SOUTHERN ILLINOIS GEOLOGY

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ERIGENIA BULBOSA

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SOUTHERN ILLINOIS NATIVE PLANT SOCIETY

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CONTENTS: SOUTHERN ILLINOIS GEOLOGY

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EDITORIAL

– MARK W. MOHLENBROCK

Imagine a warm, shallow sea teaming with marine life, including sharks and coral reefs. Inland from the sandy beaches, were swamps with numerous clubmoss-like trees, giant horsetails, and many fern and fern-like plants. Does this sound like southern Illinois to you? Well it was, for millions of years ago the climate of southern Illinois was like that of a tropical forest. Through the millenia, the area now known as southern Illinois has undergone numerous changes: from a tropical paradise as described above, to an area covered by seas or glaciers. The various forms of life and climate during Paleozoic time of southern Illinois is the topic of our first article.

A field trip log of Jackson and Union counties, southern Illinois, is presented next. This 150 mile journey guides you to various aspects of the geologic history of southern Illinois by viewing its physical record, the rock strata.

Next is an examination of the landforms occuring in southern Illinois. Causes for the varying topography of southern Illinois are revealed through use of the rock record. These landforms play a substantial role in the type of plant communities present, as do the soils of a particular area. As various as is the topography of the region, so are its soils. A characterization of the soils of southern Illinois is presented as our concluding article of this issue.

We are continually interested in producing a journal of improved quality and on this note several changes and additions have been made. First, is the addition of a co-editor position which has been filled by Margaret Gallagher of Arizona State University. Second, is the formation of an Editorial Review Board composed of four professors of botany from around the country. This board will help us maintain the publication of high quality articles. We have also modified our requirements for contribution to the journal in order to maintain quality, establish uniformity, and speed production. We are confident that you will be pleased with these changes.

ERIGENIA: 2, (1983), p. 2-18

PALEOZOIC LIFE AND CLIMATES OF SOUTHERN ILLINOIS

by

Dr. George Fraunfelter[1]

Southern Illinois is located in the southwestern part of the Illinois Basin. The Illinois Basin has been in existence since early Paleozoic times as evidenced by the presence of Cambrian age rocks. It is a broad, rather gentle, structural depression which is oval in outline, oriented northwest-southeast, and occupies much of Illinois, southwestern Indiana and western Kentucky. The Illinois Basin is bordered on the southwest by the Ozark Dome, on the northwest by the Mississippi Arch, on the north and northeast by the Wisconsin and Kankakee Arches, and on the southeast by the Cincinnati Arch (Fig. 1). The Basin was open to the south until late Paleozoic time. Between early Paleozoic and late Paleozoic times the Illinois Basin was filled with a sequence of sediments more than three miles in thickness. During much of that time the Basin was covered by warm, shallow seas, but it was drained more than fifty times and its margins emerged as dry land more than one hundred times. The deepest part of the Basin shifted from the northern end of the Mississippi Embayment in early Paleozoic times to the Fairfield area in early middle Paleozoic times (Fig. 1). This "deep" was surrounded on the west, north, and east by a shallow shelf which sloped gently toward the Fairfield "deep" (Fig. 2).

In southern Illinois the oldest rocks that occur within the Illinois Basin are of Cambrian age, the oldest Paleozoic time period. The Cambrian lasted from about 500 million years ago to 600 million years ago. During the early and middle stages of this period of time the weathering and erosion of the high, granite knobs exposed in the Ozarks to the west produced sediments in the form of debris flows and alluvial fan deposits that were laid down adjacent to the granitic knobs and in the adjacent shallow seas along the southwestern margin of the Illinois Basin by means of gravity sliding and streams resulting from torrential rainfall.

The depostion of these sediments initiated the formation of the western shelf of the Illinois Basin by infilling the marginal areas of the subsiding Basin. These early deposits are made up of conglomerates, sandstones and mudstones or shales. In places, these sandstones and mudstones contain marine brachiopods. As upper Cambrian seas encroached upon the area, marginal marine deposits in the form of interbedded conglomerates, sandstones and mudstones were laid down on top of the earlier sandstones and mudstones. These younger sandstones and mudstones also contain marine brachiopods and some trace fossils in the form of trails.

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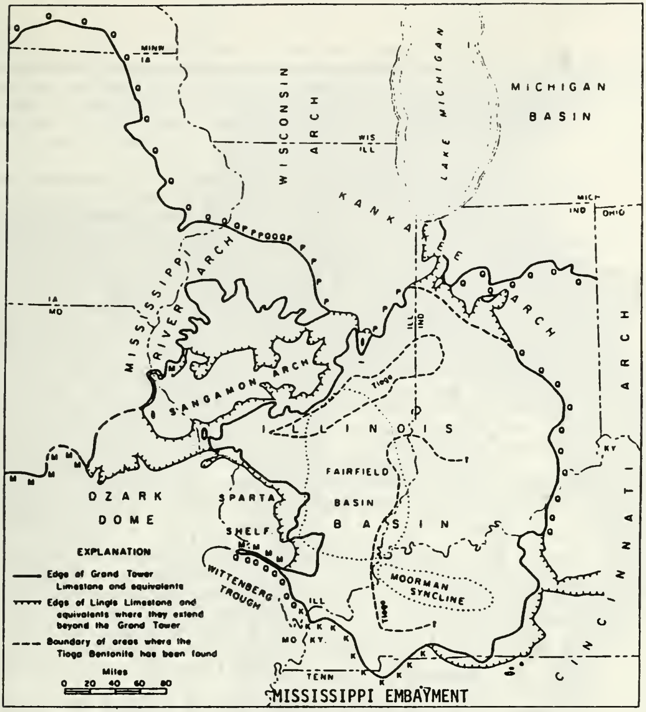


Figure 1. Map showing location of the Illinois Basin and associated structural features.The heavy black line indicates the extent of the middle Devonian Grand Tower Limestone and correlative limestone formations in the Illinois Basin and the age of truncating deposits by letters, Q - Quaternary, K - Cretaceous, P - Pennsylvanian, M - Mississippian and Upper Devonian. The dashed line shows the distribution of the Tioga Bentonite. (Modified from Meents and Swann, 1965).

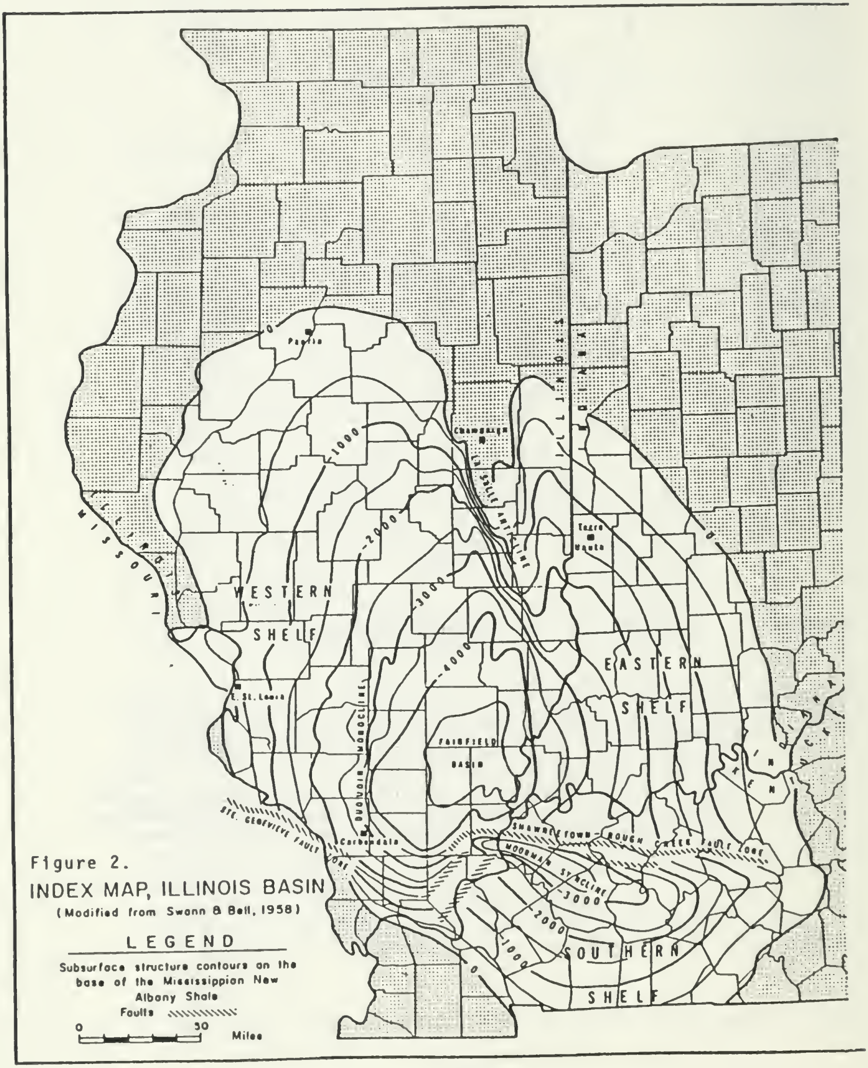


Figure 2.
INDEX MAP, ILLINOIS BASIN
(Modified from Swann & Bell, 1958)

The sediments in these sandstones and mudstones were brought into the area from the north and northeast from the southern part of the Canadian Shield and the northern Appalachians by some southwest flowing Cambrian river system. These beds like the ones beneath them are not exposed in the adjacent Illinois Basin because there they are buried under thousands of feet of younger sedimentary rocks.

Further encroachment by the late Cambrian seas produced the deposition of thick sequences of carbonate rocks, limestones, a large portion of which were later dolomitized, with interbedded shales and sandstones. Dolomites are today being formed in shallow marine waters in the supratidal zone especially in subtropical and tropical climates. These late Cambrian carbonate rocks contain abundant algal mat and digital algal structures, stromatolites, as scattered masses and as banks of reefs, one set of which nearly encircles the present day Ozarks. Similar algal mat and digitate structures occur today in places like Shark's Bay in western Australia, the Bahamas, and in the Persian Gulf, where they have formed and are forming in the intertidal and supratidal zones, for the most part, in shallow, warm, hypersaline seas. These late Cambrian dolomites also contain marine brachiopods and trilobites, in places, while the interbedded shales at one locality contain large, 2 foot and more in diameter, rounded, "algal" heads, and in other places concentrations of trilobites and the brachiopod Billingsella which is characteristic of shallow water, marine communities (Fig. 6). Trilobites and brachiopods are the characteristic fossils found in Cambrian age rocks worldwide.

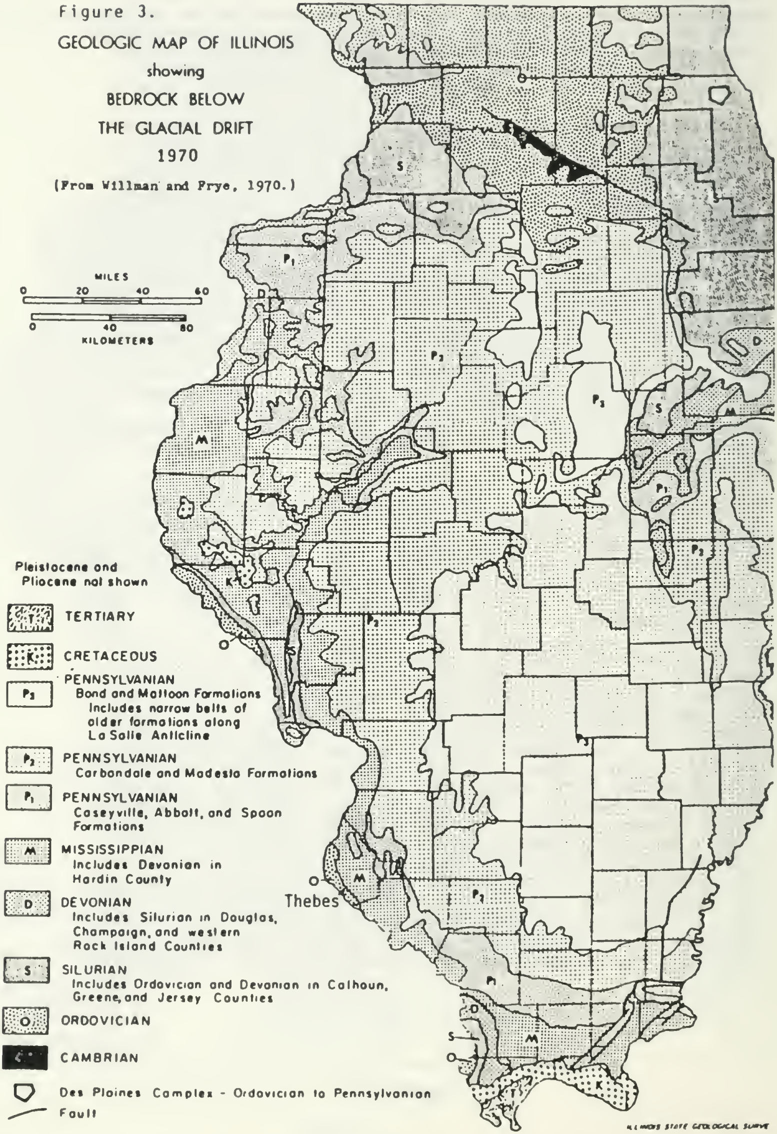
The debris flows and alluvial fan deposits of early and middle Cambrian age are indicative of torrential rainfall falling at scattered intervals. Late Cambrian sandstones are lacking in feldspar or contain well-weathered feldspar, unlike their older counterparts. This latter condition suggests a warm, humid climate for the area that was conductive to chemical weathering,ie., the "breakdown" of feldspar. The thick sequence of upper Cambrian limestones and dolomites is suggestive of warm seas.

Cambrian times were followed by those of the Ordovician. An interval that spanned the period of about 440 million to 500 million years ago. Like the rocks of Cambrian age, most of the rocks of Ordovician age are not exposed in southern Illinois, but are exposed along the rim of the Illinois Basin adjacent to the Ozarks. They are also present in the southern part of the Basin. These beds dip gently towards the center of the Illinois Basin, their deposition adding to the "buildup" of the western shelf as well as to the eastern shelf of the Illinois Basin. The only beds of Ordovician age exposed in southern Illinois are of late Ordovician age in the Thebes area (Fig. 3). In the Ozarks, the strata of lower and middle Ordovician age are composed largely of limestones and dolomites (like those of the late Cambrian of the area) and are well-exposed. The contained fauna consist of trilobites, many kinds of brachiopods, very large nautiloid cephalopods, and many gastropods and clams. In addition, these beds also contain abundant, well-developed algal stromatolites similar to those found in the late Cambrian. This flora and fauna is indicative of supratidal to onshore shelf and offshore shallow marine

Figure 3.

GEOLOGIC MAP OF ILLINOIS
showing
BEDROCK BELOW
THE GLACIAL DRIFT
1970

(From Willman and Frye, 1970.)



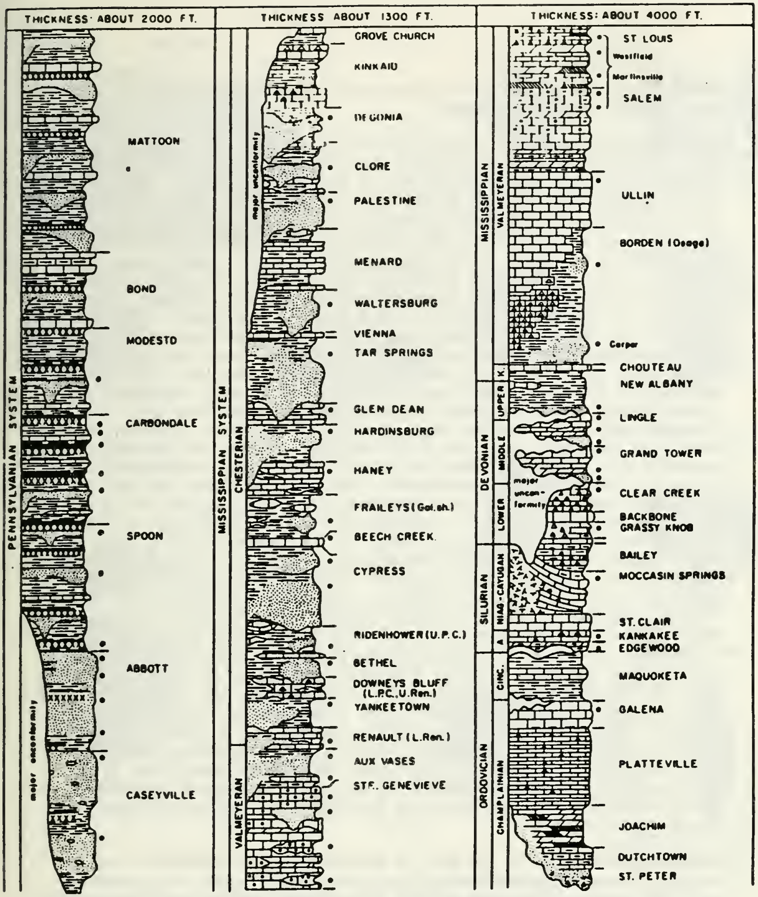


Figure 4. Generalized Geologic Column showing age, formations, and rock types exposed in southern Illinois. Black dots indicate oil or gas pay zones. (Original prepared by David H. Swann)

This column shows all of the Paleozoic rock units exposed in the southern part of the Illinois Basin.

areas, while the dolomites are indicative, once again, of shallow, supratidal, warm, marine conditions.

The middle Ordovician is characterized by dolomites that locally contain many cephalopods and other mollusks and algal stromatolites. However, this period of shallow, marine conditions is followed by a major regression of the seas which is evidenced by the presence of the St. Peter Sandstone, a very well-sorted, pure, quartz sandstone (Fig. 4). The St. Peter is characterized by alternating thick and thin cross-beds. The good sorting of materials, ie., most of the sand grains fit into a very narrow size range, is characteristic of modern windblown sands. The thick cross-bed sets are characteristic of modern dune sands, and the small cross-bed sets are suggestive of modern beach sands. Thus, the St. Peter Sandstone is indicative of sands deposited largely on land as dunes, backbeach dunes, and beach sands. No fossils have been found in the St. Peter. The remainder of the middle Ordovician is made up of a thick sequence of limestones and dolomites, for the most part, indicative of transgressing seas. The fauna of this latter sequence consists of abundant brachiopods and mollusks, along with bryozoans, crinoids, corals (including colonial types that built reefs or occurred in thickets), sponges, and trilobites (some very large), plus algal stromatolites. Again, the dolomites are indicative of very shallow, warm, marine, nearshore conditions, while the stromatolites are indicative of intertidal to supratidal, warm, shallow, hypersaline, and marine conditions. A typical brachiopod, Rafinesquina (Fig. 6), is usually found in shallow shelf faunas, while the brachiopod Hebertella is indicative of offshore communities in somewhat deeper waters. Because the southern Illinois area was still close to the Equator, at about 15° latitude, during Ordovician times, it is likely that warm weather prevailed over the entire area. However, it must be noted that some rather thick bentonite (volcanic ash) beds occur in middle Ordovician beds in the area. These beds suggest that explosive volcanic eruptions occurred in the area not unlike those of Mt. St. Helens and Chicon of recent vintage that apparently have had and will have a cooling effect on the weather because they "belched" large amounts of ash into the atmosphere. A similar cooling may have taken place in southern Illinois during the middle Ordovician. A few reworked plant fossils, other than algae, have been found in the upper middle Ordovician limestones of the area, indicating near-shore deposition. The coral thickets are indicative of very warm, clear, normal marine waters.

The upper Ordovician of the area is characterized by limestones and shales. These limestones contain rich brachiopod faunas with elements that are indicative of both onshore and offshore marine shelf communities, along with bryozoans and trilobites (Fig. 6). The shales exhibit diverse faunas that are also indicative of onshore and offshore shelf communities. A rather thick sandstone with small sets of cross-bedding and containing horizontal, filled burrows along with other trace fossils is evidence of another period of sea withdrawal from the area and shallow marine conditions. The characteristic fossil of the Ordovician in this area is Receptaculites (Figure 5).


ALGAE
Receptaculites
(Ord.-Dev.)
Cryptozoan
(Camb.-Ord.)
PROTOZOAN
Schwagerina
(Permian)
SPONGES
Astraeospongia
(Silurian)
Hindia
(Ord.-Dev.)
WORMS
Spirorbis
(Ord.-Recent)
Arabellites
(Ord.-Dev.)
CORALS
Streptelasma
(Ord.-Dev.)
Favistella
(Ord.-Dev.)
Halysites
(Ord.-Sil.)
Favosites
(Ord.-Perm.)
Hexagonaria
(Devonian)
Heliophyllum
(Devonian)
Lithostrotionella
(Mississippian)
Lophophyllidium
(Penn.-Perm.)
GRAPTOLITES
Cyrtograptus
(Silurian)
Dendrograptus
(Camb.-Sil.)

Figure 5.

The time interval that covered the span from about 400 million to 440 million years ago is called the Silurian. Again, as between the Cambrian and Ordovician, there does not seem to be any break in the rock record between the Ordovician and the Silurian in southern Illinois. And again, as with the Ordovician strata, Silurian rock exposures are confined to the Thebes area in this part of the Basin. However, the Silurian rock section is well-developed in the subsurface. The strata are primarily limestones and dolomites with some interbedded shales, some of which are very dark colored. The oldest Silurian strata in the southern part of the Illinois Basin are characteristically oolitic, ie., they are made up of tiny lime spheres about 1.5 to 2 mm. in diameter. These small spheres or oolites are forming today along the western edge of the Bahama Platform in warm, very shallow, marine waters. The overlying limestones contain a diverse fauna consisting of sponges, corals, crinoids, brachiopods, graptolites, gastropods, clams, nautiloid cephalopods and trilobites (Fig. 5-8). Among the brachiopods are elements that are common to the onshore and offshore shelf areas. By middle Silurian time the rock section becomes more shaly, and the oolitic and dolomitic limestones of the early Silurian are replaced in late lower Silurian and middle Silurian times by cherty limestones and fine-grained limestones. These limestones are shallow marine in origin, but were deposited in deeper water, for the most part, than their older Silurian dolomitic counterparts. Again, these limestones contain a diverse invertebrate fauna consisting of some sponges, corals (some of which are colonial), cystoids, crinoids, abundant brachiopods, gastropods, cephalopods, and trilobites. The dark interbedded shales contain an abudance of graptolites, _Cyrtograptus_. These shales are indicative of restricted conditions, ie., anaerobic bottom conditions with little or no currents as evidenced by the abundant presence in the shales of black organic material that has not been oxidized and the lack of bentonic fossils like brachiopods that require oxygen and the presence of planktonic forms, the graptolites, that floated near the sea surface or on it and upon death fell to the bottom. The brachiopods present are representative of both onshore and offshore shallow, marine conditions, and the coral reefs in the northwestern part of southern Illinois in the subsurface are indicative of shallow, well-lighted, clear, very warm, shallow marine water. Much of the limestone around these reefs has been dolomitized, once again suggesting deposition in warm marine seas at the shoreline. In other areas the first land plants appear in rocks of this age as does the first land animal, the scorpion, but no fossils of either one have been found in the southern Illinois area.

The Devonian strata in southern Illinois are exposed in fault blocks along the Ste. Genevieve Fault System, for the most part (Fig. 2). The Devonian spanned the time period from 350 to 400 million years ago. The lower rock units in this series consist mainly of limestones, some of which have been silicified. The contained faunas include sponges, corals, cystoids, blastoids, crinoids, bryozoans, brachiopods, clams, gastropods, nautiloid cephalopods, and trilobites, among the invertebrates. The brachiopod fauna contains elements that are characteristic of both onshore and offshore shelf communities. The beds of middle Devonian age in the area are also largely made up of limestones with some intervening sand-stones and interbedded shales and siltstones. These limestones become more shaly and dolomitic upsection, and contain an invertebrate fauna similar to that of the lower beds plus remains of bushy graptolites, sharks, and

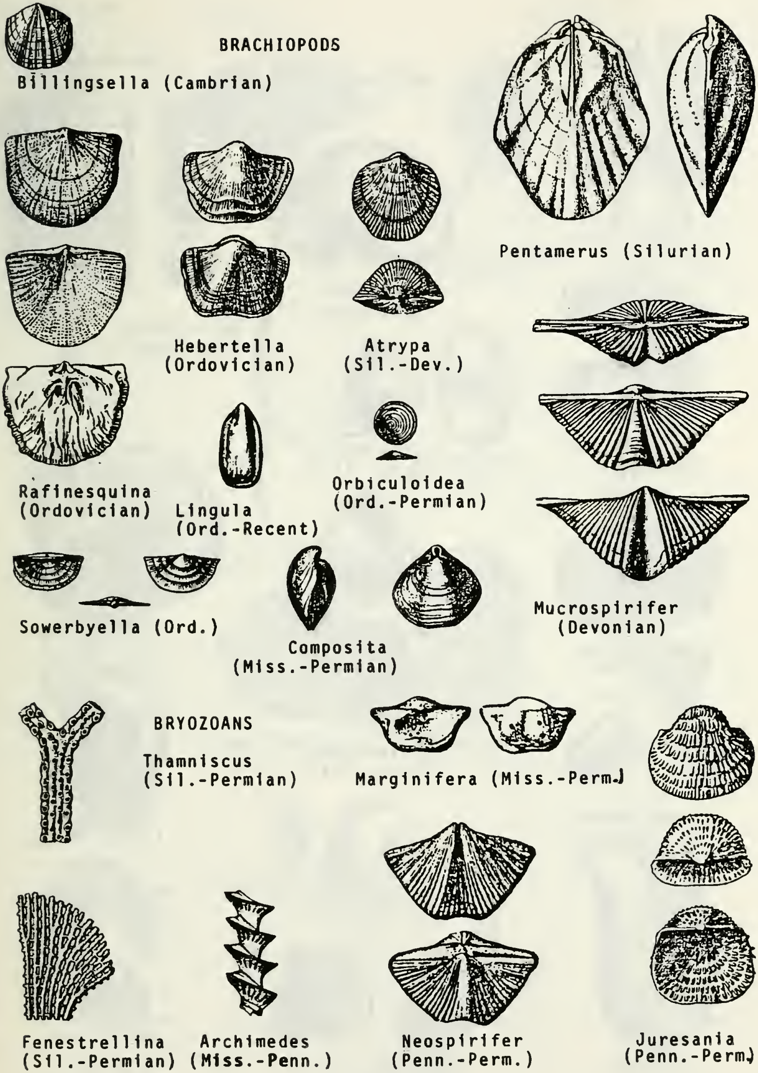

BRACHIOPODS
Billingsella (Cambrian)
Pentamerus (Silurian)
Hebertella
(Ordovician)
Atrypa
(Sil.-Dev.)
Rafinesquina
(Ordovician)
Lingula
(Ord.-Recent)
Orbiculoidea
(Ord.-Permian)
Sowerbyella (Ord.)
Composita
(Miss.-Permian)
Mucrospirifer
(Devonian)
BRYOZOANS
Thamniscus
(Sil.-Permian)
Marginifera (Miss.-Perm.)
Fenestrellina
(Sil.-Permian)
Archimedes
(Miss.-Penn.)
Neospirifer
(Penn.-Perm.)
Juresania
(Penn.-Perm.)

Figure 6.

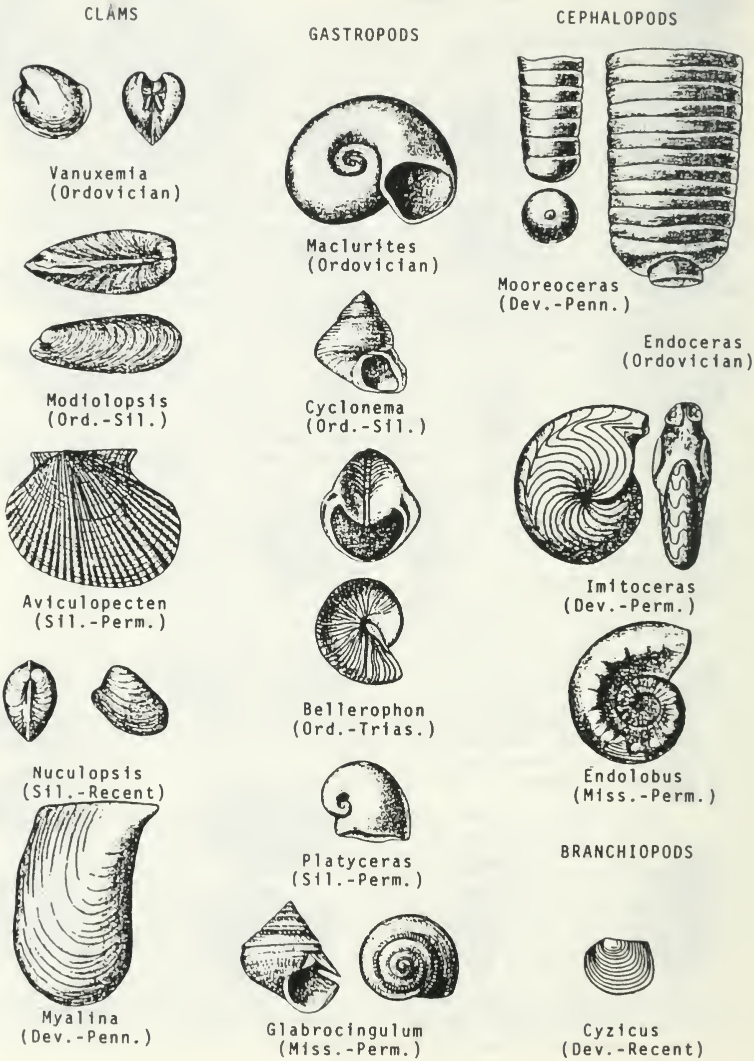

CLAMS
Vanuxemia
(Ordovician)
Modiolopsis
(Ord.-Sil.)
Aviculopecten
(Sil.-Perm.)
Nuculopsis
(Sil.-Recent)
Myalina
(Dev.-Penn.)
GASTROPODS
Maclurites
(Ordovician)
Cyclonema
(Ord.-Sil.)
Bellerophon
(Ord.-Trias.)
Platyceras
(Sil.-Perm.)
Glabrocingulum
(Miss.-Perm.)
CEPHALOPODS
Mooreoceras
(Dev.-Penn.)
Endoceras
(Ordovician)
Imitoceras
(Dev.-Perm.)
Endolobus
(Miss.-Perm.)
BRANCHIOPODS
Cyzicus
(Dev.-Recent)

Figure 7.

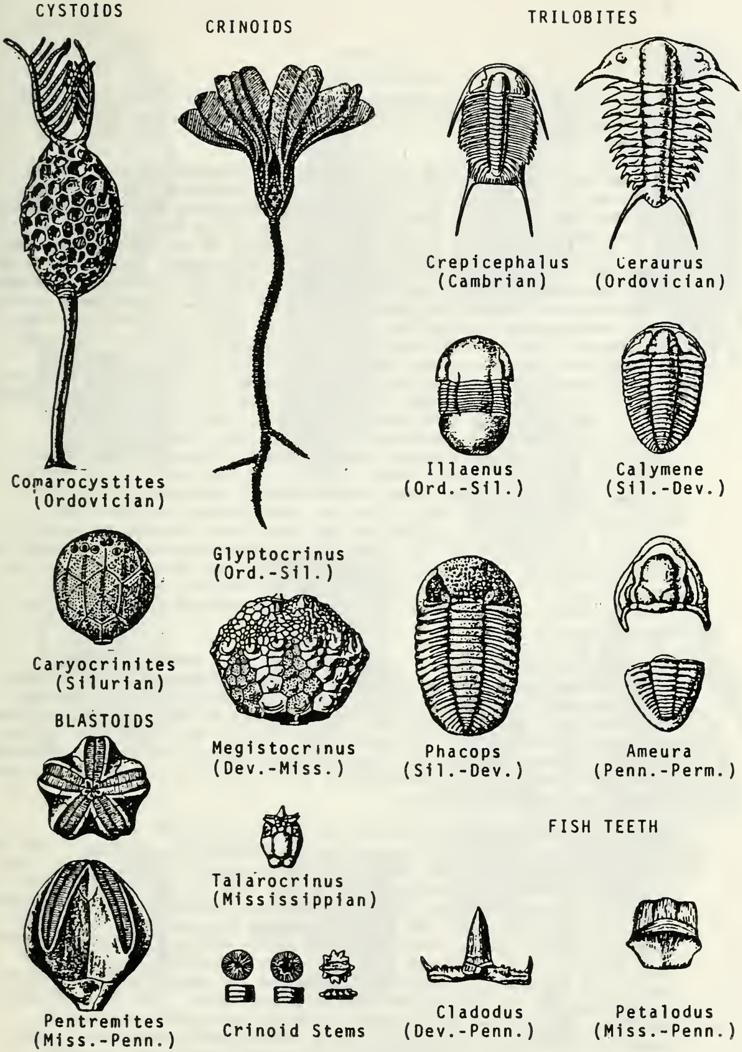

CYSTOIDS
CRINOIDS
TRILOBITES
Crepicephalus
(Cambrian)
Ceraurus
(Ordovician)
Illaenus
(Ord.-Sil.)
Calymene
(Sil.-Dev.)
Comarocystites
(Ordovician)
Glyptocrinus
(Ord.-Sil.)
Caryocrinites
(Silurian)
Megistocrinus
(Dev.-Miss.)
Phacops
(Sil.-Dev.)
Ameura
(Penn.-Perm.)
BLASTOIDS
FISH TEETH
Talarocrinus
(Mississippian)
Pentremites
(Miss.-Penn.)
Crinoid Stems
Cladodus
(Dev.-Penn.)
Petalodus
(Miss.-Penn.)

Figure 8.

armored fishes, the latter of which appear as early as middle Ordovician times elsewhere. Thickets of large colonial corals are also abundant in parts of this section.

The brachiopod faunas include both onshore and offshore elements, while the concentrations of colonial corals are again indicative of shallow, warm, clear seas. As was true during middle Ordovician times, a bentonite, the Tioga Bentonite (Fig. 1), which is present in the southern part of the Illinois Basin and along the eastern shelf of the Basin in the subsurface and can be traced eastward into the Appalachians, is indicative of another explosive volcanic eruption that blew much ash into the atmosphere and probably caused some temporary lowering of surface temperatures during middle Devonian times throughout eastern North America. To my knowledge no evidence of plant or terrestrial animal life has been found in middle Devonian rocks in the southern part of the Illinois Basin. However, rocks of lower and middle age are well-developed in the subsurface in the Basin and contain rich colonial coral as well as other invertebrate fossil faunas. The shales and siltstones of the middle Devonian have a more nektonic fauna than the limestones. The only upper Devonian strata exposed in the southern Illinois area are small patches of black shale which contain no mega-invertebrate fossils, but like some of the middle Devonian shales do contain amber to red colored "fungal capsules" of microscopic size. Black shales such as these usually represent sedimentation in restricted areas of the sea were water circulation is poor or nearly non-existent and where bottom conditions are therefore anaerobic. The characteristic fossils of this area in rocks of Devonian age are the various kinds of colonial corals and the fish fossils, most of which occur as pieces of armor plate and teeth. The Devonian is known as the "Age of Fishes".

Shaling upward of the section along with beds that contain no fossils except the nearshore species Lingula, indicate shallowing of the seaways towards the end of Devonian times. During late Devonian times the Ste. Genevieve fault system was active, causing rocks of Devonian and older ages in southwestern Illinois to be tilted and broken. The regression of the seas and faulting brought on a long period of erosion and/or non-deposition which left a large gap or unconformity in the rock record of late Devonian and early Mississippian times.

Rocks of Mississippian age (310 to 350 million years ago) are well-exposed in southern Illinois along the southwestern and southern "rims" of the Illinois Basin. Except for a basal shale sequence, most of the rocks of lower and middle Mississippian age in the area are limestones. The lower shales are apparently of marine origin as indicated by local concentrations of brachiopods. The lower limestones are somewhat cherty with some interbedded shales, while the upper middle beds are oolitic and somewhat dolomitic. On the other hand, the upper Mississippian strata are made up of alternating limestones, sandstones and shales. The limestones in this part of the section are also somewhat cherty. The invertebrate faunas of all of these limestones are diverse and consist of sponges, corals (including colonial), bryozoans, brachiopods, graptolites, clams, gastropods, nautiloid and goniatite cephalopods, blastoids, crinoids, echinoids, asteroids, worms, trilobites, and among the vertebrates, sharks. Plant fossils become rather abundant in area rocks by late Mississippian time, especially Lepidodendron (Fig. 9).

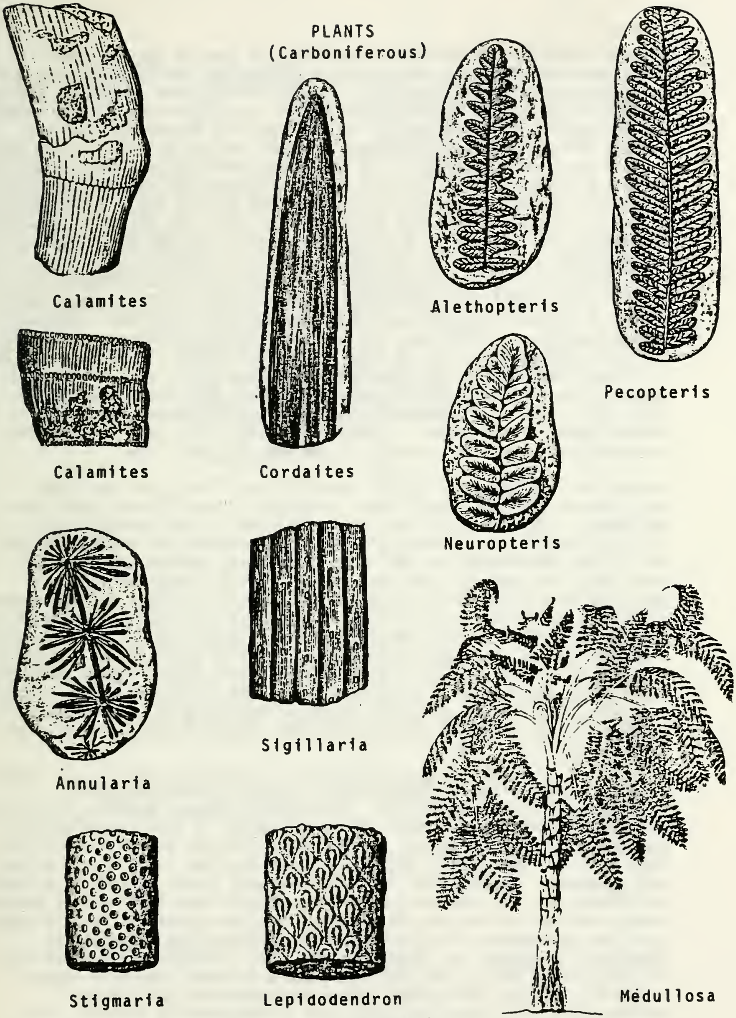

PLANTS
(Carboniferous)
Calamites
Calamites
Cordaites
Alethopteris
Pecopteris
Neuropteris
Annularia
Sigillaria
Stigmaria
Lepidodendron
Medullosa

Figure 9.

The characteristic fossils for this period of time in the Illinois Basin were the blastoids, particularly *Pentremites* and the crinoids, such as *Platycrinites* and *Talarocrinus*. The thick limestone sequences that are typical of the middle Mississippian in the upper Mississippi River valley are indicative of warm seas, and in addition, the evaporites that are present in some of these limestones in south central Illinois in the subsurface are usually indicative of restricted, very shallow arms of the sea where the climate is very hot and dry with evaporation exceeding precipitation. The brachiopod faunas contain both onshore and offshore shelf elements. The sandstones and shales in the upper part of the Mississippian are largely the product of deposition in deltaic and nearshore marine environments. The thin coals present in several of these sandstone units represent organic accumulations in swamp environments where the climate was probably warm and humid. The interbedded limestone units contain a diverse fauna containing elements typically found on shallow marine shelves. In addition, the sandstone units contain plant fossils such as *Lepidodendron*, one of the coal-forming plants of the period. The late Mississippian was characterized by fluctuation of the shoreline of the sea from north central Illinois to south of the Illinois Basin area (Fig. 10). Deep river channels cut in late Mississippian and early Pennsylvanian rocks suggest a sharp drop in sea level that left another extensive gap in the rock record of the area for that time.

During the Pennsylvanian period, about 270 to 310 million years ago, the youngest Paleozoic rocks still remaining in the Illinois Basin were deposited. Hence, much of the bedrock exposed at the surface in the Illinois Basin is Pennsylvanian in age. The oldest beds of this period are largely sandstones and shales of deltaic and shallow marine origin. These beds contain some thin coal seams. Further upsection similar sandstone beds alternate with marine and non-marine shales and limestones, along with thick and thin coal beds. The non-marine sandstones and shale beds contain plant fossils, while the marine limestones and shales contain a diverse marine invertebrate fauna consisting of foraminifera (fusulinids), sponges, corals (some colonial), bryozoans, brachiopods, clams, gastropods, cephalopods (nautiloid and goniatite), crinoids, edrioasteroids, echinoids, asteroids, trilobites, crustaceans, worms, and among the vertebrates, shark and other fish. These marine faunas contain onshore and offshore shelf elements.

The thick, extensive coal beds present indicate widespread swamp conditions with lush vegetation. Such lush vegetation requires warm, humid, climatic conditions as a rule. The small amount of wood, especially in *Sigillaria* and *Lepidodendron*, and the over-developed cortex and pith is an indication of rapid growth which is usually possible only in very moist, warm climates. In addition, the lack of annual rings, or near lack thereof, in these plants is indicative of uniform climate with little or no seasonal change and lack of wet and dry seasons. The characteristic fossils during this time period were the plants such as *Lepidodendron*, *Sigillaria*, *Calamites*, *Stigmaria*, and *Cordaites* (Fig. 9). During the Pennsylvanian in the Illinois Basin, the land surface was low with little or almost no relief, and the alternating marine and non-marine rock units, especially in the middle and upper part of this section indicate that the seas advanced and retreated over and away from the area many times. During the late Paleozoic, as during the early Paleozic, this area was

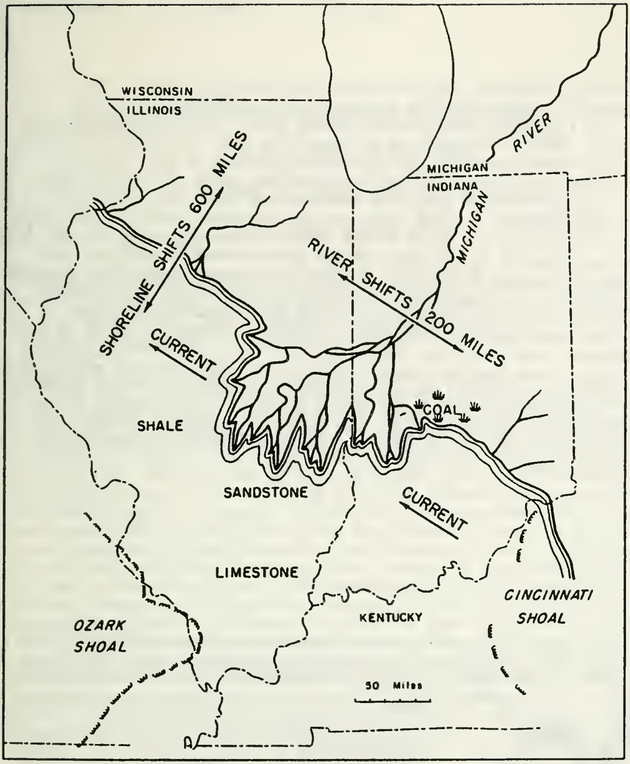


Figure 10. Paleogeography at intermediate stage of Upper Mississippian (Chesterian) deposition. (From Swann, 1963)

located near the Equator, and therefore, was relatively warm. Five major groups ot plants lived in the peat-forming swamps of this time period: the lycopods, ferns, pteridosperms (seed ferns), *Cordaites*, and sphenopsids. Each is represented by tree forms that contributed the bulk of the plant constituents of the Pennsylvanian coals in the Illinois Basin. During early Pennsylvanian times various types of lycopods were dominant. By late Atokan and early Desmoinesian times the ferns were abundant and *Calamites* reached their zenith. Somewhat later in the early Desmoinesian the lycopods again became dominant with *Cordaites* and the ferns as secondary elements in the coals of the Spoon Formation and the lower part of the Carbondale Formation. During later Desmoinesian time lycopods still dominated the younger floras, but the ferns and the pteridosperms were second and third in abundance. At the Desmoinesian-Missourian boundary the lepidodendrids (lycopods) abruptly disappeared while in late Pennsylvanian times tree ferns were dominant. In a few coals *Sigillaria* and *Polysporia* were dominant and seed ferns and *Calamites* were subdominant. These rather abrupt floral changes were probably caused by broad climatic changes. Pennsylvanian deposition was followed by a long period of uplift and/or withdrawal of the seas and consequent erosion, so that the latest Paleozoic time, the Permian, is not represented by a rock record in southern Illinois.

ERIGENIA: 2, (1983), p. 19-40

FIELD LOG TO THE DEVONIAN, MISSISSIPPIAN, AND PENNSYLVANIAN SYSTEMS OF JACKSON AND UNION COUNTIES, ILLINOIS

by Mark W. Mohlenbrock[1]

Jackson and Union counties, Illinois, are situated in the southwestern quarter of the state. To the west, they are bounded by the Mississippi River; to the east, are Williamson and Johnson counties. Maps of the counties can be found in Figures 1 and 2.

Jackson and Union counties are within two physiographic divisions. Most of Jackson and the western section of Union County are within the Shawnee Hills Section. The topography is rolling hills with a number of resistant sandstone exposures. The western portion of this two-county area south of Grand Tower is included within the Ozark Plateau Region. This area is characterized by steeply sloped hills with very well developed drainage patterns. The interface between these two divisions is denoted best by a natural line which is the faulting area of the Rattlesnake Ferry Fault. The fault line enters Illinois at Grand Tower, heads southeast to near Jonesboro, and then heads south. The presence of this and associated faults provide a number of exposed geologic units within the two-county area. The Pennsylvanian System covers much of Jackson County and the northwest section of Union County. The Mississippian System is exposed to the south of this. It runs along the Mississippi River discontinously through Jackson County, and at Grand Tower it cuts inland to Jonesboro and then south to Alexander County. The Devonian and Silurian systems are represented in bands to the west of this, with the Ordovician System exposed in the southwestern corner of Union County, and in a few other isolated sites within that general area. Very isolated locations representing the Cretaceous System are also present. Figure 3 represents an overall view of these systems in Jackson and Union counties.

This field log does not cover the following systems: the Modesto Formation of the Pennsylvanian, the Silurian, the Ordovician, and the Cretaceous. The field trip logged in this paper begins and ends at the intersection of Route 51 and Lincoln Drive (SIU). Its overall length is 150.7 miles and covers 36 stops. Each stop includes a discussion of the geologic unit(s) exposed. A geologic column can be found in Figure 4. It is recommended that this trip be taken in several smaller trips because of its overall length.

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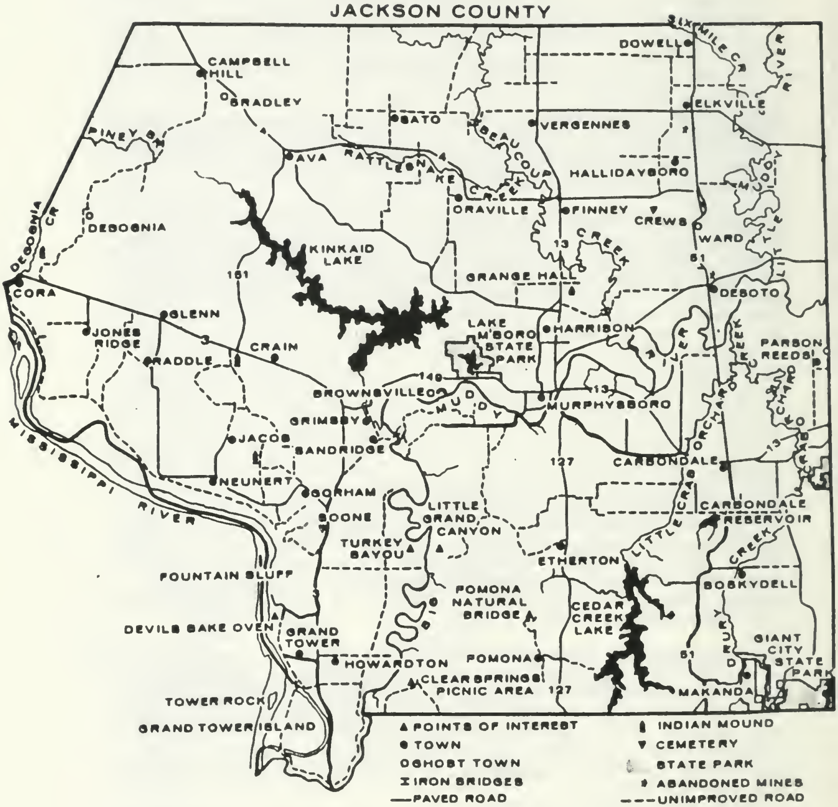
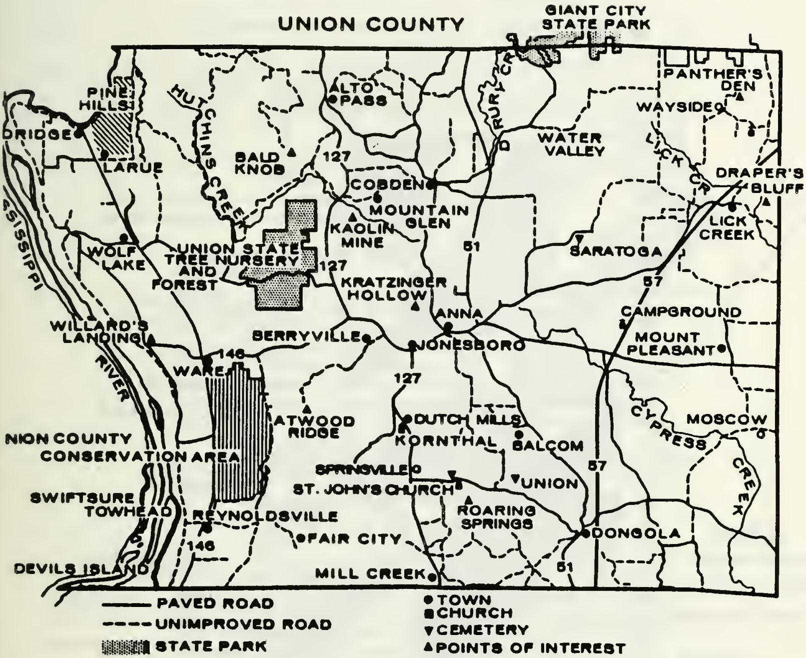
Figure 1. Map of Jackson County, Illinois



From: R. H. Mohlenbrock. 1974. A new geography of Illinois: Jackson County. Outdoor Illinois 12(2): 15-38.

Figure 2. Map of Union County, Illinois



From: R. H. Mohlenbrock. 1974. A new geography of Illinois: Union County. Outdoor Illinois 12(6): 11-42.

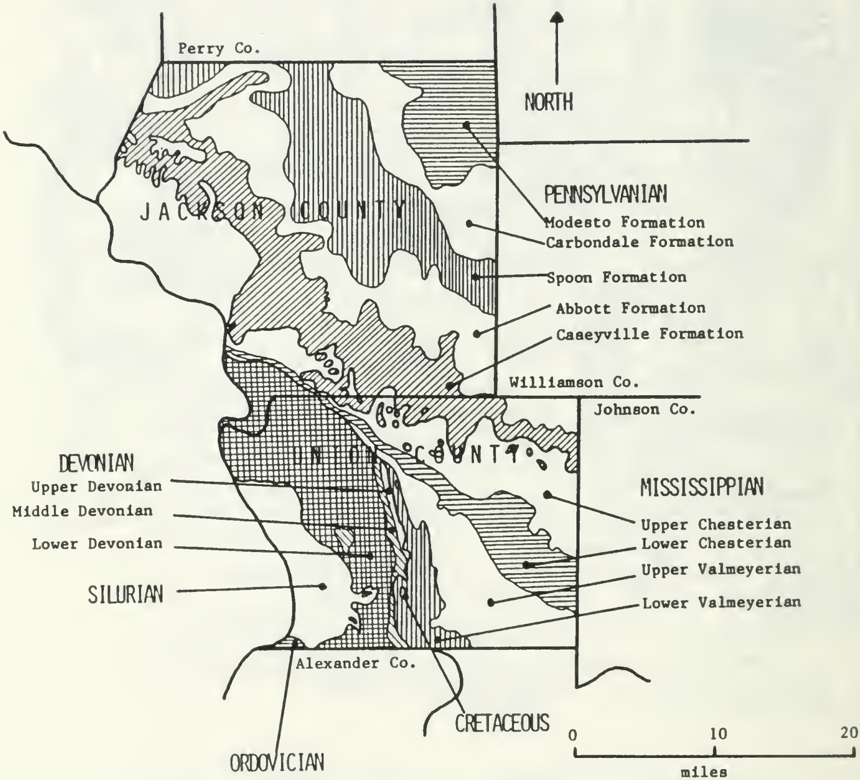


Figure 3. Geologic map of Jackson and Union counties, Illinois.

0.0	0.0	Intersection. Lincoln Drive and Route 51 (at Southern Illinois University). Turn right (south) on Rt. 51.
1.0	1.0	Traffic light. Pleasant Hill Road intersection. Continue south on Rt. 51.
2.3	3.3	Boskydell Road on left (east). Continue on Rt. 51.
0.3	3.6	Intersection. Rt. 51 turns left (south). Turn left here.
4.0	7.6	Intersection. Makanda and Giant City State Park road. Giant City State Park is an area where fantastic exposures of Pounds Sandstone occur. Continue south on Rt. 51.
1.2	8.8	Union County line.
2.3	11.1	Outcrop of Kinkaid Limestone in road cut on left and right. Do not stop.
0.4	11.5	Bridge over railroad tracks.
0.7	12.2	STOP 1. Road cut. Notice the sandstone dipping into the limestone. This sandstone is Pennsylvanian in age and is probably Wayside Sandstone. The limestone is Kinkaid Limestone and is Mississippian in age. The Kinkaid is named for Kinkaid Creek, Jackson County, Illinois, where it is also exposed. One of the thicker Chesterian units, the Kinkaid is limestone with some shaly layers. One of these layers can be noted below the massive blocks of limestone in the cut before you. Here the Kinkaid is partially eroded by the Pennsylvanian, and in many places the Kinkaid is absent. The fossils of the Kinkaid are mainly brachiopods, bryozoans, and blastoids.
0.7	12.9	STOP 2. Road cut on right is Degonia Sandstone. The Degonia Sandstone derives its name from the Degonia Township, Jackson County, Illinois, where it is exposed in the bluffs of the Mississippi River. It is generally sandstone, and is comprised of two massive beds shaped like double-convex lenses. These are white to light colored and fine grained. Most of the shales which occur are gray to dark gray; however, there is a red shale which occurs at the top of the formation.
0.1	13.0	Road to Cobden. Turn right (west).
1.8	14.8	Stop sign at Joseph St. Continue straight on Poplar St.
0.1	14.9	Poplar St. makes an "S" curve to the left, then right. Remain on Poplar St.

0.1	15.0	Stop sign at Front St. Turn right (north).
0.1	15.1	Cross bridge over railroad. Then continue straight (west).
1.1	16.2	Turn left (west) on road to Alto Pass. You are now driving on part of a Pennsylvanian escarpment in which the Battery Rock Sandstone is exposed.
3.0	19.2	Alto Pass watertower on right. Continue in a westerly direction.
0.7	19.9	STOP 3. Cliff View Park. Battery Rock Sandstone is exposed very well here. Looking south, one can see the low Tar Springs escarpment and beyond it the high Devonian escarpments. The valley between these two marks the approximate crossing of the Rattlesnake Ferry Fault. The cross in the distance is the Bald Knob Cross which is perched on a "bald" cherty knob. The knob is one of the highest points in the state and is the highest point in southwestern Illinois. The Battery Rock Sandstone member of the Caseyville Formation of the Pennsylvanian System is named for Battery Rock, Hardin County, Illinois, where it forms a massive sandstone bluff on the bank of the Ohio River. The Battery Rock Sandstone is light brown in color, medium-grained or occasionally coarse, and somewhat micaceous. It is often slightly conglomeratic, having well rounded quartz pebbles present. The sandstone is bonded by silica and iron oxide and thus becomes an important cliff former. The lower 6 to 8 feet of the bluffs here is considered to be Wayside Sandstone. This unit is named for Wayside, Johnson County, Illinois, where it outcrops. In this area, it is the lowest unit of the Pennsylvanian. It is characterized by lenses of sandstone (up to 50 feet thick) which are separated by silty and sandy shales. Continue west to Alto Pass and Route 127.
0.7	20.6	Old Alto Pass Grade School.
0.1	20.7	Intersection with Rt. 127. Turn right (north).
1.7	22.4	Cross Jackson County line.
2.0	24.4	Road to Pomona on left (west). Continue north on Rt. 127.
2.5	26.9	Begin downgrade of Tom Cat Hill.
0.5	27.4	STOP 4. Road cut on left (west) is of Pounds Sandstone and is underlain by Drury Shale. The Pounds Sandstone member is also a part of the Caseyville Fromation, as is the Drury Shale. The

Pounds is named for Pounds Hollow, Gallatin County, Illinois, where its massive bluffs are exposed. It is quite similar in its lithology to the Battery Rock member. At this location, the Pounds Sandstone overlays the shale exposures along Drury Creek, Jackson County, Illinois, south of Makanda. The Drury member is composed of sandy and silty shales and double-convex lenses of sandstone. Here it is a dark gray fragile shale.

0.1	27.5	Driveway to left. Turn around. Head south to Pomona road.
3.1	30.6	Turn right (west) on Pomona Road.
0.8	31.4	Turn right (north) on gravel road (Forest Service Road 750) at the Pomona General Store. Continue north. Do not cross railroad tracks yet.
0.8	32.2	Cross Clear Creek.
0.1	32.3	Cross railroad tracks. Ascend hill and continue on ridge top, then through a pine plantation.
1.5	33.8	STOP 5. Natural Bridge parking lot. Take trail to the Pomona Natural Bridge (¼ mile). The Natural Bridge was formed from Battery Rock Sandstone which is the first resistant bluff forming sandstone above the Mississippian System. Turn around and return to Rt. 127.
3.2	37.0	Intersection. Pomona road and Rt. 127. Turn right (south) on Rt. 127. Head toward Alto Pass.
3.9	40.9	Bridge over railroad (at Alto Pass). Continue on Rt. 127.
0.6	41.5	STOP 6. The exposure immediately to your left is Menard Limestone. The Palestine Sandstone is exposed northeast of here through the woods above. Both are Mississippian System units of the Chesterian Series. The Menard Limestone is named for Menard, Randolph County, Illinois, at a quarry. Here the Menard is a dark gray, fossiliferous, oolitic calcarenite. There are some gray-green shales present which are very fossiliferous. These shale beds separate the three limestone units associated with the Menard. While at this stop, comb the embankment for the many fossils which are present, including brachiopods, bryozoans, and crinoids.

The Palestine Sandstone is named for Palestine Township, Randolph County, Illinois. It consists of sandstone, shale, and siltstone. The sandstone is gray, fine-grained, and somewhat shaly. On occasion, the sandstone is light-colored and is coarser grained. This is usually the case in the thicker units. Fossils are present, the most common being the trunks of the extinct tree Lepidodendron.

Continue south on Rt. 127.

0.3	41.8	STOP 7. Waltersburg Sandstone exposed in the road cut on left. The Waltersburg Sandstone is directly overlain by the Menard Limestone. Both are of the Chesterian Series. The Waltersburg received its name from Waltersburg, Pope County, Illinois. It consists mainly of shale; however, beds of siltstone and sandstone do occur. Here, a sandstone bed is exposed. The sandstone bodies are often strongly linear, gray to white, very fine to fine-grained, and well jointed. The shales are dark gray or sometimes green, and are silty or sandy.
0.3	42.1	Gravel road to right (west). Continue ahead on Rt. 127.
1.4	43.5	STOP 8. Cypress Sandstone exposed on the right in the road cut. Note the ripple marks. The Cypress Sandstone is named for a bluff exposure along Cypress Creek, Union County, Illinois. Along with the Tar Springs Sandstone, this sandstone is one of the thickest and most persistant formations to be found in the Chesterian Series. It consists of massive bodies of sandstone, shale, sandy shale, and beds of shale with thin layers of sandstone. The sandstone is white to light gray, fine to medium grained, angular, and easily crumbled. The shale is generally dark green-gray (occasionally reddish). Lepidodendron trunks can be found in the Cypress. The tilting of the rock here is due to a nearby fault zone. Continue up the hill (southeast).
0.4	43.9	Turn around on the road to left (east). Note the large sink hole ponds on the west side of Rt. 127. These sink holes are overlying the Ste. Genevieve Limestone. Head north on Rt. 127 toward Alto Pass.
1.8	45.7	Turn left on gravel road, cross bridge, then immediately veer left.
0.4	46.1	STOP 9. Tar Springs Sandstone appears on left (south) underlain by black shale. The Tar Springs Sandstone derived its name from a bluff exposure at Tar Springs, Breckenridge County, Kentucky. As mentioned at Stop 8, the Tar Springs is one of the major sandstone formations of the Chesterian Series. It consists of massive beds of sandstone along with beds of shale. The sandstone is very similar to the Cypress with the exception that it may be friable or well cemented. One to three of

these sandstone bodies are developed. The remainder of the formation includes dark gray, slightly carbonaceous shale. The shaly layer here is probably of the Glen Dean Limestone.

0.1 46.2 Tar Springs Sandstone bluffs on right and left.

0.3 46.5 STOP 10. Stay in car. Note Glen Dean Limestone on the hillside to the left. The Glen Dean Limestone, which is basically a limestone-shale unit, is named for exposures at Glen Dean, Breckenridge County, Kentucky. There are often three units of limestone separated by shale. The limestone is brownish-gray, coarse, and fossiliferous. Oolitic and cherty beds can be found. The shales are dark greenish-gray and are fossiliferous. Bryozoans and blastoids are typical of the Glen Dean.

0.5 47.0 Bridge across Clear Creek.

0.5 47.5 Turn left on gravel road and cross bridge. Immediately the road becomes blacktop.

0.5 48.0 STOP 11a. Clear Creek Chert exposed on the left. Note the layers of resistant limestone sandwiched between cherty layers. The Clear Creek Chert is named for Clear Creek, Union County, Illinois. This creek is just south of here and was crossed at the last bridge. The thickness of Clear Creek Chert is not easy to determine. Here we are looking at the upper layers of the formation. To our left (west) is Bald Knob and its cross. It is beleived that Bald Knob is entirely Clear Creek Chert. It is known that the Clear Creek Chert will achieve thicknesses of up to 600 feet. Typical of the top of the formation, there is a large proportion of limestone of the predominant unit, chert. The solution of the limestone units and the fracturing of chert units cause changes in the character of the formation, including the forming of tripoli. Tripoli is used in abrasives and is composed of "vein-like" bodies of fine particles of silica. We will see an outcrop of Clear Creek later which is partially tripoli. Tripoli is mined in Alexander County, Illinois, just south of the Union County line. As mentioned above, chert is the predominant unit in this formation. It is white or at least quite light in color. The limestone is gray, very finely grained, and siliceous.

0.1 48.1 STOP 11b. Clear Creek Chert, Dutch Creek Sandstone, and Grand Tower Limestone exposed on left. The Clear Creek Chert is only exposed here at the lower west end of this cut. The Dutch Creek member of the Grand Tower Limestone rests directly above it. The Dutch Creek will be discussed further at Stop 13. All three units are Devonian in age. The Grand Tower Limestone is generally coarse-grained, light gray, cross-bedded, and pure. Its thickness is quite variable. It is very fossiliferous. The base of the Grand Tower Formation (base of the Dutch Creek member) marks the base of the Kaskaskia Sequence. Thus the Clear Creek Chert is of the Lower Devonian Series and the Grand Tower is of the Middle Devonian Series.

Continue east to Rt. 127.

1.1	49.2	Turn right (south) on Rt. 127.
3.2	52.4	Intersection. Union County Forest and Nursery road to right (west). Turn left on gravel road (east) opposite the Union County Forest and Nursery road.
0.05	52.45	STOP 12. Across the stream an exposure of Clear Creek Chert with its typical striations of chert and limestone are apparent. The Clear Creek Chert is exposed all along this stream to the west. Notice the gravelly nature of the stream. This Devonian cherty gravel is very typical of the Ozark Plateau Region which we are in. Intermixed with the gravels are fragments of black shale of the New Albany Shale Group. These shales represent the Upper Devonian Series and are probably of the Grassy Creek Formation which will be discussed at Stop 19.
0.05	52.5	Turn left (south) toward Jonesboro on Rt. 127.
0.2	52.7	STOP 13. Dutch Creek exposure on right (west). The Dutch Creek Sandstone, as mentioned earlier, is the lowest member of the Grand Tower Limestone Formation and thus the lowest member of the Middle Devonian Series. It is named for Dutch Creek, Union County, Illinois. It is a calcareous, well-rounded, medium- to fine-grained sandstone. In addition, it is fossiliferous and includes brachiopods and mounds of corals. The Dutch Creek tends to turn brown when it is exposed to the elements.
1.0	53.7	Intersection with Rt 146. Turn left (east) on Rt. 146
0.5	54.2	Turn left on blacktop road (this is just east of a sawmill). Immediately cross railroad tracks; in 1/10 mile cross bridge and turn left. Road eventually turns to gravel.
0.7	54.9	Turn right on gravel road at water works. Continue straight (east) to spillway.
0.2	55.1	STOP 14. Bluff south of spillway is composed of the State Pond member of the Springville Shale. The State Pond member of the Springville Shale is named for this locality. It is greenish-gray, soft, and glauconitic. Fossils of conodonts and ostracods

are present. The State Pond member is probably a deep-water deposit.
Return to Rt. 146.

0.9 56.0 Turn left (east) on Rt. 146 toward Jonesboro.

0.4 56.4 STOP 15. Alto Limestone exposed on the right. This area is near a fault which exposes this outcrop. The Alto Limestone Formation is named for Alto Township, Union County, Illinois, where it is exposed along a creek. The lower unit of the Alto is dolomitic and calcareous. It may be in the form of shale or siltstone. The upper unit is a silty, cherty, gray to dark gray dolomite. The chert is white, gray, or black. Only a few microfossils are known from the Alto Formation.

1.7 58.1 City square of Jonesboro. Continue straight (east) on Rt. 146 to Anna.

1.5 59.6 Cross railroad tracks (downtown Anna); turn right on Rt. 146. Continue on Rt. 146 to Rt. 51 north.

1.2 60.8 Turn left (north) on Rt. 51 north.

0.5 61.3 STOP 16. Small pull-off on left (west). View of the Anna Limestone Quarry (beyond russian olive hedge). This quarry produces limestone for construction and agriculture purposes. The pit which you are now viewing is the second pit dug at this quarry. The original pit is slightly west of here. The bulk of the stone quarried here is of the Ste. Genevieve Formation which is named for Ste. Genevieve, Missouri, where it forms the bluffs of the Mississippi River. At this part of Union County, it is a subsurface formation and is exposed only in mines such as the one here. However, it does outcrop in the southeastern portion of the county. It is usually light gray, but there are oolitic beds present which often appear almost white. Chert is abundant and is generally gray or black. These cherty areas cause problems for the quarry as they are less desirable. The Ste. Genevieve Limestone has three members. These are the Fredonia Limestone, the Spar Mountain Sandstone, and the Karnak Limestone. There are abundant fossils embedded in the Ste. Genevieve, including crinoid fragments.

The St. Louis Limestone, named for exposures at St. Louis, Missouri, is exposed at the deepest part of the quarry. It is also exposed in outcrops in the southeastern portion of Union County. The St. Louis is a fine-grained, micritic to lithographic, cherty limestone. Dolomite, crystalline limestone, fossiliferous limestone, and evaporites are also present in the St. Louis. The rugose coral *Lithostrotionella* is characteristic of the formation.
Turn around and return to Jonesboro city square.

3.2	64.5	Go 3/4 around the square and south on Rt. 127.
4.9	69.4	Turn left (east) on the Dongola road. STOP 17. Note the Salem Limestone in the ditch at left. The Salem Limestone is named for locations where it is quarried at Salem, Washington County, Indiana. It is composed of fossil fragments as well as whole fossils and is often banded with "oolitic-like" outgrowths. The Salem is classified as a biocalcarenite. Continue east on Dongola road.
1.4	70.8	Stop 18. St. John's Lutheran Church. Stop in the parking lot. South and west of the church can be seen the abandoned quarry were Harrodsburg Limestone was mined for marble production. The Harrodsburg Limestone, which is a member of the Ullin Limestone, is named for exposures near Harrodsburg, Monroe County, Indiana. It is composed of bryozoan and crinoid debris and is light-colored. Turn around and return to Rt. 127.
1.4	72.2	Turn left (south) on Rt. 127.
2.5	74.7	Bridge across creek.
0.2	74.9	Bridge across creek. Turn right (very sharp) on gravel road.
0.1	75.0	Cross railroad tracks.
0.5	75.5	STOP 19. Springville Shale and Grassy Creek Shale on the right (north). Of major importance here is the Grassy Creek Shale. The Springville will be discussed at Stop 20. The Grassy Creek Shale is named for Grassy Creek, Pike County, Missouri. It is a blackish shale which is brittle and contains conodonts.
0.7	76.2	Cross bridge. Road veers southwest.
0.1	76.3	Cross bridge. Road turns right (west).
0.8	77.1	Cross bridge. "Y" intersection. Turn left.
0.3	77.4	STOP 20. Ford. Bluff on left is Springville Shale. The top section is composed of the "calico shale". The Springville Shale is the lowest formation of the Valmeyeran Series of the Mississippian System. It is named for Springville, Union County, Illinois, where outcrops are located in a nearby creek. The shale is clayey and is greenish-gray to dark brownish-gray. Portions of the upper unit of the shale are splotched with red and green and are known colloquially as "calico shale". Higher up this cliff is exposed the Hartline Chert which is the lower unit of the "Burlington-Keokuk" Limestone.

0.7 78.1 STOP 21. Ford. Lingle Shale and Limestone exposed to left. The Lingle Formation is named for Lingle Creek, Union County, Illinois. It contains both limestone and shale. It differs from the Grand Tower Limestone which lies directly below it by being more argillaceous, more shaly, darker in color, and finer grained. The shale exposed here is from the Misenheimer Shale member. It is named for Misenheimer Creek, Union County, Illinois. We are in the general area of major outcropping. It is calcareous and its color ranges from dark gray to gray-brown. Other than spores, very few fossils are to be found.

At the top of the hill which the creek is cutting into are outcrops of oolitic Lingle Limestone, This is probably of the Walnut Grove Limestone member which is named for Walnut Grove Church, Union County, Illinois. The Walnut Grove is a silty, cherty, galauconitic, fine-grained limestone. Crinoids, coral, brachiopods, and sporangites are fossils that can be found in this member. Near the base is a distinctive oolitic bed which characterizes the Walnut Grove member.

Turn around at the farm (north of the ford) and return to the "Y" intersection.

1.0 79.1 "Y" intersection. Turn left (north).

0.2 79.3 STOP 22. Ford. Note "calico shale" in the stream cut to the left and the dipping or sagging of the layers toward the center of the exposure. This sagging is due to weaker rocks underlying those exposed.

0.1 79.4 STOP 23. Fault in the Springville Shale. To the right side of the fault zone, the Upper Springville Shale is exposed. This fault zone, which is about 2 to 3 feet wide, is filled with blocks of shale and chert. To the left of this zone, the Lower Springville Shale is exposed.

3.5 82.9 Cross bridge. Continue straight (north).

0.4 83.3 Turn right on blacktop road. This road is known as the Plank Road. At one time it was one of only three routes that went across the bluffs and hills to the west, eventually reaching the Mississippi River and Cape Girardeau, Missouri.

0.1 83.4 STOP 24. Exposure of New Albany Group shale, Sylamore Sandstone, and Alto Limestone on the right (east) side of the road. Here over 50 feet of shale of the New Albany Group (probably Springville Shale) overlies a thin bed of Sylamore Sandstone. Below this unit lies less than 20 feet of Alto Limestone.

The Sylamore Sandstone is named for Sylamore Creek, Stone County, Arkansas. It is very thin, less than five feet thick, and is discontinuous. It is characterized by rounded, fine- to medium-grained, friable to well cemented sandstone.

0.4	83.8	Turn right (east) on road to Kornthal Church.
0.3	84.1	STOP 25. Abandoned limestone quarry exposing Salem Limestone. It is located less than 100 yards south of Kornthal Church. It can be reached by crossing the grown-up area or by heading south down the creek and turning right when the concrete ruins of a bridge are reached.
		Kornthal Church was constructed in 1860 by a group of Austrians who immigrated to this country. The settlement, known as Kornthal (valley of grain), was mainly a farming community, but it did have a grist mill, general store, and a box factory. Turn around and return to the Plank Road.
0.3	84.4	Intersection with the Plank Road. Turn right (north).
0.1	84.5	Turn left (west) on gravel road just before reaching a bridge.
0.4	84.9	Note minor exposure of Springville shale on left (south).
0.5	85.4	Bridge over Dutch Creek.
1.6	87.0	"T" intersection at Lockard Chapel. Turn right (north).
1.7	88.7	Intersection with Rt. 146. Turn left (west).
1.5	90.2	Intersection with Rt. 127. Turn right (north).
1.2	91.4	Turn left on road to Union County Forest and Nursery.
0.6	92.0	Note Clear Creek Chert exposure in the creek bank to the left across the field. Here the chert is partially weathered to tripoli.
1.0	93.0	STOP 26. Road cut through Clear Creek Chert. Here red clay soils have extensively stained the normally light-colored chert. Careful examination of these rocks will uncover many fossil casts and molds, including crinoids, brachiopods, and borings of marine animals.
1.4	94.4	Exposure of Clear Creek Chert in the creek bank on the left (south).
1.0	95.4	Bridge across creek. Continue west.
3.2	98.6	Turn right (north) on gravel road to Pine Hills. Immediatedly cross a ford.

3.0 101.6 Note Grassy Knob Chert in ravines.

0.8 102.4 McGee Hill picnic grounds.

0.1 102.5 STOP 27. Overlook to left. Rock exposed here is Grassy Knob Chert. Looking below, one can see the La Rue Swamp. It occupies what was at one time the river channel of the Big Muddy River. Today the Big Muddy River cuts across the Mississippi River bottom and joins the Mississippi slightly north of here.

Continue on to Saddle Hill overlook. Note the extreme steepness of the hills.

1.5 104.0 "Y" intersection. Veer left.

0.3 104.3 Saddle Hill overlook. Rock exposed here is Grassy Knob Chert.

1.1 105.4 STOP 28. Old Trail Point. From here can be seen the expansive Mississippi River bottom, Fountain Bluff (far right), Walker Hill (right), and the Devil's Backbone (right, and somewhat behind Walker Hill).

1.3 106.7 "T" intersection. Turn right (north) on Forest Service Road 345. Rock at left of intersection is Bailey Limestone. Note Bailey Limestone bluffs on right all along the road.

1.3 108.0 Road veers right (east). Hill straight ahead is part of Grassy Knob, the type locality of Grassy Knob Chert. The Grassy Knob Chert is characterized by being somewhat light in color and containing many thick beds of solid chert. Fossils are very uncommon in the Grassy Knob.

1.3 109.3 "Y" intersection. Turn left. This is the approximate location of the crossing of the Rattlesnake Ferry Fault.

0.1 109.4 STOP 29. Pull-out on left. Note the extreme dipping of the rocks on the western hill. This is the result of the Rattlesnake Ferry Fault. The Rattlesnake Ferry Fault is also known as the Ste. Genevieve Fault from Ste. Genevieve, Missouri. In Illinois it cuts across Jackson and Union counties in a northwest to southeast direction. To the north of the fault, Mississippian and Pennsylvanian formations are exposed, whereas on the southern side, Devonian strata are exposed. This exposure of Devonian strata to the south and later strata to the north has created two natural physiographical divisions. The south makes up part of the Ozark Plateau Region, and the north is part of the Shawnee Hills Section. The Ozark Plateau differs from the Shawnee Hills in that there are many cherty streams which run generally year-round, steep, well-developed drainage systems, and cherty soil layers.

Turn around and return to "Y" intersection.

0.1	109.5	"Y" intersection. Turn right (southwest).
2.6	112.1	Road to left ascends the Pine Hills. Continue straight.
0.2	112.3	STOP 30. Bailey Limestone. Bluffs of the Pine Hills. The Pine Hills is one of the best exposures of the Bailey Limestone. Here the bluffs tower some 400 feet above the river bottoms below. The limestone shows weathering along major joints in its construction and a well-developed talus slope at its base. The Bailey is named for Bailey's Landing, Perry County, Missouri, along the Mississippi River. It is characterized by being gray to greenish-gray, silty, cherty, thin-bedded, and very hard. The chert is found in either nodules or beds and is black to dark gray. The upper unit of the Bailey Limestone is less cherty and is white and coarsely crystalline.
0.2	112.5	Levee road. Turn right (west). Continue on levee road to Rt. 3.
0.6	113.1	STOP 31. View of the cliffs of Bailey Limestone directly behind. Big Muddy River to the right (north), La Rue Swamp to the left (south).
2.2	115.3	Intersection with Rt. 3. Turn right (north). You are now driving across the Mississippi River floodplain.
0.1	115.4	Jackson County line.
4.7	120.1	Turn left (west) on road to Grand Tower.
1.1	121.2	Front St. Levee straight ahead. Road turns to right.
0.5	121.7	"Y" intersection. Veer left onto levee.
0.2	121.9	South end of Devil's Backbone. Road turns right.
0.1	122.0	STOP 32. Abandoned quarry on left. This quarry is a remnant of the Works Progress Administration of the 1940's. Exposed here is Backbone Limestone. The upper 25-30 feet of the rock cut is Clear Creek Chert. The Backbone Limestone derived its name from this isolated ridge known as the Devil's Backbone. This is the type location of the formation. It is characterized by being light gray, crystalline, and pure. Fossils are abundant. These include crinoids, gastropods, bryozoans, conodonts, and trilobites. About 2/5 the distance north from the southern end of the Backbone, the Rattlesnake Ferry Fault crosses. Thus, exposures ahead are of Middle Devonian age or younger.

0.4	112.4	"T" intersection. Turn left, then right once past the Backbone. <u>STOP 33.</u> Grand Tower Limestone overlain by Lingle Limestone. Here one may find corals and brachiopods in abundance at and near the cap of Lingle Limestone and thin-bedded units.
0.3	122.7	Veer right to the base of the pipeline bridge. <u>STOP 34.</u> Rock outcrop to the left is the Devil's Bake Oven. The Devil's Bake Oven is the type locality for the Grand Tower Limestone. Note the angle in which the rock of the Bake Oven rests. This is due to the Rattlesnake Ferry Fault. Exposed at the Bake Oven, beginning at its base, is the top unit of Clear Creek Chert (remember that this was at the top of the rock cut at the quarry at the southern end of the Backbone due to the presence of the fault). Above the Clear Creek Chert lies the Dutch Creek Sandstone member. Overlying the Dutch Creek is the Grand Tower Limestone which is capped by Lingle Limestone. Leave the Bake Oven by turning east.
0.2	122.9	Cross railroad tracks. Continue east on 20th St.
0.2	123.1	"T" intersection. Straight ahead is the northern end of Walker Hill. Like the Devil's Backbone, Walker Hill is on the upthrown side of the Rattlesnake Ferry Fault and is composed of Salem and St. Louis Limestone. Turn left (north) on Third Ave. Straight ahead is Fountain Bluff. Fountain Bluff is on the downthrown side of the Rattlesnake Ferry Fault.
1.0	124.1	"T" intersection. Turn right (east) at the base of Fountain Bluff.
1.3	125.4	"T" intersection. Turn left (north) on Rt. 3.
1.7	127.1	Road on right (east) to Oakwood Bottoms.
1.4	128.5	<u>STOP 35.</u> Left (west) are bluffs of Battery Rock Sandstone. Fountain Bluff is a resistant "island" of Battery Rock Sandstone. At one time in the past, the Mississippi River went around Fountain Bluff on its north side and through the river bottom we are in now. Exposures dip to the north, thus exposing some Mississippian formations on its south facing bluffs. The Rattlesnake Ferry Fault lies south of Fountain Bluff and the Pomona Fault bounds its northern bluffs.
0.5	129.0	Railroad overpass. Note Battery Rock Sandstone exposed in the road cut on the road to the left across the railroad tracks.
1.7	130.7	Turn right (east) on the road to Sand Ridge just south of the railroad tracks.

1.8	132.5	Sand Ridge was named for the sand dune remnants of this area. To the right (south) is one of these remnants.
0.8	133.3	Bridge over the Big Muddy River.
0.5	133.8	Pounds Sandstone exposed in the road cut to the left. Road veers to the left.
3.6	137.4	Outcrop in creek to the left is of the Spoon Formation.
1.0	138.4	Cross Big Muddy River. Enter Murphysboro.
0.4	138.8	Turn right (east) on Shomaker Drive.
0.2	139.0	Cross railroad tracks.
0.8	139.8	Intersection with Bridge St. (Rt. 127). Turn right (east).
0.2	140.0	Cross Big Muddy River.
0.5	140.5	Intersection. Turn right (south) on Rt. 127.
0.5	141.0	Turn right (west) on blacktop road.
0.9	141.9	STOP 36. Spoon Formation of the Pennsylvanian System. The shale which is exposed in the gullies on the left side of the road is covered with an abundance of plant fossils. These shales are associated with the Murphysboro Coal member of the Spoon Formation which was extracted from nearby mines. They are characterized by being light brown to light gray, quite fragile, and containing carbon imprint plant fossils. Turn around and return to Rt. 127.
0.9	142.8	Intersection with Rt. 127.
0.5	143.3	Intersection. Turn right (east) toward Carbondale (Old Rt. 13).
4.8	148.1	Intersection with Rt. 13. Turn right (east).
1.6	149.7	Intersection with Rt. 51. Turn right (south) (University Ave.).
1.0	150.7	Intersection with Lincoln Drive on right (west).

END OF FIELD TRIP

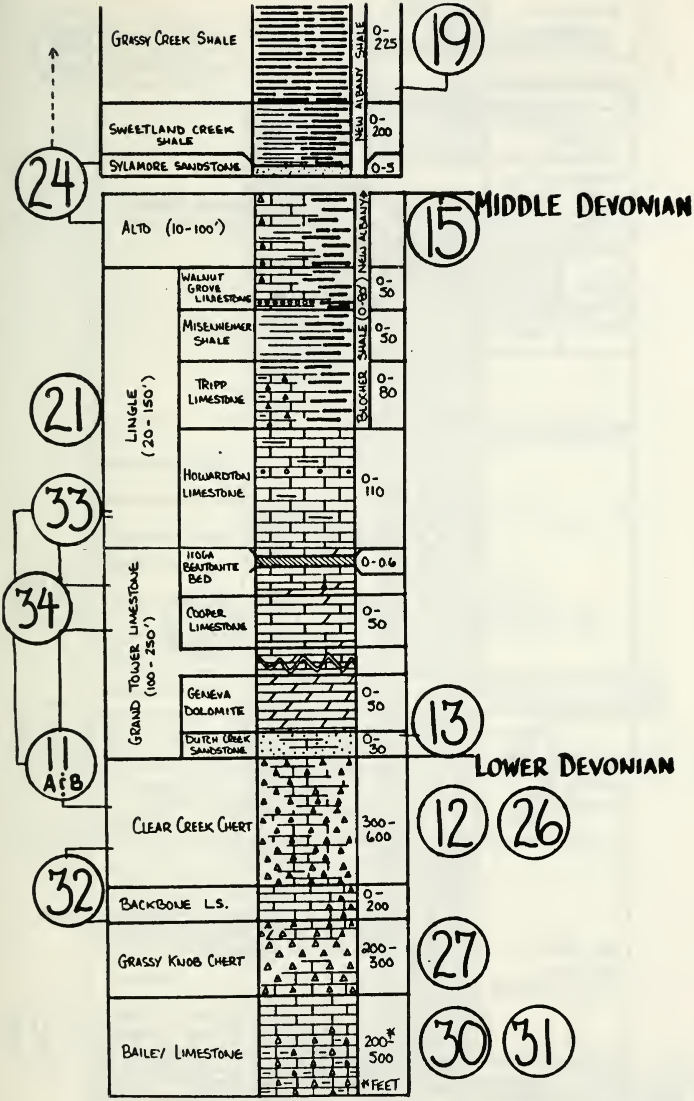


Figure 4. Geologic column of southern Illinois (part 1).

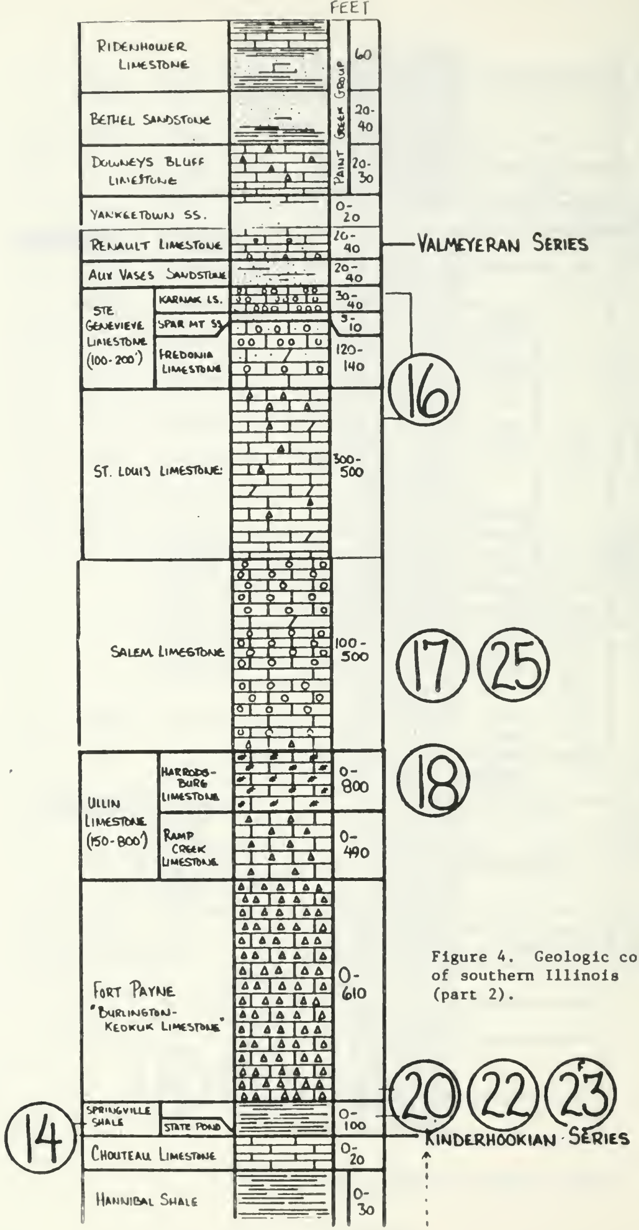


Figure 4. Geologic column of southern Illinois (part 2).

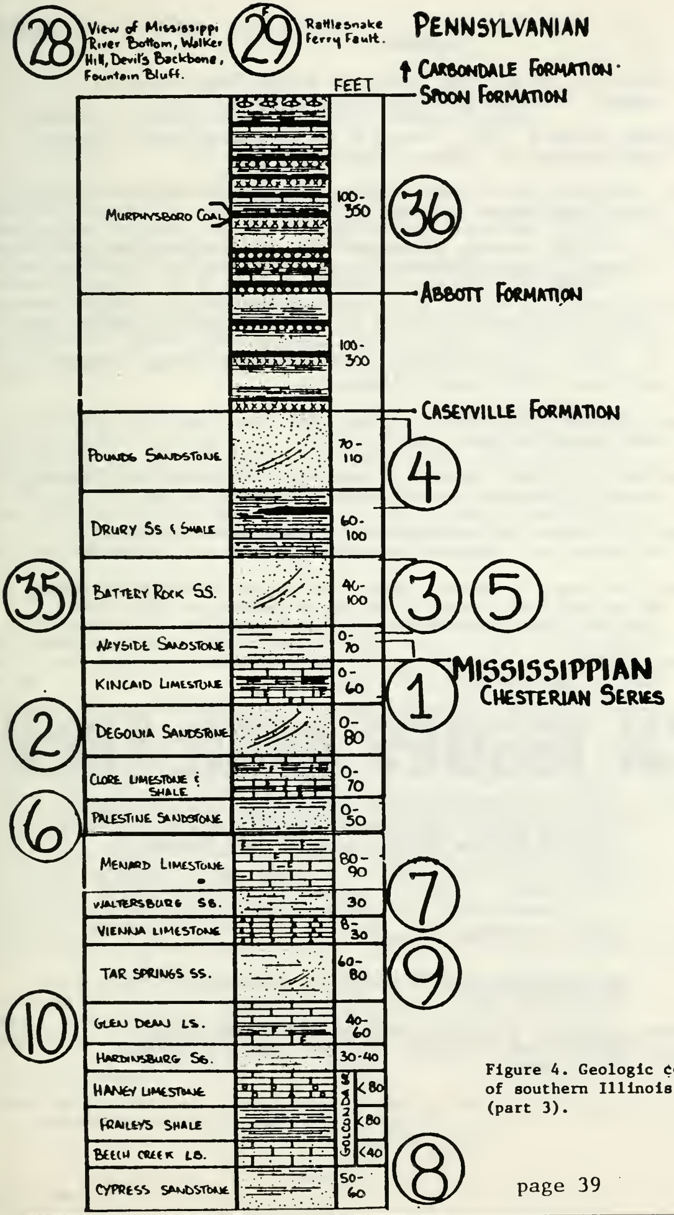


Figure 4. Geologic column of southern Illinois (part 3).

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LANDFORMS OF THE NATURAL DIVISIONS OF SOUTHERN ILLINOIS

by
Stanley E. Harris, Jr.[1]

I suppose most botanists become interested in the geologic character of a region just as geologists, concerned with the Earth's surface, become intrigued with the distribution and composition of the vegetation. This essay seeks to give some insight into the character of the topographic form and the surface and near-surface materials of Southern Illinois. To do so it is necessary to consider the earth processes which are at work or have been at work and some aspects of the long geologic history. I am sure the reader will understand that the story here given is sketchy indeed, on two counts: first, I have had to leave out so much and second, there is so much still to be learned.

Southern Illinois lies at the junction of four major physiographic divisions of North America: the Central Lowlands, the Interior Low Plateaus (Shawnee Hills Section), the Ozark Section of the Interior Highlands and the Mississippi Embayment of the Coastal Plains (Fig. 1). In addition, the bottom lands and valley-side borders of the Mississippi, Ohio and Wabash rivers occupy large and distinctive areas (Fig. 2). This provides endless diversity of scenery and unlimited opportunities for geologic and ecologic studies and research.

Central Lowlands

The largest physiographic subdivision of our region lies within the Central Lowlands. It is a province characterized by low topographic relief and a veneer of surficial deposits related to Pleistocene glaciation.

The topography is typified by the extensive nearly flat upland Effingham plain, traversed by I-70, and the somewhat more rolling topography of Mt. Vernon Hill Country. Several streams of moderate size, such as the Kaskaskia and Saline rivers, with their many tributaries dissect this plain. The valley walls are steep in some places, especially where the river comes against them, but do not rise high above the valley floor. Bottomlands are broad with terraces. Stream channels tended to be meandering, some strongly so, but many have been straightened since settlement. When driving cross-country one drives across a flat upland, descending now and again into the valleys. Should the road extend along the upland near a valley (i.e., State Highway 51 north of Pinckneyville), the crossing of many short tributaries gives an impression of a hilly countryside.

Low hills do rise above this flat upland in some localities, such as Lebanon and Carlyle. Probably the hills in St. Clair County are related to an end moraine while those to the north and east are more sandy and may be crevasse fills. The latter accumulated as meltwaters

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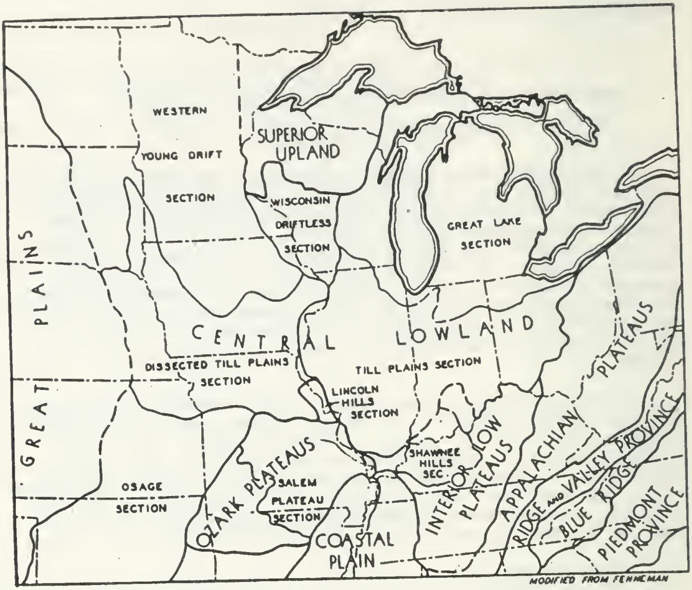

Fig. 1 Major physiographic divisions in central United States.

from the stagnating Illinois glacial ice sheet left debris in the widening fractures in the ice.

The Illinoian glaciation of Southern Illinois was much earlier than those of central Illinois -- older than can be measured by the C^{14}/C^{12} method, some 60,000 years. Furthermore, studies of the Illinoian glacial deposits of central Illinois suggest a very complex history this must be expected in our region as well.

In point of fact, one looks in vain for the classic topographic forms one would expect from lessons learned in Principles of Geology. Northeastern Illinois and adjacent Wisconsin represent the classic form with irregular moraines, kame hills, lakes and swamps, outwash plains, etc. These were formed 14,000 to 12,000 years ago; modification by other surficial processes has been initiated. The Mid-Wisconsin

THE NATURAL DIVISIONS OF ILLINOIS

1 Wisconsin Driftless Division

2 Rock River Hill Country Division
- a Freeport Section
- b Oregon Section

3 Northeastern Morainal Division
- a Morainal Section
- b Lake Michigan Dunes Section
- c Chicago Lake Plain Section
- d Winnebago Drift Section

4 Grand Prairie Division
- a Grand Prairie Section
- b Springfield Section
- c Western Section
- d Green River Lowland Section
- e Kankakee Sand Area Section

5 Upper Mississippi River and Illinois River Bottomlands Division
- a Illinois River Section
- b Mississippi River Section

6 Illinois River and Mississippi River Sand Areas Division
- a Illinois River Section
- b Mississippi River Section

7 Western Forest-Prairie Division
- a Galesburg Section
- b Carlinville Section

8 Middle Mississippi Border Division
- a Glaciated Section
- b Driftless Section

9 Southern Till Plain Division
- a Effingham Plain Section
- b Mt Vernon Hill Country Section

10 Wabash Border Division
- a Bottomlands Section
- b Southern Uplands Section
- c Vermilion River Section

11 Ozark Division
- a Northern Section
- b Central Section
- c Southern Section

12 Lower Mississippi River Bottomlands Division
- a Northern Section
- b Southern Section

13 Shawnee Hills Division
- a Greater Shawnee Hills Section
- b Lesser Shawnee Hills Section

14 Coastal Plain Division
- a Cretaceous Hills Section
- b Bottomlands Section

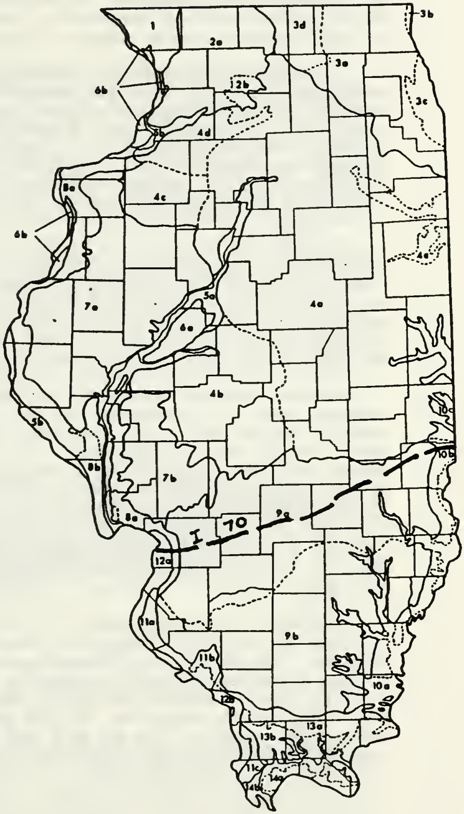

Fig. 2

The natural divisions are described in detail in "Comprehensive Plan for the Illinois Nature Preserves System, Part 2, The Natural Divisions of Illinois", published by the Illinois Nature Preserves Commission, 1973.

region around Champaign represents a second stage of some 20,000 to 18,000 years. First, the small features disappeared by sheet wash erosion, and sediment filling of the low places. Second, an integrated stream system was gradually formed, draining lakes and swamps. Third, wind-blown silts (loess) blanketed the area.

For southern Illinois the alterations must extend over at least 180,000 years. The topography no longer has the look of a glaciated depositional area. The clearest evidence of glaciation lies in the till veneer above the bedrock. It consists of a heterogeneous mixture of all textures and rock compositions, including crystalline pebbles and boulders whose nearest source is Canada.

Of particular interest to botanists is the nature of the soils which have developed. Since melting of Illinoian glaciers, there have been repeated changes in climate, affecting both rainfall and temperature. Furthermore, soils formed in at least four superimposed materials: 1) on the bedrock 2) on the glacial till 3) on Mid-Wisconsinan loess (Roxana) and 4) on the late Wisconsinan loess (Peorian) which may itself be compound. The modern fragipan soils have a heavy clay B-zone inhibiting water and root penetration.

Distribution of vegetation at time of settlement is intriguing as most of the flat uplands were dominantly prairie while the valley slopes and bottomlands were forested (some marshes existed). This is not the place for speculation, but perhaps prairie survived as much because of standing water as fire. The flat uplands are lacking in waterways of concentrated flow so that snow melt and rainfall did not run off, and the tight subsoil permitted very slow percolation.

Another important topographic feature is the extensive terrace surfaces representing backwater lake deposits in the basins of the Big Muddy and Saline rivers. The headwaters of those rivers do not reach back to the Wisconsinan glaciated plain so they did not receive meltwaters as did the Kaskaskia, Little Wabash and Embarras. However, Wisconsinan glacial meltwaters carried such a large load of sediment that the main valleys aggraded. The tributaries were dammed causing backwater deposits to accumulate in the lower part of the basins. At the junction of these nearly level deposits and the modern flood plains there are extensive swamps (north of West Frankfort, northeast corner of Jackson County).

Bedrock is not exposed widely in the Central Lowland except in the hilly portion of the Mt. Vernon Hill Country in Jefferson and Hamilton counties. The rock is all of Pennsylvanian age and dominantly shale. A table of bedrock units will be found on page 45. Some sandstone units which are locally 40 or 50 feet thick form ridges, though the relationship is not easily recognized. All the commercial coals in the state occur in this province. In our area they tend to be quite continuous in underground extent but are mined in an arc from the St. Louis area south-eastward to Marion and Shawneetown. The coal layers come to the surface in outcrop bands dipping downward toward the east and north into the center of the Illinois Basin in Wayne County. The coals are strip mined where they lie within 100 feet or so of the surface, and by slope or shaft mines at greater depths.

Shawnee Hills

The Shawnee Hills is a complex of cuestaform hills extending across southern Illinois from Randolph County at the Mississippi River to Gallatin County on the Ohio River. Massive sandstone layers belonging to the lower Pennsylvanian/upper Mississippian systems rise 300 to 700 feet above the Central Lowalnds. In contrast to the gentle relief of the Central Lowlands the Shawnee Hills is a maturely dissected region mostly in slope, with rather narrow upland divides. Some parts of the Lesser Shawnee Hills are more open with lesser slopes. The Illinoian glaciers pushed into the hills from the north but did not cross them.

The higher elevation and topographic form result from the greater resistance to erosion of the massive Caseyville sandstones which outcrop here, not to a massive pile up of glacial deposits or to some tectonic upheaval. It is in this province where the structure of the bedrock most obviously affects the topography. The diagram (Fig. 3) represents the attitude of the sedimentary rocks which compose the bedrock of the Shawnee Hills. The rock layers rise at an angle of only about 1° (92 ft/mi) from beneath the Central Lowlands.

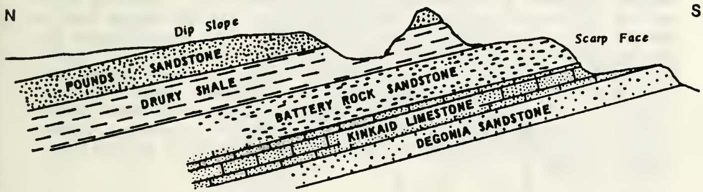

Fig. 3 Cross-section profile of cuestas of Shawnee Hills Section.

Each successively older bedrock unit reaches the surface in an east-west band, one after another. The more resistant sandstones rise gradually higher forming a gently rising backslope, but the eroded edges form scarps marked by high cliffs as at Draper's Bluff and Garden of the Gods. From the escarpment crest (as above Cobden) one may look southward across lowlands formed in weaker rocks and occupied in many places by strike streams (Harris, et.al., 1977, p. 110-1170. No streams cross the escarpment.

Several streams rise near the crest and flow southward, transecting a series of these sandstone units. They provide the unique cliff and shelter bluff environments of Lusk Creek, Hayes Creek, Bay Creek, Happy Hollow in Ferne Clyffe State Park, etc. Other streams have eroded valleys sloping northward. The headwaters of these streams likewise have cliffs, waterfalls, and rocky stream channels, i.e., Pounds Hollow, Burden Falls, Panthers Den, Giant City, Pamona Natural Bridge. A variety of ecologic environments are juxtaposed ranging from mesic, relatively cool alluviated valley floors to dry, sunny cliff-tops with little or no soil cover.

The ridge crests and upper slopes have a thick cover of loess with relatively well-drained soils. Under natural vegetation cover they must have been relatively stable, but cultivation has exposed them to severe sheet and gully erosion. The ridges are nearly continuous along the main cuesta crests, so most roads and dwellings are on the upland. These ridges are famous for their orchards, while the alluviated bottomlands yielded cucumber, pepper and tomato crops. No natural areas are known from the ridges, but are numerous along the canyons and cliffs because they were sites difficult to cultivate or timber.

Faults with large displacements cause sharp discontinuities in the topography. Ste. Genevieve (Rattlesnake Ferry) Fault crosses the Mississippi River just north of Grand Tower. It brings up cherty Devonian rocks on the south so they lie against the Mississippian Chester sequence, a displacement of about 2500 feet. This also forms part of the boundary between the Shawnee Hills and the Ozarks (see map Fig. 2). On the east, Gold Hill and Cave Hill rise sharply above the Central Lowlands. Their north face is a fault line with about 2000 feet of displacement. Slices of Devonian rocks have been turned vertically and can be seen in an old quarry at Horseshoe. Faults are most numerous in the fluorspar district (Fig. 2). Some were highly mineralized and supported rich mines. Others apparently served as channelways for mineralizing solutions but were not themselves the loci of mineralization.

The southern portion of the Shawnee Hills is underlain by thick limestones. Some units are cavernous. Their outcrop contains many sinkholes with sinking streams and springs but few surface streams -- karst topography. It is a westward extension of the Pennyroyal Plateau of Kentucky.

Loess deposits veneer the Shawnee Hills. The silt cover is as much as 15 feet thick on the upland near the Mississippi bluff. The loess thins gradually eastward to about 4 feet, but thickens again near the Ohio River. The source was the aggrading and nearly barren fluvio-glacial sediments of the valley.

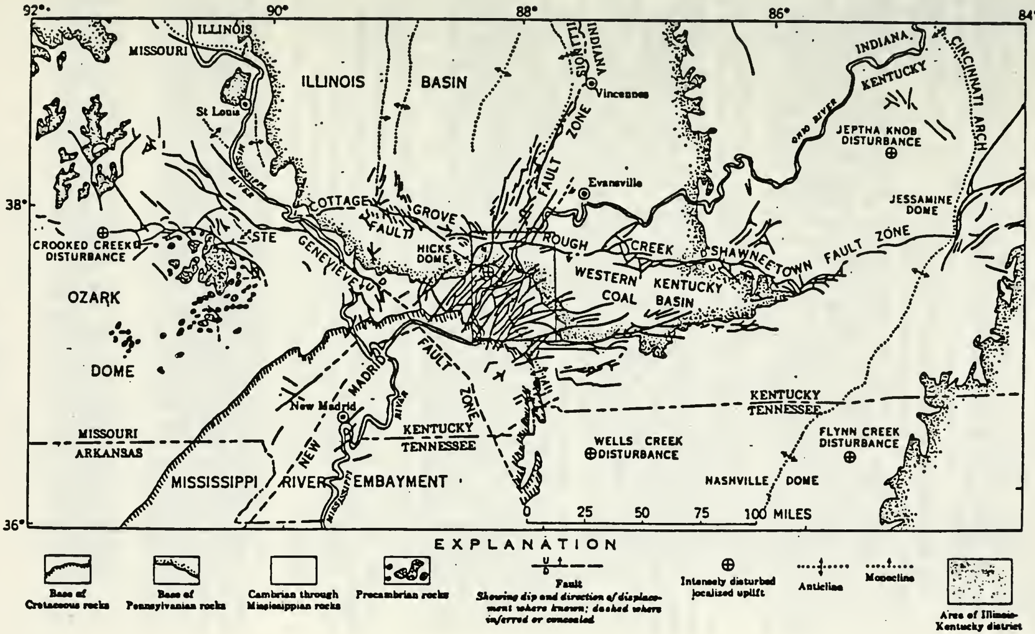

Fig. 4 Map centered on southern Illinois showing regional structures.

Bedrock is extensively exposed in the Shawnee Hills. Sandstones form cliffs along the escarpments and in the deeply entrenched valleys both on the scarp and backslope. Limestone cliffs occur along the Ohio River. Rock is exposed in many places in stream channels and on valley sides. Loess is thick on the upland ridge crests, but is thin on many slopes. Rapids and waterfalls are common in the midcourse of streams, whereas broad silt-covered floodplains characterize the downstream portions. Silts eroded from the loess of the uplands form most of the alluvium.

The Pleistocene glaciers were stopped by the Greater Shawnee Hills, though they must have been playing out anyway as a result of warming at lower latitudes. In fact, the glaciers did send fingers up the north sloping valleys and spread over the upland to an elevation of at least 600 feet. Glacial till may be seen in the roadcut at the Williamson-Johnson County line on I-57 just south of the junction with I-24. Jackson (1977) made a study of a rich plant accumulation in terminal glacial deposits in Jackson County. This is the locale of southernmost penetration of continental glaciers in North America.

The Lesser Shawnee Hills section is underlain by the Chester Series of alternating limestone-shale and sandstone-shale units and by more massive Mid-Mississippian limestones. The Chester sandstones likewise form cuesta ridges but they have been transected by streams so as to form rocky water gaps (Harris, et.al., 1977, p. 6). The topography of the sandstone ridges is similar to those of the Greater Shawnee Hills but on a lesser scale and with a thinner cover of loess. Backslope streams are short, not very deeply incised, but very rocky. The lowlands areas are underlain by the limestone-shale and tend to be much more open than in Greater Shawnee Hills. Some areas have many sinkholes, springs and caves. Two karst areas are prominent: one southeast of Jonesboro, the other in south-central Hardin County. These, too, provide special environments within sinks, small caves, and collapse gulfs. The moderating influence of underground temperatures and moisture are clearly visible in the vegetation. It is an exciting experience to come upon the green vegetation of the Roaring Springs area after traversing snow-covered pasture and forest.

If one happens to be interested in fossils, excellent opportunities for study of marine assemblages are provided by the shaly limestones and plant remains in the coaly layers of the shaly sandstone units of the Chester Series.

Ozarks

A small segment of the Ozark Physiographic Province forms a half-moon-shaped area along the Mississippi Valley from the Ste. Genevieve Fault to the western end of the Cache Lowland (Fig. 2). This is a maturely-dissected region of very steep slopes and very narrow ridge crests. Valley bottoms are mostly narrow. The stream channels alternate between pools and riffles. The riffles are formed by gravel bars of chert pebbles.

A cover of 10 to 15 feet of loess mantles the ridges but erosion has removed much of the silt from the slopes. Bare rock or cherty rubble is exposed on many steep slopes, especially close to the Mississippi Valley as at Pine Hills and Atwood Ridge. Quite a contrast in erosion --

is apparent between north-facing and south-facing slopes. South and west-facing slopes tend to be hotter and drier in the summer and suffer repeated freeze-thaw during the winter. Erosion is, therefore, more severe and soil thin. On north slopes soils are better developed in loess.

Stream characteristics of the Ozarks are very different from those of the Shawnee Hills. The cavernous limestone bedrock of the Ozarks takes in much of the rainfall, releasing it slowly through springs and seeps. The cherty residual veneer also favors infiltration. In the Shawnee Hills lesser infiltration means more rapid runoff but lesser discharge between rains. Though the waters of both become muddy after rains, Ozark waters soon clear up. There is a two-fold explanation: 1) the large contribution of filtered underground water, 2) the filtering effect of the chert gravels.

Stream channels in the Ozarks have an alternation of pools and chert-pebble bars. During high water much gravel is carried downstream but is deposited as the flow decreases, accumulating at one of the gravel bars. The open pores between pebbles become an efficient filter for the fine-grained fraction of the sediment load -- and the water clears up. The filter bed is maintained by scour during flood and deposition at declining discharge.

Bedrock in the Ozarks is dominated by limestones of Devonian and Silurian age. Over much of the area they have been so silicified that the residuum consists largely of chert. On steep slopes where loess is eroded the chert fragments form active talus. In some areas considerable clay matrix is present. No doubt the very angular, "spongy" character of the residual chert is partly responsible for the steepness of the slopes. The oldest bedrock is Ordovician in age exposed in Thebes Gap in the railroad cut and in the bed of the Mississippi River itself.

At the south end of the Ozark Division the consolidated bedrock is covered on the uplands by gravel deposits and remnants of Coastal Plain sands. Stream dissection penetrates these deposits so that the topography has an aspect similar to the area farther north.

A disjunct segment of the Ozark Section is present above the Mississippi bluffs largely in Monroe County (Fig. 2). The bedrock is massive limestone belonging to the Mississippian System. Some units, notably the Ste. Genevieve and St. Louis formations, tend to be cavernous. The topography is pockmarked by sinkholes and an absence of surface streams. Caves, springs, sinking streams, and "rises" are numerous.

The karst area is terminated on the west by the dissected Mississippi Valley bluffs and border section. Fountain Creek is an interesting through stream channel, much of it with a rock floor. Continuous stream flow exists only in rainy periods.

Bedrock has a thick cover of loess near the Mississippi Valley. Scattered erratic crystalline pebbles suggest that Illinoian glaciers reached the valley but thick glacial till deposits are not known west of the boundary as shown on the Quaternary Map of Illinois (Lineback, 1979).

Coastal Plain

Just north of the Ohio River unconsolidated sands and clays form the substrata. These represent the northern-most extremity of deltaic and marine deposits laid down in a marine embayment in the middle of the continent during the late Cretaceous and early Tertiary period (Fig. 4). Subsequent retreat of the seas left a coastal plain continuous with that around the Gulf of Mexico.

This division has moderate relief but is actually very hilly with steep, unstable slopes. Erosion by sheetwash and gullying is severe; cultural activities have had a severe impact on a naturally dynamic landscape.

The Ohio River, forming the Illinois-Kentucky border, joins the Cumberland and Tennessee rivers as they turn westward to meet the Mississippi River (see Fig. 5). The river, below the junction of the Tennessee, lies against the bluffs of the north side of the valley so that no floodplain exists on the Illinois side.

Paleozoic bedrock is exposed by streams at the base of the ridge in the eastern portion of the area. Some of the limestones are cavernous with springs issuing from solution passages. The Coastal Plain sediments were deposited on the erosional unconformity which can be seen in some of the limestone quarries. The unconsolidated coastal plain sediments lie on the ridge, but are veneered by thick loess deposits. These consist of white chert gravels, very fine-grained white sands and silts and clays. They are of marine and non-marine origin. The Porter's Creek Clay is famous for its plant fossils (see Table 1).

CAIRO, LA CENTER, AND THEBES QUADRANGLES

	SYSTEM AND SERIES		GROUP OR FORMATION	GENERALIZED ROCK COLUMN	THICKNESS IN FEET
FORMATIONS EXPOSED	QUATERNARY	Pleistocene	loesses and valley fill		0 - 250
	TERTIARY	Pliocene	"Lafayette" Gravel		5 - 50
		Eocene	Wilcox		50 - 250
		Paleocene	Porters Creek Clayton		50 - 170
	CRETACEOUS	Gulfian	Owl Creek McNairy Levings Mbr Tuscaloosa		25 - 470

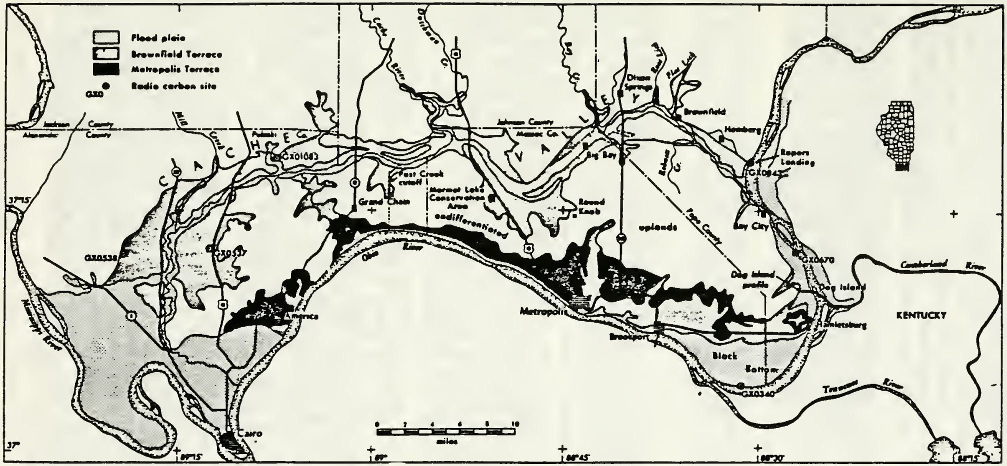

Fig. 5 Distribution of alluvial features along the Cache and Lower Ohio valleys in southern Illinois. From Alexander and Prior (1968).

On many ridge tops, gravel pits expose a distinctive brown chert gravel. The gravel lies beneath the loess and unconformably above the Coastal Plain sediments. They have been used extensively in road construction. The gravels are remnant parts of a great river-laid sheet deposit which extends across western Kentucky, the Commerce Hills and Crowley's Ridge in Missouri (Potter, 1955). Remnant outliers are found in the Ozarks and on bluff tops along all the major rivers. These chert gravels are probably late Tertiary in age; at least they contain no glacial erratics. The conditions of their origin is unknown. Interbedded sands and clays have yielded meagre plant fossils. The gravels, themselves, consist of pebbles derived from the weathering of the Paleozoic cherty limestones. They have many of the characteristics of the alluvial cherts which form the gravel bars in the rivers of the Ozarks.

One of the interesting features of the division is the presence of many springs and groundwater seeps (Schwegman, 1969; Harris, et.al., 1977). Some springs with a single orifice and a considerable discharge yield water from the cavernous underlying limestone. Others discharge from sands which overlie impervious materials. These springs and seepages commonly support a very distinctive flora.

Schwegman (1973) has placed the extensive lowland called the Cache-Bay Creek bottomland with the Coastal Plain. It nearly follows the junction between the Paleozoic upland and the Coastal Plain sediments.

Originally this bottomland was largely swamp interrupted by elongate sandy ridges. The gentle surface gradient is westward from the Ohio River, between Golconda and the mouth of the Cumberland River to the Mississippi River between Thebes Gap and the junction with the Ohio. Ohio River water now flows through it only at times of highest floods, as in 1927 and 1937. Two small underfit streams "drain" it: the Cache entering through Little Black Slough and Heron Pond and flowing westward, and Bay Creek entering near Columbia and flowing eastward. Bay Creek has barbed tributaries which are consequent on the alluvial surface. Bay Creek channel has worked headward from the somewhat entrenched modern Ohio River channel in a direction opposite to the gradient of the lowland.

This bottomland must once have been similar in character to Little Black Slough with great canopy trees of cypress and tupelo. During the spring it must have been largely covered by water, as is the lower Cache today. By late summer much of it must have been dried out. Once the forest was cut, the landowners wished to farm it and the numerous drainage ditches have lowered the water table so that cultivation is successful in all but the lowest portions. Today "the scatters" retains a feeling of the original swamp; steps have been taken to preserve the best which remains.

The geologic story of the origin of this great valley has not been established. Certainly the Ohio River once flowed through it, but whether it was also the course of the Cumberland and/or Tennessee has not been ascertained. The bedrock valley was once nearly 200 feet deeper than the present alluvial surface. The great load of sediments carried by meltwater during the waning of the Wisconsinan glacial stage resulted in aggradation of the valley. It is probable that this aggradation was also responsible for overflow of the Ohio into the Cumberland-Tennessee valleys and establishment of a more southerly course to the Mississippi River.

This aggradation was also responsible for filling the lower courses of the tributaries from the north. Thus, the extensive wetlands along Mill Creek and upper Cache and Bay Creeks were caused by backwater accumulations of fine sediment. Cores taken from these sediments should yield a fascinating story of the vegetation history since the late Pleistocene.

The River Valleys and Their Borders

Schwegman's classification recognized the distinctive nature of the alluvial bottomlands. In addition he separated the bordering dissected bluffs with their cliffs and short, steep tributary valleys (see Fig. 2). Geomorphically and ecologically these areas are affected by quite a different set of processes from the adjacent uplands. Thus, the soils and vegetation differ in kind and in association.

The three great valleys, Mississippi, Ohio and Wabash (the Illinois, too), are subject to extensive flooding. Flooding occurs within the natural or manmade levees at time or extended rain periods of 6 to 9 inch downpours even without levee breaks. Backwater floods also occur due to regional rainy periods when the main channels are overfull. Water backs up all the tributaries and lower portions of the floodplain. Furthermore backwater areas tend to have tight, fine-grained soils, which inhibit downward percolation even when flood conditions do not exist. Thus, the vegetation must be able to endure periods when the soil is saturated.

Floodplains are not flat. Abandoned meander bends are prominent features with swampy, clay-filled channels. Sandy natural levees border the outside of the bends and swell and swale point bars parallel the inside of the curve. The levees near the river channel commonly are a barrier to access by the tributaries. Thus, the Big Muddy flows next to the east bluff of the valley for 11 linear miles before reaching an intersecting now abandoned meander of the Mississippi; Clear Creek and Dutch Creek don't join until the Mississippi enters Thebes Gap. Great meanders are more numerous on the Wabash than on the Mississippi.

Alluvial lowlands commonly contain "second bottoms", i.e. terrace remnants and alluvial fans which flood less frequently or are currently above even the maximum flood levels. They have been aggraded somewhat by repeated deposits of sediment left by receding floodwaters. These surfaces are favored for agriculture as their soils tend to be moderately well-drained and contain the beginnings of a soil profile. Terraces are the remains of alluviated surfaces now partly removed by erosion of a deepening river channel. Terraces in the main valley of the Mississippi have been removed except for a few remnants protected by Fountain Bluff and Walker Hill; terraces are more common in the tributaries. Terraces are extensive on the Wabash. Alluvial fans are accumulations of material deposited where the steep gradient of small tributaries meet the nearly level alluvial valley. An excellent example of a compound alluvial fan is found along the east side of Fountain Bluff. It is traversed by Highway Rt. 3 and is occupied by a very productive farm. A smaller fan forms higher ground at the deboucher of Glen Creek between two abandoned Mississippi River meanders (see Fig. 6).

The Wabash valley does not have high bluffs at the valley wall.

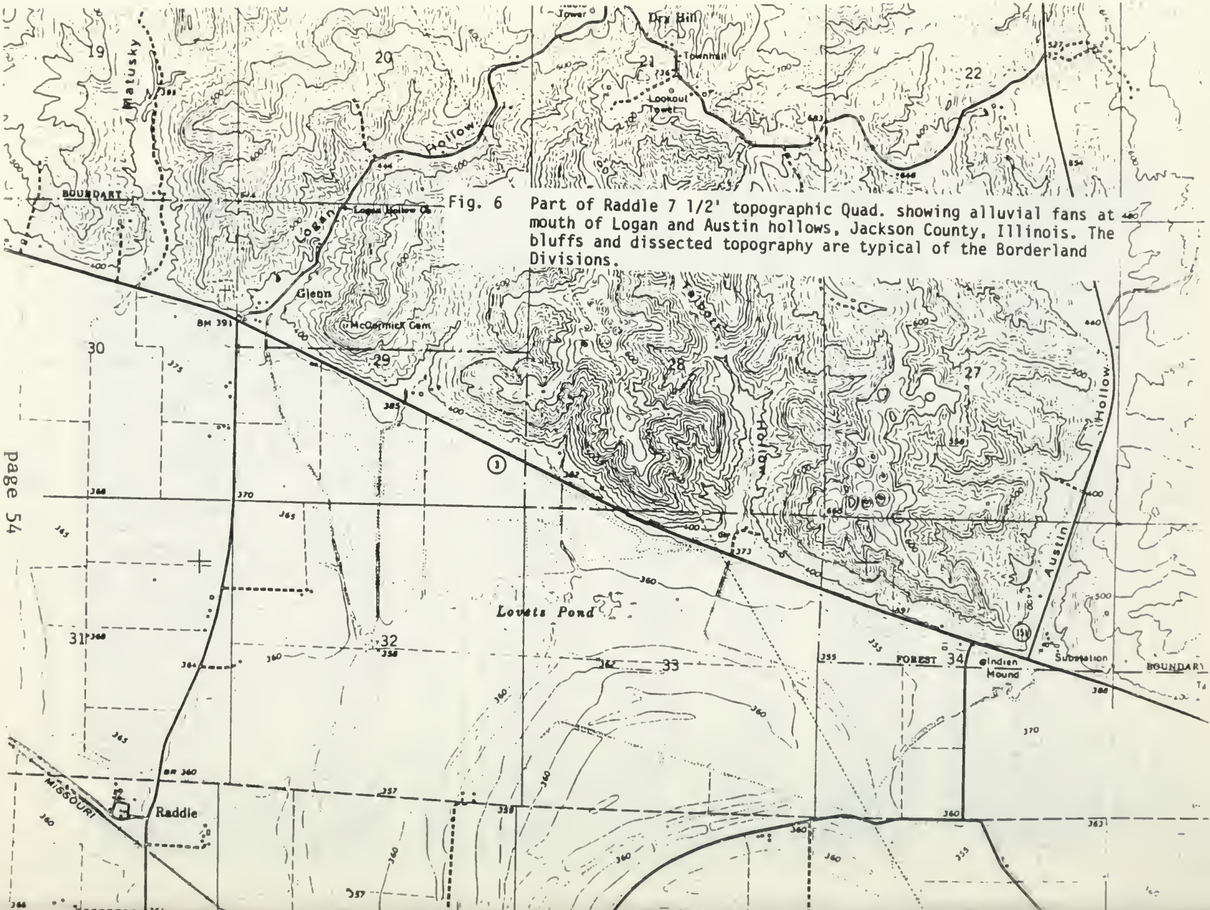

Fig. 6 Part of Raddle 7 1/2' topographic Quad. showing alluvial fans at mouth of Logan and Austin hollows, Jackson County, Illinois. The bluffs and dissected topography are typical of the Borderland Divisions.

This is because the underlying rocks are weak. In fact the glaciated upland seems to grade into lowland terrace deposits, and boundaries are masked by loess deposition and colluvial wash. The Wabash and its tributaries have extensive Pleistocene valley train and backwater deposits. Sandy soils, even sand dunes, are widely distributed. Near the junction with the Ohio River the meander belt is broad and frequently flooded. Oxbow lakes and swamps occupy abandoned meanders. Remnants of cypress swamps still exist on the Indiana side, and Beall Woods near Mt. Carmel preserves giant trees of a more mesic bottomland forest.

The Valley Bluff borderlands are characterized by great cliffs which are intersected by small tributaries at intervals of every mile or two. The tributaries have steep gradients and commonly rise within a mile or two of the bluffs. The tributaries may also be lined with cliffs. Side streams may be rocky with waterfalls and chutes.

The borderlands are therefore maturely dissected with very steep slopes. The interfluve ridge crests are narrow with a thick cover of loess. Crop yields are surprisingly high but erosion of the fields is severe. North-facing slopes are relatively cool with lesser evaporation than south-facing counterparts. The lower course of the tributaries generally contains a floodplain, some of which possess mature woodlands.

Bedrock of limestone or sandstone form the cliffs but the crest of the bluffs has a cap of thick loess. The narrow ridges between tributaries, especially their "noses", are very dry and commonly support hill prairies. Even the casual observer will note the variation in plant associations according to slope, orientation and substrate.

Of all the divisions the borderlands are most diverse and seem to call for further subdivision on the basis of their physical relationships almost on a microscale.

The varied landform of southern Illinois offer great opportunities for those of us who open our senses and minds to the land and rocks, water and air around us. Scenic beauty on both macro and mini scales surrounds us. Seasonal changes in aspect of the vegetation, presence of standing and flowing water, and in the active geomorphic processes provide ever-changing conditions even at the same geographic locality. Wherever we go we can speculate about the "native vegetation" and search out "natural areas" to represent a wide range of ecologic conditions. Conditions are dynamic, readily altering in response to fluctuating climatic cycles or people's activities. Also continual are the dynamic processes of weathering, masswasting and the work of running water, ground water movement, the wind, etc. Response of vegetation to the effects of these processes is slower and less noticeable, but not hard to recognize with careful observation. The more we learn the more we see, and the more we want to learn.

As a geologist I am more likely than most to speculate about the past and look for clues which identify events and long-term interacting processes which formed this land we call southern Illinois. The botanist contributes much to this understanding. In the short term, plant composition indicates stability or change; in the long term, plant fossils and especially pollen, indicate successions of climatic change.

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THE SOILS OF SOUTHERN ILLINOIS

by Dr. B. Klubek[1], Dr. J. Jones[1], and Dr. E. C. Varsa[1]

The soils of southern Illinois, lying roughly south of a line from St. Louis, Mo. to Terre Haute, In., are generally characterized as moderately sloping to sloping land dominated by forest vegetation. These soils are not as productive as those of central and northern Illinois, but an estimated 14,549,950 acres or 44.3 percent of the total arable acres are under cultivation (Fehrenbacher et al., 1971).

At the present time, there are approximately 375 different soil series mapped in Illinois which have been grouped into 57 soil associations (Fehrenbacher et al., 1967; 1982). Of this total, 40% or 23 soil associations (21 upland and 2 bottomland soils) are known to occur in southern Illinois (Fehrenbacher et al., 1982). The factors affecting the development of southern Illinois soils, and the characteristics of its soil associations are varied.

FACTORS AFFECTING SOIL FORMATION IN SOUTHERN ILLINOIS SOILS

The development of soils are a result of the sum total of all biological, chemical and physical processes on parent and rock materials. The origin and nature of the parent material, climatic factors, type of vegetative cover, topography and time all contribute to a soil's unique characteristics.

For southern Illinois soils, loess, alluvium and outwash are the main parent materials (Fig. 1). Loess deposits are generally the greatest on the leeward side of major rivers or streams due to southwesterly winds. The total thickness of loess deposits vary from less than 36 inches to greater than 300 inches (Fehrenbacher et al., 1968).

Alluvium deposits occur throughout the stream valleys of Illinois, but are more extensive in southern Illinois. These soils are not strongly developed, light in color, acidic and vary from sand to clay in texture, although many characteristics are inherited by flood water sediments and deposits (Fehrenbacher et al., 1968).

Outwash deposits within Illinois were predominately developed during the Wisconsinian age. In southern Illinois, these areas are most extensive along the Wabash and Ohio Rivers, and vary in texture from gravel to clay (Fehrenbacher et al., 1968).

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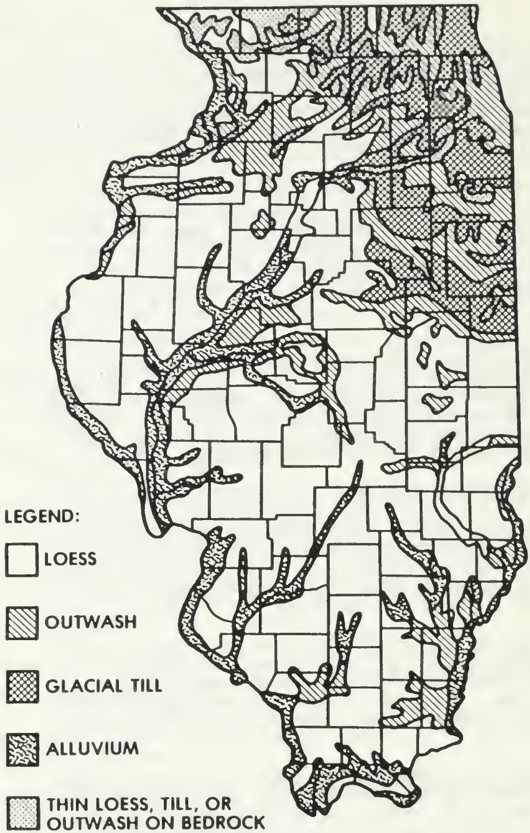

Figure 1. The extent of the primary types of soil parent materials in Illinois (after Fehrenbacher et al., 1967).

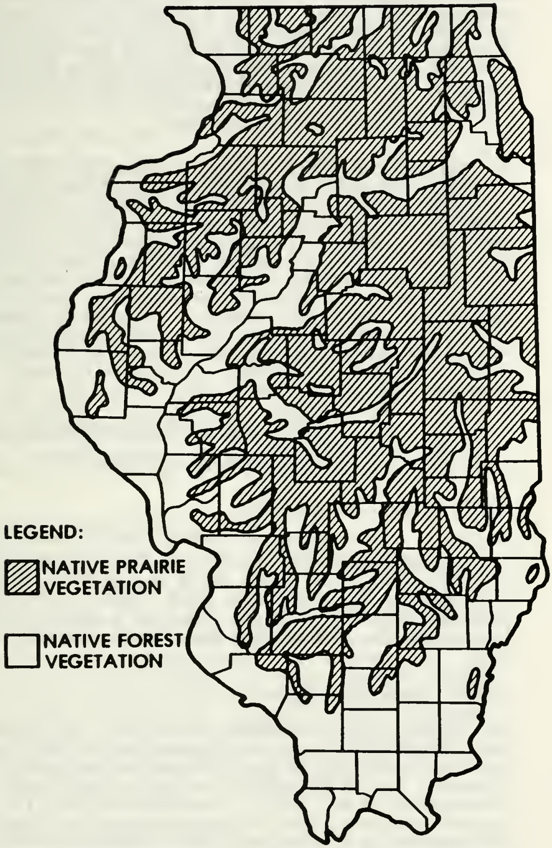

Figure 2. Native vegetation in Illinois (after Fehrenbacher et al., 1967).

Another major component affecting southern Illinois soil development was the presence of vegetative cover, primarily forest and secondarily prairie. The significance of vegetative cover in soil development is related to the input of organic matter to the soil. Soils developed under prairie vegetation are moderately dark to dark colored soils, high in organic matter content; whereas soils developed under forest vegetation are light colored and low in organic matter content. Figure 2 illustrates the distribution of grassland and forest vegetation within Illinois (Fehrenbacher et al., 1968). It is interesting to note the existence of moderately dark colored soils under forest vegetation along prairie-forest borders. The history and characteristics of these soils suggests the encroachment of the forest vegetation on the prairie (Bailey et al., 1964; Jones and Beavers, 1964).

The moisture status of any soil under any given climate is dependent upon the topography and slope. Water infiltration, runoff and erosion are affected by topography. Indirectly, the amount of water within a soil is also affected by topography or slope, and in turn, will affect the rate of the weathering of the soil and the movement of its end products. Hence, these end products usually leach out of the A horizon and reside at some variable depth within the B horizon depending on soil porosity, permeability, and/or the presence of flocculating agents. Southern Illinois soils vary from nearly level land to sloping uplands. Most of the soil associations are composed of similar soil types differing primarily in internal drainage and moisture characteristics (Fehrenbacher et al., 1968).

SOIL ASSOCIATIONS OF SOUTHERN ILLINOIS

A. UPLAND SOILS DEVELOPED UNDER FOREST VEGETATION

Alford - Goss - Baxter Soils

The Alford - Goss - Baxter soil association borders the Mississippi and Ohio River Valleys, and are characterized by loess parent material (12 to 20 ft. thick) on limestone (Alford) or loess deposits less than 10 in. thick (Goss and Baxter) on limestone at a depth of 60 in. or greater. These soils are silt loam in texture, with moderate permeability (Fehrenbacher et al., 1982).

Alford - Muren - Iva Soils

The Alford - Muren - Iva association borders the Mississippi and Wabash River Valleys, and are characterized by loess parent material greater than 60 in. thickness with calcareous deposits (5 to greater than 20 ft. thick) at or below a soil depth of 42 in. (Fehrenbacher et al., 1982). These soils are dark grayish brown in color with silt loam A horizons and silty clay loam B horizons. The permeability of these soils vary from well drained (Alford) to somewhat poorly drained (Iva). The topography also varies from flat to sloping land. Yield potentials for corn, soybeans and wheat are estimated to be 93, 33, and 40 bu/a respectively (Fehrenbacher et al., 1967).

Alford - Wellston Soils

The Alford - Wellston association borders the Mississippi and Ohio River Valleys, and have developed from thin to thick loess or loamy materials, with or without residuum on interbedded sandstone, siltstone or shale. The Alford soils are light colored soils with moderate development and drainage. Loess deposits vary from 12 to 20 ft. thick on sandstone, siltstone or shale. Wellston soils are also light colored soils with moderate development and drainage. However, for this soil series, loess deposits are thinner (20 to 40 in. thick) on acid residuum overlying sandstone, siltstone or shale at a depth of 40 to 72 in. There are no yield estimates for this soil association (Fehrenbacher et al., 1967; 1982).

Ava - Bluford - Wynoose Soils

These strongly developed soils are common throughout southern Illinois and have developed from loess deposits (1½ to 4 ft.) on Illinoian till. The surface A horizon is dark grayish brown in color with a silt loam texture. The B horizon varies in texture, silty clay loam to heavy silty clay, and usually extends into the glacial till. The moderately well drained Ava and the poorly drained Bluford soils have some evidence of fragipan development in the lower regions of the B horizon, thus restricting water movement and root penetration. The Wynoose soil has a very slowly permeable claypan present in the B horizon and drainage may be accomplished by furrows or open ditches. Fertility and erosion control are additional problems for this soil association. Applications of limestone, nitrogen, potash and phosphate have resulted in significant crop responses. Erosion control may be achieved by contouring farming, terracing, long rotations of hay or pasture, or grass waterways. Corn, soybean and wheat yields are estimated to be 67, 26, and 36 bu/a (Fehrenbacher et al., 1967).

Clinton - Keomak - Rushville Soils

This soil association occurs in southwest Illinois and occupies 2,804,600 acres or 7.9 percent of the total state acreage (Fehrenbacher et al., 1982). These soils are dark grayish brown in color with silt loam A horizons and heavy silty clay loam B horizons. The permeability of these soils vary from moderately slow (Clinton) to very slow (Rushville). Tile drainage is sometimes used to remove excess water, however a few well placed ditches function more satisfactorily. Topography is variable, ranging from level to sloping land. Erosion control is required for the sloping lands and may be accomplished via contouring, terracing, long rotations including hay or pasture, and grass waterways. The estimated yields for corn, soybeans, and wheat are 83, 28, and 32 bu/a (Fehrenbacher et al., 1967).

Fayette - Rozetta - Stronghurst Soils

These soils are predominately found in a narrow belt bordering the Mississippi River Valley. They are moderately developed soils, dark grayish in color with silt loam A horizons and silty clay loam B horizons. The texture of the parent material is silt loam. Permeability varies from well drained (Fayette) to somewhat poor drainage (Stronghurst). Corn, soybeans, and wheat yields are estimated to be 93, 31, and 39 bu/a respectively (Fehrenbacher et al., 1967, 1982).

Grantsburg - Zanesville - Wellston Soils

The Grantsburg - Zanesville - Wellston association primarily occurs in Johnson, Pope and Hardin counties, on gently sloping to very strongly sloping lands, often on narrow ridges bordered by deep ravines. These soils are light colored, moderately slow to moderately drained soils, with silt loam A horizons and silty clay loam to clay loam B horizons. The parent material for the Grantsburg series is a thin loess deposit (48 to 80 in. thick) on sandstone, siltstone and shale. Zanesville soils of this association has loess parent material (24 to 48 in. thick) on acid residuum overlying sandstone, shale and siltstone at a depth of 40 to 80 in. The Wellston series of this association, also has loess deposits (20-40 in. thick) on acid residuum overlying sandstone, shale, and siltstone at a depth of 40 to 72 in. The yield potential of the Grantsburg series for corn, soybeans and wheat is estimated to be 62, 23, and 32 bu/a respectively (Fehrenbacher et al., 1967, 1982).

Hosmer - Stoy- Weir Soils

The Hosmer - Stoy - Weir soil association are light colored, strongly developed soils developed from either loess deposits (4 to 10 ft. thick) on Illinoian till or loess deposits (7 ft. thick) on bedrock residuum. These soils occur on nearly level to very strongly sloping lands and account for 3.4 percent of the total state acreage. The A horizon is characterized by dark grayish brown color with a silt loam texture; whereas the B horizon varies in texture from a silty clay loam to a heavy silty clay loam. Permeability also varies from moderately slow to slow. The Hosmer, and to some extent the Stoy, has a fragipan in the lower region of the B horizon thus restricting water movement and root penetration. The corn, soybean and wheat yield potentials are estimated to be 76, 28, and 35 bu/a respectively (Fehrenbacher et al., 1967).

Hosmer - Zanesville - Berks Soils

The Hosmer - Zanesville - Berks association primarily occurs in extreme southern Illinois, and formed from thin to thick loess or loamy materials on interbedded sandstone, siltstone or shale (Fehrenbacher et al., 1982). The Hosmer soil series is light colored with strong development, but moderately well drained. Loess deposits, 7 to 12 ft. thick, occur on sandstone, siltstone, and shale. Zanesville soils of this association are light colored soils with moderately strong development and moderate drainage. Thin loess deposits (24 to 48 in. thick) occur on acid residuum overlying sandstone, shale and siltstone at a depth of 40 to 80 in. The Berks series are light colored, well drained soils with weak profile development. The parent material of these soils are a channery shale, siltstone, and sandstone residuum, or an acid shale, sandstone, and siltstone, at a depth of 20 to 40 in. Estimated yield for wheat is 25 bu/a (Fehrenbacher et al., 1967; 1982).

Markland - Colp - Del Rey Soils

The Markland and Colp soils of the Markland - Colp - Del Rey associations occur mainly adjacent to the Big Muddy, Ohio and the Wabash Valleys respectively. These soils are dark grayish- brown in color with silt loam A horizons and silty clay loam to clay B horizons, developed from lacustrine deposits. Markland soils are slightly acid with carbonate deposits at shallower depths (2 to 3½ ft.), whereas Colp soils tend to be more acidic. These soils are characterized by slow to very slow drainage, and ditches are required for drainage since tile drainage is inadequate. Erosion control is an additional problem due to sloping to strongly sloping lands. Contouring and terracing are difficult due to short slopes. Many of the steeper locations are only used as pasture or forest lands. Yield potential for corn, soybeans, and wheat are estimated to be 63, 26, and 33 bu/a (Fehrenbacher et al., 1967).

Martinsville - Sciotoville Soils

The Martinsville - Sciotoville soil association occurs in the Ohio and Wabash River Valleys. These soils are dark grayish-brown in color with silt loam A horizons and silty clay loam B horizons. The Martinsville soil was formed from loess or silty material less than 20 in. thick above a loamy material on calcareous glacial outwash. Limestone deposits are present at a depth of 40 in. or greater. The Sciotoville soils developed from silt loam material, 30 to 50 in. thick, on stratified micaceous silt loam to loam glacial outwash. The permeability varies from well drained to moderately slow drained soils. The topography is also variable with moderately sloping to sloping lands. The estimated yields for corn, soybeans, and wheat is 80, 26, and 34 bu/a (Fehrenbacher et al., 1967, 1982).

Oakville - Lamont - Alvin Soils

These soils mainly occur along the Wabash River Valley, but also in the Big Muddy River Valley. They are light to dark grayish-brown in color, with sandy loam to fine sandy loam A horizons and sandy loam to sandy clay loam B horizons. Oakville soils have very weak development or no B horizon to a depth of 60 in., and were formed from parent material of fine sand or loamy fine sand greater than 60 in. thick. Lamont and Alvin soils developed from sandy loams or fine sandy loams, 20 to 40 in. thick, on leached sand to loamy fine sand parent material. Lamont soils have weak B horizons 15 to 30 in. thick, while Alvin soils have moderately developed B horizons, 15 to 30 in. thick. These soils are all characterized by moderately rapid to rapid drainage on nearly level to strongly sloping lands. Major problems associated with these soils are drouthiness, low fertility, wind and water erosion. Applications of limestone, nitrogen, phosphorus, and potash are required and may be needed frequently. Wind erosion may be controlled by cover crops, although reforestation offers a better means of management. Water erosion may be controlled by the use of hay and pasture crops in long rotations. The yield potential for corn, soybeans, and wheat are estimated to be 68, 25, and 29 bu/a (Fehrenbacher et al., 1967, 1982).

St. Charles - Camden - Drury Soils

The St. Charles - Camden - Drury soil association is characterized by a dark grayish brown color with silt loam A horizons and silt loam to clay loam B horizons. These soils developed from silt loam loess material over glacial outwash. The permeability of these soils is moderate on nearly level to sloping land. The estimated yields for corn, soybeans, and wheat are 89, 33, 41 bu/a (Fehrenbacher et al., 1967).

B. BOTTOMLAND SOILS DEVELOPED UNDER FOREST VEGETATION

Haymond - Petrolia - Karnak Soils

Haymond - Petrolia - Karnak soils are characterized by acid bottomland soils developed from sandy to clayey alluvial sediments and are widely distributed over southern Illinois. This soil association accounts for 4.9 percent of the total state acreage. These soils are dark gray to grayish brown in color, with silt loam to silty clay top soils and silty clay loam to clayey subsoils. The permeability of these soils vary from very slow to moderate drainage on level to nearly level land. Haymond soils have no profile development and were formed from medium acid to medium alkaline silt loam parent material (greater than 40 in. thick) overlying silt loam deposits with sand lenses. Petrolia soils, like the Haymond series, has no profile development. These soils were developed from medium acid to mildly alkaline silty clay loam parent material, greater than 40 in. thick. Karnak soils have weak profile development, and were formed from strong to medium acid silty clay or clay parent material (45 to 60% clay), greater than 40 in. thick. Tile or open ditches supplimenting tile drainage is used to remove excess water. The yield potential for corn, soybeans, and wheat is estimated to be 85, 30, and 35 bu/a respectively (Fehrenbacher et al., 1967, 1982).

C. UPLAND SOILS DEVELOPED UNDER PRAIRIE VEGETATION

Harco - Patton - Montgomery Soils

The Harco - Patton - Montgomery association is moderately developed which primarily occur on the high terraces in the Wabash River Valley (Fehrenbacher et al., 1967). These soils are characterized by a very dark gray color, and silt loam or silty clay loam A horizons with silty clay loam B horizons. Harco and Patton soils are moderately permeable, while Montgomery soils are slowly permeable. Carbonates are found at a depth between 2 to 3½ feet. The yield potential for corn, soybeans and wheat is estimated to be 95, 35, and 40 bu/a (Fehrenbacher et al., 1967).

Herrick - Virden - Piasa Soils

This soil association is found to occur in southwestern and western Illinois. These soils developed from loess as the parent material. The topography of these soils varies from nearly level (0 to 2% slope) to sloping lands (3-7% slope), and are characterized by a moderately slow to moderate permeability. The soils are black to very dark gray or brown in color with a silty to silty clay texture. The subsoils vary from dark gray to brown in color, and a silty clay to heavy silty clay in texture. The potential yields for corn, soybeans and wheat are estimated to be 110, 35, and 45 bu/a respectively (Fehrenbacher et al., 1967).

Hoyleton - Cisne - Huey Soils

The Hoyleton - Cisne - Huey soil association is found on the uplands of south-central and southern Illinois, and occupies 4.2 percent of the total state acreage (Fehrenbacher et al., 1982). These soils have developed from loess deposits on weathered Illinoian glacial till. They are acidic soils with strong to very strong development, and gray to grayish-brown in color. These soils are also characterized by silt loam A horizons, light colored A_2 horizons, and silty clay to heavy silty clay B horizons which extend to the glacial till. The permeability of these soils vary from very slow to moderately slow thus requiring erosion control on sloping uplands. Contouring, terracing or sod crop rotations are practiced. On level areas of land, drainage is required and is achieved by shallow ditches. Drainage tile do not function satisfactorily. Mean yield potential for corn, soybeans and wheat are estimated to be 74, 28, and 35 bu/a respectively (Fehrenbacher et al., 1967).

Jasper - La Hogue - Selma Soils

Jasper - La Hogue - Selma soils are commonly found in northern and central Illinois, but are also found to occur in the Wabash River Valley. These soils are very dark gray to black in color, with loam A horizons and clay B horizons moderately developed from medium textured parent material of sand or silty sand outwash. The permeability of these soils are moderate on nearly level to moderately sloping lands. The yields for corn, soybeans, and wheat are estimated to be 93, 34, and 38 bu/a (Fehrenbacher et al., 1967).

Lorenzo - Warsaw - Wea Soils

The Carmi and Omaha soils are members of this soil association and are most common in the Wabash River Valley. These dark colored soils have moderate to weak development, derived from medium textured material on gravel, and B horizons characterized by a clay loam to gravelly clay loam texture. Non-calcarious gravel also underlies the B horizon at depths of 2 to 3½ feet. The topography of these soils vary from nearly level to moderately sloping uplands, or may be found on stream terraces. The well drained Carmi and imperfectly drained Omaha are subject to droughtiness and fertility problems. Due to the thinness of the surface soil to gravel, moisture storage capacities are low. Hence, winter wheat is a major crop since growth is completed by June before soil moisture becomes deficient. Generally crops respond to additions of limestone, and nitrogen, potash and phosphate fertilizers with moderate to moderately high yields. Estimated yields for corn, soybeans and wheat under a high level of management is 83, 31, and 38 bu/a respectively (Fehrenbacher et al., 1967).

Oconee - Cowden - Piasa Soils

Oconee - Cowden - Piasa soils are found to occur in southcentral and southwestern Illinois and occupy 1.7 percent of the total state acreage (Fehrenbacher et al., 1982). These soils have developed on loess deposits over weathered Illinoian glacial till (Fehrenbacher et al., 1967). The topography varies from nearly level (1 to 2% slope) to sloping (4 to 8% slope) land. The A_1 horizon is strongly developed and is characterized by a moderately dark gray to grayish brown color due to inherent acidity. The A_2 horizon is also grayish in color. The top soil of this soil association is classified as silty in texture, while the subsoil soil varies from a silty clay to heavy silty clay texture. Hence, the permeability of these soils range from slow to moderately slow. Piasa is a unique member of this association. It is known as a "slick spot" soil because of its high sodium content and dispersed soil structural state. Very poor drainage, difficulty in tillage and reduced crop growth are all characteristics of such soils. Drainage, erosion control and fertility are the major concerns for this association. Substantial amounts of applied limestone, potash and phosphate have secured good yields. Erosion control on the upland areas may be achieved by contouring, terracing, no-till crop rotations or grass waterways. Nearly level areas require drainage due to the slow permeability of these soils and may best be achieved via surface ditches (Fehrenbacher et al., 1967). The potential yields for corn, soybeans and wheat are rated as good, and estimated to be 96, 30, and 40 bu/a respectively (Fehrenbacher et al, 1967).

Plano - Proctor - Worthen

This soil association is most extensive in northern and central Illinois although Worthen soils are known to occur in strips along the Mississippi and Wabash River Valleys. These soils are weakly developed with a silt loam texture in both the A and B horizons. The topography varies from nearly level to moderately sloping land with moderate drainage. The estimated yields for corn, soybeans and wheat are 102, 34 and 40 bu/a (Fehrenbacher et al., 1967).

Tama - Muscatine - Sable Soils

The Tama - Muscatine - Sable soil association is most common to central Illinois. However, this soil association also occurs in a narrow belt along the Mississippi River Valley (Fehrenbacher et al., 1982). These soils are weakly developed and are characterized by silt loam A horizons and silt loam to heavy silt loam B horizons (Fehrenbacher et al., 1967). The drainage classification of these soils is moderate. The estimated yield potential for corn, soybeans and wheat are 100, 34, and 40 bu/acre respectively (Fehrenbacher et al., 1967).

D. BOTTOMLAND SOILS DEVELOPED UNDER PRAIRIE VEGETATION

Lawson - Sawmill - Darwin Soils

This soil association is a member of the bottomland soils occupying the Mississippi and Wabash River Valleys (Fehrenbacher et al., 1967, 1982). These soils are characterized by a very dark gray to black color, with silt loam, silty clay loam, or silty clay A horizons, and silt loam, silty clay loam or silty clay to clayey B horizons. The topography varies from nearly level to gently sloping land with slow to moderate drainage. The soil reaction also varies from slightly acidic to neutral, thus requiring some additions of limestone, phosphate and potash. The estimated yields for corn, soybeans and wheat are 96, 33, and 37 bu/a (Fehrenbacher et al., 1967).

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