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

GUIDE LEAFLET

GEOLOGICAL SCIENCE FIELD TRIP

Sponsored by
ILLINOIS STATE GEOLOGICAL SURVEY

LAWRENCEVILLE AREA

Lawrence and Crawford Counties

Birds, Vincennes, Summer, and Hardinville Quadrangles

Leader
George M. Wilson

Urbana, Illinois
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GUIDE LEAFLET 57A

HOST: Lawrenceville High School

THE LAWRENCEVILLE GEOLOGICAL SCIENCE FIELD TRIP

ITINERARY

Today we will observe sediments from the recent geological past as well as those of the "Coal Age" or Pennsylvanian. A vast region covering more than 35,000 square miles in Illinois is covered by rocks of Pennsylvanian age. Virtually all of these rocks are covered by a mantle of clayey material, called glacial drift. The Lawrenceville region has an interesting geological history.

0.0	0.0	Start from parking lot, Lawrenceville High School. Turn south.
0.1	0.1	STOP, turn right.
0.1	0.2	CAUTION, traffic signals.
0.2	0.4	CAUTION, railroad crossing.
0.1	0.5	CAUTION, traffic signals. Intersection of State Route No. 1 and U.S. 50. Turn right.
0.2	0.7	Embarrass River (pronounced "Ambraw").
2.0	2.7	Leaving flood plain, rising onto the clay and silt plains of the same level as the higher terraces along the Wabash Valley. These sediments were deposited as backwater deposits during the extensive flooding of the Wabash during the Wisconsinan stage of glaciation.
1.1	3.8	Note the flatness of this surface - a lake-bed plain.
1.5	5.3	CAUTION, Pinkstaff Road.
0.9	6.2	Bedrock hill.
1.2	7.4	Note the flatness of the lake-bed deposits on the right.
0.8	8.2	CAUTION, road to Birds on right.
2.1	10.3	CAUTION, Sugar Creek bridge. Oil wells on right and left. Slow. Turn right on gravel road. We are now on lake-bed deposits of Wisconsinan age.
0.9	11.2	SLOW, caution, rough bridge. Railroad crossing. Bridge.
0.1	11.3	STOP NO. 1.

This section is in the Pennsylvanian system of rocks. As has already been indicated, more than 35,000 square miles of Illinois has "Coal Age" rocks at the surface beneath the mantle of unconsolidated drift. Economically the Pennsylvanian rocks of Illinois are largely developed in the coal mining regions, and at the present time there are more than 45 million tons of coal mined in Illinois each year valued at $184 million.

In eastern Illinois the Pennsylvanian rocks are also developed for the oil that they may contain. Much of the early oil production in Illinois came from the shallow sands in Crawford, Lawrence, Clark, and Wabash Counties.

The rocks that you will see here have no economic value in themselves, but are of interest because of the information that specialized geologists can learn from the fossils found in the beds. This series of different beds is called a cycle of sedimentation. The section here is as follows:

	Ft.	In.
Shale, medium, olive gray	15	
Shale, medium-dark gray, with rounded ironstone bands	4	
Smut streak with bone coal and thin underclay		½-1
Shale, dark gray, earthy, calcareous, very fossiliferous, with ironstone nodules	3	
Shale, dark gray-black, weak		10
Shale, black, with coaly residue		3
Underclay, poorly laminated, soft, plastic, with coaly interlaminations	2	
grades down to		
Siltstone, medium gray, shaly, fine, carbonaceous	2	

0.5 11.8 CAUTION, slow, turn left.

0.2 12.0 STOP NO. 2.

Soil profile:

	Ft.	In.
Soil, gray loessal		7
Loess, yellow, plastic when wet, non-calcareous	2	
Loess, yellow, as above, but with an occasional small quartz pebble	2	
Till, definitely brown-red, gravelly	3	

0.2 12.2 Note oil well on left.

0.3 12.5 Note lake-bed deposits on lowland on left.

0.3 12.8 SLOW, caution, bridge; note the red gravelly clay in ditch on the right.

0.5 13.3 SLOW, rough wash-board road, turn left.

0.1 13.4 Note the soil profile on the left.

	Ft.	In.
Gray plastic top soil		8
Yellow-brown, tight, plastic sub-soil (lake-bed deposits)	2	

0.4 13.7 SLOW, caution, railroad crossing.

0.1 13.8 Turn right, then left.

0.8 14.7 CAUTION, stop. Route 1, turn right.

0.6 15.3 Note the dissected character of the upland surface.

0.2 15.5 SLOW, turn right on the Flatrock road.

0.1 15.6 STOP NO. 3

The stop here is more complete since the coal is well developed. The section here is as follows:

	Ft.	In.
Sandstone, stained yellow and brown, with thin streaks of carbonaceous material. Note the conglomerate developed at the base.	10	
Shale, medium olive gray, well laminated	2	
Limestone, earthy, weak, medium gray, very fossiliferous - gastropods, brachiopods, corals.	2-3	
Shale, black, massive, pyritized, with pyritized fossils		4
Limestone, as above, pyritic		0-4
Shale, dark gray, massive, medium grained, hard		8
Shale, black, fissile		9
Coal	1	

Downstream the sandstone which underlies the coal is exposed. In the region east of Flatrock, this coal has been stripped with horses and scrapers to uncover the limestone and coal.

It is of interest to know that several seams of minable coal are to be found in this immediate region. The first minable coal encountered is the Illinois No.7 which lies at a depth of approximately 350 feet near Vincennes, then the Jamestown, at a depth of 380 feet, Illinois No. 6 at 395 feet, Illinois No. 5 at 470 feet, Indiana No. 1 at 580 feet, and Indiana No. 3 at 630 feet. From the diamond drill information available, all of the above listed coals were found to be at least as much as 3 or 7 feet in thickness.

The minable coals occur in a sequence of rocks similar to the one seen here. This outcrop affords an opportunity to make comparisons.

0.4 16.0 Enter the town of Flatrock.

0.3 16.3 CAUTION, stop, turn left.

0.2 16.5 SLOW, turn right, railroad crossing.

0.6 17.1 CAUTION, one lane bridge, rough.

0.6 17.7 CAUTION, slow, turn right.

0.4 18.1 SLOW, bridge, turn left.

0.5	18.6	T-road south, continue ahead.
0.1	18.7	Note the entrenchment of roadway into the loess.
0.5	19.2	T-road south, continue ahead.
0.6	19.8	CAUTION, crossroads.
0.5	20.3	CAUTION, crossroads.
1.3	21.6	T-road south, continue ahead.
0.6	22.2	Note siltstone outcrop on the left. The upland for the past several miles has had a thin mantle of glacial till on bedrock. The long period of erosion since the end of Illinoian times has allowed the dissection of the uplands, and the loess which lies upon the till conforms to the topography.
0.7	22.9	SLOW, stop, turn right on Route 33.
1.8	24.7	We are leaving the upland which we refer to as a portion of the physiographic province of the Mt. Vernon Hill country. At this point we are crossing an abandoned sluiceway.
1.3	26.0	Note the Wabash River on the left, which is only a few hundred feet away at this point.
0.3	26.3	Ascending the slope of a buried island hill. An island hill is a bedrock hill surrounded and partially buried by unconsolidated sediments. The hills are erosional remnants partially buried in an alluviated valley. Strictly speaking, the bedrock hill in the process of being left as an erosional remnant is a circum-denuded hill and in the process of becoming covered is called a circum-alluviated hill.
1.0	27.3	Note the sand dunes on the right.
1.0	28.3	We are now on the higher terrace which developed in Woodfordian time.
0.4	28.7	SLOW, entering Russellville.
0.9	29.6	Abandoned gravel pit in terrace deposit on left.
2.9	32.5	SLOW, turn right (west).
0.4	32.9	Edge of terrace, drops down into an old channel or sluiceway.
0.7	33.6	SLOW, turn left.
0.2	33.8	Turn right.
1.1	34.9	SLOW, stop. Proceed ahead.
0.7	35.6	CAUTION, T-road, note gravel in roadside beneath the terrace surface.
0.2	35.8	Note the great number of prickly pear (Opuntia) on the north road bank.
0.7	36.5	CAUTION, rough bridge. Crossroad, slow ahead.

0.1 36.6 STOP NO. 4 Lawrenceville Gravel Company pit.

The section here is as follows:

	Ft.
Humic gravelly soil	1
Stained gravel	5
Gravel	25

The terrace surface is a surface of aggradation which developed during Woodfordian time, but the sluiceway just east of the gravel pit developed during late Woodfordian-to-Twocreekan time and is a cut channel. The lower terrace level is also a cut terrace.

1.7 38.3 Turn caravan around and go east. Stop, turn right.

0.8 39.1 Note dunic hills on left.

0.8 39.9 CAUTION, crossroads. Note the abandoned gravel pits on the right. This pit was in the higher terrace level, and the immediate ridge was capped by sand dunes.

0.7 40.6 Low terrace level. An erosional surface.

0.4 41.0 Note the high terrace level on the left on Robeson Hills. The Robeson Hills are "Island Hills" or circum-alluviated hills.

2.0 43.0 CAUTION, slow, railroad tracks.

0.4 43.4 Bear left.

0.3 43.7 CAUTION, stop sign. Turn left, entering Route 50.

1.0 44.7 CAUTION, T-road left, Route 33.
Note the high terrace on the southeast side of Robeson Hills.

0.3 45.0 Crossing Wabash River.

0.2 45.2 SLOW, entering Vincennes, Indiana.

0.2 45.4 CAUTION, traffic signal.

CAUTION, CITY TRAFFIC AHEAD.

0.2 45.6 Traffic signal, turn left.

0.1 45.7 " " , continue ahead.

0.0 45.7 " " ,

0.3 46.0 " " .

0.3 46.3 " " .

0.1 46.4 Railroad crossing.

CAUTION, CITY TRAFFIC AHEAD.

0.2	46.6	Railroad crossing.
0.1	46.7	Traffic signals.
0.6	47.3	" " , turn right.
0.3	47.6	Railroad crossing.
0.2	47.8	Stop, turn right, enter Route 50.
0.2	48.0	Slow, turn right into city park.
0.1	48.1	STOP NO. 5 LUNCH.
0.3	48.4	Stop, turn right, leaving park.
0.1	48.5	", " , entering Route 50.
0.8	49.3	Traffic signals, continue ahead.
0.2	49.5	Railroad crossing.
0.2	49.7	Traffic signals, continue ahead, bear left.
0.2	49.9	" " , " " .
0.3	50.2	" " , " " .
0.1	50.3	" " , " " .
0.1.	50.4	" " , turn right on U.S. 50.
0.1	50.5	" " .
0.1	50.6	" " .
0.2	50.8	STOP NO. 6 Turn left, entrance to Lewis and Clark Memorial. Stop for tour of grounds.
0.1	50.9	CAUTION, enter U.S. Route 50.
0.3	51.2	Cross Wabash River. Turn right into Lincoln Memorial parking lot.
		STOP NO. 7
0.2	51.4	CAUTION, Route 33.
4.1	55.5	Follow U.S. 50, crossing sluiceways and low-lying terraces (cut) of late Woodfordian-to-Twocreekan time.
1.5	57.0	Main or upper terrace level.
0.8	57.8	Sand dunes on right and left.

0.9	58.7	Texas Company Refinery on the left. The refinery was originally built to process the oil produced from the Lawrence, Wabash, and Crawford County area. Production has come from shallow sand formations in the Pennsylvanian rocks and from virtually every Mississippian formation that has sufficient porosity to give oil. New oil continues to be found in the Lawrence County region. Secondary recovery or waterflood techniques are of real importance in the oil industry, especially in this area, for many of the producing zones are in sandstones with rather thick pay zones.
0.4	59.1	Crossing Embarrass River. Note the dipping beds on the right. This is an excellent exposure for observation except in periods of high water or flooding.
0.3	59.4	SLOW, entering Lawrenceville.
0.8	60.2	CAUTION, traffic signals, continue ahead.
0.2	60.4	CAUTION, railroad crossing.
0.1	60.5	CAUTION, traffic signals, continue ahead.
0.4	60.9	Bear left at Y in U.S. 50.
0.4	61.3	Note the Texas Company refinery and storage tanks on the left.
1.0	62.3	Note the old oil well, pump, and wooden oil storage tanks on the left. Some of the wells in this region have been in production since 1906. Contrast these wells and storage facilities with the pump equipment and storage facilities on the right.
		STOP NO. 8
1.7	64.0	SLOW, entering Bridgeport.
0.7	64.7	SLOW, turn right. Note the modern offices on the right.
0.9	65.6	Stop sign for U.S. 50. Turn right to go to Lawrenceville. Turn left for Olney.

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PART II. GEOLOGICAL HISTORY OF LAWRENCEVILLE AREA

BEDROCK FORMATIONS

The bedrock exposed in the Lawrenceville area, where streams have cut through the cover of glacial drift, belongs to the Pennsylvanian or Coal Period. Deep oil wells and tests have penetrated to still older rocks of Mississippian and Devonian age. In other parts of Illinois deeper wells pass through additional hundreds of feet of sandstone, shale, and limestone, belonging to the Silurian, Ordovician, and Cambrian periods (see appended geologic column), and some reach the Pre-Cambrian basement beneath. The "basement" is made up of very old, hard, crystalline rocks such as granite, gabbro, basalt, gneiss, and schist which come to the surface in the far north around Lake Superior and in Canada. Fragments of these rocks from the far north have been brought to the Lawrenceville area by the glaciers of the Ice Age.

EARLY GEOLOGIC HISTORY

The rocks of the "basement," formed in Pre-Cambrian Time, were folded to mountain ranges and then beveled by erosion to a low plain over 500,000,000 years ago. Between that time and the beginning of the Coal Period, an interval of some 250,000,000 years, the region was covered much of the time by shallow seas that covered a large part of the continent. At intervals, the seas withdrew and the region became a low coastal plain.

PENNSYLVANIAN HISTORY

With the beginning of Pennsylvanian time, more than 250,000,000 years ago, mountains arose in the general area of the present Appalachians. In the interior of the country the land lay virtually at or below sea level. Changes of a few feet in sea level brought considerable changes in life over the vast interior of the continent. A rise in the sea level brought marine life which left their shells in the many limestones, two of which we will see today.

Plants grew luxuriantly in these swampy areas, and it is with good reason that the rocks of Pennsylvanian age are called "Coal Age" rocks. There are more than 50 cycles of sedimentation in Illinois, any one of which could have developed a bed of minable coal. In fact there are 13 recognized beds of minable coal in Illinois. From plant fossils and coal ball concretions we learn the nature of the plants that grew so long ago.

Aside from the limestone and coal of the Pennsylvanian time most of the rocks are shale, siltstone, sandstone, and clay. As has been previously indicated, there were cycles of sedimentation--many repetitions of similar sequences of rocks deposited. You will find a copy of an ideal cyclothem included in the itinerary--compare the rocks found at Stops 1 and 2 with the ideal.

THE LOST INTERVAL

Following Pennsylvanian Time, the land rose to a moderate elevation above the sea and was never again covered by marine waters. Under these conditions, erosion slowly cut down the land and removed a part of the Pennsylvanian deposits. The material was carried away by the streams to be deposited far away. Thus we must depend on the rock record of other areas to tell us of the life and times of the post-Pennsylvanian - pre-Pleistocene interval.

ICE AGE HISTORY

The Pleistocene epoch began about 1,000,000 years ago when glaciers began moving down across the United States from the far north. There was not just one glacial stage, but four, each separated by a long interval of from 100,000 to 300,000 years during which mild climate prevailed, vegetation flourished, and the animals that had retreated before the advancing ice, returned. The Nebraskan, or first glacial advance, probably did not reach the Lawrenceville area. The second, or Kansan, is believed to have reached the vicinity of Lawrenceville, but evidence is largely concealed under later glacial drift. The Illinoian glaciation, from its center of accumulation east of Hudson Bay, moved across nearly all of Illinois to the Ohio and Mississippi Rivers, covering all of this area. The last or Wisconsinan ice sheet, which covered most of the northeast quarter of the state, did not reach Lawrenceville.

The terrace development in the Wabash Valley came during the lower Woodfordian substage during which time the terminal moraine of the Wisconsinan glacier was developed. The cutting of the lower terrace level coincided with the Lake Maumee feature of the late Woodfordian. The development of the sluiceways is a feature of the Twocreekan erosion and has continued to cut into the valley lower terraces during flood times.

The loess mantle developed during all of Wisconsinan time, covering the Sangamon soil which developed upon the Illinoian till.

It is estimated that less than 6,000 years have elapsed since the Wisconsinan glacier melted away from the upper end of Lake Michigan. Are we still living in the Ice Age? The ice may return again in one or two or three hundred thousand years, but most of us prefer to worry about more immediate dangers.

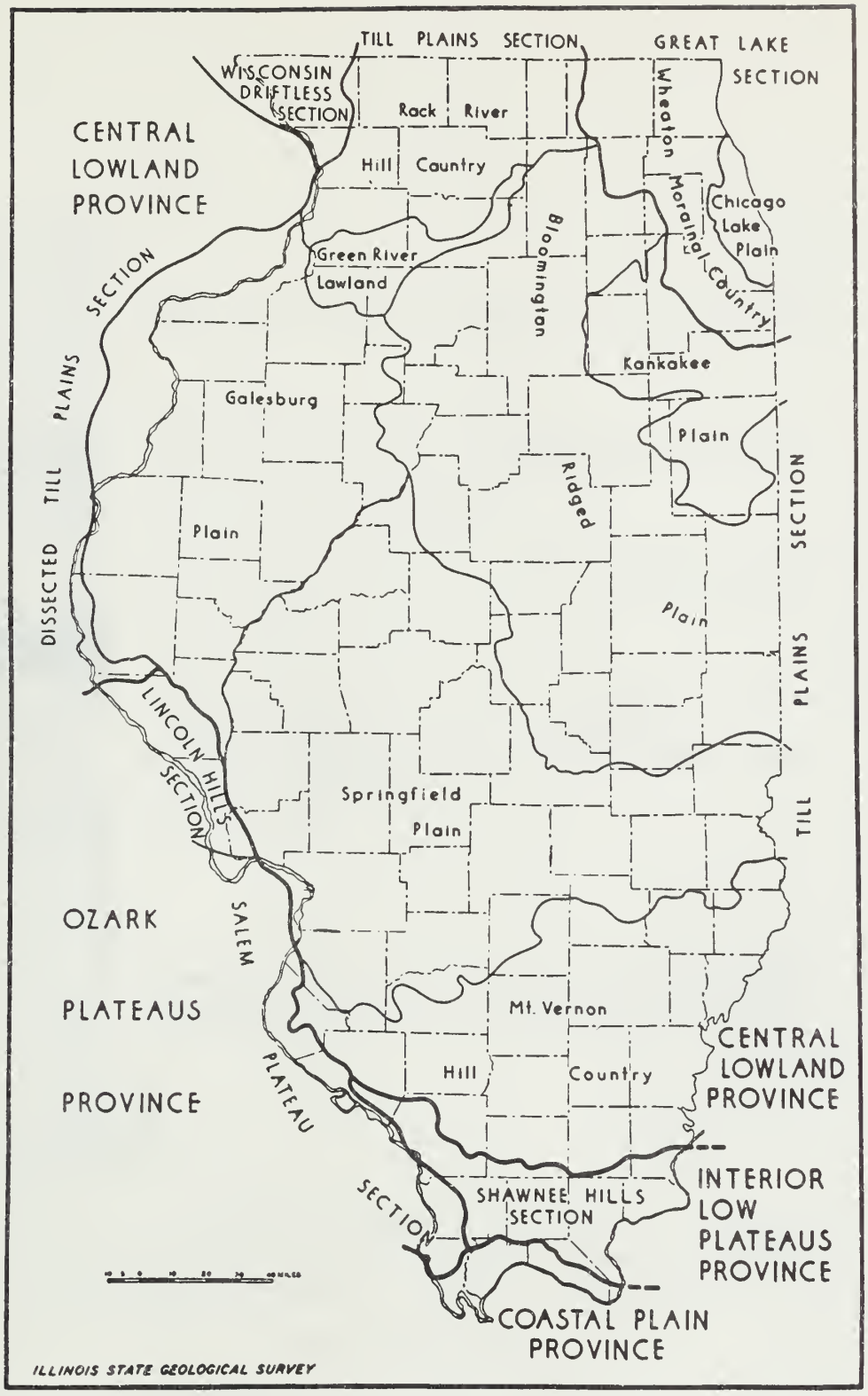
RECENT GEOLOGIC HISTORY

As the Wisconsinan ice slowly wasted away, the cold, dry climate of this region became warmer and more humid. Vegetation, which had been scarce, advanced northward, the forests following the valleys and the prairies occupying the uplands. Even where man has cleared or tilled the land, analysis of the soil shows us what areas the old forests and prairies occupied.

The increasingly humid climate has caused the streams to cut down into the fill which accumulated in valleys during Wisconsinan time. This process is continuing at present aided by increased run-off due to deforestation and cultivation.

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

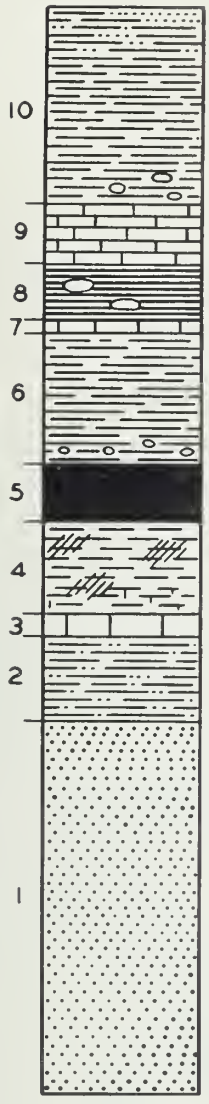
Stage	Substage	Nature of Deposits	Special features
Recent		Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
	5,000 yrs.		
Wisconsinan	Valderan	Outwash	Glaciation in northern Illinois
	11,000 yrs.		
	Twocreekan	Peat, alluvium	Ice withdrawal, erosion
	12,500 yrs.		
	Woodfordian	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)

(47669—15M—11-61)



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)

TERRACE DEVELOPMENT IN WABASH VALLEY NEAR LAWRENCEVILLE

GEOLOGICAL COLUMN * LAWRENCEVILLE AREA

ERAS		PERIODS	EPOCHS	REMARKS
Cenozoic "Recent Life"	Age of Mammals	Quaternary	Pleistocene	Exposed in Lawrenceville area: Recent post-glacial stage Illinoian glacial drift Wisconsin terraces and loess mantle
		Tertiary	Pleiocene Miocene Oligocene Eocene Paleocene	Not present in Lawrenceville area.
Mesozoic "Middle Life"	Age of Reptiles	Cretaceous		Not present in Lawrenceville 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	Sandstone, limestone, shale, coal.
			Carbondale	Sandstone, limestone, shale coal in deep wells.
			Tradewater	
		Mississippian	Chester (Upper Mississippian)	Sandstones, limestones, and shales in deep wells; several oil sands.
			Iowa (Lower Mississippian)	Limestone, shale, and sandstone in deep wells. Several oil sands.
	Age of Fishes	Devonian		Black shale and limestones in deep wells.
	Age of Invertebrates	Silurian		Some data available.
		Ordovician		Some data available.
		Cambrian		No data available.
Proterozoic Archeozoic		Referred to as "Pre-Cambrian" time. No data available.		