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State of Illinois
Department of Registration and Education
STATE GEOLOGICAL SURVEY DIVISION
John C. Frye, Chief

EARTH SCIENCE FIELD TRIP
GUIDE LEAFLET
GREENUP AREA

CUMBERLAND COUNTY

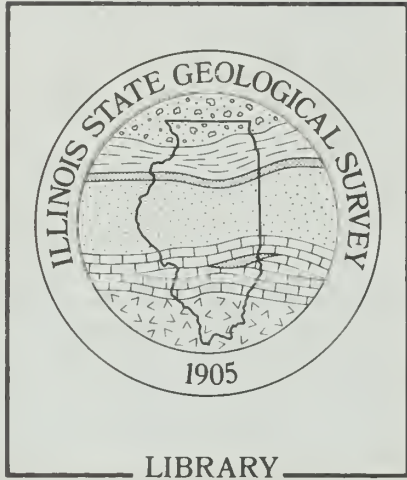
CASEY, KANSAS, OAKLAND, AND TOLEDO QUADRANGLES



Leaders
George M. Wilson and I. Edgar Odom
Urbana, Illinois
September 26, 1959

GUIDE LEAFLET 1959-E

HOST: CUMBERLAND COUNTY HIGH SCHOOL



GREENUP EARTH SCIENCE FIELD TRIP

ITINERARY

- 0.0 0.0 Northeast corner of the Cumberland High School Yard, at the T-road south from Route 121.
- CAUTION in entering Route 121. Turn left.
- .1 .1 Turn right. Entering a crushed rock road. For the next several miles the upland surface is on the Illinoian till plain. The Illinoian was the third of the glacial stages in North America during the Pleistocene and was the most extensive in Illinois.
- .2 .3 Turn right.
- .1 .4 Turn left. The Illinoian glacier reached as far south as Equality, Illinois, as far southwest as six or seven miles south of Carbondale and reached to the bluffs of the Mississippi River. The Illinoian till plain is characterized by flatness of the upland surfaces though the till plain has been considerably dissected by erosion from streams that have developed since Illinoian time, especially in the Wisconsin stage of glaciation and following.
- .8 1.2 CAUTION crossroads.
- .9 2.1 Turn right (east) at T-road south.
- .6 2.7 Turn left (north). By referring to your map you will note that we are paralleling the north-south course of the Embarrass River (pronounced Embraw). As we progress northward in this route we will find till exposures which have heretofore been called Illinoian but would appear at the present time to be of fluvial origin and not Illinoian, possibly pro-Wisconsin.

.9 3.6 STOP 1

		Ft.	In.
Zone A	A gray timber soil, with finely divided humic material	1	6
Zone B-1	A brownish gray sub soil		5
B-2	Brown-reddish brown, plainly showing the redeposition of the iron-bearing minerals that have been leached from Zone A and B-1.		
Zone C-1	Glacial till oxidized and not leached and effervesces freely with acid.	3	

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- C2- Glacial till unaltered-gray; with several thin sand lenses showing throughout the entire outcrop; shows faint traces of laminations. 10


Before we can properly approach our field trip today we must give thought to the problem of where and how most of the soils of Illinois were derived. They were brought to Illinois as glacial drift and have developed in place as soils.

Tens and hundreds of thousands of years ago most of Illinois, together with most of northern North America, was covered by huge ice-sheets or glaciers. These glaciers expanded from centers in what is now eastern Canada. They developed when for some reason not yet determined the mean annual temperatures in the region were somewhat lower than now, so that not all of the snow that fell during the winters was melted during the summers. The snow residues accumulated year after year until they became a sheet of ice so thick that as a result of its weight the lowermost part began to flow outward, carrying with it the soil and rocks on which it rested and over which it moved. The process continued until the glacier extended into our country as far south as Missouri and Ohio rivers.

Moderation of temperatures halted the glacier. For a while the melting of the ice balanced its accumulation and expansion, so that its margin remained stationary. Later the melting exceeded the accumulation and expansion, and the ice front gradually melted back until the glacier disappeared entirely.

As the glacier melted, all of the soil and rocks which it had picked up as it advanced were released. Some of this material or drift was deposited in place as the ice melted. Such material consists of a thorough mixture of all kinds and sizes of rocks and is known as till. Some of the glacial drift was washed out with the melt-waters. The coarsest outwash material was deposited nearest the ice-front and gradually finer material farther away. The finest clay may have been carried all the way to the ocean. Where the outwash material was spread widely in front of the glacier it forms an outwash-plain; where it was restricted to the river valleys it forms what are called valley-trains.

At times, especially in the winters, the outwash-plain and valley-trains were exposed as the melt-waters subsided, the wind picked up silt and fine sand from their surfaces, blew it across the country, and dropped it to form deposits of what is known as loess. Glacial loess mantles most of Illinois. Near the large river valleys it may be as much as 60 or 80 feet thick. Far from the valleys it may be measured only in inches, if it can be identified at all.



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It is now commonly known that there were four major periods of glaciation during the Pleistocene or Great Ice Age (see accompanying table), and that between each pair there was a long interglacial period in which conditions were as they are today. It is also commonly known that during each major glaciation there were a number of retreats and readvances. This was particularly true during the last or Wisconsin glacial stage.

The Greenup area was invaded certainly by the glaciers during the last three - Kansan, Illinoian, and Wisconsin - glacial stages, because glacial drift of these ages may be found in the region. Probably the region was also invaded by the Nebraskan or oldest glacier, although no materials positively of Nebraskan age have been identified.

The position of the ice-front at each advance of the glacier is usually marked by a ridge of till or moraine. The moraine represents the accumulation of drift at the ice-margin while the advance and melting were essentially in balance, when more and more material was being brought to the edge of the advancing ice. When melting exceeded advance, so that the ice-front retreated, the resulting drift deposits form a drift-plain or till-plain, whose surface may be almost level or more or less billowy. Fifty feet north of this particular outcrop, is a very gravelly zone near the top of the soil profile in position of B2. From the standpoint of an erosion cycle this section of the country is in a very youthful stage of erosion.

- .6 4.2 Crossroads. In general the till in this section of the country is comparatively thin.
- .5 4.7 Oftentimes the streams are bottomed in bedrock as we note here, with an average thickness of glacial drift in this section of 35 or 40 feet.
- .5 5.2 Crossroads. With an earlier publication, written by Dr. M. M. Leighton and Paul MacClintock, the till here was identified as Illinoian with underlying older tills. Due to the slumping in this section of the country we have been unable to find the exposure along the roadside.
- .7 5.9 Note the thickness of the soil zone. The B Zone is perhaps 5 feet thick and grades imperceptibly into the C Zone, but note the faint traces of laminations in Zone C.
- .7 6.6 At T-road south, turn right (east).
- .2 6.8 Note the farm buildings on the left and the terrace upon which the buildings are built. We are entering the flood plain of the Embarrass River.

- .3 7.1 Crossing the Embarrass River, note the Pennsylvanian rocks outcropping on the east bank of the river.
- .1 7.2 Ascend hill and turn left, leaving the valley of the Embarrass. This is the highest level terrace developed on the Embarrass.
- .2 7.4 Turn right (east). Note gray till capped with reddish brown sandy soil among the hills on the far left.
- .4 7.8 This is a middle terrace level.
- .1 7.9 This is the lowest terrace level.
- .1 8.0 CAUTION rough bridge.
- .1 8.1 STOP 2. Stop 2 is a gravel pit owned by the Casey Stone Company, developed in the Embarrass terrace. The gravel here is some 75 feet in thickness. From the present point of view, I would suggest that the terrace developed as a pro-Shelbyville deposit or in the earliest stage of the Shelbyville when great quantities of meltwaters entered the Embarrass Valley. With the development of the valley train in the Embarrass Valley the gravel carried by the great quantities of water was laid down because of the overloading of the streams. Then with the development of the later stages of the Shelbyville ice and the succeeding stages of the Cerro Gordo, West Ridge, Champaign, Urbana, and other moraines, the Embarrass was re-cut into these terraces, with the resulting two lower terrace levels, before reaching the valley of the Embarrass.
- .4 8.5 Note the gravelly soil on the left, reaching nearly to the upland.
- .7 9.2 Stop. CAUTION in entering Route 130. Turn right (south).
- .2 9.4 Note the thin soil profile on the Illinoian till upland on the right.
- .7 10.1 Note the thin profile of Zone A and B.
- .1.1 11.2 Note the gravelly soil on the east side of the highway.
- .4 11.6 Entering Hurricane Creek Valley. Hurricane Creek was a sluiceway for the effluent waters of the Shelbyville stage of glaciation and as a result considerable quantities of gravel have been deposited along this stream.
- .7 12.3 Slow. Turn left (east).
- .3 12.6 Note the gravelly soil on the left as well as thin lenses of gravel. The soil here is calcareous to within 3 feet of the surface of the earth.

- .7 13.3 T-road north. Continue ahead.
One of the most striking characteristics of the Illinoian till plain is the comparative flatness of the upland surface. This, however, may be slightly altered by the presence of a thin veneer of Wisconsin drift. The statement still holds true that the Illinoian till plain upland surface is definitely flat.
- 1.0 14.3 CAUTION. Rough bridge. Load limit, 5 tons.
- .1 14.4 STOP 3.

Soil Profile in Illinoian Till

		Ft.	In.
Zone A	Timber soil - gray with finely divided, humic material		7
Zone B-1	Oxidized, leached brown - olive	1	6
Zone B-2	Brown - reddish brown	1	6
Zone C-1	Deeply oxidized and non-calcareous till, reddish brown	3	
Zone C-2	Oxidized and quite calcareous till	2 plus	

The soil profile here is sufficiently far from the sluiceways of the Shelbyville that there is a normal soil profile development.

- .5 14.9 T-road north. Continue ahead (east).
- .6 15.5 CAUTION. Crossroads. Continue ahead (east).
- 1.0 16.5 Slow. Turn left (north).
- .8 17.3 Crossroads. Turn right (east).
- .8 18.1 We are in the Siggins Pool, one of the early oil fields of Illinois, which was developed in sand of Pennsylvanian age and has produced since about 1905. The primary production has given about 10,000 barrels per acre for the center portion of the field. Since the development of secondary recovery techniques, which were introduced to Illinois by the late Dr. Frederick Squires, a second crop of oil has been obtained. This has resulted in the production of more than 10,000 barrels per acre for a portion of the pool. The more productive part is the zone where the sand is thickest and has the best interconnected porosity and permeability.
- .5 18.6 Slow. T-road west. Turn left (north).

STOP 4. Turn right for discussion of the Siggins Pool.

- .5 19.1 Turn left (north).
What remains for the third crop of oil will remain to be developed in later years. Whether or not the addition of heat and fire will drive out another crop, remains to be proven.
- .4 19.5 Turn left (west).
Note that the pump jacks are quite small, the reason being that the wells are comparatively shallow. Since the beginning of the water flooding operations some 50,000,000 barrels of water have been injected into this oil field by the Forest Oil Corporation. The Forest Oil Corporation is one of the operators in this field, and other interests have injected water also.
- .5 20.0 Slow. Turn right.
- .6 20.6 Turn left (west).
- .4 21.0 CAUTION. Rough bridge.
- .6 21.6 Crossroads. CAUTION.
- 1.0 22.6 CAUTION. Crossroads at Union Center.
- 1.0 23.6 CAUTION. Crossroads.
- .6 24.2 Note the sandy soil in the roadcut on the right and left.
- .2 24.4 STOP 5.
At this stop we have a dune sand perched on top of the hill. This dune sand is of Wisconsin age and ranges from nothing to five feet in thickness. Beneath this is Zone A, which is loessal in appearance, is buff to tan and is perhaps 3 feet thick. Zone B-1 is about 2 feet thick. Zone B-2 is brown weathered and oxidized non-calcareous throughout; that is, Zone A, B-1 and B-2. The lower portion of B-2 is also non-calcareous, oxidized, and leached. B-2 is about 7 feet in thickness. Some 150' further west is an interesting development in that the soil here is quite gravelly and is calcareous to within 3 feet of the surface. This development is due to a terrace development in the Embarrass Valley and is not of Illinoian age as were the previous deposits but is of Wisconsin age.
To the north, only a short distance, is a gravel operation developed in a lower terrace level on the Embarrass Valley.
- .2 24.6 Crossing Hurricane Creek,

The till profile is even better than in the exposure and reads thus:

		Ft. In.
	Zone A Gray and slightly humic timber soil	7
	Zone B-1 Developed in the Wisconsin sand	3
	Buried Illinoian Soil	
	Zone A Brown, sticky, fine, oxidized leached	6-7
	Zone B-1 Buff-colored, oxidized, leached	3
	Zone B-2 Concentration of quartz pebbles in upper portion, oxidized, leached	5
	Zone C-1 Exposed at bottom of bluff, effervesces freely with acid.	5
.9	25.5 Slow. STOP. Turn right, entering Route 130.	
1.0	26.5 Notice the hills dead ahead some six or seven miles. This is the Shelbyville Moraine of the Wisconsin stage of glaciation.	
.7	27.2 We are rising imperceptibly toward the moraine.	
.8	28.0 We are rising on the normal slope of the Shelbyville Moraine.	
1.3	29.3 Slow. Turn left, entering Fox Ridge State Park.	
.2	29.5 Y road, hold to the right.	
.9	30.4 LUNCH STOP 6. At the pavilion of the Fox Ridge State Park. When lunch is over make sure that the lunch sacks are placed in waste receptacles. Retrace the same road to Route 130.	
1.2	31.6 CAUTION on entering Route 130. Turn left (north).	
.1	31.7 Note the gravelly till on the right.	
.2	31.9 We are climbing the front of the Shelbyville moraine, which in this section of the country has three crests, indicating the probability of three separate advances of the Shelbyville ice.	
2.7	34.6 Crest of the moraine. We are going down the back slope of the Shelbyville entering the Embarrass Valley.	
1.0	35.6 Gravel pit on the right developed in a terrace in the Embarrass Valley.	
.4	36.0 Cross the Embarrass River.	

Slow. Turn right, entering Charleston City Park.

- .1 36.1 Turn right.
- .2 36.3 STOP 7 for visit to the Pennsylvanian plant fossil-bearing shales and siltstones below the dam on the Embarrass. The section here is, beginning at the top, terrace gravel some seven or eight feet in thickness, followed by 15 feet of brownish to olive-colored shale, which is filled with ironstone concretions. After a slight unconformity, gray shale, medium to coarse-grained, unconformably overlies the sandstone, which has an irregular upper surface. The sandstone is estimated to be 15 feet in thickness.

At the beginning of Pennsylvanian time, some 250 million years ago, conditions changed when high mountains began to rise along the Atlantic Coast. Toward the west, in Illinois and elsewhere, was a low hot swampy plain, somewhat resembling the present Amazon Basin. Across the plain, rivers from the eastern mountains wandered toward the sea which lay off in Nebraska, Kansas, and Oklahoma. As the lowland sank, the sea from time to time extended eastward to deposit marine limestone or fossiliferous shale. At other times there were vast jungle swamps in which luxuriant vegetation accumulated as half-rotten, peat-like masses. But most of the time the lowland was occupied by rivers, shallow lakes, and bayous in which mud and sand, washed out from the mountains, was deposited. In time, thousands of feet of sediments piled up, and the pressure of this great weight of mud and sand helped to compress the peat to coal with a repetition of similar sequences.

This succession of different kinds of strata is repeated in much the same sequence some 50 times where the Pennsylvanian (Coal Measures) rocks are thickest. Each succession of Pennsylvanian rocks is called a cyclothem (see attached chart).

These different strata indicate many rapid changes of environment which took place repeatedly during the Pennsylvanian period. At that time rivers were bringing sediments from the north and east, possibly from as far away as the present Atlantic coast. The ocean lay to the west and south. The country in between, which is now the Middle West, was a low flat swampy area in which the sediments were being deposited. There is no area on earth today that has conditions like those that existed during Coal Measures time.

The plants and trees that grew at that time were very luxuriant. As the plants fell into the swampy waters they were partially preserved, buried by later sediments, and converted into coal. Some times the sediments were fine silts and clays, and at still other times the sea covered the area and left marine fossils.

Continue ahead, following the black-top route through the park.

- .5 36.8 CAUTION in descending hill. Shift into lower gear. Turn right.
- .2 37.0 STOP. CAUTION in re-entering Route 130. Turn left.
- .1 37.1 Cross Embarrass River.
- 1.3 38.4 Turn left on the Hutton Road.
- .8 39.2 Slow. Turn left to enter East-West road. This road follows the crest of the second lobe of the Shelbyville Moraine.
- 3.0 42.2 The outermost lobe of the Shelbyville Moraine is on the far right.
- .4 42.6 Crossroads. The building on the southwest corner is a barn of log construction, dating back to the latter part of the 19th century.
- .5 43.1 Here is an excellent view of the southernmost lobe of the Shelbyville Moraine. We are traveling on the middle ridge.
- STOP 8. Here the middle lobe of the Shelbyville ice has overridden the outer lobe. Here we have an excellent view of the Illinoian till plain to the south. The topographic difference between the top of the ridge here and the Illinoian till plain is 110 feet.
- 1.3 44.4 Turn left.
- .1 44.5 Turn right.
- .1 44.6 A view of the second crest of the Shelbyville Moraine is afforded to the north, some mile and a half or two miles away.
- .4 45.0 Enter the town of Westfield, Illinois.
- .4 45.4 An excellent view of the Illinoian till plain to the southeast.
- STOP. Turn left (north). Enter the main north-south street of Westfield with caution.
- .3 45.7 CAUTION. Turn right on main east-west street in village of Westfield.
- .5 46.2 CAUTION. STOP. Turn left continue entering Route 49.
- .5 46.8 The sub-glacial channel that developed during the last advance of the Shelbyville drained through the middle and first lobes of the Shelbyville Moraine.

- 1.0 47.8 Through this small stream drained a portion of the meltwaters which accumulated behind the second lobe of the Shelbyville. Ahead is the last and highest ridge of the Shelbyville.
- .3 48.1 We have begun to climb the ridge of the Shelbyville.
- .2 48.3 An excellent view to the north slope of the moraine and to the east of the south side or front of the Shelbyville Moraine.
- .4 48.7 Another view of the drainage way for the water which accumulated behind the Shelbyville Moraine. The stream on the right is still the drainage outlet for waters which now accumulate behind the inner Shelbyville Moraine.
- 1.9 50.6 We are on the crest of the moraine and are going down the back slope of the inner Shelbyville.
- .9 51.5 CAUTION. Slow. STOP. Turn left, entering Route 16. To the left you will see the rolling character of the back slope of the Shelbyville Moraine.
- 1.4 52.9 Note the sand in the roadcut on the left.
- .7 53.6 Slow. Enter the town of Ashmore.
- 1.0 54.6 Another sand knoll.
- 2.1 56.7 A series of sandy ridges on the left. Most of the streams along this route are southward flowing entering Polecat Creek, which developed on the back slope of the inner Shelbyville Moraine.
- 1.5 58.2 Slow. Turn right. Cross railroad with EXTREME CAUTION.
- .5 58.7 Turn left (west).
- .1 58.8 Slow. Turn left, entering pit of the Olen Humphre Stone Company.
- .3 59.1 This operation includes stripping the overburden from the gravel and loading the gravel out, then taking the stone for crushing operations. Follow the roadway to the right, not into the quarry but into an abandoned portion of the pit where you will see, beginning at the top of the hill, till in which a normal soil profile is developed, then a gravel zone some 10 feet thick, then 15 feet of till. This till is 15 feet thick, light gray and almost completely unaltered. Then there are 10 to 20 feet of cross-bedded, medium-to coarse-grained gravel containing many mud balls. Lying beneath this and depending upon whether or not the underlying limestone is even or uneven, a gray shale of several feet in thickness may, or may not, be present.

You then will see the limestone, light gray in color and ranging from 6 to 11 feet in thickness, followed by 2 feet of shale, then 2 to 3 feet of very fossiliferous gray earthy limestone, followed by $\frac{1}{4}$ to 8 feet of medium gray earthy-colored lime. Beneath this some 3 or $\frac{1}{4}$ feet is a coal about 12 inches in thickness, which is followed by an underclay. Immediately beneath the limestone is a black shale which comes between the limestone and the coal.

Pennsylvanian sediments are unlike older sediments in that they consist of many different and highly variable rock types, the outstanding type being coal, which occurs in cycles. An ideally complete cycle with its various units is shown near the back of the itinerary. This type of rhythmic succession of different kinds of strata is repeated in much the same sequence some 50 times where the Pennsylvanian rocks are thickest. Each rhythmic succession is called a cyclothem. The Millersville limestone belongs in the Millersville Cyclothem and corresponds to unit 9 in the ideally complete cyclothem at the back of the itinerary.

The many different rock types in the Pennsylvanian system indicate many rapid changes of environment which took place repeatedly. At that time rivers were bringing sediments from the north and east, possibly as far away as the present Atlantic coast and the region south of Hudson Bay. The Midwest was a low flat swampy area lying just a little above sea level, but subject to frequent marine invasions as the land rose or sank, or the sea level raised or lowered. That these conditions existed is evident from the nature of the sediments. Many of the shales, limestones, and ironstones above the coals contain marine fossils. The coals are believed to have formed in broad fresh-water marshes somewhat like the Dismal Swamp of Virginia. Most of the sandstones, conglomerates, underclays, underclay limestones, and some shales probably accumulated in fresh-water environments such as river valleys, lagoons, lakes, or lowland plains. There is no area in the world today that has conditions like those that existed during "Coal Measures" time.

The plants and trees that grew in "Coal Measures" time were very luxuriant. In the jungle-like growths the plants most common were huge tree ferns that had fronds five or six feet long and grew to a height of more than 50 feet. Along with them were seed ferns, now extinct, giant scouring rushes, and large scale trees, which grew to heights of 100 feet or more.

The large scale trees we find preserved in the coals do not have growth rings. The luxuriant growth and lack of growth rings probably indicate that the climate that prevailed at this time was warm and without seasonal change. As the plants fell into the swampy waters they were partially preserved, buried by later sediments and converted into coal.

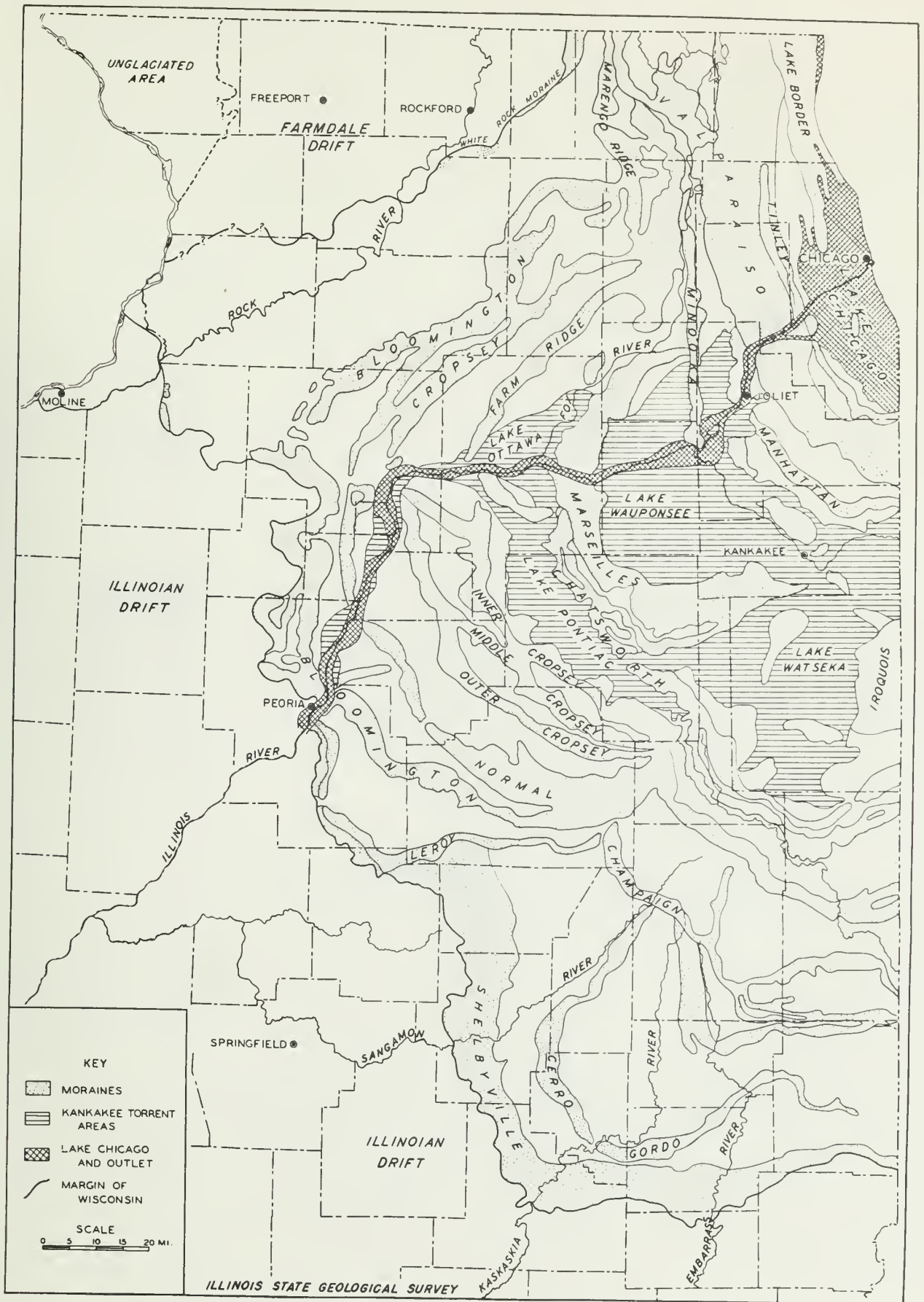
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.8 59.9 Cross the ditch with caution in leaving the quarry. The early stage of the Shelbyville is believed to have brought in the first 10 to 20 feet of gravel. The middle stage of the Shelbyville brought in the drift which overrides and incorporates, in part, some of the gravel in the till with long fingers of gravel reaching $3\frac{1}{2}$ to 4 feet up into the unaltered till. Following this was another stage of gravel which could have been brought in during the early development of the inner stage of the Shelbyville Moraine. And this gravel, in turn, was overridden by the inner moraine of the Shelbyville.

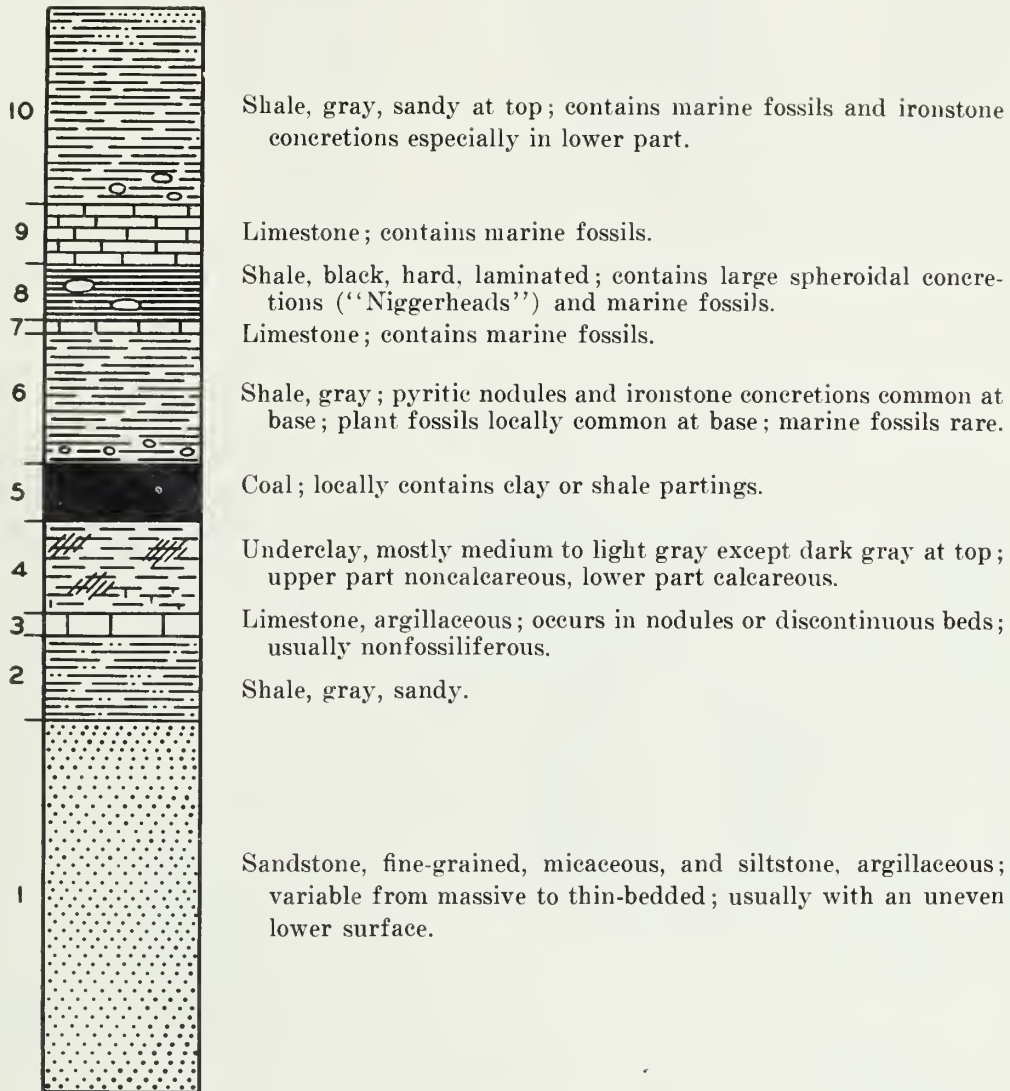
We recommend for best fossil collecting the upper 2 feet of the lower bench of the lime. However, much of the waste material that has been brought out and dumped on the pile below the abandoned portion of the pit comes from this zone, so good hunting!

PART IV. GEOLOGICAL COLUMN - Greenup Area.

ERAS		PERIODS	EPOCHS	REMARKS
Cenozoic "Recent Life"	(Age of mammals)	Quaternary	Pleistocene	Exposed in Area: Recent post-glacial stage Wisconsin glacial stage Illinoian glacial stage
		Tertiary	Pliocene Miocene Oligocene Eocene Paleocene	Not present in area.
Mesozoic "Middle Life"	(Age of reptiles)	Cretaceous		Not present in area.
		Jurassic		Not present in Illinois.
		Triassic		Not present in Illinois.
Paleozoic "Ancient Life"	Age of Amphibians and Early Plants	Permian		Not present in Illinois.
			McLeansboro	Livingston limestone, etc. exposed.
			Carbondale	In deep wells only.
			Tradewater	In deep wells only.
			Caseyville	
	Mississippian	Chester	Iowa	Thin sandstones, limestones and shales in deep wells.
				Limestone, sandstone and shale in deep wells.
	Age of Fishes	Devonian		Dark shales and limestones in deep wells.
	Age of Invertebrates	Silurian		Magnesian limestones in deep wells.
		Ordovician		Maquoketa Shale, Middle Ordovician Limestones, and St. Peter Sandstone & Shakopee limestone in deep wells.
Cambrian			No data available.	
Proterozoic Archeozoic		Referred to as "Pre-Cambrian" time	No data available.	



GLACIAL GEOLOGY OF NORTHEASTERN ILLINOIS
 George E. Ekblaw
 Revised 1957



AN IDEALLY COMPLETE CYCLOTHEM

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

COMMON TYPES of ILLINOIS FOSSILS



GRAPTOLITE



Cup coral



Lithostrotion



Honeycomb coral

CORALS



CRINOID



CYSTOID



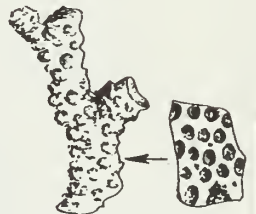
PENTREMITE



Fenestella



Archimedes



Branching

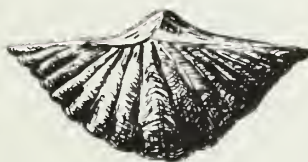
BRYOZOA



Lingula



Orbiculoidea



Spiriferoid



Productoid



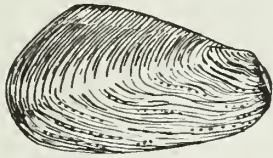
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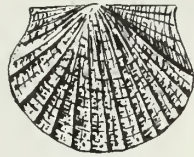
Pentameroid

BRACHIOPODS

COMMON TYPES of ILLINOIS FOSSILS



"Clam"



"Scallop"

PELECYPODS



High - spired



Low - spired



Flat - spired

GASTROPODS



Curved cone



Straight cone

CEPHALOPODS



Coiled cone
(Nautilus)



Bumastus



Calymene
(coiled)



Calymene
(flat)

TRILOBITES



OSTRACODS
(greatly enlarged)

Wally -
call 939 ask for
Eldridge to come up.
