Geol. Survey

State of Illinois
Department of Registration and Education
STATE GEOLOGICAL SURVEY DIVISION
Urbana, Illinois

John C. Frye, Chief

GUIDE LEAFLET

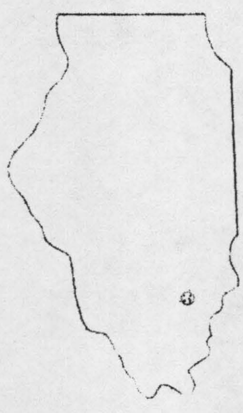
GEOLOGICAL SCIENCE FIELD TRIP

Sponsored by
ILLINOIS STATE GEOLOGICAL SURVEY

FAIRFIELD AREA

Wayne County

Fairfield and Albion Quadrangles



Leader
George M. Wilson

April 16, 1955

GUIDE LEAFLET 1955A

HOST: Fairfield Community
High School

FAIRFIELD GEOLOGICAL SCIENCE FIELD TRIP

ITINERARY

0	.0	Assemble at Fairfield Community High School. Head cars east toward Route 45.
0.1	.1	Stop. Turn right onto Route 45.
0.1	.2	CAUTION. Railroad crossing.
3.5	3.7	Slow. Turn left on gravel road.
1.5	5.2	Go east on gravel road.

Weather permitting, this side trip will be included:

(0.6 0.6) Go south on road to see a small abandoned coal strip mine.

During the early 1930's, the coal was stripped and used locally. The coal, shale, underclay, and sandstone are of Pennsylvanian age. This is one of the few coal outcrops in Wayne County. The coal beds that are mined extensively elsewhere in Illinois are found in Wayne County at depths of more than 1,000 feet.

Following is a typical section of the outcrop:

	Thickness Ft.	In.
Surface soil	1	
Gray shale	3	
Coal, impure and shaly.		8
Underclay, gray, with plant fossils . . .		10
Sandstone, gray, fine		10

Go back north to point 5.2 miles.

0.5 5.7 STOP 1. Till-plain.

Much of southern Illinois is covered with glacial till - the Illinoian till plain. Physiographers call it the Mt. Vernon Hill Country. Here we see a soil profile in Illinoian till as it has developed in Wayne County.

Thousands of years ago much of Illinois was covered by great ice-sheets. We have evidence that at least four great ice-sheets, or glaciers, invaded Illinois. We do not know just why the great ice-sheets developed, but we can be sure that the average annual temperatures were so low for such a long time that great quantities of ice and snow accumulated in the northern part of North America. The great weight of the ice and snow forced the ice to move outward in plastic flow. The rocks and stones frozen into the base of the ice moved with the ice. During the process many rocks were ground to "rock flour." The glacier carried a great load of finely ground clay, pebbles, and boulders.

Where the ice-sheet melted, it dropped its load, and its path is marked by an unsorted mixture of clay, sand, pebbles, and boulders called glacial drift or till. This is the deposit we see before us.

When melting at the edges of the ice balanced the advance of the glacier, the edge of the glacier stayed fairly stationary. But the advancing ice kept bringing more glacial drift, gradually building up a thickened belt or ridge of drift called a moraine. We will see a moraine later on this trip.

Some of the glacial drift was washed out by the melt-water and was sorted by the streams that flowed from the glacier. The streams dropped the heaviest and coarsest rocks and boulders nearest the glacier, carried the sand and gravel farther, and carried the finest clay and silt still farther; some of it went 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 concentrated in a stream valley, it forms a valley-train.

During the Wisconsinan glacial stage, later than the Illinoian, sand and gravel deposited in the valley of the Wabash dammed its tributaries. Melt-waters flowing down the Little Wabash River and the Wabash River were ponded. When the melt-waters lost their momentum, they dropped their load of silt and clay which formed a widespread deposit on the floors of the glacial lakes and ponds. We will see such a deposit and study a section of the soil profile (see description of how soil profiles develop).

	Feet
Surface soil	2
Clay, leached and oxidized	3
Till, brown, silty, with black concretions (iron-manganese), and with glacial pebbles	3
Till, silty, brown, medium hard, with glacial pebbles.	4

NOTE producing oil well. The oil comes from the Mississippian rocks which lie below the Pennsylvanian rocks (see chart).

2.0 7.7 Proceed on gravel road. Notice the soil profile on the right; it resembles the one described above.

1.1 8.8 Notice the sandstone in the road. Such stone has been quarried at various places in Illinois and used for foundation stone. There is a small quarry not far from this spot.

0.5 9.3 STOP 2. This soil profile is of special interest because of the great quantity of local material incorporated in the till.

	Feet
Surface soil, sandy	2
Till, brown, gray, sandy, pebbly; lower part weathers to a pebbly band.	4
Sandstone residium with glacial pebbles and till, and with much locally derived sandstone.	3

0.8 10.1 Notice the sandstone rubble in the till which here lies directly on the sandstone bedrock.

0.2 10.3 Proceed on road. Turn right.

0.5 10.8 CAUTION - Dangerous cross-roads.

0.8 11.6 Notice sandstone on right-hand side of road.

0.2 11.8 Turn right.

0.3 12.1 Turn left.

0.3 12.4 STOP 3. Back-water deposit.

As described above, when a river carrying melt-water was dammed, the ponded waters spread into a lake in which the fine sediment was dropped, building a wide flat lake floor. Note on the topographic map that the elevation is about the same over the wide valley flat. Since the lake silts were deposited, other materials from the immediate area have been washed over the lake silts.

	Inches
Surface silt, gray	8
Organic soil, gray	18
Silt, tan, light gray.	20
Silt, as above but with "iron" nodules	10
Silt, light gray, hard, sandy.	24

Only a few hundred feet farther along the route, we see a feature somewhat unusual for this section of Illinois - a moraine. This is the thick ridge of glacial drift that accumulated because for a long time the glacier melted as fast as it advanced. Examine the soil profile and compare it with the previous soil profiles.

	Feet
Surface soil, sandy	2
Till, reddish-brown, pebbly, sandy, weathered, with coarse bands of weathered pebbles	12
Sand, reddish, clayey, with bands of pebbles	3

0.5	12.9	Go ahead on road, turn left.
0.1	13.0	STOP 4. Outwash material.

The sand we see here is part of the outwash material from the glacier that deposited the moraine.

	Feet
Gravel, reddish-brown and weathered	15
Sand, fine, light brown	10

From this point to the bottom of the hill, the outcrops indicate that the materials are largely sand.

0.3	13.3	STOP 5. Vantage point with good view of both morainal topography and the valley flat which shows the level floor of the back-water silt deposit.

(Note the many oil wells in the area.)

1.9	15.2	STOP 6. Note the sandstone ledge in the road. This is one of the Pennsylvanian sandstones that the pioneers quarried for foundations for their houses and barns.
0.9	16.1	Continue north. Note the glacial boulders in the ravine on the left.
0.9	17.0	CAUTION. Railroad crossing.
0.8	17.8	Stop. Turn left on Route 15.
6.9	24.7	Go west to Fairfield, southeast corner of square, turn right (north) and follow cavalcade to city park.

LUNCH STOP.

1.9	26.6	Leave park, drive to First Street, turn left and proceed on Elm to 7th Street, turn right and go to small abandoned quarry.

STOP 7. The limestone exposed in the abandoned quarry is fossiliferous, especially rich in fusulina (one of the many foraminifera). Such fossils as these are useful in correlating rocks from place to place.

This limestone is one of many that occur in the Pennsylvanian rocks. Some of the limestones are only thin streaks, others are as much as 50 feet thick in some areas in the "Coal Measures" rock of Illinois. Beneath the limestone is black shale, and beneath the black shale is a thin coal which was mined when the limestone was quarried.

Limestone, black shale, coal, underclay, sandstone. The succession of strata is repeated as many as 50 times through the Pennsylvanian rocks. Such a sequence is called a cyclothem (see attached chart). The repeated sequence means that certain changes in conditions of sedimentation were repeated many times back in Pennsylvanian times.

In Pennsylvanian times rivers were bringing sediments from the north and east, possibly from as far away as the present Atlantic coast. The ocean lay far to the west and south, perhaps as far away as Nebraska, Oklahoma, and Texas. The country in between, now the Middle West, was a low flat swampy area in which the sediments were being deposited. Conditions were unlike any on earth today.

The plants and trees grew luxuriantly. When they died and fell into the swampy waters, they were partially preserved, buried by later sediments, and finally converted into coal. Sometimes the sediments were fine silts and clays which later became shales; sometimes they were sands which became sandstones. At still other times, the sea covered the area and left in the limy sediments marine fossils which became limestones.

End of Trip

Reprinted 1962

SOIL PROFILES - The Rate of Weathering

After the glacial till was deposited, natural weathering began. The rate of weathering is slow, but where till remained undisturbed a soil profile developed in the upper portion of the till.

Following the practice established about 30 years ago by the Russian scientist Glinka, soil scientists consider that the soil or weathering profile consists of three zones, designated A, B, and C from the top down. The A zone is the "soil" zone, normally black or gray. The B zone is the "subsoil" zone, and the C zone is the unaltered parent material.

The zonal effect comes about because the four major weathering processes progress at different rates, although all of them depend on the downward movement of groundwater. These processes, listed according to their rate of progress and beginning with the most rapid, are: (1) oxidation, (2) leaching of carbonates, (3) decomposition of more resistant minerals, and (4) accumulation of humus.

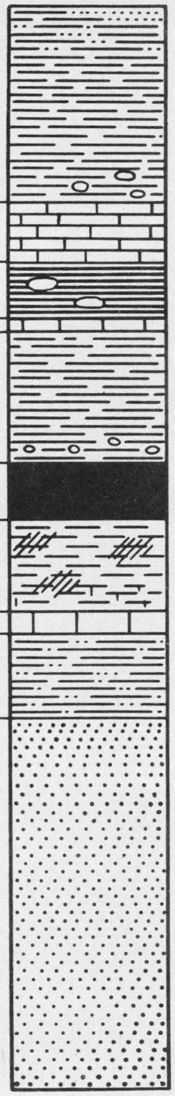
In the A zone, in which humus material from decaying plants has accumulated, the rock minerals are oxidized, leached, and decomposed. In the upper part of the B zone, the rock minerals are only oxidized (oxidation is shown by reddish or yellowish color caused by oxidation of iron minerals). The leached zone is determined by absence of carbonate rocks, such as limestone, and is revealed by tests with a solution of hydrochloric acid.

The soil profiles developed on the older drifts - Illinoian, Kansan, and Nebraskan, can be divided into five zones, designated by numbers instead of letters in order to avoid confusion. Horizon 1 is the old "soil" or humus zone. Horizon 2 is a dense layer, very gummy and plastic when wet, very hard when dry. Horizon 3 is the leached and oxidized zone, and Horizon 4 is the oxidized but calcareous zone. Horizon 5 is the unaltered parent material.

Deep weathering has developed the five recognizable zones in the old drifts. Oxidation, leaching, and decomposition of minerals have all progressed deeper. Another process (the downward transfer of clay minerals) has not only left Horizon 1 more silty than it was originally but has also made Horizon 2 much more dense and plastic than it was originally. This dense plastic "gumbo" horizon is known as "hardpan" and is widespread in southern Illinois.

GEOLOGICAL COLUMN - Fairfield Area

ERAS		PERIODS	EPOCHS	REMARKS
Cenezoic "Recent Life"	Age of Mammals	Quaternary	Pleistocene	Recent post-glacial stage Wisconsinan loess Illinoian glacial drift Kansan glacial drift
		Tertiary	Pliocene Miocene Oligocene Eocene Paleocene	Not present in Fairfield area
Mesozoic "Middle Life"	Age of Reptiles	Cretaceous		Not present in Fairfield 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
		Pennsylvanian	McLeansboro	Shale, coal, underclay, sandstone, limestone
			Carbondale	Present at depth
			Tradewater and Caseyville	Present at depth
		Mississippian	Chester (Upper Mississippian)	Sandstones, limestones, and shales in deep wells
			Iowa (Lower Mississippian)	Limestone, shale, and sandstone, in deep wells
	Age of Fishes	Devonian		Black shale and limestone in deep wells.
	Age of Invertebrates	Silurian		Limestone.
		Ordovician		Shale, limestone, and sandstone
		Cambrian		No data available
Proterozoic Archeozoic		Referred to as "Pre-Cambrian" Time.		No data available



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.

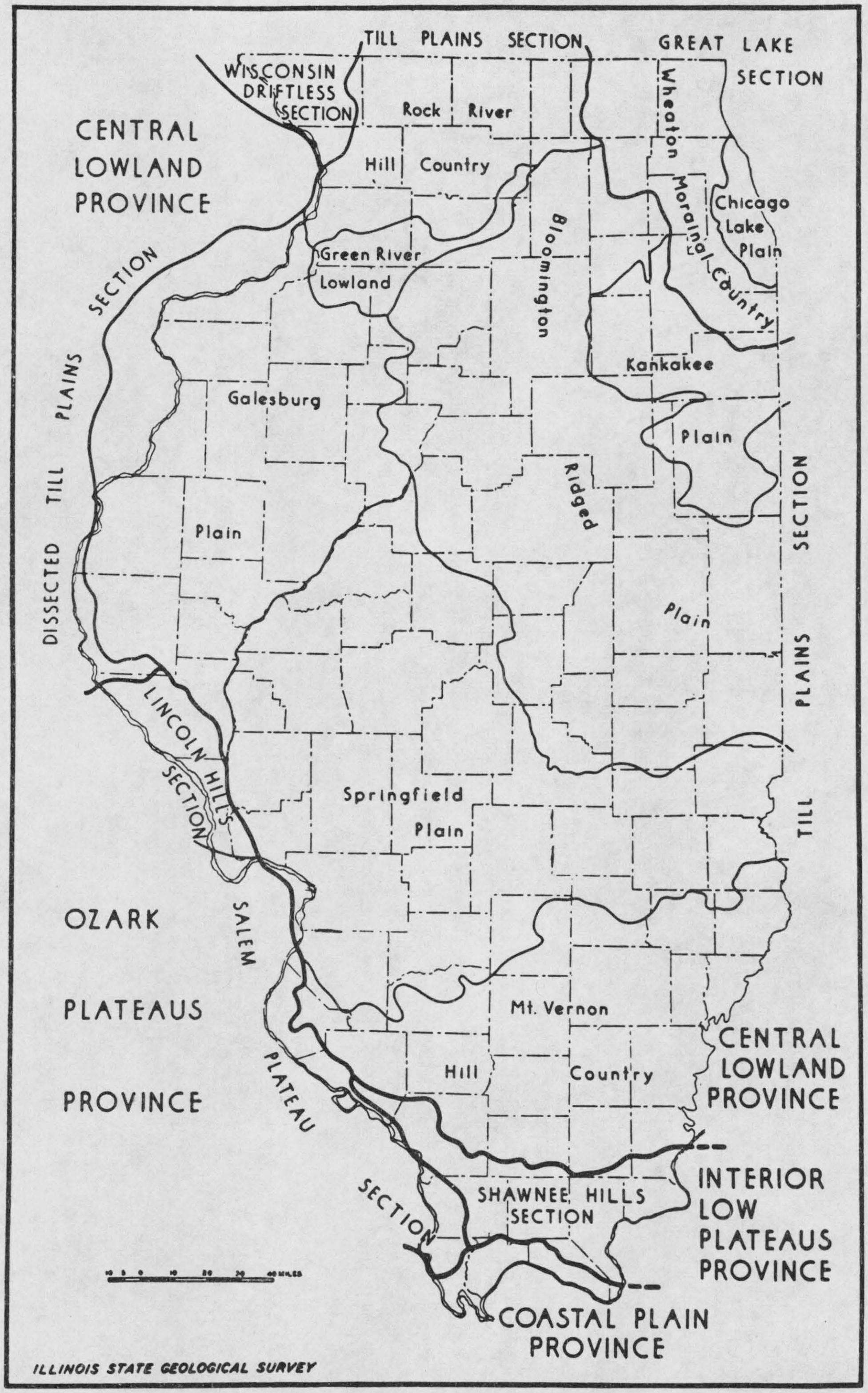
AN IDEALLY COMPLETE CYCLOTHEM

(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)

(47669—15M—11-61)

Time Table of Pleistocene Glaciation
(after M. M. Leighton and H. B. Willman, 1950, J. C. Frye and H. B. Willman, 1960)

Stage	Substage	Nature of Deposits	Special features
Recent		Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
	5,000 yrs.		
Wisconsinan	Valderan	Outwash	Glaciation in northern Illinois
	11,000 yrs.		
	Twocreekan	Peat, alluvium	Ice withdrawal, erosion
	12,500 yrs.		
	Woodfordian	Drift, loess, dunes lake deposits	Glaciation, building of many moraines as far south as Shelbyville, extensive valley trains, outwash plains, and lakes
	22,000 yrs.		
	Farmdalian	Soil, silt and peat	Ice withdrawal, weathering, and erosion
	28,000 yrs.		
	Altonian	Drift, loess	Glaciation in northern Illinois, valley trains along major rivers, Winnebago drift
	50,000 to 70,000 yrs.		
Sangamonian (3rd interglacial)		Soil, mature profile of weathering, alluvium, peat	
Illinoian (3rd Glacial)	Buffalohartan	Drift	
	Jacksonvillian	Drift	
	Paysonian (terminal)	Drift	
	Lovelandian (Pro-Illinoian)	Loess (in advance of glaciation)	
Yarmouthian (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	



PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

(Reprinted from Illinois State Geological Survey Report of Investigations 129, "Physiographic Divisions of Illinois," by M. M. Leighton, George E. Ekblaw, and Leland Horberg)

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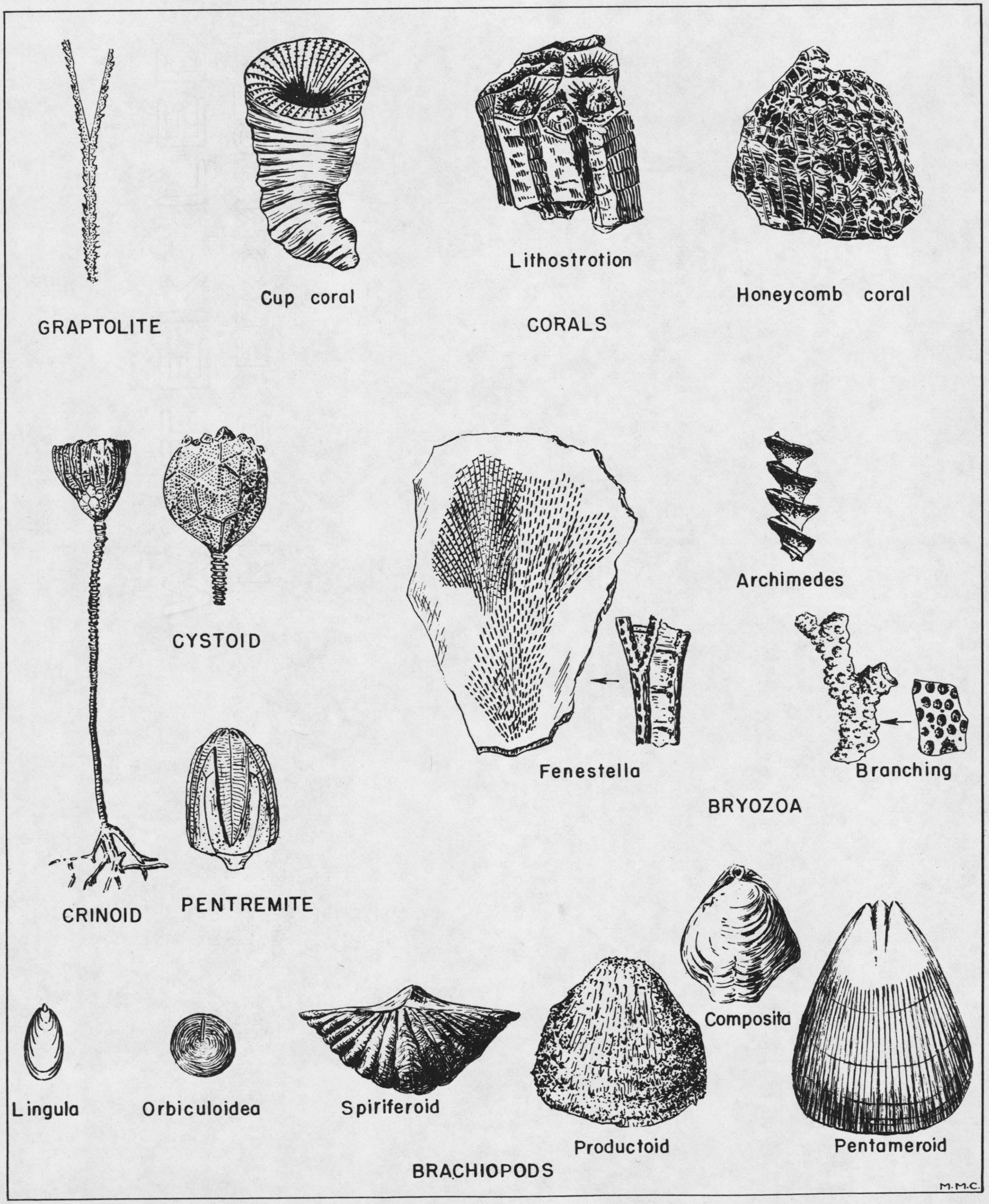
COMMON TYPES of ILLINOIS FOSSILS



COMMON TYPES of ILLINOIS FOSSILS