GUIDE LEAFLET

GEOLOGICAL SCIENCE FIELD TRIP

VIENNA AREA

JOHNSON COUNTY

VIENNA, PADUCAH QUADRANGLES

LEADER
Gilbert O. Raasch
Illinois State Geological Survey, Urbana
November 5, 1949

HOST: Vienna Township High School
Caravan Assembles on west side of Vienna Township High School.

CAUTION. Route 45. Turn right (S) on 45.

CAUTION. Junction with Route 146. Turn left (E) on 146.

CAUTION. Railroad crossing.

Turn right (S) on gravel road.

Road forks; go left (SE).

STOP No. 1. Mississippian, Hardinsburg Sandstone along creek. The thin, even sandstone layers can be seen sloping (dipping) northerly at an angle steeper than the fall of the creek. All of the bedrock strata in the Vienna Area show this northerly dip. They were, of course, deposited in a horizontal position. Then movements of the earth's crust after Pennsylvanian Time caused an upward tilting of the formations so that the layers sloped downward to the north.

Erosion then planed across this uplift and exposed the edges of the series of formations.

The Mississippian Formations of the Vienna Area were formed in late Mississippian time and are referred to as the Chester Group. This is a series of sandstone, limestone, and shale formations. The shales are weakest, erode rapidly, and are generally concealed in the valley bottoms. The sandstone formations are the hardest and act as caprock of the ridges.

You will note as we progress southward that the north slopes of the ridges are gentle, conforming closely to the inclination of the bedrock; but the south slopes are steep. This is because here erosion has broken through the hard caprock and cut down rapidly through the weaker formations below. (See sketch in Appendix.) Such ridges are called cuestas; and their steep sides are called escarpments. The most prominent escarpment in southern Illinois runs along the north edge of the Vienna Quadrangle and is formed by the thick sandstone mass (Caseyville Sandstone) that lies at the base of the Pennsylvanian.

This present outcrop illustrates very well the horizontal bedding of water-deposited rock strata. The rock is also closely divided by vertical fractures, known as joints. A hard layer of sandstone, when it is deeply buried in the earth, is like a sheet of glass. If a sheet of glass is twisted, it will shatter in a pattern of quadrangular fragments. The twisting that the Hardinsburg Sandstone layers have suffered has similarly caused a breaking into quadrangular slabs.

The breaking of rock by the jointing process throws it open for attack by erosion. Note how the waters of the creek follow and widen the joint crevices. In places where pebbles accumulate, the eddying motion of the water enables them to wear "pot-holes" in the sandstone.

Continue ahead (S) toward New Columbia.

Checkpoint - New Hope School.
1.0 11.2 Turn right (S) where blacktop begins.

0.5 11.7 Outcrop of Cypress Sandstone. (Descend Cypress escarpment.)

1.2 12.9 Road junction, turn left (S).

1.3 14.2 Turn left (E) in Cache Bottom.

1.4 14.8 Turn left (N) and ascend bluff of Mississippian Tar Springs Sandstone.

1.1 15.9 STOP No. 2. Walk east on old road and southeast across field. We are looking south across the valley of the Ohio River to the low rolling hills of the Gulf Coastal Plain beyond.

Today the Ohio River does not flow through the valley it had cut across southern Illinois. Instead it has borrowed the valley of the Tennessee River in its course from Paducah to the Mississippi.

How this came to pass is a fairly complicated story. Before the Ice Age, the Ohio River above Cincinnati flowed northwestward across Indiana and central Illinois to the Mississippi. When the glaciers moved down they blocked this northward flowing drainage and caused the Ohio to cut a new valley westward south of the ice masses.

This valley, which lies in the foreground, runs past Homberg and Brownfield, and westward past Belknap, Karnak, Ullin, and Olive Branch. The eastern part of this valley is now occupied by Big Bay Creek and the western part of Cache Creek. The portion of the valley in the foreground has no stream today.

The last of the ice sheets to come down from the north, the Wisconsinan Glaciation, did not reach southern Illinois. But when it melted away, it released great quantities of water and of sediment. This load of sediment continued to build up on the valley floor, until the stream flowed several hundred feet above its original level. The old Ohio valley was also filled by sediment, partly by material washed down the Wabash and partly by silt and clay deposited in the backwaters from the swollen Mississippi.

At a later stage in Wisconsinan Time a torrent pouring down the Wabash broke through the low divide between the Ohio and the Cumberland and from thence onward the Ohio flowed down the valley of the Tennessee. Finally the river abandoned its older, northern channel, except in times of very high water such as the flood of 1937.

15.9 Resume route.

1.9 17.8 Junction with main gravel road at east end of New Columbia. Turn right (E).

0.4 18.2 CAUTION. Begin descent of hill.

0.1 18.3 STOP No. 3. Cliff of Mississippian, Tar Springs Sandstone that once was the Ohio River bluff at time when that river flowed through Cache-Big Bay Valley.

The folding in the thinner layers near the top of the cliff is probably not the result of earth movement since it is not reflected in the massive sandstone below. The same thin bedded sandstone above the falls on the west side of the road shows no folding.
A clay zone of irregular thickness between the two sandstone zones probably caused the folding as this clay was irregularly compacted by the weight of strata above it.

Resume route and cross Cache Valley. Note absence of any natural stream in this abandoned river valley.

Ascend low ridge that marks SE side of valley. This may be a natural levee.

Road corner in Round Knob Village; turn right (S).

STOP No. 4. Roadcut on Round Knob-Metropolis Road.

Since crossing the Big Bay Creek-Cache Creek Valley, we have been traveling over the rolling topography of the upper Gulf Coastal Plain. This belt of country can be traced southeastward across the Kentucky "Panhandle," Tennessee, eastern Mississippi and Alabama, and thence round the south end of the Appalachians to become the Atlantic Coastal Plain. Geologically we are in the "Deep South," and this southern flavor is reinforced here by glimpses of cypress and of cotton.

The hills north of the Cache-Big Bay Valley are carved in bedrock of Paleozoic Age. The country to the south is underlain by much younger and largely unconsolidated sands, clays, and gravels of Cretaceous and Tertiary age.

The unconsolidated deposits of the Coastal Plain Province in Illinois fall into three groups. The first and oldest group was deposited here as the result of the Gulf of Mexico Embayment which in earlier times extended as far north as the southern tip of Illinois. The sediments laid down in Illinois at this time came to rest largely in lowlands bordering the sea of Cretaceous and Eocene time.

There followed a period of moderate uplift during which the Eocene and part of the Cretaceous sediments were removed. This interval of non-deposition in southern Illinois extended through Oligocene and Miocene Time.

In Pliocene time that followed a blanket of gravel was deposited over the eroded land surface of what is now Illinois. These gravels, to which the term LaFayette is loosely applied, occur widely over the Mississippi Valley and Atlantic Coastal Plain. They are peculiar for their highly polished surfaces and for the fact that they consist of only the most resistant types of rocks such as chert, quartz, and quartzite.

Upon these gravels, or separated from them by a limited thickness of colluvial sand or silt wash, are several layers of loess, and ashy, pulverent material deposited over the uplands by the winds of the Ice Age (Pleistocene.) Since there was not one, but four glacial stages during the Pleistocene, there are zones of loess corresponding to several of these glaciations. Between the glacial stages there were long mild periods during which soils formed and the upper part of the respective underlying loess was leached by the downward moving rain waters. This alteration of the loess zones of different age permits their recognition and discrimination.
At this outcrop, about 10 feet of ashy Cretaceous clay is present overlain by about ten feet of loess except at the north end of the exposure. Here a layer of Pliocene, LaFayette gravel intervenes between the clay and the loess. Elsewhere along the loess-clay contact is a zone with masses of limonite and pebbles from the LaFayette gravel. Evidently the LaFayette deposit once extended continuously above the clay but was removed before the deposition of the loess. The loess itself consists of zones of different ages but their discrimination is difficult because of recent weathering.

- 23.7 Continue ahead (S).

0.6 24.3 STOP No. 5. Cretaceous red sand is seen here above the Cretaceous silty and micaceous clay. Above this lies from 1 to 5 feet of LaFayette gravel overlain in turn by Pleistocene loess. At the preceding stop (no. 4), the Cretaceous sand had been removed by erosion before the deposition of the LaFayette gravel.

- 24.3 Continue ahead (S).

0.4 24.7 STOP No. 6. Outcrop of about 10 feet of Cretaceous red sand and sandy clay overlain by 12 feet of loess and loessal soil. The LaFayette gravel is missing here, but its former presence is indicated by a zone of residual pebbles between the Cretaceous sand and the Pleistocene loess.

Note that in this area, the LaFayette gravel, when present, may lie on various zones of the Cretaceous. Such an irregular relationship between two formations is termed an unconformity usually involving some uplift and erosion between the period of origin of the lower formation and that of the upper.

Similarly the loess base is unconformable, resting in places on the LaFayette gravel, in others on various zones of the older Cretaceous strata.

- 24.7 Continue ahead (S).

0.7 25.4 Round Knob Hill on left. South of here to Metropolis route is over low, flat river terraces of Pleistocene age.

4.6 30.0 Junction with Route 45 at Sinclair filling station in Metropolis. Go half left (SE) on Route 45.

1.6 31.6 Enter Fort Massac State Park and follow park road past George Rogers Clark monument.

0.4 32.0 Go right on gravel road to Tourist Camp.

0.2 32.2 LUNCH STOP.

- 32.2 Continue ahead (W) to Route 45.

0.1 32.3 Turn left (S) and follow Route 45 through Metropolis.

2.6 34.9 Leave Metropolis on Route 45, going NW over Pleistocene river terrace.
4.9 39.8 Choat. We are now among rolling hills of Cretaceous and Pliocene formations. Pit on hill to right is in LaFayette Gravel.

2.4 42.6 Enter Cache-Big Bay Valley, here separated by a low ridge, probably a natural levee, from a backwater area immediately south. This backwater still exists as a swamp today.

2.6 44.8 Mermet.

1.1 45.9 STOP No. 7. Walk west into Mermet Stone Company Quarry. Quarry is in an "island" of Mississippian bedrock lying south of the Cache-Big Bay Valley. Pockets of red sand and clay which cut down into the top of the quarry limestone are of Cretaceous age. They serve to tie this spot to the Gulf Coastal Plain Province rather than to the Shawnee Hills Province to which the hills of Mississippian strata belong.

The old bedrock surface profile, which here lies well above the level of Cache bottom, slopes steeply to the South at the rate of 40 to 50 feet per mile, so that at the Ohio it lies hundreds of feet below the present surface. From the Mermet Quarry southward, the rock disappears beneath the cover of Cretaceous and Tertiary sediments.

The location of this limestone quarry well to the south in a region where otherwise only unconsolidated sediments outcrop is an economic advantage. The rock is sold for agastone and road stone.

The limestone in this quarry, the Ste. Genevieve, is the highest formation of the Middle Mississippian Valmeyer Series and the oldest rock to be seen on the trip;

- 45.9 Continue ahead (NW) and cross Cache bottom.

4.7 50.6 Junction with Belknap Road. Turn left (W).

1.8 52.4 CAUTION. Railroad crossing.

1.1 53.5 Cross Cache River at a point where it leaves its own valley (lying among the hills to the north) and enters the oversized valley abandoned by the Ohio. From this point it flows west and south in the abandoned Ohio Valley to join the present Ohio just above Cairo.

0.5 54.0 STOP No. 8. Belknap Quarry. Limestones and shales of the Renault and Paint Creek formations of the Chester Series exposed in the quarry, with a very thin remnant of Cypress Sandstone remaining at top. Fossils are vary abundant in some of the shaly limestones. Most numerous types are fenestellid bryozoae, brachiopods, and the blastoid Pentremites. Some of limestone layers are oolitic, that is, full of tiny spherical concretions, resembling fish eggs.

- 54.0 Continue ahead (SW).

0.6 54.6 Intersection in Belknap. Make U-turn and reverse route to Highway 45.

4.0 58.6 Junction with Route 45. Turn left (N) on No. 45.
1.2 59.8 Outcrop of Golconda Limestone on right. A better exposure lies 1½ miles northeast, in the SW ½ of NE ¼, sec. 22, T. 13 S., R. 3 E.

2.4 62.2 STOP No. 9. Quarries west of Highway. Exposure consists primarily of two quarries, one lying to the south, the other to the west.

Mississippian, Glen Dean Formation, with 30 feet of white to light gray solid limestone at base, made up largely of ground-up fossil remains. Above this is about 25 feet of dark gray, fissile shale with interbedded ferruginous limestone layers near top which show current ripple-marks, pebbles, and other indications of the shallow water origin of the rock. This is also indicated by cross bedding in the lower massive limestone.

In the south quarry a mass of Tar Springs Sandstone cuts down into the shale to within 5 feet of the lower massive limestone. The sandstone evidently fills an old channel cut into the top of the Glen Dean Formation.

Many of the joint crevices in the Glen Dean Limestone have been widened through solution by underground waters. Here the fossils, especially crinoidal remains have been etched into relief by erosion. Masses of dull brown travertine are scattered about the floor of the quarry, but their immediate source is not evident.

Vienna 1.5 miles north.

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<thead>
<tr>
<th>ERAS</th>
<th>PERIODS</th>
<th>EPOCHS</th>
<th>REMARKS</th>
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<tr>
<td>Cenozoic</td>
<td>Quaternary</td>
<td>Pleistocene</td>
<td>Unglaciated; glacial stages represented by loess zones and alluvial terraces.</td>
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<tr>
<td></td>
<td>Tertiary</td>
<td>Pliocene</td>
<td>LaFayette gravel.</td>
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<td></td>
<td></td>
<td>Miocene</td>
<td>Not present in Illinois.</td>
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<td></td>
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<td>Oligocene</td>
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<td></td>
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<td>Eocene</td>
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<td></td>
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<tr>
<td></td>
<td>Pennsylvanian</td>
<td>Chesterian</td>
<td>A thick series of rather thin sandstone, limestone and shale units.</td>
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<td></td>
<td></td>
<td>Mississippian</td>
<td>Valmeyerian</td>
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"Recent Life" Age of Mammals
"Ancient Life" Age of Reptiles
"Ancient Life" Age of Amphibians and Early Plants
"Ancient Life" Age of Fishes
"Ancient Life" Age of Invertebrates
Pre-Cambrian
Geologic History

If borings for deep wells went thousands of feet deeper than they do in the Vienna Area, they would doubtless reach a foundation of hard crystalline rocks such as granite and basalt. We know this is the case elsewhere in Illinois and adjoining states. This foundation is made up of most ancient rocks of Pre-Cambrian Age. Some of them originated as sediments in seas, some from molten magma injected deep in the crust or expelled as lava, but all now broken and twisted by ancient mountain-making stresses. The mountains themselves are long gone, having been planed away to their roots by erosion before the ancient Paleozoic seas swept over the North American Continent.

This "reign of the ancient seas" began some 500 million years ago and endured for over 250 million years. The lands surrounding these inland invasions of the sea were low and could not supply much sediments, so that for the most part, limestones were deposited in the clear and shallow waters. This continued to be the case until late in Mississippian time, when the lands began to rise intermittently, erosion set to work, and sands and muds began to fill the interior sea. By Pennsylvanian time, with the rise of the mountains along the East Coast and in the Midcontinent, prodigious quantities of sediments were brought into the interior sea blotting it out much of the time, to turn the region into a swampy coastal plain. It was under these conditions that Illinois' rich coal deposits were formed.

Following Pennsylvanian time, all of Illinois rose above the sea, most of it never to be submerged again. Erosion set to work to cut away the rock layers and to carry the detritus thus formed off into distant oceans. By Cretaceous Time the sea again approached Illinois and the Gulf of Mexico extended over the southern tip of the State. Here it remained through the early part of the Tertiary Period that followed. Then, by Oligocene Time, the rise of the lands to the north brought all of the state above the waters where it has remained since that time.

Late in Tertiary Time when the Western Cordillera were rising to great heights vast quantities of sand and gravel were washed down across the western half of the Mississippi Basin to form deposits of great thickness. A characteristic of these gravels is their highly polished surfaces.

In Illinois at this time a similar deposit of highly polished pebbles (Pliocene, LaFayette Gravel) accumulated in a thin but fairly continuous blanket over much of the state. The pebbles, however, did not come from the western mountains but are largely of local origin, with probable additions from the Ozarks and from the states to the north.

The immediately following period, the Quaternary, witnessed the successive advance and retreat of great continental ice sheets that had their centers of accumulation in various parts of Canada. None of them reached the Vienna Area, but one, the Illinoian, stopped only ten miles north of the city.

Nevertheless, the area has been profoundly affected by the glaciation. The ice movements displaced major rivers and caused them to cut new valleys, the great quantities of sediment washed from the melting ice filled existing valleys for hundreds of feet above their bedrock floors, and a blanket of fine dust, or loess, was blown from these sediment-chocked flood plains, to accumulate over the uplands.

There is, of course, no evidence that the Ice Age is ended. It has been only some 25,000 years since the last of the continental glaciers melted away. In as much as some interglacial intervals lasted for several hundred thousand years, the present period may merely be another such interval, to be terminated in a hundred thousand years or more, by a fifth readvance of the ice.
PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

Diagram of relations of bedrock topography across Shawnee Hills and Coastal Plain.