined here, coal production totaled 65,347 tons. Coal was mined for 40 of the 81 years covered by these records. The following other mineral commodities (in order of decreasing value) were produced in Brown County in 1969: clay products, stone, crude oil, common sand, and gravel. Their total value for 1969 was $24,492, placing the county 99th among the state's 102 counties in mineral production.

ITINERARY

0.0	0.0	Assemble at the east side of Brown County High School. Please park heading north to avoid delays when the trip begins.
0.0	0.0	Turn left (west) onto U.S. Route 24 at stop sign.
0.25	0.25	Bear right off highway at drive-in corner and continue west.
0.2	0.45	STOP. 4-way stop. Turn right (north) on North Jefferson Street.
0.25	0.7	Continue north around the slight jog to the left at the fairground entrance.
0.7	1.4	Descend hill and curve to the right. Pennsylvanian bedrock exposures in the roadcut on the right.
0.15	1.55	Pennsylvanian Hanover Limestone Member exposed at the right in cutbank.
0.05	1.6	Cross creek. Medium dark gray shales become progressively lighter colored upward in the steep-cut creek bank to the right. They are overlain by the thin-bedded Pleasantview Sandstone Member, which occurs beneath the Hanover Limestone previously noted. Continue ahead.
0.3	1.9	Just around the upcoming curve to the left is an excellent example of a geologic hazard. On the right (east) side of the road there is a scarp (bare spot) high up on the slope. The slope from the scarp down to the road is a wedge of unstable material that has slipped or flowed downslope toward the road. The fence is out of line, the ditch partially filled, and the telephone pole is no longer vertical because of differential (unequal) movement down slope.
0.5	2.4	T-road from right. Continue ahead straight.
1.3	3.7	CAUTION. Prepare to descend hill and make stop.
0.4	4.1	Stop 1.

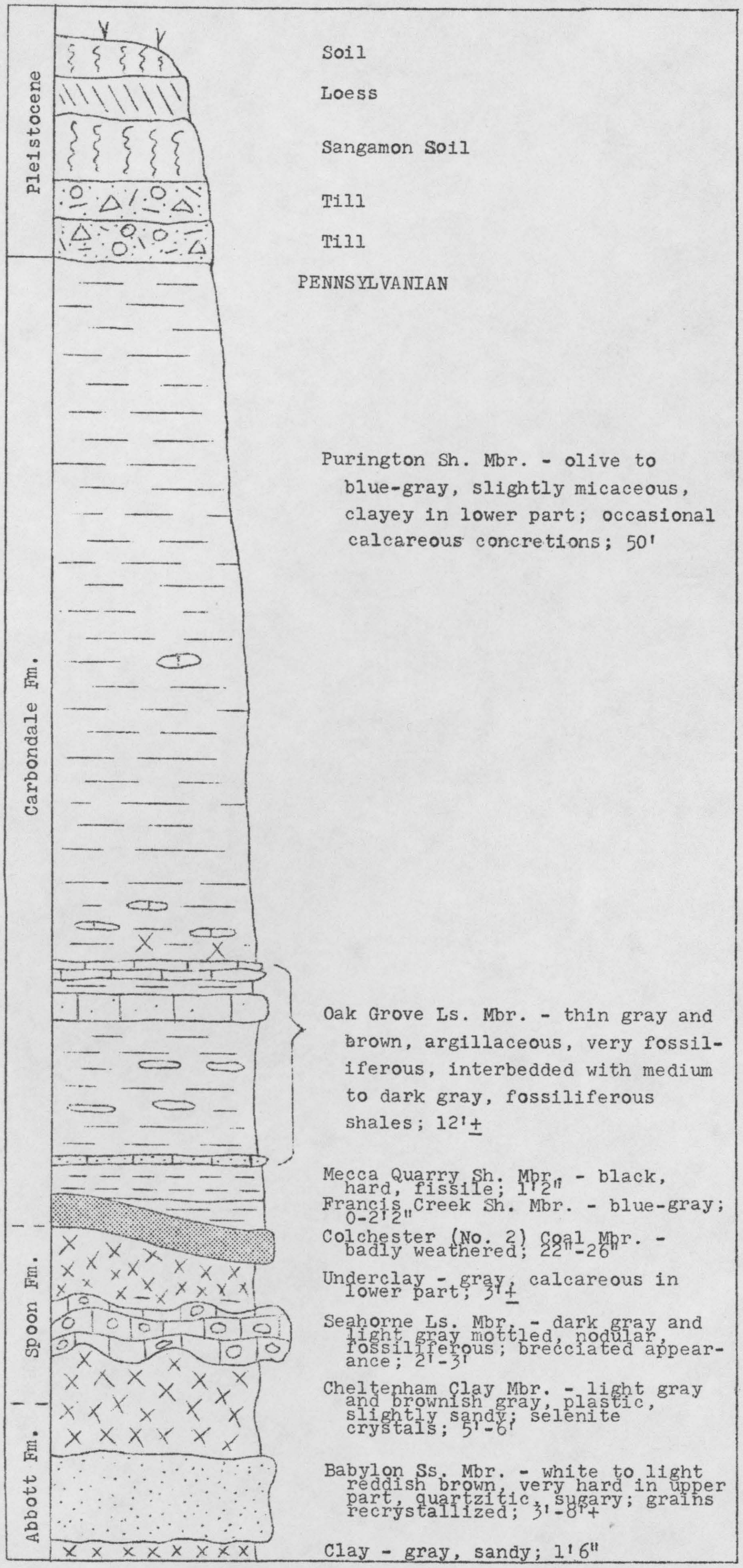


Fig. 7 - Strata exposed at Stop 1.

Stop 1. Lower Pennsylvanian strata exposed in ditch along northwest side of road. (Near center Sec. 34, T. 1 N., R. 3 W., Brown County; Rushville 15' quadrangle.)

Portions of three Pennsylvanian formations (see fig. 7) and three cyclothems are exposed at this locality. The basal sandstone and clay belong to the Abbott Formation, which is the only representative of the McCormick Group in western Illinois. The overlying clay (Cheltenham) and Seahorne Limestone Member belong to the Spoon Formation, while the remainder of the overlying rocks are members of the Carbondale Formation. The last two formations compose the Kewanee Group in Illinois. The thinness of the various rock strata illustrates the diverse sedimentary conditions that existed in this area during their deposition.

Exposed strata belong to, in ascending order, the Babylon, Seahorne, and Liverpool Cyclothems. As is true elsewhere, the cyclothems exposed here do not contain all 10 units of the ideal cyclothem. Some units were never deposited because the changes from marine to nonmarine environments, and vice versa, were extremely abrupt and frequent. During periods of emergence, some strata were removed by erosion. Sedimentary conditions in the Mt. Sterling area during the Pennsylvanian Period were less variable at times than in areas in the deeper parts of the Illinois Basin. Emergent conditions and erosion or nondeposition appear to have been prevalent much of the time because of the effect of the Pittsfield and Fishhook Anticlines to the south and the Mississippi River Arch just to the west. The Pennsylvanian strata thin towar(the axes of these structures, suggesting that movements of the structures may have been taking place during early Pennsylvanian time. The area over the structures must have been topographically higher than adjacent areas and would thus have received less sediment. Near Pittsfield, about 30 miles to the south, the interval between the No. 2 Coal and the underlying Mississippian strata is as little as 4 feet. In the field trip area the interval may be as little as 7 feet 12 miles to the southwest along Little Missouri Creek or nearly 20 feet as at this stop, or slightly more. The interval between the No. 2 Coal and the base of the Pennsylvanian in the deepest part of the Illinois Basin is as much as 1,200 feet. This great thickness of strata accumulated in the basin in the same amount of time as the 20 feet accumulated here because of the greater amount of subsidence of the basin.

From the Beardstown Quadrangle southward to the St. Louis area, the Cheltenham Clay Member is an interesting development in the lower Pennsylvanian strata. Most of the coals, shales, and sandstones of the Spoon Formation wedge out southward so that the underclays from several cyclothems appear to be superposed one above another. In some instances, rather distinct color bands separated by thin carbonaceous films can be found in the clay. The carbonaceous films represent the position of coals that did not develop. Conditions of deposition must have remained fairly stable for a considerable length of time for the accumulation of so great a thickness of fine clay. Because the clay also contains quartz, it is a refractory material.

The Seahorne Limestone Member has a distinct, easily recognizable appearance. Irregular, dark gray, algal limestone nodules and biscuits in a lighter brownish gray algal matrix give the rock a conglomeratic or brecciated character. The texture is characteristic of algal limestones. Some of the masses show a septarian structure with joints filled with calcite and siderite crystals. The lower surface of the limestone is also highly irregular. Fossils noted in the dark gray limestone include Chonetes granulifer, Mesolobus mesolobus, Phricodothyris, Marginifera muricatina, Composita, branching Bryozoa, crinoid stem fragments, and occasional small corals.

The No. 2 Coal is one of the most widespread of the economically important coals in Illinois. It is extensively mined in western and eastern Illinois, where it reaches a thickness of 2 to 3 1/2 feet. Some years ago, the coal was produced from a number of comparatively small mines in this region. Although the coal thins toward Pittsfield and localities farther west, the thickness observed here and that to the north and northeast is minable. A large strip mine in southwestern Fulton County and another along the Illinois River, also in Fulton County, have operated in the No. 2 Coal for several years and represent the closest large-scale operations.

In Brown County most of the estimated strippable coal reserves average about 24 inches thick. Information is limited principally to exposures and old mines along the larger stream valleys located in the south and north of the county. There are few reliable data on areas distant from the major streams. Estimates of reserves indicate 80.5 million tons of No. 2 Coal having overburden thicknesses between 0 and 50 feet may be available in the county. More than 160.6 million tons are calculated to occur with 50 to 100 feet of overburden, and nearly 145.4 million tons have overburden thicknesses from 100 to 150 feet.

The designation of the coals in Illinois by number began in the middle 1800s when geologists recognized that the coals were widespread and rather easily identified. They numbered the coals in an attempt to understand and interpret the Pennsylvanian strata better. The coals were numbered consecutively, the oldest (lowest) being designated No. 1 and the youngest (highest) No. 8. Later, geologists discovered additional coal beds that had not been recognized previously, which made the numbering system confusing. Letter-number combinations were used for a while, but it was finally decided to use geographic names in accordance with the standard practice of stratigraphic nomenclature. However, because of long usage, the numbers are still used along with geographic names for the more widespread, commercially important coals.

The Francis Creek Shale Member is a gray, pyritic shale that occurs immediately above the No. 2 Coal (unit 6 of the ideal cyclothem). Locally, plant fossils may be found near the base; marine fossils are rare. As can be observed here, the shale is lenticular although it may be totally missing locally so that the hard, slaty black Mecca Quarry Shale Member lies immediately on top of the coal.

The Oak Grove Limestone Member occurs above the black roof shale of the No. 2 Coal. Although this member consists of as many as 14 distinct marine limestone and shale units elsewhere, perhaps here only 5 to 9 thin units can be assigned to the Oak Grove. Some of the limestone and shale units are exceedingly fossiliferous and, although they are only a few inches thick, may be traced laterally for miles. Here the limestones are so argillaceous that they readily break down by weathering into masses of fossil debris. Fossils noted include Composita, Crurithyris planoconvexa, Derbya crassa, Chonetes granulifer, Marginifera muricatina, Mesolobus mesolobus, branching Bryozoa, crinoid stem fragments, and occasional corals and straight cephalopods.

Part of the Purington Shale Member is exposed just below the glacial drift at this locality. It is an olive to gray shale that contains many ironstone concretions throughout. It is unit 10 of the ideal cyclothem.

0.0	4.1	Leave Stop 1. Continue down to bottom of hill.
0.05	4.15	Turn around at gate. Retrace itinerary back toward Mt. Sterling.
1.8	5.95	T-road from left. Continue ahead (south).
1.45	7.4	Enter Mt. Sterling. Continue south on North Jefferson Street.
0.35	7.75	Intersection of North Jefferson and East Washington Streets. Turn right (west) on Washington.
0.1	7.85	STOP. CAUTION. Dangerous intersection. Continue ahead (west).
0.15	8.0	Courthouse to the left. Continue straight ahead.
0.1	8.1	STOP. Junction with Route 99. Continue straight ahead (west) on Washington Street and Route 99.
0.2	8.3	Turn right (northwest) on Camden Road and Route 99.
0.5	8.8	Stop 2. Pennsylvanian Summum Cyclothem exposed at small waterfall on West Creek 25 feet east of Route 99. (SW¼ SW¼ NE¼ Sec. 8, T. 1 S., R. 3 W., Brown County; Mt. Sterling 15' quadrangle.) (See fig. 8, next page.)

Stratigraphically, strata exposed here belong slightly above those studied at Stop 1, where the Purington Shale was unit 10 of the underlying Liverpool Cyclothem. The Pleasantview Sandstone, unit 1 of the ideal cyclothem, is exposed below this waterfall in West Creek. Although the Summum (No. 4) Coal Member is hardly more than a carbonaceous shale streak here, elsewhere in Illinois it is of minable thickness. About 30 miles northeast of here, near the village of Summum in southwestern Fulton County, the Summum (No. 4) Coal was locally 5 feet thick and was mined by both underground and strip mining methods. Cyclothem units occurring above the marine Hanover Limestone are difficult to study here because these strata are poorly exposed.

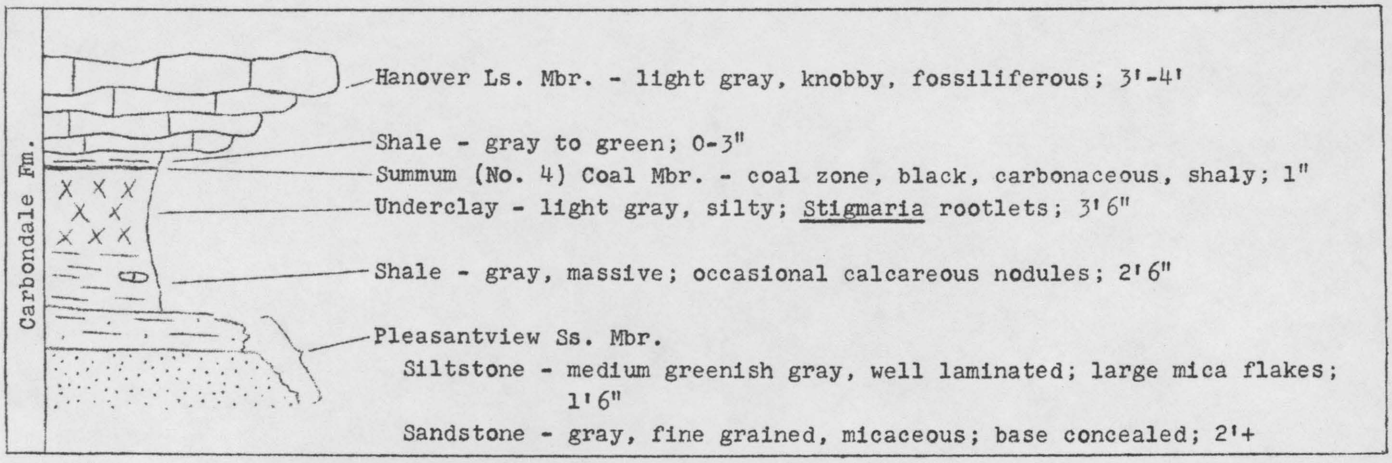


Fig. 8 - Strata exposed at Stop 2.

0.0 8.8 Leave Stop 2. Continue ahead (north).

1.2 10.0 Prepare to turn left.

0.2 10.2 Crossroads. Turn left (west).

0.65 10.85 T-road from left. Turn left (south).

1.3 12.15 T-road from right. Continue ahead (south).

0.35 12.5 To the right, West Creek contains limestones in a number of small discontinuous exposures downstream (eastward) toward Stop 2. These limestones occur stratigraphically above the Springfield (No. 5), Herrin (No. 6), and Danville (No. 7) Coals. The coals here are nothing more than thin, weathered carbonaceous streaks. About 1 mile downstream a small quantity of No. 5 Coal, 18 to 20 inches thick, was mined from a limited area. Elsewhere in the region this coal is only a streak. The three coals mentioned, however, are the state's most important commercial coals in other areas.

0.4 12.9 Enter Mt. Sterling. Continue straight (south) on Damon Road.

0.25 13.15 STOP. Intersection with U.S. Route 24. Continue straight ahead (south).

0.3 13.45 CAUTION. Two unguarded railroad tracks. Continue ahead (south).

2.5 15.95 T-road intersection. Turn right (west).

0.45 16.4 T-road intersection. Turn left (south).

0.6 17.0 T-road intersection from right. Bear right on the main gravel road.

0.3 17.3 Cross Dry Fork Creek. Immediately beyond the creek, on both sides of the road, is a quarry operating in the medium gray Purington Shale and the overlying tan Pleasantview Sandstone. Approximately 70 feet of highwall exposed.

Continue ahead (west).

0.7 18.0 T-road intersection from left. Continue ahead straight.

1.05 19.05 Y-intersection. Turn left. STOP.

0.05 19.1 Continue ahead (south) on blacktop.

0.45 19.55 Crossroads. Continue ahead (south).

0.45 20.0 Buckhorn. Continue ahead (south).

0.1 20.1 T-road from right. Continue ahead (south).

0.45 20.55 Y-intersection. Turn right (west) on the gravel Kellerville Road.

1.4 21.95 Cross bridge. Cronin Hollow.

0.8 22.75 Crossroads. Continue toward the southwest.

The road to the left leads south to the discovery well of the Siloam oil pool. This well, drilled in October 1959 by Charles Eager on the W.L. Davis farm, is located in the SE¼ SW¼ SE¼ Sec. 8, T. 2 S., R. 4 W., Brown County. Initially the well flowed at the rate of 120 barrels of oil per day but was completed for 530 barrels per day. The pay zone is porous Silurian dolomite averaging 4 feet thick at a depth of about 634 feet. The pay zone extends for 280 acres in which 26 wells have been completed; 18 of these were producing at the end of 1969. The deepest test hole in the pool bottomed in the Ordovician St. Peter Sandstone at a depth of 1,115 feet. Oil production from this pool amounted to 1.6 million barrels in 1969. From 1959 through 1969 the pool has produced approximately 218 million barrels of oil.

1.25 24.0 Cross Wells Fork.

0.05 24.05 Crossroads. Continue ahead straight.

0.5 24.55 Cross Purpus Creek.

0.65 25.2 Pond on the left appears to receive drainage with a high fertilizer content, indicated by the complete green algal cover.

0.9 26.1 CAUTION. Entering Kellerville.

0.15 26.25 Crossroads. Continue ahead (west) on blacktop road.

The discovery well of the Kellerville oil pool is located about 1 mile south and 0.1 mile west of this intersection. This well, drilled by Ray Starr in May 1959 on the Wendell Doole farm, is located in the NE¼ NE¼ NE¼ Sec. 11, T. 2 S., R. 5 W., Adams County, and was completed for 3 barrels of oil per day. Other wells in this pool, however, have been higher producers. As in the Siloam pool, the pay zone in this field is porous Silurian dolomite, but here it averages about 7 feet thick. This zone, 639 feet deep and about 580 acres in extent, has had 52 wells completed in it, 37 of which were producers at the end of 1969. The deepest test drilled in this pool bottomed in the Ordovician St. Peter Sandstone at 1,075 feet. Oil production from this pool amounted to 4.1 million barrels during 1969. Cumulative production through 1969 has been approximately 197.5 million barrels.

0.35 26.6 T-road from left. Continue ahead.

0.2	26.8	In the distance notice the road appears to be rising toward the west as we come up onto the back slope of the Illinoian Mendon Moraine. Soils exposed in the road ditches in this vicinity are ashy and bleached. They were formed under moist, cool climatic conditions and are low in iron, lime, and alumina. Soils of this type are called podsols.
0.5	27.3	T-road from right. Continue ahead. Prepare to turn left. Before turning, briefly note view ahead, which is down across the Illinoian Mendon Moraine. The front of the moraine is about 1½ miles to the west, but erosion has altered the front and lowered it in this area. The distant horizon is the Kansan till plain. The high ground here before the turn is the crest of the Illinoian moraine in this area.
0.1	27.4	T-road from left. Turn left toward Siloam Springs State Park.
1.5	28.9	Roadcut on the east side shows an excellent exposure of Illinoian silts and till when it is cleaned off. Grass cover prevents a view of these beds.
0.9	29.8	Crossroads. (Entrance to Siloam Springs State Park on the left.) Continue ahead straight.
0.4	30.2	T-road from left. Continue on around the curve to the right and prepare to stop.
0.25	30.45	Stop 3. Illinoian and Wisconsinan silts exposed on north side of roadcut. (Siloam Springs West Section. SW¼ SE¼ SE¼ Sec. 15, T. 2 S., R. 5 W., Adams County; Mt. Sterling 15' quadrangle.)

Pleistocene Series	Thickness
Wisconsinan Stage	
Woodfordian Substage	
Peoria Loess	
Loess, massive, leached, mottled tan and gray; surface soil in top	4'6"
Loess, massive, leached, mottled light tan-brown and gray-tan	6"
Altonian Substage	
Roxana Silt - massive, leached, medium tan-brown with mottling of gray-tan; contains some clay and very fine sand; gradational contacts	3'
Illinoian Stage	
Loveland Silt	
Sangamon Soil; sand, very fine to fine; silt with some clay, massive, leached, yellow-tan at base grading upward to red-brown in B-zone of Sangamon Soil; extends to bottom of road ditch	3'

This exposure is about a mile west of the Mendon Moraine, which is the end moraine marking the limit of Illinoian glaciation. At the town of Mendon, 20 miles northwest of here, the moraine is a conspicuous ridge, but in this area it is a discontinuous, indistinct feature. The line on the itinerary map delineating the Mendon Moraine is, for several reasons, drawn along the east slopes of McKee and Fishhook Creeks. No Illinoian till is found west of this boundary. Illinoian lake deposits found along McKee Creek show that the valley of an east-flowing stream was dammed by the Illinoian Liman glacier near our present position. Several exposures, like this one, show the Loveland Silt with a Sangamon Soil development. Since this relation is typically found beyond the limits of Illinoian glaciation, the boundary is drawn east of these exposures. It is also likely that the courses of McKee and Fishhook Creeks were aligned by the Mendon Moraine when it was a more positive feature: they flowed along its front.

The Liberty-Pittsfield ridge can be seen about 5 miles due south of us. It is the highest feature that can be seen in that direction.

The beds in this exposure are silts and loesses largely transported by wind from the outwash of the Illinoian and Wisconsinan glaciers. The Loveland Silt is the lowermost bed and was probably deposited continuously during Illinoian glaciation. Some deposits of the silt laid down ahead of the advancing ice were overridden and are found interbedded with till. The Loveland Silt in the cut here was a surface deposit and was weathered during the interglacial Sangamonian Stage. Since the ditch shows only the soil zone developed on the Loveland Silt, the unit is called Sangamon Soil.

The Sangamon Soil is a weathered zone developed on many types of surfaces, including bedrock. The B-zone remarked in the description refers to a system of describing soil zonation. The A-zone of a soil is the top layer, a clay-depleted layer rich in organic material. The A-zone is depleted of clays because they have been washed down by weathering. The underlying B-zone is enriched with clays from the A-zone.

The Roxana Silt is a wind-blown silt that accumulated at the beginning of the Altonian (earliest Wisconsinan) glacial advance, so it may be found, as it is here, bedded between two silts or loesses or, where it was overridden by the glacier, under Woodfordian Drift. (Refer to the figure "Sequence of Glaciations and Interglacial Drainage in Illinois" following page 4 for the relation of this section to the position of the various glacial lobes.) The source of the silt was the valley train of the Ancient Mississippi River, the valley of which is now occupied by the Illinois River between St. Louis and the Big Bend of the Illinois. The Roxana Silt is widespread in the area outside the Woodfordian Drift and generally composes 20 to 30 percent of the loess thickness there.

The Peoria Loess, at the top of the exposure, was deposited during and after the Woodfordian Substage. This loess was continuously deposited to the close of the Wisconsinan Age and averages 5 feet thick over 90 percent of the state. Like the other units in this exposure, the loess is interbedded with till east of here in central Illinois, where it was deposited in the path of the advancing Woodfordian glacier, which overrode and buried it. In places where the loess interfingers with till, the loess above the till has been renamed Richland Loess and that below is called Morton Loess.

Outside the area of Woodfordian Drift, 65 to 75 percent of the loess is Woodfordian. This extraordinary volume of loess was derived from large quantities of outwash. From other evidence it seems likely that the ice moved forward comparatively rapidly, even when the glacier was melting and its ice front was retreating. The great volume of meltwater released during the Woodfordian, and the glaciers blocking the courses of several ancient rivers, evidently are responsible for diverting the Ancient Mississippi and Ancient Ohio Rivers into their present courses.

0.0 30.45 Leave Stop 3. Continue ahead.

0.6 31.05 T-road from left. Turn left (east) at the crest of the hill.

0.95	32.0	STOP. Intersection with blacktop road. Turn right and head north.
0.35	32.35	Entrance to Siloam Springs State Park to the right. Turn right.
0.7	33.05	T-road from right. Continue ahead on blacktop.
0.15	33.2	View of Crab Apple Lake to the right.
0.3	33.5	Shelter house on right. Continue ahead.
0.4	33.9	T-road from left. Ranger headquarters. Bear right.
0.25	34.15	Turn right at sign pointing to boat dock and dam. SLOW. Winding Road.
0.1	34.25	Intersection. Bear right.
0.1	34.35	Y-intersection. Bear left onto rock road to dam.
0.55	34.9	Follow circle drive around to right at foot of hill.
0.2	35.1	Stop 4. Pennsylvanian exposure in auxiliary spillway just over the little ridge and to the left. (SE¼ SW¼ NW¼ Sec. 24, T. 2 S., R. 5 W., Adams County; Mt. Sterling 15' quadrangle.)

Quaternary System
  Pleistocene Series
    Kansan Stage - probably till; no bedding apparent; rusty brown, weathered and oxidized, clayey, sandy, and very pebbly; 1'+

Pennsylvanian System
  Carbondale Formation
    Oak Grove Limestone Member
      Shale, gray brown; weathers with pronounced iron staining; fair bedding; partially slumped, with fossiliferous limestone fragments up to ½-inch thick scattered over surface; 3'2"
      Limestone, brown, weathered, somewhat lenticular but persistent across exposure, fossiliferous (*Chonetes*, *Mesolobus*); 2"
      Shale, drab, fairly well bedded, soft, fossiliferous; sulfur masses and crystalline selenite in basal 3"; 1'1"
      Shale, dark gray to black, well bedded, fissile; 9"; grades downward into:
      Shale, gray with considerable limonite on partings and bedding surfaces; fairly well bedded; contains large irregular masses of small selenite crystals; 2'2"
    Mecca Quarry Shale Member, black, slaty, fissile; 2'9"
    Colchester (No. 2) Coal Member, weathered, blocky; top 1" contains considerable fusain; 1'4"
    Underclay, dark gray; Stigmaria rootlets; 1"
    Underclay, light gray; *Stigmaria* rootlets; 2'±
  Abbott (?) Formation
    Babylon (?) Sandstone Member, white with brown weathered crust, fine to medium grained, fairly firm; 1'+ (Base concealed)

Strata exposed here give an indication of the profound unconformity that exists between the Pleistocene and older rocks in Illinois. At Stop 1 the Illinoian (?) till rests upon Pennsylvanian Purington Shale, whereas here the Kansan drift overlies part of the Oak Grove Limestone. When just these two stops are compared, it is evident that at least 50 feet of strata, including the upper portion of the Oak Grove and the overlying Purington studied at Stop 1, were eroded away before Pleistocene deposits mantled the area of Stop 4. Actually, much more rock probably was removed, as is evidenced by near-by exposures in which higher, younger Pennsylvanian strata can be seen. At some places in the state, bedrock older than Pennsylvanian immediately underlies the Pleistocene.

Other differences also are found here. The Francis Creek Shale, which appears to occur only in sags on top of the No. 2 Coal, is missing, although it is present elsewhere in this vicinity. The No. 2 Coal is thinner toward the southwest, closer to the Pittsfield and Fishhook Anticlines and the Mississippi River Arch. The clay section below the coal is thin and not too well developed. If the sandstone at the base of this section is Babylon, which it appears to be, then the intervening Seahorne Limestone and Cheltenham Clay have lensed out toward the higher parts of these structures.

Data for the No. 2 Coal, the only coal recognized in minable thickness in Adams County, are sparse and are for widely separated localities. In the southeastern part of the county the coal averages about 18 inches thick. However, northward it does thicken locally to as much as 36 inches. The coal has been strip mined in the northeastern part of the county. Estimates of reserves indicate 88.3 million tons of No. 2 Coal having overburden thicknesses between 0 and 50 feet may be available in the county. More than 328.5 million tons are calculated to occur with 50 to 100 feet of overburden, and more than 202.4 million tons have overburden thicknesses from 100 to 150 feet.

0.0	35.1	Leave Stop 4. Continue ahead up hill.
0.7	35.8	Junction with blacktop road. Bear right (northeast).
0.15	35.95	Y-intersection. Turn right (east).
0.05	36.0	Y-intersection. Bear right (southeast).
0.3	36.3	CAUTION. Descend steep hill.
0.2	36.5	Turn right into parking area.

Stop 5. LUNCH. Siloam Springs village site. (E½ NE¼ NE¼ Sec. 24, T. 2 S., R. 5 W., Adams County; Mt. Sterling 15' quadrangle.)

The spring waters rising in this valley contain minerals that affect the taste, and in the last century their supposed medicinal properties inspired the construction of the Siloam Forest Home--a hotel with bath houses, swimming pool, and other facilities for "takers of waters." In other areas having spas and medicinal waters, it was frequently thought that the worse the water tasted, the greater its curative powers.

A village with about 75 inhabitants grew up around the resort. It had two general stores, a post office, a blacksmith's shop, and a grist mill. But, though the springs were visited by the famous A. G. Ringling and P. T. Barnum and the great meat magnate, P. O. Armour, the spa failed, and in 1935 the hotel and its grounds were sold.

Siloam Springs State Park, with over 2,800 acres, is one of the largest of Illinois' recreational areas. The oak-hickory forests, bordered by prairie-type plants such as sassafras, sumac, and willow, came under the protection of the state in 1940. Crab Apple Lake covers 68 acres and has a watershed of 1,280 acres.

0.0	36.5	Ascend hill and retrace itinerary to park entrance.
0.5	37.0	Y-intersection. Bear right.
0.1	37.1	Y-intersection from left. Continue ahead.
0.25	37.35	Y-intersection. Bear left.
1.55	38.9	Intersection with blacktop road at park entrance. Turn left (south).
0.4	39.3	Continue ahead (south) on the blacktop past Stop 3.
0.8	40.1	Descend hill into McKee Creek Valley bottom. In the far distance the Cretaceous uplands form the horizon.
0.9	41.0	Cross McKee Creek. View of the Illinoian moraine front to the east.
0.8	41.8	Cross Fishhook Creek. Continue ahead (south).
0.5	42.3	Cross Fishhook Creek.
1.9	44.2	From here south the itinerary is on top of Cretaceous sediments capping this ridge. Continue south on the main gravel road.
0.2	44.4	T-road from right. Continue ahead (south).
0.4	44.8	STOP. Intersection with Route 104. Turn right (west) on Route 104.
0.75	45.55	Crossroad. Beverly road. Continue ahead on Route 104.
0.8	46.35	Crossroad. Turn left (south) on gravel road.
0.25	46.6	House constructed of local stone on right.
1.0	47.6	Narrow culvert. Continue ahead (south).
0.1	47.7	Stop 6. Cretaceous Baylis Formation exposed in cutbank on east side of road. (NW¼ SW¼ SW¼ Sec. 16, T. 3 S., R. 5 W., Adams County; Mt. Sterling 15' quadrangle.)

	Thickness
Pleistocene Series	
Wisconsinan Stage	
Colluvium of silt and sand, leached, massive, tan to brown . .	4'0"
Cretaceous System	
Baylis Formation	
Kiser Creek Member	
Sand, massive, brown and gray, brown mottled, clayey; contains dispersed small chert pebbles in some zones	6'0"
Hadley Gravel Member	
Gravel and sand, brown; contains pebbles and cobbles of chert, quartz, and quartzite of several colors but no igneous rocks	1'0"
Gravel and sand, dark brown to black, densely iron cemented, brittle; breaks through the quartz pebbles	1"
Pennsylvanian System	
Abbott Formation	
Shale, dark gray, brown and purple; weathered in upper part	10'0"

The outcrop here is part of the Cretaceous Baylis Formation that forms the Liberty-Pittsfield ridge discussed in the introduction. Two small outlying bodies of these sediments have been identified, one to the west, at Richland, and the other at Mendon, to the north. Altogether, the area of the Baylis Formation is thought to be 80 to 100 square miles. Commonly the ridge crest lies at elevations between 840 and 860 feet, and it may have been as much as 200 feet above the level of glacial Lake McKee and 150 to 200 feet above the Illinoian till plain. Because the ridge is a prominent feature and lies parallel to known Illinoian moraines, it has previously been thought to be the Illinoian end moraine.

The Baylis Formation is isolated from other Cretaceous outcrops; the nearest deposits of the same age are in Minnesota, western Iowa, and southern Illinois.

This outcrop is a good example of the lithology of the two members of the Baylis Formation. Typically, the Hadley Gravel Member rests unconformably on the weathered surface of a Pennsylvanian shale, and its basal first inch or so in contact with the shale is a dark brown, iron-cemented zone. The "iron" cement in this zone is a mixture of quartz, goethite, and hematite, and it binds the unsorted quartz and chert sands and gravels that compose the whole member. The Hadley Gravel is generally less than 10 feet thick.

The Kiser Creek Member is an uncemented, fine to medium quartz sand and clayey sand that contains zones of small pebbles and lenses of silty clay. The Baylis Formation is known to be 25 feet thick but could be as much as 100 feet thick under the ridge.

The Baylis Formation physically resembles some beds known to be Cretaceous sediments, but Cretaceous age for the Baylis was confirmed only after heavy mineral and X-ray diffraction analyses of its finer sediments revealed close similarities to samples from known Cretaceous deposits and great dissimilarities to Paleozoic and Pleistocene sediments. No animal or plant fossils have been found in the Baylis.

The origin of the Baylis is obscure. Its contact with the underlying Pennsylvanian shale is a nearly flat unconformity. The erosion surface covered by the Baylis Formation was created by the removal of all the strata deposited after the Pennsylvanian shale that lies under the Baylis, so it must be presumed that before the Baylis was deposited the area was uplifted prior to or during Cretaceous time. The types of sediments deposited in the Baylis and their sorting and stratification suggest to some geologists that the Baylis was deposited near shore on a bottom with an exceptionally gentle gradient.

0.0	47.7	Leave Stop 6. Continue ahead (south).
0.55	48.25	Enter Village of Beverly.
0.15	48.4	STOP. Dangerous intersection. Turn left (east).
0.8	49.2	Turn left (north).
1.5	50.7	View to north. On the horizon is the Illinoian moraine.
0.3	51.0	STOP. Intersection with Route 104. EXTREME CAUTION. Entering highway. Turn right (east). The high upland areas to the south of the highway are all underlain by Cretaceous sediments.
0.7	51.7	Siloam Springs road to left. Continue straight ahead (east).

1.2 52.9 Pennsylvanian bedrock exposed to the right in a creek bank.

0.5 53.4 T-road from left. Turn left onto gravel road.

1.2 54.6 T-road from right. Continue ahead (north). The road along this part of the itinerary roughly parallels the front of the Illinoian terminal moraine, approximately half a mile to the east.

0.5 55.1 CAUTION. Narrow bridge. Fishhook Creek.

0.6 55.7 T-road intersection. Turn right (east).

0.1 55.8 From here on the itinerary ascends the Illinoian end moraine.

0.45 56.25 Exposure of loess to the left. Typical vertical development of the face. On the right the face has been beveled, and slope wash has deeply furrowed it.

0.15 56.4 T-road from right. Continue ahead (north).

0.05 56.45 Stop 7. Pleistocene deposits exposed in cutbank on east side of road. Greenwood School South Section. (SW¼ SW¼ NW¼ Sec. 36, T. 2 S., R. 5 W., Adams County; Mt. Sterling 15' quadrangle.)

Pleistocene Series
  Wisconsinan Stage
    Woodfordian Substage
      Peoria Loess
        Loess, massive, leached, light tan-brown; surface soil; 1'; grades down into:
        Loess, massive, leached, medium brown with slight reddish cast, more silty than above; 1'6"
  Illinoian Stage
    Liman Substage
      Teneriffe Silt, medium brown with reddish cast, darker than above and and more sandy and clayey; weathered surface is lighter colored and exhibits crust having only very fine polygonal cracking; Sangamon Soil; 1'4"
      Glasford Formation - Kellerville Till Member, medium dark brown mottled with some yellow-brown, more sandy, clayey, and tougher than silt above; contains irregular blotches and streaks of light gray sand; occasional small iron-manganese speck noted; weathers as distinctive light rusty brown streak across outcrop; Sangamon Soil; 9"
      Petersburg Silt
        Silt, light gray and yellow gray mottled, tight, very tough, clayey; some black iron-manganese nodules and staining on joints; nodules increase downward; lower part of exposure shows rusty brown and light gray mottling; surface shows persistent fine polygonal cracks; about 1' below top rusty brown iron-manganese nodules cover surface; Sangamon Soil; 2'6"
        Silt, rusty brown with occasional light gray mottling; iron-manganese nodules present; not as tight and compact as silt above; 4'
  Kansan Stage
    Till, rusty brown and light gray mottled; weathers as distinct gray-brown horizon across exposure; iron-manganese nodules and streaks abundant; clayey; fairly tight and compact; leached; coarse polygonal cracking on weathered surface; Yarmouth Soil; 1'1"

Till, medium to dark yellow brown, contains pebbles and cobbles that increase in abundance downward; bottom $4\frac{1}{2}$ to 5 feet of very gravelly material that looks like outwash, is fairly fresh and contains igneous, metamorphic, and sedimentary rocks, including pieces of geodes; base not exposed; 7'+

As igneous rocks are decomposed by weathering processes, clay minerals, among other things, are formed. Thsse minerals, which are mica-like silicates with varying compositions, are very fine grained, the grains being usually less than 5 microns. Because of their extremely small size, identification of these minerals with any degree of certainty is difficult except by the use of X-ray, optical, chemical, or other special techniques.

The clay minerals in the glacial deposits here were identified by X-ray analysis and they aid in deciphering the sequence of Pleistocene events. According to the results of earlier investigations, the Kansan glacier brought material from the north and northwest that contained a high percentage of the clay mineral montmorillonite. As the tills exposed in the lower part of the bank contain a high percentage of montmorillonite, they are probably of Kansan age.

The overlying Petersburg Silt represents a transition from Kansan to Illinoian materials. This silt has a fairly high precentage of montmorillonite, which decreases upward, as could be predicted because the silts are derived in part from reworked Kansan drift. The clay mineral illite has been identified as coming into this area from the northeast via the Illinoian glacier. Meltwater flowing away from the advancing glacier carried illite out across the Kansan till plains where it became mixed with montmorillonite. As the Illinoian glacier approached, more illite-bearing material was available and the silts that were deposited became increasingly rich in this clay mineral. The overlying Kellerville Till Member has a high percentage of illite, as do the rest of the overlying younger materials. The clay mineral composition of the Teneriffe Silt is almost identical with that of the Kellerville because it was derived in large part from reworking of that till.

0.0	56.45	Leave Stop 7. Continue ahead (north).
0.45	56.9	T-road intersection from left. Turn left (west).
0.1	57.0	An excellent view out across the front of the Illinoian moraine toward the Kansan till plain to the west.
0.1	57.1	Descend front of the moraine. In various places along the roadcut are small amounts of gravel from the till.
1.0	58.1	Intersection with Siloam Springs Road. Turn left (south).
0.4	58.5	Cross Fishhook Creek.
2.5	61.0	STOP. Intersection with Route 104. CAUTION. Turn left (east).
1.95	62.95	Straight ahead beyond Fishhook Creek, the ridge is the front of the Illinoian moraine. Continue ahead.
0.65	63.6	Cross Fishhook Creek and ascend Mendon Moraine.
1.7	65.3	View to the left of the Purington Shale and Pleasantview Sandstone along valley walls of Fishhook Creek.

0.05 65.35 T-road from right toward Fishhook. Continue ahead (east).

This is the area of the Fishhook gas field (note itinerary map). The discovery well of the Fishhook gas pool was drilled by W. Vette in March 1955 on the Layne property about 2.5 miles south and 0.6 miles west of this road intersection in the NE¼ SE¼ SE¼ Sec. 30, T. 3 S., R. 4 W., Pike County. This well, which was completed in Silurian limestone at a depth of 460 feet, initially produced over 1 million cubic feet of gas per day.

The Fishhook gas pool, which is located about 70 miles northwest of Illinois' main oil-producing region, is about 5.5 miles long and 2.5 miles wide. It covers an area of approximately 5,500 acres and contains 57 gas wells. The field has been shut-in because of the lack of a market.

0.45 65.8 View to the east down the backslope of the Illinoian end moraine.

3.85 69.65 Crossing a small tributary valley. The till is eroding severely, to the right of the highway in particular. Beginning of badland topography.

2.35 72.0 Cross a branch of Middle Fork McKee Creek. The creek bed to the right (south and east) contains many geodes that have varied mineral inclusions.

0.8 72.8 Intersection. Junction with Route 107. Turn left (north) on Route 107 toward Mt. Sterling.

2.4 75.2 Enter Brown County.

1.7 76.9 Groves School (abandoned) on the left. Continue ahead.

0.3 77.2 T-road from right. Continue ahead.

0.65 77.85 Stop 8. Abandoned quarry on east side of Route 107. (SE¼ SW¼ NW¼ and NE¼ NW¼ SW¼ Sec. 21, T. 2 S., R. 3 W., Brown County; Mt. Sterling 15' quadrangle.)

The Mississippian rocks here consist predominantly of dolomite and limestone with minor amounts of sandstone and shale. About 25 feet of brown dolomite underlies the quarry floor. The dolomite is fossiliferous, but the fossils have been largely destroyed by dolomitization.

Above the quarry floor is about 6 to 10 feet of coarse-grained, cross-bedded fragmental limestone (Salem ?), which is a hash of fossil fragments. This limestone was quarried for building stone, and is similar to the Salem Limestone, known as the "Indiana Limestone," that is quarried for building stone in Indiana.

Section exposed in north quarry face

Pennsylvanian System	Ft.	In.
Fireclay, buff-tan, silty	1	6
Shale, light gray, fine, well laminated	2	
Coal zone, carbonaceous shale		½
Siltstone, gray, carbonaceous; *Stigmaria*	2	
Siltstone, medium gray; *Stigmaria*		10
Sandstone, loose, clayey, light gray	1	5
Clay, green, mottled		10

Mississippian System		
Limestone, bright red, weathered and oxidized; opalescent chert in and under the limestone	½-2	
Shale, green, silty, with irregular nodules of chert	3	
Siltstone, dolomitic with shale laminations, fossiliferous	4	
Shale, gray, medium grained, well laminated	2	
Siltstone, gray, fine; medium gray shale interlaminations	4	
Dolomite, buff	1	6
Limestone, light gray; oolites and Endothyra	6	
Dolomite, gray, silty	1	6
Siltstone, dark gray, fossiliferous		6
Dolomite, buff	10	

0.0 77.85 Leave Stop 8. Continue ahead.

0.3 78.15 Cross McKee Creek.

0.3 78.45 Stop 9. Roadcut along Illinois Route 107. (SW¼ SW¼ SW¼ Sec. 16, T. 2 S., R. 3 W., Brown County; Mt. Sterling 15' quadrangle.)

Here is another example of a geologic hazard. The roadbed has been cut through unstable Pleistocene deposits. Because of high moisture, poor drainage, and the road-building techniques used, the unstable materials have slumped and flowed down hill, especially on the west side of the road. Although there has been flowage out across the highway, the most damage and danger results from the considerable amount of material that has slipped under the curbs and elevated them above the pavement. Through the trees on the upper slope, the fresh scarp formed when flowage occurred can be seen. Merely cleaning the slumped material from the roadway will not solve the problem, because this will throw the unstable slope farther out of equilibrium and cause further slumping to occur.

To control this roadway properly will probably entail the expenditure of considerable money and time. The slope must be cut to a low angle of repose, adequate drainage must be installed to maintain reasonably dry conditions, and wide, stable shoulders should be made along the pavement.

Builders, developers, and engineers should study the geology of an area carefully in advance of projected construction. This is especially true when it is known that unstable materials and conditions exist in the area. Such unstable conditions exist over more of the state than was originally thought.

0.0 78.45 Leave Stop 9. Turn around and retrace itinerary to south.

0.3 78.75 Cross McKee Creek.

0.8 79.55 Prepare to turn left.

0.15 79.7 CAUTION. Turn left (east).

0.7 80.4 T-road from left. Continue straight ahead.

0.6 81.0 T-road from right. Continue straight ahead.

1.25 82.25 CAUTION. Slumping of unstable road materials on left side.

0.75 83.0 Cross McKee Creek.

0.3 83.3 Entering road that was cut through Pleistocene material and Mississippian bedrock. Notice the tremendous amount of slumping from the Pleistocene deposits on both sides of the road, including an outward flow of the material onto the road.

0.3 83.6 Stop 10. Roadcut exposure of Warsaw Shale. (SW¼ NW¼ NE¼ Sec. 24, T. 2 S., R. 3 W., Brown County; Meredosia 15' quadrangle.)

The Mississippian rocks are thickest in the deepest part of the Illinois Basin in southeastern Illinois, where they total about 2,500 feet, but around the edges of the basin, as here in the Mt. Sterling area, they are only 400 to 500 feet thick.

On the west and northwest shelf of the basin the Mississippian limestones, shales, and sandstones interfinger and grade into each other laterally and vertically (see fig. 9). These interfingering sedimentary rocks, called facies, were deposited contemporaneously in different parts of a shallow-water deltaic environment. The interfingering of the limestones, shales, and sandstones is due to variations in the amounts of land-derived sand and mud carried into an area and deposited at any one time. These variations were due to fluctuations in the rate of supply of sand and mud transported seaward by rivers, and to seaward and landward oscillations of the Mississippian shoreline.

The sandstones occur as tongues and lenses deposited in distributary and tidal channels. These sandstones grade laterally into sandy shales or sandy limestones and dolomites. The shales were deposited in quiet-water areas between distributary channels and in depressions on the sea floor. The limestones were generally deposited farther from shore than the shales and sandstones, but some limestone was deposited nearer shore wherever the water was clear and mud-free. The limestones

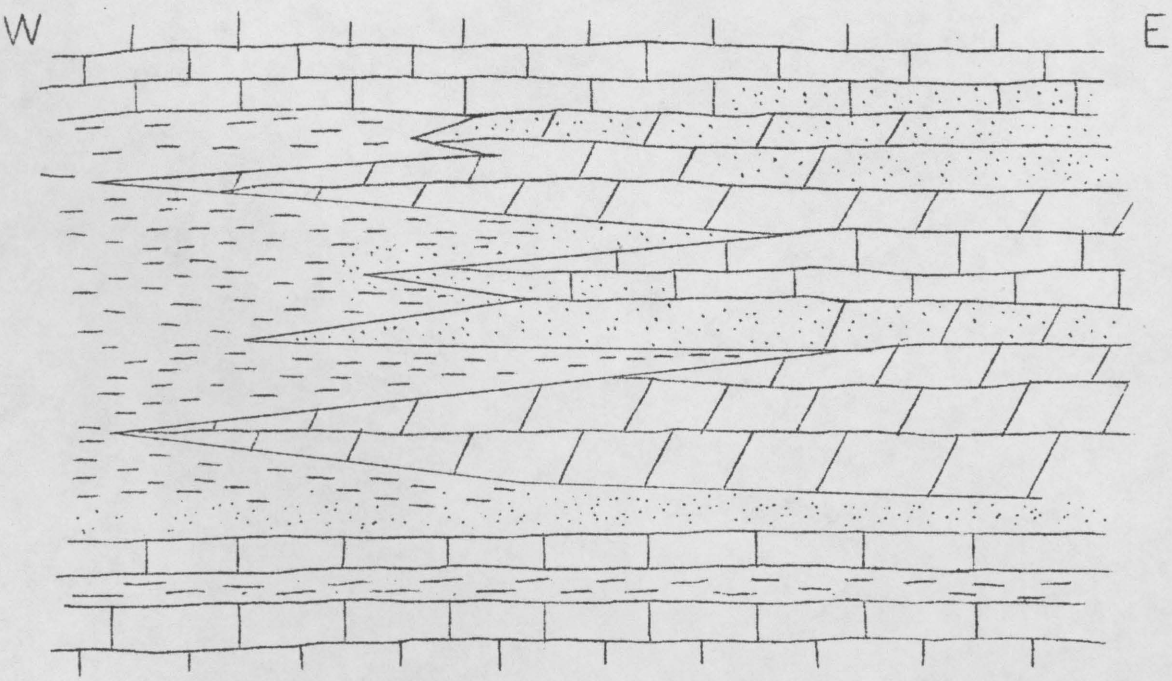


Fig. 9 - Hypothetical cross-section illustrating kinds of facies relations in Mississippian sedimentary rocks of western Illinois. Units along any near-horizontal line were deposited at the same time.

are richly fossiliferous, and some zones consist largely of a hash of crinoid and bryozoan fragments broken by wave action. Oolitic and cross-bedded zones also indicate shallow-water, high-energy conditions.

0.0 83.6 Leave Stop 10. Continue ahead.

0.2 83.8 T-road from left. Continue straight ahead.

1.4 85.2 CAUTION. Railroad crossing. Enter Versailles.

0.25 85.45 Street intersection. Turn left (north).

0.35 85.8 Intersection with Illinois Route 99. Continue ahead (north) across Route 99 onto gravel road.

0.8 86.6 T-intersection from right. Continue ahead (north).

0.3 86.9 T-road from left. Continue ahead and bear right (northeast) along the valley of Camp Creek.

0.25 87.15 Cross Camp Creek.

1.6 88.75 T-road from right. Continue ahead (north).

0.15 88.9 Y-intersection. Bear right (northeast).

0.7 89.6 The small valleys crossed here are the head waters of Little Creek, which drains the uplands in this area.

1.4 91.0 Crossroads. Continue ahead (north) on blacktop road.

The upland surface in this locality is cut by a northwest-southeast trending shallow channel about 40 feet deep that carried ponded glacial meltwater during the Illinoian Stage. Lakes dotted the till plain as the glaciers melted because the larger valleys were still clogged by ice and blocked the drainage. When the lake levels rose high enough, the water spilled over the interstream divides and flowed from one lake to another generally toward the south and west. A series of these spillway channels, some of them cut deeply into the upland surface, have been found from the vicinity of Peoria southwestward to Versailles, a distance of more than 80 miles. Here the spillway carried meltwater from a tributary of Logan Creek south-southeast into Little Creek. The topographic expression of this spillway is not as well developed as some others just to the east of the itinerary.

0.8 91.8 T-road from left. Continue ahead (north).

0.45 92.25 Crossroads. Continue ahead (north) on gravel.

1.45 93.7 T-road from right. Bear left (northwest).

0.6 94.3 Cross Logan Creek.

0.7 95.0 STOP. T-road intersection. Turn left.

0.15 95.15 STOP. Intersection with Route 24. Turn right (northeast).

0.5 95.65 Enter Village of Ripley.

0.3 95.95 Lower Pennsylvanian rocks exposed in roadcut on either side.

0.25 96.2 Cross La Moine River.

0.1 96.3 Stop 11. Roadcut along U.S. Route 24 exposing Pennsylvanian channel developed in the underlying Mississippian. (SE¼ NW¼ NE¼ and NE¼ SW¼ NE¼ Sec. 33, T. 1 N., R. 2 W., Schuyler County; Rushville 15' quadrangle.)

At the close of the Mississippian Period the Mississippian sea retreated, and a long interval of weathering and erosion occurred. A system of streams extended from the north and northeast across the newly emergent sea floor, cutting channels into the Mississippian sedimentary rocks. During this time, several hundred feet of Mississippian rocks including tne entire Chesterian Series and the upper part of the Valmeyeran Series were stripped away in the Mt. Sterling area prior to the advance of the Pennsylvanian sea.

The channel exposed here was probably a small tributary to a larger stream that crossed the early Pennsylvanian landscape (see fig. 10). The sediments filling the channel are fine-grained sandstones, siltstones, and shales of the Pennsylvanian Abbott Formation. These fine-grained sediments indicate that the stream must have been rather sluggish, much like the present Sangamon and La Moine Rivers. Vegetation and pieces of tree limbs that became water-logged and sank into the channel muds can now be seen as small streaks and patches of coal in channel sediments. When the Pennsylvanian sea advanced across the area, the channel was drowned and became choked with mud and sand. The channel filled up with sediments and later was buried beneath a cover of marine sediments and preserved.

Virtually everywhere in Illinois the basal Pennsylvanian sedimentary rocks are separated from the underlying Mississippian rocks by an erosion surface. Such an erosion surface separating younger sedimentary rocks from older sedimentary rocks is called an unconformity. The Mississippian-Pennsylvanian unconformity can be seen here as the sharp boundary between the channel sediments and the underlying Mississippian dolomite. Above the contact is a thin, discontinuous conglomeratic zone with chert pebbles.

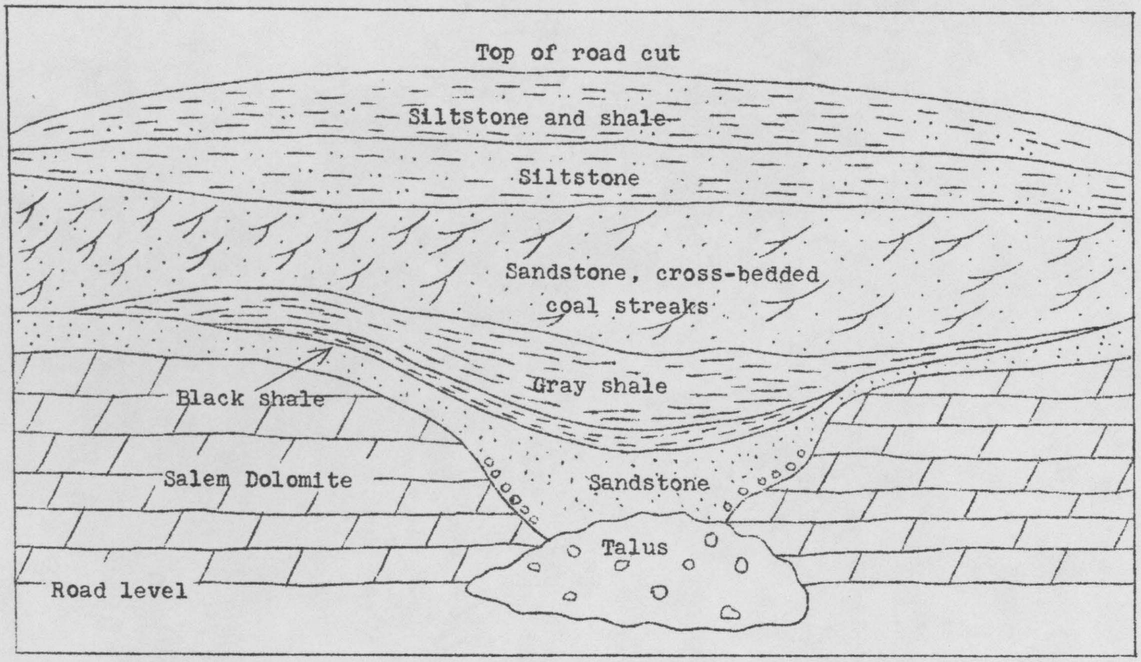


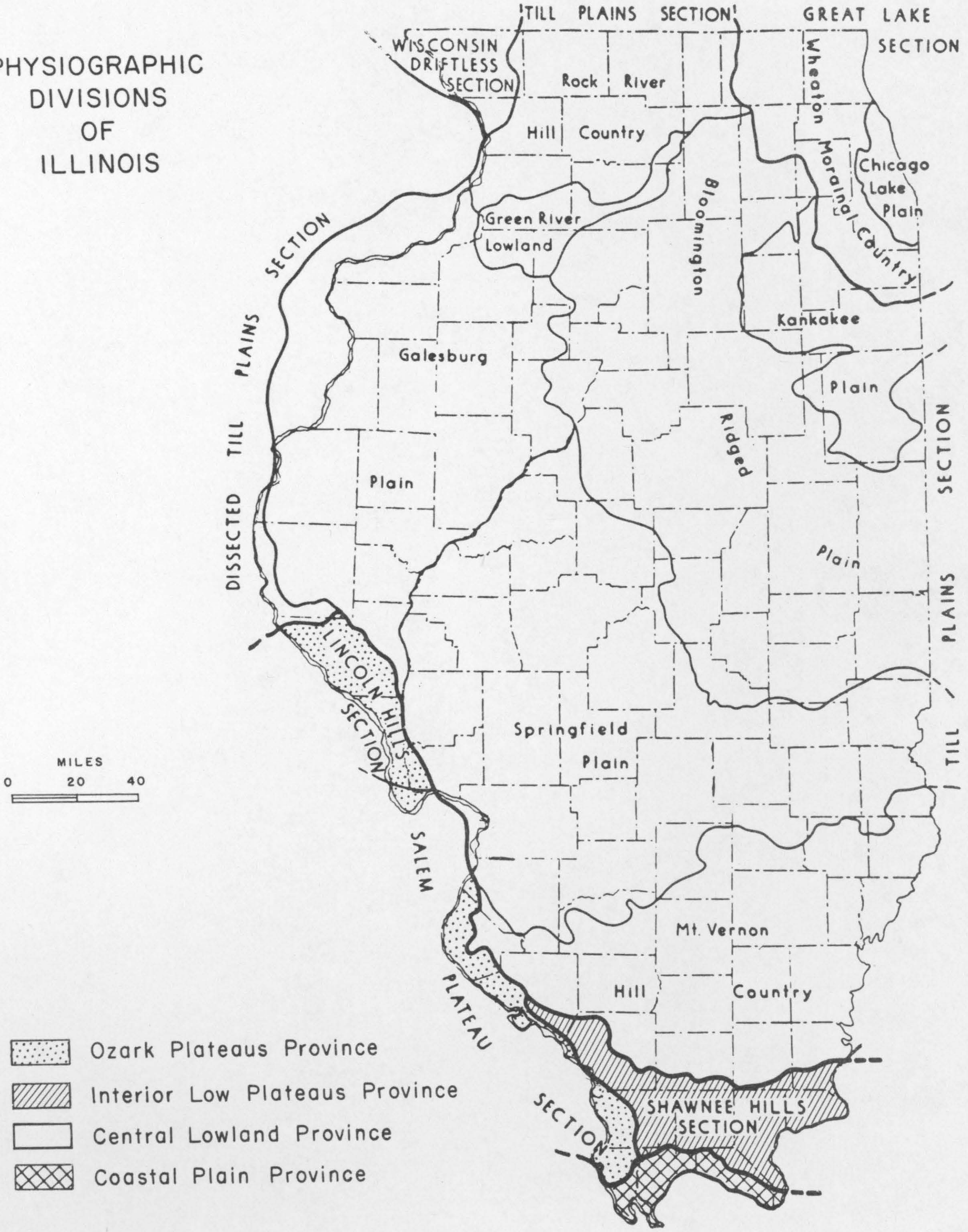
Fig. 10 - Pennsylvanian channel in Mississippian Salem Dolomite.

TIME TABLE OF PLEISTOCENE GLACIATION

STAGE	SUBSTAGE	NATURE OF DEPOSITS	SPECIAL FEATURES
HOLOCENE	Years Before Present	Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
	7,000		
WISCONSINAN (4th glacial)	Valderan	Outwash, lake deposits	Outwash along Mississippi Valley
	11,000		
	Twocreekan	Peat and alluvium	Ice withdrawal, erosion
	12,500		
	Woodfordian	Drift, loess, dunes, lake deposits	Glaciation; building of many moraines as far south as Shelbyville; extensive valley trains, outwash plains, and lakes
	20,000		
	Farmdalian	Soil, silt, and peat	Ice withdrawal, weathering, and erosion
	28,000		
	Altonian	Drift, loess	Glaciation in northern Illinois, valley trains along major rivers
	75,000		
SANGAMONIAN (3rd interglacial)		Soil, mature profile of weathering	
	200,000		
ILLINOIAN (3rd glacial)	Jubileean	Drift, loess	Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois
	Monican	Drift, loess	
	Liman	Drift, loess	
	250,000		
YARMOUTHIAN (2nd interglacial)		Soil, mature profile of weathering	
	600,000		
KANSAN (2nd glacial)		Drift, loess	Glaciers from northeast and northwest covered much of state
	700,000		
AFTONIAN (1st interglacial)		Soil, mature profile of weathering	
	900,000		
NEBRASKAN (1st glacial)		Drift	Glaciers from northwest invaded western Illinois
	1,000,000		

(Illinois State Geological Survey, 1971)

PHYSIOGRAPHIC DIVISIONS OF ILLINOIS



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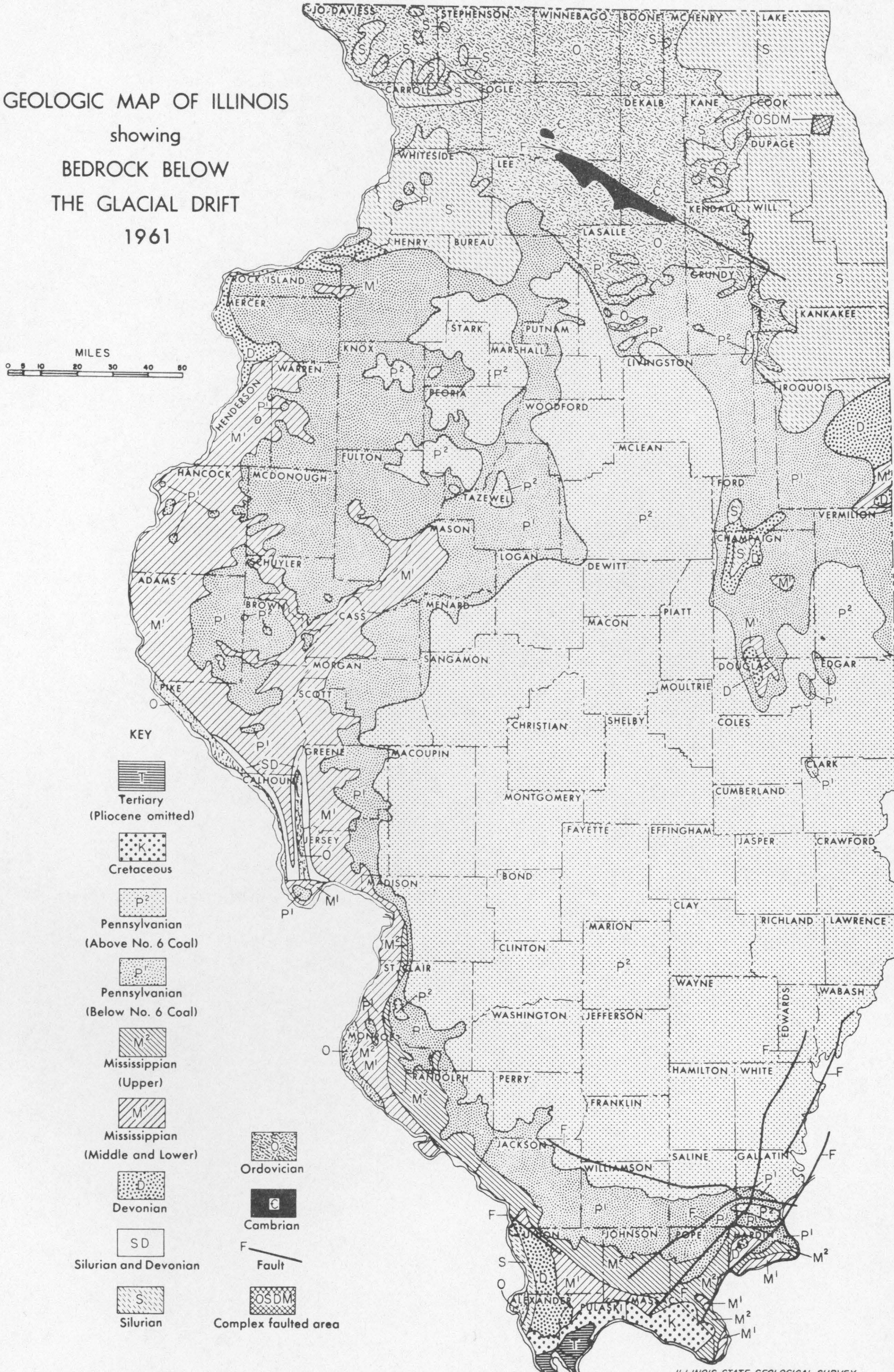
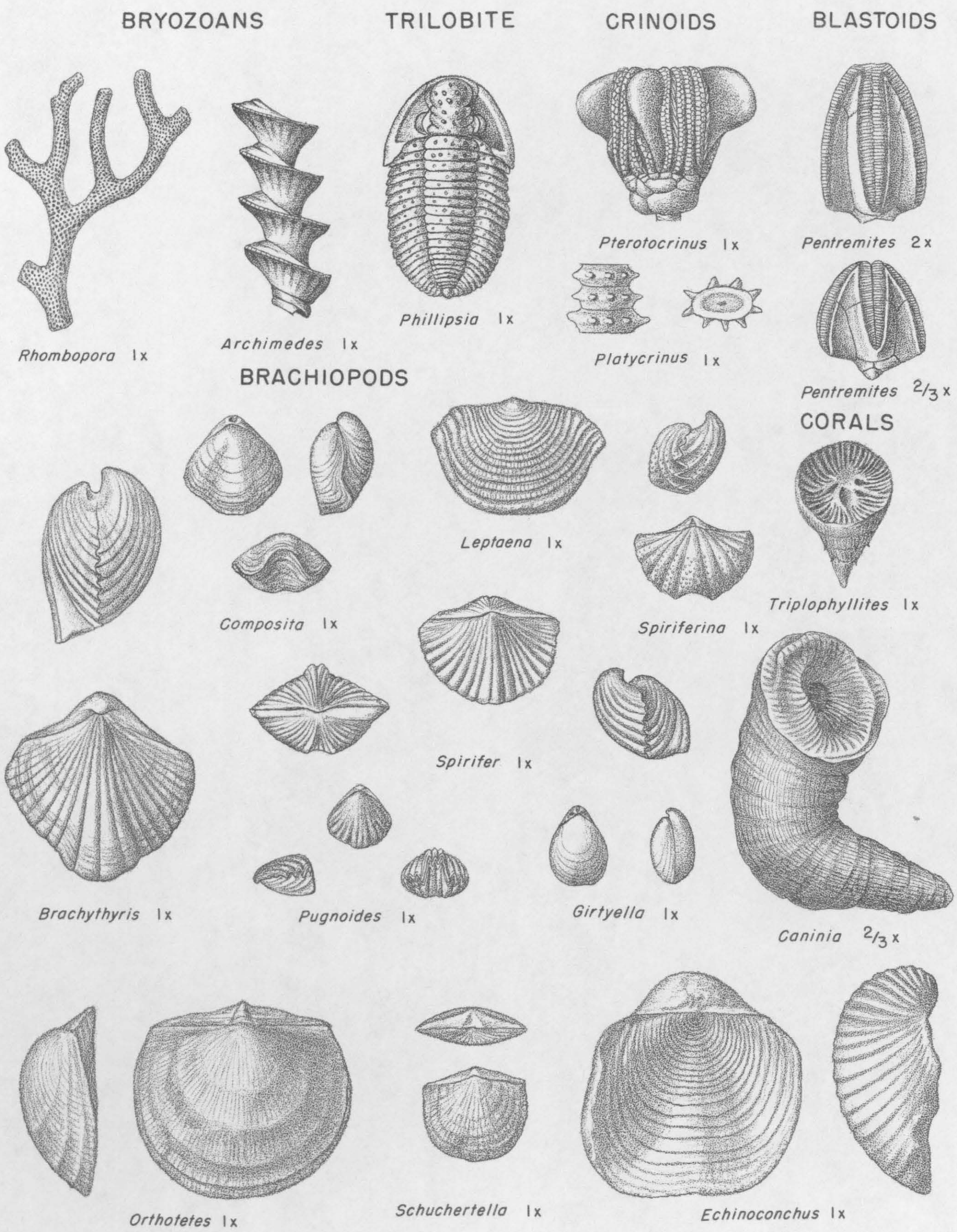
ILLINOIS STATE GEOLOGICAL SURVEY

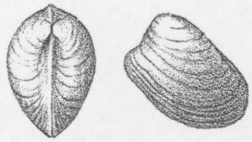
GEOLOGIC MAP OF ILLINOIS
showing
BEDROCK BELOW
THE GLACIAL DRIFT
1961



ILLINOIS STATE GEOLOGICAL SURVEY

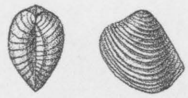

BRYOZOANS
TRILOBITE
CRINOIDS
BLASTOIDS
Pterotocrinus 1x
Pentremites 2x
Phillipsia 1x
Rhombopora 1x
Archimedes 1x
Platycrinus 1x
Pentremites 2/3 x
BRACHIOPODS
CORALS
Leptaena 1x
Composita 1x
Spiriferina 1x
Triplophyllites 1x
Spirifer 1x
Brachythyris 1x
Pugnoides 1x
Girtyella 1x
Caninia 2/3 x
Orthotetes 1x
Schuchertella 1x
Echinoconchus 1x

PELECYPODS



Nucula (Nuculopsis) girtyi 1x

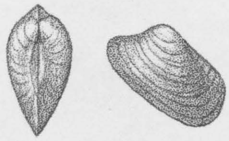
Edmonia ovata 2x



Astartella concentrica 1x

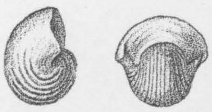
Dunbarella knighti 1 1/2 x

Cardiomorpha missouriensis
"Type A" 1x



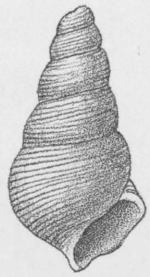
Cardiomorpha missouriensis
"Type B" 1 1/2 x

GASTROPODS

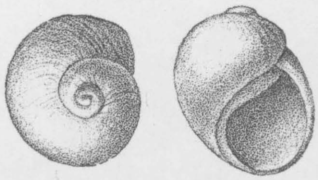


Euphemites carbonarius 1 1/2 x

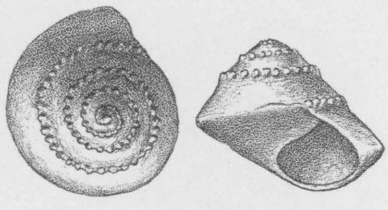
Trepospira illinoisensis 1 1/2 x



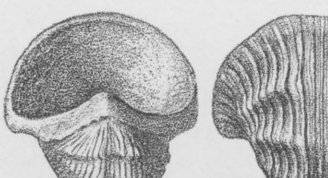
Donaldina robusta 8x



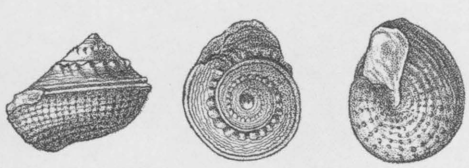
Naticopsis (Jedria) ventricosa 1 1/2 x



Trepospira sphaerulata 1x

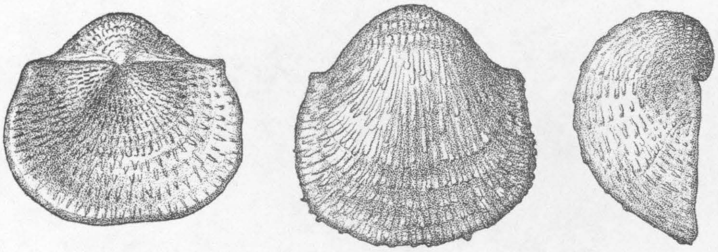


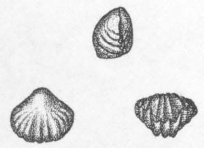
Knightites montfortianus 2x



Glabrocingulum (Glabrocingulum) grayvillense 3x

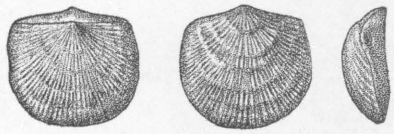
BRACHIOPODS





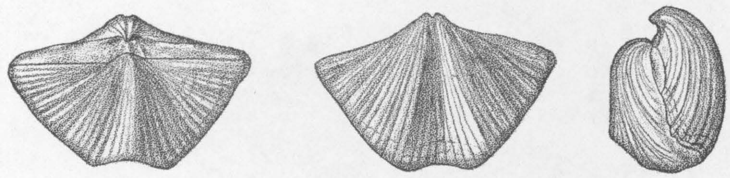
Wellerella tetrahedra 1½ x

Juresania nebrascensis ⅔ x

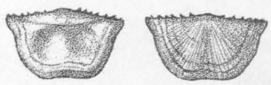


Derbya crassa 1x

Composita argentia 1x

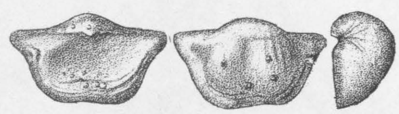


Neospirifer cameratus 1x

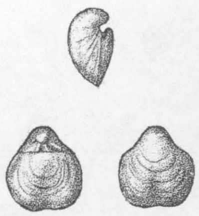


Chonetes granulifer 1½ x

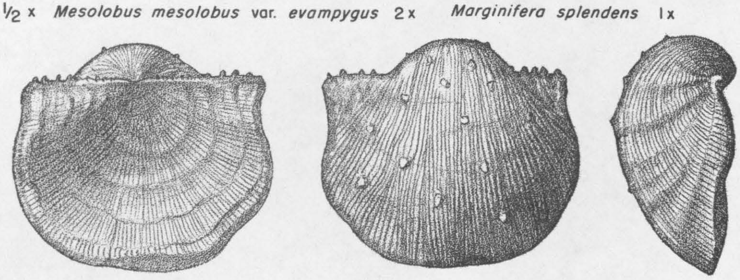
Mesolobus mesolobus var. *evampygus* 2x



Marginifera splendens 1x

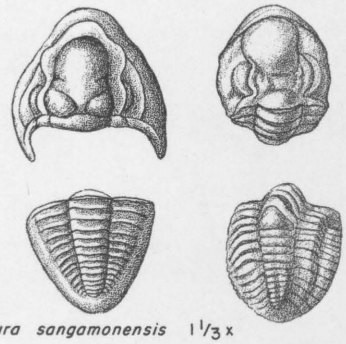


Crurithyris planoconvexa 2x



Linoproductus "cora" 1x

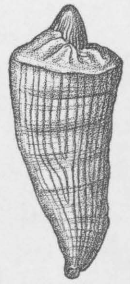
TRILOBITES



Ameura sangamonensis $1\frac{1}{3}$x

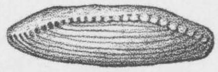
Ditomopyge parvulus $1\frac{1}{2}$x

CORALS



Lophophllidium proliferum 1x

FUSULINIDS

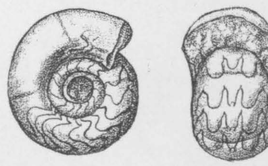


Fusulina acme 5x

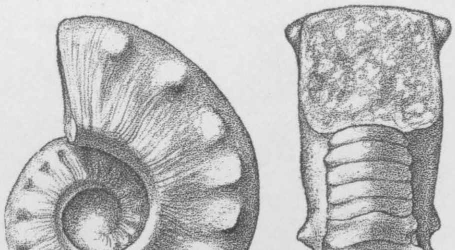
Fusulina girtyi 5x

CEPHALOPODS

Pseudorthoceras knoxense 1x

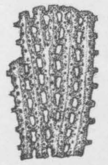


Glaphrites welleri $\frac{2}{3}$x

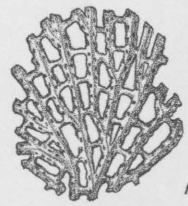


Metacoceras cornutum $1\frac{1}{2}$x

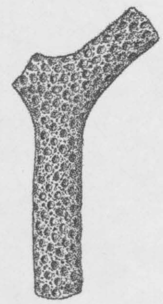
BRYOZOANS



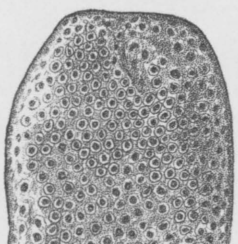
Fenestrellina mimica 9x



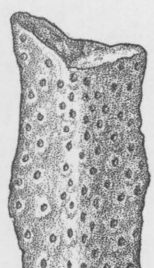
Fenestrellina modesta 10x



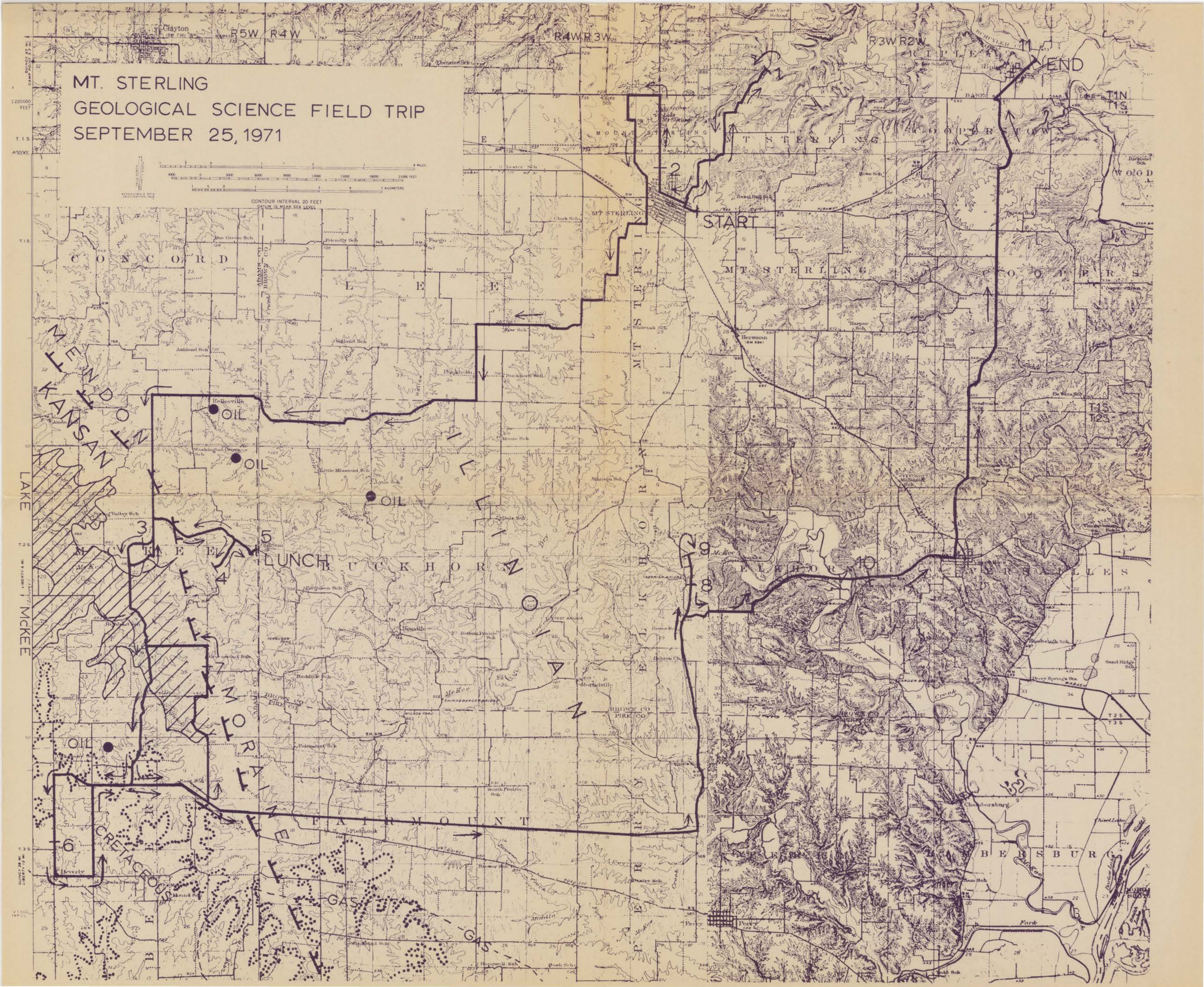
Rhombopora lepidodendroides 6x



Fistulipora carbonaria $3\frac{1}{3}$x



Prismopora triangulata 12x


MT. STERLING
GEOLOGICAL SCIENCE FIELD TRIP
SEPTEMBER 25, 1971
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
START
END
LUNCH
OIL
GAS
KANSAN
ILLINOIAN
MORAINE
CRETACEOUS
LAKE
McKEE
CONCORD
LEE
MT STERLING
BUCKHORN
FAIRMOUNT
ELKHORN
VERSAILLES
COOPERSTOWN
Clayton
R5W R4W
R4W R3W
R3W R2W
T1N
T1S
T2S
T3S
Perry
Chambersburg