GUIDE LEAFLET

GEOLOGICAL SCIENCE FIELD TRIP

Sponsored by
ILLINOIS STATE GEOLOGICAL SURVEY, URBANA

FREEPORT AREA

Stephenson County
Freeport and Lena Quadrangles

Leader
Gilbert O. Raasch
Urbana, Illinois
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GUIDE LEAFLET 1953B
FREEPORT GEOLOGICAL SCIENCE FIELD TRIP

Caravan faces west on Empire Street at Freeport High School.

Continue ahead (west), across American Avenue (Rt. 26).

STOP. Entrance to Krape Park.

Stop 1.

Although dissected moderately by small stream valleys, the surface topography to right and left rises to a uniform level. This is a rock bench carved by erosion on the top of the Galena Limestone bedrock. Although the region was later covered by the Wisconsinan Glacier, most of the topography seen in the Freeport and Lena Quadrangles is controlled by the bedrock underneath the cover of glacial debris.

Continue ahead (west).

Turn left (south) with blacktop at Centennial School.

Stop 2.

Like the Galena bench across which you have been traveling, the hills to the west (right) are controlled by bedrock, in this case of Maquoketa (Upper Ordovician) and Alexandrian (Lower Silurian) age. The Maquoketa strata are mainly shale which weathers readily and forms the gentle lower slopes of the rise, whereas the Alexandrian beds are a relatively hard magnesian limestone which forms the steep upper slopes and caps the flat summits.

Continue ahead (south).

Curve right (west) with blacktop.

Stop 3. Park along roadside in cut.

The roadcut exposes an unconsolidated clayey mass studded with pebbles and cobbles of many kinds. Local magnesian limestone, some of it highly fossiliferous, from the local Ordovician and Silurian formations is mingled with harder crystalline rock such as granite, quartzite, basalt, and gabbro, very old igneous and metamorphic rocks which lie deeply buried in Illinois. They rise above the surface northward, however, in the region around Lake Superior and in Canada.

The glacial ice moved down from the far north, collected rocks of many ages and kinds in its long journey to Illinois. When the glacier melted, it dropped the load of rock and earth over the landscape as a blanket of "glacial till".

Although there were four periods of glacial invasion during the million year span of the Ice Age (Pleistocene), only two invasions reached the Freeport area. These were the third or Illinoian and the fourth or Wisconsinan Stages of glaciation.
0.0 7.8 Continue ahead (west) and cross creek.

0.8 8.6 Stop 4. Park along roadside on top of hill.

The rock exposed in the road cut is a thin-bedded magnesian limestone interbedded with the soft blue-gray clay characteristic of the upper part of the Ordovician, Maquoketa Formation. The Silurian, Edgewood Limestone, is exposed in a small pit slightly higher on the hill to the north.

The Maquoketa deposits formed beneath the waters of an ancient Ordovician sea as shown by the abundance and nature of the fossil remains that cover the thin limestone slabs. The abundant brachiopod shells are mainly species known to have lived in the seas of North America near the end of Ordovician time. Among species identified are:

- *Plaesiomya subquadrata*
- *Opikina* sp. nov.
- *Rafinesquina* sp.
- *Strophomena planumbona*
- *Strophomena wisconsinensis*
- *Strophomena neglecta*
- *Platystrophia acutilirata*
- *Hebertella sinuata*
- *Rhynchoptrema neenah*
- *Rhynchoptrema parlamellosum*
- *Rhynchoptrema anticostiense*
- *Zygospira modesta*
- *Resserella corpulenta*
- *Leptoena unicostata*

In the addition to the brachiopods, there are many kinds of bryozoa (see supplement); and impressions of pelecypods (clams) gastropods (snails) and cephalopods (Endoceras) are found in splitting the layers. Many other types of animal life, including microscopic forms, may be found here.

0.0 8.6 Continue ahead (west).

0.4 8.6 Turn right (north) on side road at base of hill.

0.8 9.8 Intersection. Turn right (east).

0.2 10.0 Stop 5. Walk north to agricultural limestone quarry.

The quarry stone is of early Silurian age. It has few fossils, and those found are of species different from those seen at Stop 4, which lies at a slightly lower elevation. The rock at Stop 5 is a magnesian limestone, which shows little shale but has clay scattered through the 30 feet of rock belonging to the Edgewood Formation. The white chert seen above the quarry rock is weathering out of the overlying Kankakee Formation, also of Silurian Age. Small fossils occasionally are found in this chert. The cherty dolomite resists erosion more successfully than the rocks below and forms the caprock on many of the higher hills.

0.0 10.0 Continue ahead (east), ascending hill.

0.0 10.0 Continue ahead (east).

0.8 10.8 Junction. Turn left (north).
1.1 11.9  Intersection. Turn left (west).

1.2 13.1  Intersection. Continue ahead (northwest).


In the side road at the cemetery is a shallow outcrop of the same blue gray shale and fossiliferous limestone as seen at Stop 4. Up the grade to the north and into the woods to the right is a quarry in the highest pinnacle in the vicinity (1020 feet above sea level). The quarry shows about 8 feet of clayey Edgewood magnesian limestone on which rests 10 feet of cleaner, purer, cherty Kankakee magnesian limestone.

While today the Silurian limestones are limited to the higher hills, they once extended as a continuous limestone formation over this entire region. Long before the Ice Age, erosion by streams had cut away the bulk of the formation, leaving only a few remnants called outliers along the higher divides.

0.0 14.2  Continue ahead (west).

1.1 15.3  STOP. Turn right (north) on Rt. 73. Travel north over Galena Limestone rock terrace.

1.9 17.2  Turn right (east) on gravel road.

1.0 18.2  Intersection. Continue ahead (east).

0.8 19.0  Roadcut through well-stratified Silurian (Edgewood) beds.

0.3 19.3  Intersection. Continue ahead (east).

0.6 20.7  Quarry in woods on right rises into lowest beds of Niagaran (Middle Silurian) age, at elevation 1040 feet. View northwest is across dissected Galena rock terrace to Waddams Mound (1168 feet) which rises into the Silurian northwest of Lena.

0.0 20.7  STOP. Turn left (west) onto Rt. 20 in Eleroy. Continue on highway.

4.1 24.8  STOP. Turn right (north) on Rt. 73.

1.1 25.9  Enter Lena.

0.4 26.3  Lena High School on right.

0.2 26.5  Turn left (northwest) on main street and go north to water tower.

0.0 26.5  Lunch Stop in Lena.

0.3 26.8  Return to Rt. 73.

0.3 27.1  STOP. Go left (northeast) on Rt. 73.
Cross Waddams Creek and turn immediate right (east) on side road.

Stop 7. Park at base of grade opposite quarry.

This quarry for agricultural limestone and for roadstone exposes the upper, non-cherty part of the Galena Formation, the bedrock that underlies much of the country over which you have been traveling. The sandy appearance of the rock is a result of the loosely crystalline texture and should not be confused with sandstone, a rock composed dominantly of fragmental quartz particles.

The poorly preserved impressions of gastropods (snails), pelecypods (clams), cephalopods, and other animals that lived in the Galena sea may be observed in the porous strata. In the floor of the quarry and below the loader are numerous nodules of white chert, which mark the lower half of the formation.

The Galena Formation is named for the lead ore which it contains in northwestern Illinois and adjoining parts of Wisconsin and Iowa.

Reverse route and turn right (north) on Rt. 73.

Stop 8. Park along roadside in front of farm house, and walk west into gravel pit.

When a glacier melts, it drops glacial till, an unsorted mass of earth and rock; but, wherever the glacial debris (glacial drift) is contacted by melt waters, they exercise a sorting and stratifying influence.

Here sand and gravel, evidently washed out from the ice as it stood a short distance to the east, were deposited as a delta in a temporary lake. Such glacial delta deposits, formed in evanescent glacial lakes, are called kames. In this case, the retreating ice sheet probably lay across the mouth of the eastward-trending valley of Waddams Creek and converted it to a deep lake. This lake disappeared suddenly when the ice front withdrew far enough eastward to clear the valley's mouth.

Again, as in the case of the glacial till at Stop 3, many kinds of rocks are found. But in the gravel deposit, most of them have been rounded by the abrading action of the waters; those in glacial till develop flat, facetted sides as they are ground beneath the ice mass.

The stratification into courser and finer streaks of sand and gravel is plainly evident as is the steep inclination of the lines of stratification, indicating rapid deposition in deep water along the front of the expanding delta.

Continue ahead (north) on Rt. 73.
Note: Those wishing to leave the field trip may turn right a short distance beyond this point onto blacktop road to McConnell, Buena Vista, and Rt. 26, running southward to Freeport.

An optional trip north to observe Ordovician formations concealed beneath the Galena Limestone in the Freeport area follows.

5.4 36.6 Enter Wimslow.

1.3 37.9 Wisconsin State Line. Route continues as County Highway M, through Martintown.

0.4 38.3 Cross Pecatonica River and observe old quarries in Decorah dolomite (magnesian limestone) which directly underlies the Galena Formation.

3.6 41.9 Turn left (west) on Rt. M at transformer station.

0.2 42.1 Junction with Highway B. Turn right (north) on Rt. M. Quarries in hills to right and left are in Platteville Formation, a marine dolomite which underlies the Decorah Formation.

1.7 43.8 Enter Browntown.

0.4 44.2 Descend steep hill and cross railroad in Browntown.

0.1 44.3 Turn left (west) on blacktop and cross Rt. 11.

0.3 44.6 Cross Skinner Creek and railroad spur. Park at silica sand pit.

0.6 45.2 Stop 9. The sand pit is in the St. Peter Sandstone, a blanket deposit of sand of high purity which lies beneath the Platteville Formation and extends from the St. Paul-Minneapolis area (St. Peter or Minnesota River) across Wisconsin, Iowa, Illinois, and Missouri, into Ohio, Arkansas, and Kentucky.

The environment in which this sand deposit was laid down is not thoroughly understood, but in many regions the sandstone overlies the rocks below with a highly irregular surface, indicating that a land surface existed and was eroded before the sand overspread the region.

The sand is valuable for glass sand, for certain types of metal casting, and for ground silica, an important filler and abrasive.

0.0 45.2 Continue ahead (west) past cliffs of St. Peter Sandstone.

1.6 46.8 Junction. Turn left (south) with pavement.

0.2 47.0 Cross abandoned railroad grade (I.C. line to Mineral Point and Dodgeville).

0.2 47.2 DANGER. Cross Pecatonica River and railroad. STOP for Rt. 11.
0.2 47.4

Turn left (east) on Rt. 11 and park on shoulder of highway.

Stop 10. Former railroad cut along the now abandoned Dodgeville Branch of the Illinois Central Railroad.

St. Peter Sandstone can be seen at both ends of the cut, but the mid-portion is occupied by a mass of magnesian limestone in thin and irregular layers. This is the Shakopee Dolomite of Lower Ordovician age, once a rocky, projecting knob of the old pre-St. Peter landscape. The St. Peter sand was deposited around and over the knob, completely engulfing it.

Such an irregular contact between two formations is called an unconformity. The unconformity records the following sequence of events:
1) Deposition of lime mud over the floor of the shallow Shakopee Sea.
2) Hardening of the mud to limestone.
3) Uplift of the region to a moderate height above sea level.
4) Erosion of the Shakopee and older formations, to produce a landscape of hills and valleys.
5) Deposition of the St. Peter sand by wind or by fresh waters filling the irregularities of the landscape.

The dolomite was deposited in marine waters as shown by the abundance of gastropod (snail) shell impressions on some of the bedding surfaces. Lower in the formation, shown in the floor of the cut, lime-secreting algae built dome-like laminated masses called Cryptozoa. Similar structures are built by modern algae in shallow waters.

The clay along the contact between the limestone and sandstone contains a mineral, metabentonite, generally an indication of the admixture of volcanic dust which may have originated many hundreds of miles away. No evidence of local volcanic activity has ever been found.

To pick up Rt. 73 for Freeport, go east 11 miles on Rt. 11 to Monroe, Wisconsin.

Revised January 1964
GEOLOGIC HISTORY

Early Geologic History

After the Precambrian when the most ancient "basement" rocks were formed, folded, and then worn down to a nearly level plain, the Freeport area was almost continuously covered by the waters of inland seas down through the latter part of the Cambrian, the Ordovician, much of the Silurian, and a part of the Devonian Periods. The Mississippian and Pennsylvanian Seas, prominent farther south in the state, might have extended over this area, but evidence is lacking.

On the other hand, since the Pennsylvanian (Coal Period) at least, there is no reason to believe that the sea ever returned to this area, which remained dry land at moderate elevations above the sea. Except for a broad, gentle arching which took place before the Pennsylvanian and had its apex in central Wisconsin, the rock layers were not seriously disturbed. Through the millions of years which make up Mesozoic and Tertiary time, weathering by the atmosphere and erosion by streams wore away hundreds of feet of strata which once overlaid this region. These forces carved the landscape to its present pattern of hills and ridges. In the course of this wearing down, the harder Galena and Silurian Dolomites resisted erosion more successfully than did the intervening Maquoketa Shales. Therefore, the two dolomites form flat terraces above steep slopes, while the shales form broad gently rolling terraces. Where limestone layers are present in the Maquoketa Formation, they tend to form small knolls as a result of the protection of this limestone caprock.

Ice Age History

During the Pleistocene Period (Ice Age) beginning about a million years ago, continental glaciers moved from northern Canada into northern United States four times. Between these periods of glaciation were intervals of mild climate which endured for hundreds of thousands of years. During these milder periods the glacial ice disappeared, plant and animal life returned in abundance, and soils developed above the debris of former glaciers.

Beginning with the earliest, the four glacial invasions that entered Illinois are the Nebraskan, Kansan, Illinoian, and Wisconsinan. While all of these moved south into Illinois beyond the Freeport area, only the 3rd or Illinoian actually passed over it.

During the following (Wisconsinan) glacial invasion, however, the winds lifted the dust from the flats of the rivers flowing from the wasting ice and deposited a "loess" blanket over the uplands.

Today the winds, the rain, and the running streams continue in their efforts to erode the region to a base level close to the level of the present oceans. Man, through his soil conservation policies, attempts to arrest this pace.
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<th>ERA</th>
<th>SYSTEM</th>
<th>SERIES</th>
<th>FORMATIONS AND REMARKS</th>
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<td>Tertiary</td>
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<td>Illinoian glacial drift Loess deposits on upland Alluvium in river valleys</td>
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<td>Silurian</td>
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<td>Niagaran</td>
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<td>Alexandria</td>
<td>Kankakee cherty dolomite Edgewood thin-bedded earthy dolomite</td>
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<td>Cincinnatian</td>
<td>Maquoketa Shale and shaly limestone</td>
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<td>Ordovician</td>
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<td>Champlainian</td>
<td>Galena Dolomite Platteville Dolomite St. Peter Sandstone</td>
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<td>Canadian</td>
<td>Shakopee Dolomite Oneota Dolomite in wells</td>
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<td>Referred to as &quot;Precambrian&quot;</td>
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<td>Stage</td>
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<td>Nature of Deposits</td>
<td>Special Features</td>
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<td>Recent</td>
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<td>Soil, youthful profile of weathering, lake and river deposits,</td>
<td>Outwash along Mississippi Valley</td>
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<td>peat</td>
<td>Ice withdrawal, erosion</td>
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<td>5,000 yrs.</td>
<td>Outwash</td>
<td>Glacier, building of many moraines as far south as Shelbyville, extensive valley</td>
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<td>11,000 yrs.</td>
<td>Peat and alluvium</td>
<td>trains, outwash plains, and lakes</td>
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<td>12,500 yrs.</td>
<td>Drift, loess, dunes</td>
<td>Ice withdrawal, weathering, and erosion</td>
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<td>22,000 yrs.</td>
<td>Soil, silt and peat</td>
<td>Glaciation in northern Illinois, valley trains along major rivers, Winnebago</td>
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<td>28,000 yrs.</td>
<td>Drift, loess</td>
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<td>50,000 to 70,000 years</td>
<td>Soil, mature profile of weathering, alluvium, peat</td>
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<td>Sangamonian</td>
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PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

COMMON TYPES of ILLINOIS FOSSILS

GRAPTOLITE
Cup coral
Lithostrotion
Honeycomb coral

CORALS

CYSTOID

CRINOID
PENTREMITE

BRYOZOA
Archimedes
Fenestella
Branching

BRACHIOPODS
Lingula
Orbiculoidea
Spiriferoid
Productoid
Pentameroid
COMMON TYPES of ILLINOIS FOSSILS

PELECYPODS

"Clam"

"Scallop"

PELECYPODS

Low-spired

High-spired

GASTROPODS

Curved cone

Coiled cone (Nautilus)

Straight cone

CEPHALOPODS

Bumastus

TRILOBITES

OSTRACODS (greatly enlarged)

Calymene (coiled)

Calymene (flat)