Guide Leaflet

Illinois Academy of Science
Geological Field Trip

Charleston Area
Oakland and Toledo Quadrangles

Eastern Illinois State College
May 3, 1952

Itinerary

0.0	0.0	Caravan assembles in parking area west of library. Turn right (N).
0.3	0.3	Turn right (E).
0.1	0.4	Administration Building, Eastern Illinois State College. Continue ahead (E).
0.7	1.1	Stop sign. Turn left (N) on Route 130.
0.9	2.0	Stop sign. Turn right (E) on Route 16.
0.3	2.3	Leave CHARLESTON.
2.7	5.0	Cross Embarrass River.
0.7	5.7	Turn left (N) onto side road crossing Railroad.
0.3	6.0	STOP NO. 1. Park along roadside.

All of the surface features in the Charleston area were fashioned during the Pleistocene Period or during the few thousand years since the end of that period.

The level plain east of the road is a till plain formed when the melting of the Wisconsin Ice Sheet dropped a residue of mud and stones as a blanket over the landscape.

But to the west is a narrow ridge rising 20 to 40 feet above the plain. This ridge, excavations have shown to consist of sand and gravel, sorted and stratified by stream action. Remnants of this ridge can be traced for a distance of nearly two miles northeasterly past Miller School. Obviously this material must have been supplied by a stream flowing somewhat above the level of the present upland. This could have come about only through the presence of a stream flowing within the ice walls of a melting glacier. When the ice disappeared, the stream bed formed in the icy canyon was left behind as a ridge upon the till plain prairie. Such a ridge is called an <u>esker</u>.

0.0	6.0	Continue ahead (N).
0.2	6.2	Junction. Turn left (W).
0.1	6.3	Junction. Continue ahead (W) and descend steep hill.
0.3	6.6	Limestone quarry on right.
0.1	6.7	Cross Embarrass River and turn left (S) on quarry road to Long's Quarry.

0.3 7.0 Operating limestone quarry on right.

0.2 7.2 STOP NO. 2. Limestone quarry.
Where the Embarrass River has cut down through the glacial drift, the bedrock is exposed, including a limestone formation which has proved a valuable resource for roadstone and agstone. The limestone deposit exists as a continuous sheet but quarrying operations are limited economically by the amount of overburden. An example of the nature of this overburden is well shown at the present quarry.

Above the main quarry rock, which is 6 feet thick, is about 12 feet of shale with nodular limestone lenses, containing numerous fossils, chiefly small brachiopod shells (Composita), gastropods (snails) and bryozoa ("moss animals"). All of this rock belongs to the Pennsylvanian ("Coal") Period, and was deposited in marine waters some 250 million years ago.

Above the shale and limestone is a gravel deposit that was laid down not much over 100 thousand years ago, during the waning stages of Illinoian glaciation during the Ice Age. The line of contact between the gravel deposit above and the shale below thus represents a time gap of immense duration. Such a time-loss line is called an hiatus.

The gravel above the shale is about 10 feet thick and in places showing inclined stratification (cross-bedding). The cross-bedding and the coarseness of the sediments indicate strong currents. The gravel grades upward into finer sediments, sands and silts, some of the latter probably loessal and including carbonized plant matter. This may indicate an alternation of dry land and river conditions toward the close of the formation of the deposit. All of this suggests the deposit formed in the valley from the melted waters of a retreating rather than an advancing glacier (probably during the Illinoian retreat).

The gravel deposit is overlain by at least 25 feet of glacial till to the top of the hill. This till was laid down by the advance of the Wisconsin glacier, which carried the ice as far south as the Shelbyville Moraine, a few miles south of Charleston.

0.0 7.2 Reverse route to road.

0.5 7.7 Cross road and go north to Humphrey's Quarry.

0.3 8.0 Weighing house. Continue ahead.
CAUTION: watch for trucks.

0.3 8.3 STOP NO. 3. To observe active stripping and quarrying.

0.2 8.7 STOP NO. 4. Along upper quarry road. Descend to quarry. The bedrock exposed in this quarry, from top to base, is as follows:

Shale, gray, fossiliferous	Several feet
Limestone, nodular, clayey	8 feet
Shale, bluish gray	1.5 feet
Limestone, massive--bedded	6 feet
Shale, clayey, bluish and greenish gray	0.5 foot
Shale, fissile ("slaty"), black, fossiliferous	0.5 foot
Coal	0.7 foot
Underclay, gray, soft	

During the Pennsylvanian Period, high mountains were rising in the neighborhood of the Atlantic Coast, while the sea, which had covered this region through most of the preceding Paleozoic time, had retired to the southwest, to Nebraska, Kansas, and Texas, and beyond. The intervening area, including most of Illinois was a great swampy lowland between the mountains and the sea.

Heavy rains falling on the west slopes of the mountain ranges, assembled in torrents that gullied the mountain slopes and carried away great quantities of sediment as a product of this erosion. When the streams reached the swampy plain, their reduced velocity forced them to drop the coarser portion of their load; but the streams coalesced and flowed on across the lowlands to the western ocean.

In the intervening area they built natural levees, deltas, flood plains, and fans, of sand and mud. When waters stood for long periods over great swampy tracts, dying jungle vegetation fell into stagnant waters, where the poisons arrested decay; in time these masses of half rotten vegetation hardened to coal.

More rarely, a rise of sea level allowed marine water to spread eastward and deposit limestone and fossiliferous shale.

Here in the quarry, we see only a few of these environments, represented by rock layers of varied type. The underclay at the base is believed by many to have been the soil in which the coal forest grew, and to have been leached to pale color and non-calcareous nature by humic acids from the matted vegetation above. The coal bed then would represent the climax stage of the coal swamp. The coming of the sea is fore-shadowed by the black, fissile shale ("roof slate"), high in carbonaceous matter, but also containing a brackish or a stagnant-marine animal fauna. The limestone represent clear-water marine conditions; and the fossiliferous shale above, the approach of littoral mud flats encroaching into the temporary expansion of the sea.

Above the Pennsylvanian bedrock, can be seen hard gray

clay, peppered with sand and studded with pebbles and cobbles of rocks of many kinds. There is no sorting or stratification. Most of the stones are flat-sided, faceted, and striated.

These are the characteristics of unleached glacial till, which is the residue of earth and rock that was carried beneath, within, or upon, the glacier as it moved down out of the north, and which was left behind when the glacier melted away. The variety among the pebbles is a consequence of the wide area over which they were collected by the glacier in its travels. The facetting, smoothing, and striating was produced as the glacier dragged the stones across the bedrock surface over which it passed.

Above the gray glacial till may be seen a thickness of sand and gravel, washed, sorted and stratified. When glacial waters came in contact with unsorted till, they had the effect of sorting the material, rounding the pebbles and carrying off the clay in the soily glacial waters. The sand and gravel in the present outcrop resulted from the melting of a glacier some distance up stream; such a deposit is called a valley-train gravel.

0.0	8.7	Continue ahead (N) on upper quarry road.
0.1	8.8	Pass through gate and turn right on gravel road.
0.3	9.1	STOP NO. 5. Ravine to north of road, in its V-shaped valley and raw, unvegetated slopes, represents extreme youth of its erosion cycle. Melted waters from the Cerro Gordo glacier, which halted upstream near Oakland, poured down the Embarrass Valley and cut a deep trench through the glacial drift. The side valleys and ravines are still busy cutting their valleys down to the grade of the major stream. This youthful erosion serves to emphasize the recency of the disappearance of the Wisconsin ice.
0.9	10.0	Junction. Turn right (S) on esker ridge. For next 1.5 miles the road closely follows the esker, which can be recognized not only by the topography, but also by the change in soil color in the plowed fields.
1.4	11.4	Junction. Turn left (E).
0.1	11.5	Junction. Turn right (S).
0.5	12.0	DANGER. Railroad crossing and Stop sign. Turn right (W) on Route no. 16.

3.7 15.7 Highway junction. Turn left (S) on Route No. 130.

3.5 19.2 Descend steep grade and turn left to LAKE CHARLESTON.

0.2 19.4 STOP NO. 6. Park and walk east across small dam. Before the construction of the dam in 1946-47, the river flowed through this channel.

On the west side of the old channel can be seen a ledge of Pennsylvanian limestone overlain by about 3 feet of dark, fissile shale containing very large, rounded clay-ironstone concretions. The irregular distribution of the carbonate in the shale is responsible for the concretions, but the reason for this irregular distribution is not well understood.

The bank east of the small dam is in Pleistocene deposits divided by a terrace flat at road level. The lower bank rising above the water is in Illinoian glacial till most of which is oxidized to a buffy color and leached of its carbonate. This grades upward into a gumbotil which has a pasty consistency and from which all pebbles except those made of nearly insoluble silica (quartz, chert, quartzite) has been destroyed by weathering and solution. This gumbotil represents weathering that acted for a very long time on the Illinoian till sheet during the 100,000 years or so, of the Sangamon interglacial stage that followed the melting of the Illinoian glacier.

The terrace is in sand and gravel deposits probably laid down in an older Embarrass valley ahead of the Wisconsin (Shelbyville) glacier. Behind a barn on the other side of the spillway on old soil, overlain by wind blown Farmdale loess occupies this same interval.

At both places, the interglacial deposits are overlain by another glacial till, calcareous, and only partially oxidized, which was deposited by the Wisconsin glacier which advanced over this place and as far south as Fox Ridge State Park (Shelbyville advance).

0.0 19.4 Continue across small dam, along north side of river.

0.3 19.7 LUNCH STOP at north side of main dam.

STOP NO. 7. Pennsylvanian bedrock is exposed in the river bank at the north end of the dam, and in the river bed below. This rock grades, more or less laterally, from shale to siltstone to sandstone, the latter in places with the imprints of the trunks and leaves of Pennsylvanian trees and ferns.

Here we see the fresh water alluvial and deltaic deposits of the Pennsylvanian, probably varying from stream channel to backwater flood plain deposits. This environment alternated very many times with that of the coal swamp and of the sea, through the duration of the Coal Period in Illinois (see appended chart of "cyclothem").

Alluvial deposits of glacial and post-glacial times fill the rest of the valley here. Many glacial boulders have been concentrated just above the bedrock surface, and include rocks of many kinds and ages. Some stones are hematites (iron ore) from the Huronian formations (Pre-Cambrian) of the Lake Superior country. Also present are boulders of glacial till more than 600 million years old that came from Pre-Cambrian (Keweenawan) glacial drift that crops out north of Lake Huron in Ontario. In contrast to this, our own Pleistocene Ice Age began only a short million years ago.

0.0 19.7 Reverse route to Highway

0.4 20.1 STOP SIGN. Turn left (SE) on Route No. 130.
Road climbs out of valley of the Embarrass and levels off of the very gently rolling Wisconsin till plain. However, because of the nearness to the river gorge, many deep, V-shaped valleys can be seen heading close to the road, and some of this distructive erosion is in places unchecked.

3.3 23.4 Road curves left and ascends gentle north slope of Shelbyville Moraine.

1.2 24.6 Entrance to Fox Ridge State Park on left. Continue ahead (S) on Route No. 130.

0.8 25.4 Turn left (E) onto side road at schoolhouse.

0.3 25.7 STOP NO. 8. Along roadside.
When the edge of a glacier remains stationary for a long time, it means that for a long time the speed of the ice in pushing forward was almost exactly counter-balanced by the speed with which the ice front melted away. The result was that a great deal of rock and earth was dropped here along the ancient battle line. When the hundreds (possibly thousands) of feet of ice finally melted away, a ridge of glacial drift, called a moraine, was left behine.
We are here parked on the outer slope of the Shelbyville Moraine, which marks the farthest advance of the Wisconsin Glacier. The Wisconsin Glaciation was the last of four major periods of Pleistocene glaciation.
A half mile to the south and stretched thence southward to the horizon is a plain with a very flat surface. This is the Illinoian till plain, made by the Illinois Glacier which preceded the Wisconsin. The Illinoian Glacier, unlike the Wisconsin, covered nearly the whole of Illinois.
Buried beneath the Illinoian till sheet, is the glacial drift of the earlier Kansan glacier. The earliest, or Nebraskan,

glaciation did not reach this part of Illinois.

0.0	25.7	Continue ahead (E).
1.0	26.7	Note immense glacial boulder of granite along fence-line to right. This must have been carried a minimum of many hundreds of miles, by glacial action.
0.8	27.5	Crossroads. Turn right (S).
1.0	28.5	Crossroads. Turn right (W).
1.0	29.5	Road junction. Continue ahead (W).
0.1	29.6	STOP NO. 9. Park along roadside. Remain in cars. View north to hills of Shelbyville Moraine. The extreme flatness of the Illinoian till plain (plus modifying cover of loess and soil) is here well shown. The Illinoian till plain is flatter than the gently rolling Wisconsin till plain, but is more dissected by stream valleys, as the streams have had a much longer time to work, in the region south of the Wisconsin glaciation.
0.0	29.6	Continue ahead (W).
0.7	30.3	Stop sign. Turn left (S) on Route No. 130 and travel on flat surface of Illinoian till plain.
1.0	31.3	Crossroad. Continue ahead (S).
1.0	32.3	Crossroad. Turn right (W) onto gravel.
1.0	33.3	STOP NO. 10. Park along roadside. Gravel pit in Wisconsin outwash gravel. The Embarrass Valley existed previous to the Wisconsin glacial advance. When the ice front stood along the Shelbyville Moraine, a half mile to the north, the waters from the melting ice discharged down the river, and an alluvial fan or outwash apron of sand and gravel was built in front of the glacier. At first the torrents from the rapidly melting ice were adequate to carry cobbles and boulders, but as the ice diminished, the amount and velocity of the waters lessened, until silt was the chief deposit at the close. Because the silt cap was thin and underlain by highly permeable sand and gravel, the silt was strongly leached and particles carried downward into the sand, so that a gradation from fresh sand and gravel upward to leached silt is apparent today.

0.0	33.3	Continue ahead (W).
0.3	33.6	Cross Clear Creek.
0.3	33.9	Clear Creek School (L) and Church (R).
0.4	34.3	Road turns left (S).
0.1	34.4	Junction. Turn right (W) and descend to river.
0.1	35.5	Ryan Bridge over Embarrass River.
2.1	37.6	Road junction. Turn right (N).
1.1	38.7	Road junction. Turn left (W).
0.2	38.9	Road junction. Turn right (N) at Webster School.
1.3	40.2	Stop sign. Turn right (E) on oiled road. Historical marker reads: "The Last Farm. In 1837, Thomas Lincoln erected a cabin on a tract of land 1/2 mile to the east. Here he resided until his death in 1851. Abraham Lincoln visited here frequently and after 1841 held title to 40 acres of the land on which his parents lived. The state now owns most of the Lincoln Farm."
0.4	40.6	Turn left into entrance to Lincoln Log Cabin State Park.
0,1	40.7	STOP NO. 11, in parking area. Optional stop for historical site.
0.0	40.7	Continue ahead through park.
0.4	41.1	Stop sign. Turn right (N) on highway and pass through CAMPBELL (formerly Farmington).
2.4	43.5	Descend steep grade to Indian Creek.
0.2	43.7	Turn right (E) just short of bridge over Indian Creek.
0.4	44.1	STOP NO. 12. Park along road side. Exposures of Pennsylvanian massive, cross-bedded sandstone along road and in bed of creek. Many large glacial boulders may also be seen in the creek, where they have been left behind as the

creek removed all finer material in entrenching its deep valley into the Wisconsin till plain.

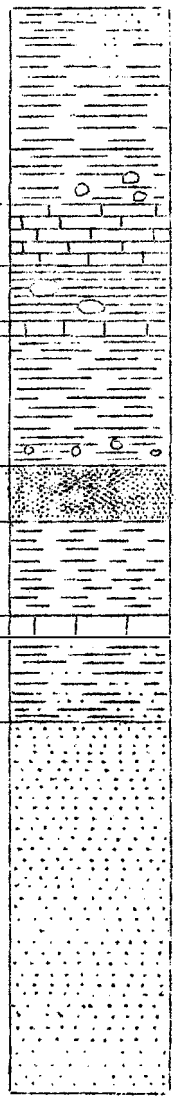
0.0	44.1	Continue ahead (E)
0.5	44.6	Exposure of leached and weathered till.
0.4	45.0	Road junction; continue ahead (E).
0.6	45.6	Embarrass River on right.
0.5	46.1	Ascend long grade.
0.4	46.5	Road junction; turn right (E).
0.7	47.2	Cross Riley Creek.
0.4	47.6	Ascend steep grade. Outcrops of glacial till along roadside.
0.8	48.4	Mt. Zion School; continue ahead (N).
0.5	48.9	Stop sign. Junction with Route 130. (Charleston 2 miles north on Route 130). End of Conference.

PART IV. GEOLOGICAL COLUMN - Charleston 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	Thin sandstones, limestones and shales in deep wells.
			Iowa	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.

Time Table of Pleistocene Glaciation
(after M. M. Leighton and H. B. Willman, 1950)

Stages	Sub-stages	Nature of Deposits	Special Features
Recent		Soil, infant to youthful profile of weathering, lake and river deposits, dunes, peat.	
Wisconsin (4th glacial)	Late Mankato	Fluvial deposition - Mississippi, Illinois, and Ohio river valleys, dune sand, some loess deposits along Mississippi River Valley, and deposits in Lake Chicago.	Lake Agassiz Torrent eroded Late Mankato deposits
	Early Mankato		Lake Duluth Torrent eroded Early Mankato deposits
			Forest bed, Two Creeks, Wisconsin
	Cary	Drift, loess, dunes, beginning of deposits in Lake Chicago.	Kankakee and Lake Maumee Torrents
	Tazewell	Drift, loess, dunes, lake deposits.	Fox River Torrent Westward diversion of Mississippi River into Iowa by Tazewell ice lobe
	Iowan	Drift, loess, dunes.	
	Farmdale (Pro-Wis.)	Loess (in advance of glaciation)	
Sangamon (3rd interglacial)		Soil, mature profile of weathering, alluvium, peat.	
Illinoian (3rd glacial)	Buffalo Hart	Drift	
	Jacksonville	Drift	
	Payson (terminal)	Drift	
	Loveland (Pro-Ill.)	Loess (in advance of glaciation)	
Yarmouth (2nd interglacial)		Soil, mature profile of weathering, alluvium, peat.	
Kansan (2nd glacial)		Drift Loess	
Aftonian (1st interglacial)		Soil, mature profile of weathering, alluvium, peat.	
Nebraskan (1st glacial)		Drift	



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

9 Limestone; contains marine fossils.

8 Shale, black, hard, laminated; contains large spheroidal concretions ("Niggerheads") and marine fossils.

7 Limestone; contains marine fossils.

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

5 Coal, locally contains clay or shale partings.

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

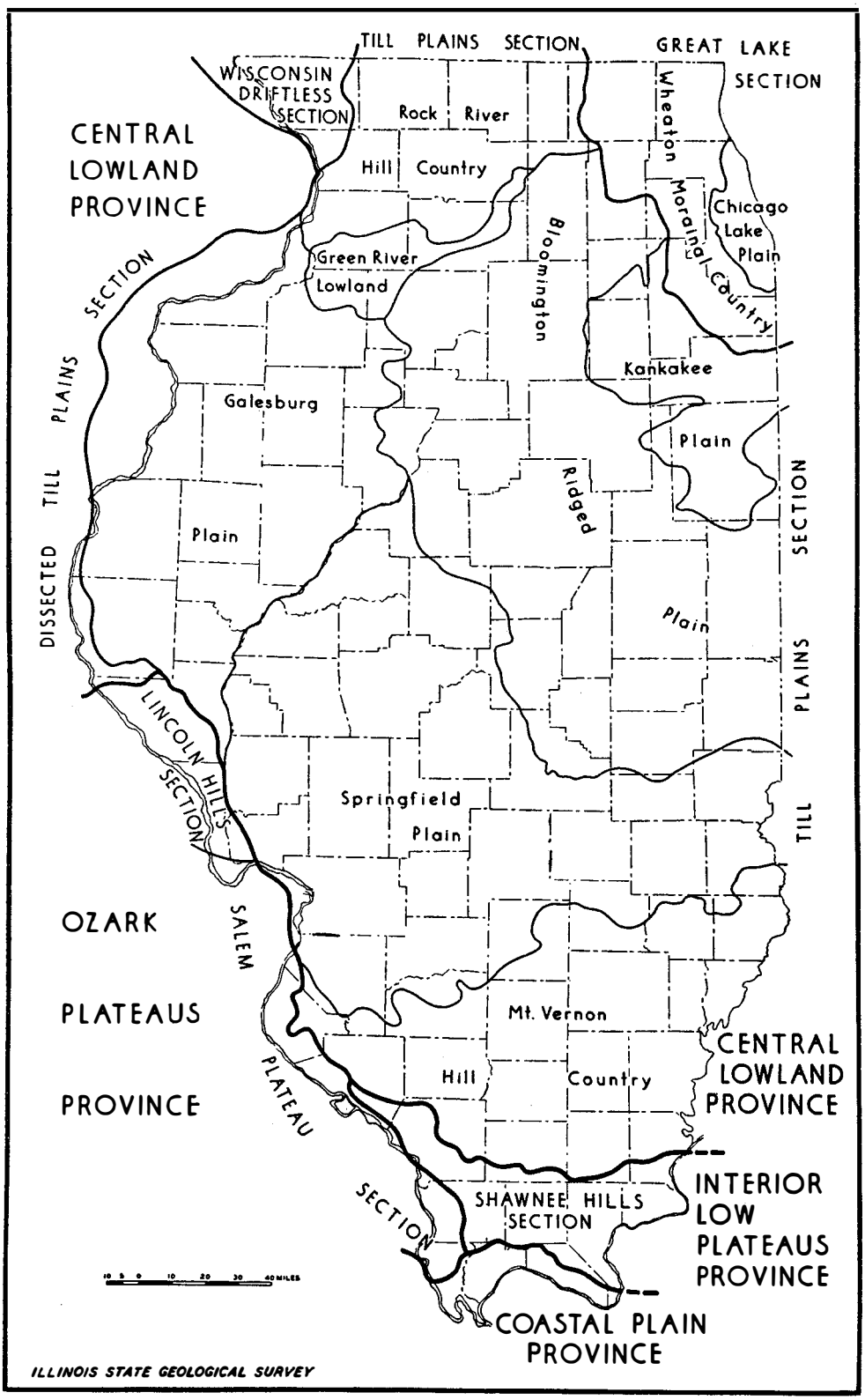
3 Limestone, argillaceous; occurs in nodules or discontinuous beds; usually nonfossiliferous.

2 Shale, gray, sandy.

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

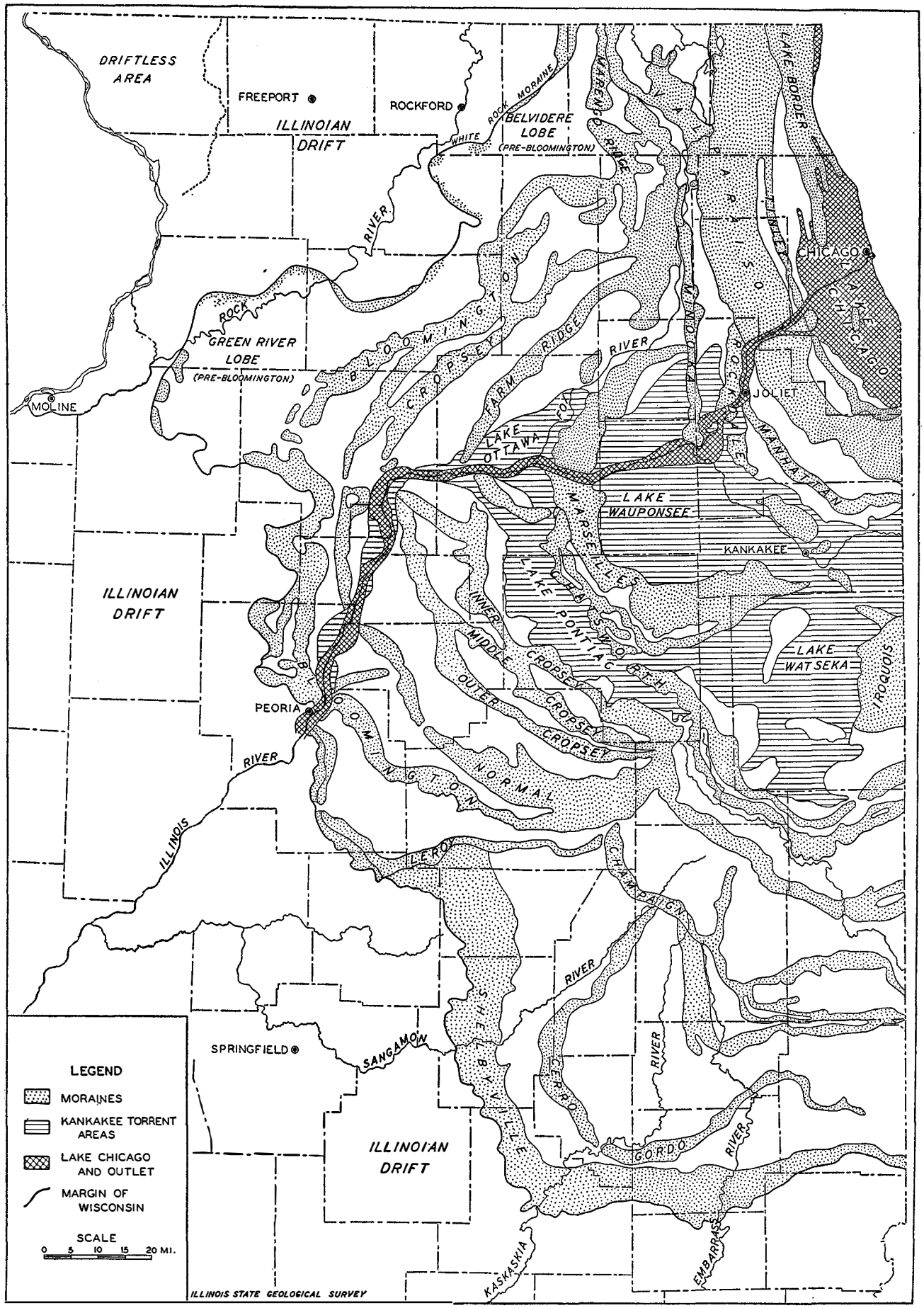
AN IDEALLY COMPLETE CYCLOTHEM

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



PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

(Reprinted from Report of Investigations No. 129, Physiographic Divisions of Illinois, by M. M. Leighton, George E. Ekblaw, and Leland Horberg)



GLACIAL GEOLOGY IN NORTHEASTERN ILLINOIS
Compiled by George E. Ekblaw from data furnished by the Survey
January 1, 1942

(40550—5M—7-56)