GUIDE LEAFLET

GEOLOGICAL SCIENCE FIELD TRIP

Sponsored by
ILLINOIS STATE GEOLOGICAL SURVEY, URBANA

JONESBORO AREA

Union and Alexander Counties
Jonesboro and Dongola Quadrangles

Leaders
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Urbana, Illinois
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HOST: Jonesboro High School

GUIDE LEAFLET 1964
Prepared by Ed Odom
INTRODUCTION

There is so much of geological interest in the Jonesboro area that it is impossible to plan a one day field trip that even includes the major points of interest. Since few opportunities exist elsewhere in Illinois to examine the rock succession that composes the Mississippian and Devonian Systems, these sequences of strata have been chosen as the general theme of the Jonesboro trip.

The city of Jonesboro is underlain by Mississippian limestones that belong to the Valmeyeran Series (see geologic column in back of guidebook.) About one and one half miles northeast of the city appears the outcrop belt of the younger Mississippian Chesterian Series, and farther to the north beyond Cobden even younger Pennsylvanian (Coal Age) strata are at the surface. Approximately one and a half miles southwest of the city older strata which are part of the Devonian System are exposed. Farther to the southwest, near Thebes and Gale, still older strata of Silurian and Ordovician age crop out, and across the Mississippi River in Missouri successively older strata are exposed as the central part of the Ozark Dome is approached.

The morning segment of the Jonesboro trip will deal with the Mississippian rocks and the afternoon segment with Devonian rocks.

Itinerary

0.0 0.0 Assemble in front of Anna-Jonesboro High School. Turn left (west) on Route 146.
1.0 1.0 Jonesboro business district. Keep to right. Turn south on Route 127.
0.4 1.4 CAUTION. C & E I Railroad.
0.5 1.9 Note sinkholes on right.
0.3 2.2 Large sinkhole on right.
0.7 2.9 Outcrop of the Springville Shale on left.
0.9 3.8 Kornthal Church on right. An abandoned quarry in Valmeyeran (Mississippian) limestones is located directly south of the church.
3.1 6.9 Outcrop of the Springville Shale on left.
0.1 7.0 SLOW. Springville. Turn right. CAUTION. Railroad crossing.
0.5 7.5 Stop 1.

The elevation at this spot is approximately 540 feet above sea level and approximately 140 feet above Route 127 at Springville.

Hill country is visible in all directions. Careful observation reveals a distinct difference in the topographic form or morphology of the hills to the east as contrasted with the hills to the west. The break between these contrasting regions occurs approximately along the course of Mill Creek.
The hills west of this boundary are considered part of the Missouri Ozarks. East of this boundary are the Shawnee Hills. These divisions are shown on the plate "Physiographic Divisions of Illinois" near the back of the guide leaflet.

The Jonesboro area was not glaciated as was central and northern Illinois. Consequently, the bedrock is frequently exposed or is mantled by only a veneer of loess or thin soil cover. The topography probably has been developing since early in the Pleistocene Epoch or for nearly one million years.

The topography of the Shawnee Hills Section is controlled in part by rock structure and in part by the resistance of the rocks underlying the area. The Shawnee Section is underlain by thick lower Pennsylvanian sandstone as well as Mississippian (Chesterian) sandstone, shale, and limestone. These rocks display considerable variation in resistance to the attack of the agents of erosion. The sandstones are more resistant, and weather much more slowly than the weaker shale and limestone. In the Shawnee Hills Section, the hills are usually underlain by sandstone, while the slopes and valleys are underlain by shale and limestone.

The rock strata underlying the Shawnee Hills Section dip or slope northward. This northerly tilt causes the rock formations, which vary in composition and resistance, to outcrop along a northwest-southeast belt with the younger formations in the north and the older formations in the south.

The Salem Plateau Section is characterized by a more rugged topography, closer drainage texture and higher elevations. This region is underlain by Devonian chert and cherty limestone. The boundary between the Shawnee Hills Section and the Salem Plateau Section roughly coincides with the contact between the Devonian and Mississippian rocks.

There is little structural control of the topography of the Salem Plateau Section. The topography is strongly related to the resistance of the bedrock, namely the thick cherty Devonian strata.

1.1 8.6 SLOW. Turn left (east). Note the exceptional width of these small creek valleys. This is caused by alluviation or filling with wash from the slopes. Springville and Grassy Creek shales on left.

0.6 9.2 Note outcrops of Springville and Grassy Creek shales on left.

0.4 9.6 SLOW. Bridge.

0.1 9.7 CAUTION. Railroad crossing.

0.1 9.8 Turn left (north) on Route 127. Note exposures of siliceous shale and chert on right.

0.5 10.3 Mississippian limestone and shale outcropping on left.

1.2 11.5 SLOW. Turn right (east) on Dongola Road. Mississippian Salem or Harrodsburg Limestone outcrops in ditch on left.

1.2 12.7 CAUTION. Crossroad.

0.2 12.9 Stop 2. Lutz commercial marble and building stone quarry and the
Jonesboro Stone Company's aggregate and lime quarry. Walk to the quarry from the road.

These quarries both produce limestone from the Salem Formation of Mississippian age, but for different uses. The Jonesboro Stone Company produces the limestones for aggregate, agstone, and road surfacing. The Lutz Quarry produces the stone for building stone and commercial marble. The Lutz quarry will be examined in detail since it is an unusual operation.

The massively bedded limestone is quarried in large blocks 4 feet by 4 feet by 8 feet and larger. The blocks are cut by drilling closely spaced holes vertically around the margins. Then the blocks are wedged loose. The preparation plant where the stone is shaped, worked, and polished will be seen at the next stop.

The Salem Limestone is extensively quarried in southern Indiana for building stone.

Two formations are exposed in this area, the Salem Limestone and the Harrodsburg Limestone. The Harrodsburg is massively bedded, coarse textured, and light brown to dark gray, and is composed of large calcite crystals and fossil fragments in a fine-grained matrix. Fragments of lacy bryozoa of the fenestellid type are abundant. The Salem differs in that it is medium to fine-grained and medium to dark gray.

The Harrodsburg works easily and is used for building stone and for polishing. Slabs cut at a right angle to the bedding have a banded appearance. Slabs cut parallel to the bedding have a mottled appearance.

The coarse Harrodsburg stone at this locality is over 50 feet thick.

0.1 13.0 Turn around at St. John's Lutheran Church.
0.4 13.4 SLOW. Turn right (north) on gravel road.
0.1 13.5 Note thick loess in bank on left.
1.2 14.7 Note thick loess deposits in banks on left and right. Y-road.
0.1 14.8 Y-road. Continue ahead. Note small sinkhole in field.
0.2 15.0 Pond on right is a plugged sinkhole.
0.2 15.2 T-road. Continue ahead.
0.8 16.0 Note sinkholes on right and left. Sinkholes indicate that the region is underlain by relatively pure and soluble limestone.
0.3 16.3 T-road (east) continue ahead.
0.3 16.6 Large pond on left is a sinkhole.
0.6 17.2 Peach orchard on right and left.
0.2 17.4 T-road. Turn left.
0.9 18.3 This area is famous for its apple and peach orchards. The soil,
which is developed entirely in loess, is well suited for this use.

0.4 18.7 Entering Anna.

0.3 19.0 Stop 3. Lutz Marble Company preparation plant.

A guided tour, courtesy of Jerome Lutz, owner and manager, will go through the plant to see the processes used to prepare the Harrodsburg Limestone for building stone and commercial marble. Please stay in line, keep moving, and keep away from all machinery. Do no sample collecting during the tour as samples of the polished stone will be given at the end of the tour.

0.1 19.1 Old preparation plant of the Lutz Marble Company.

0.5 19.6 Stop. Turn left (west) on Route 146.

0.5 20.1 High school on left. Turn right on Peacock Street.

0.8 20.9 STOP. Turn right on Main Street in Jonesboro.

0.1 21.0 Stop 4. Lunch. Lincoln Memorial Park. Turn around and return to Main Street.

0.3 21.3 Turn right (south) on Main Street.

0.2 21.5 CAUTION. Railroad crossing.

0.1 21.6 STOP. Route 127. Turn right (west) on Route 146.

1.1 21.7 Turn left (southwest) on gravel road in Berryville.

1.4 23.1 Stop 5. Outcrop of Dutch Creek Sandstone overlying Clear Creek Chert.

From Jonesboro to here the route crossed the Mississippian and the Upper Devonian rock formations. In this locality, the Middle Devonian Dutch Creek Sandstone Formation is seen resting on the Lower Devonian Clear Creek Formation.

The Dutch Creek Sandstone is rusty brown in color and very massive, and contains rounded grains of quartz sand. The brown color is to some extent caused by weathering, since fresh exposures of common white are only slightly iron stained.

Here the sandstone is friable, but locally it is quartzite and very hard. The remains of fossils are preserved in prolific numbers as casts and molds. This sandstone was probably very calcareous at the time of deposition.

The Dutch Creek Sandstone is approximately 10 feet thick, although from the outcrops along the stream it appears thicker because of several small faults with only a few feet of displacement.

The Dutch Creek Sandstone is overlain by the Grand Tower Limestone (not seen in this area) and is underlain by the Clear Creek Formation. The Clear Creek consists of white chert and subordinate amounts of siliceous limestone. This formation is exposed in the bottom of the ditch. Note that
the chert is hard and brittle. At Stop 7 the Clear Creek Chert Formation will
be seen where it has been intensely weathered and broken down to a soft powdery
material called tripoli.

Since 1939 and 1940 oil has been produced from the Grand Tower Limestone
and the Dutch Creek Sandstone in the Centralia-Salem area. In 1959, oil was
discovered in the Dutch Creek in Wayne County.

0.3 23.4 Turn left (southeast).
1.6 25.0 Bridge over Dutch Creek.
0.5 25.5 Outcrops of Mississippian Springville Shale and Burlington-Keokuk
Limestones.
0.4 25.9 T-road. Turn right (south).
0.2 26.1 Mississippian Burlington-Keokuk Limestone exposed in streambank on
left.
0.2 26.3 Excellent exposures of the Springville Shale.
0.2 26.5 Stop 5A. Springville Shale, Sylamore Sandstone, and Alto Limestone.

In the east bank of Harrison Creek about 60 feet of Springville Shale
is underlain by a one foot discontinuous sandstone (Sylamore) and 15 feet of
gray siliceous limestone containing buff chert nodules (Alto Limestone). The
Springville Shale is overlain by limestone of the Burlington-Keokuk Formation,
which crops at the top of the bluff. An abandoned quarry in the Burlington-
Keokuk Limestone is located on the north face of the bluff directly across from
Kornthal Church.

The lower part of the Springville Shale is quite soft while the upper
part is slightly harder because it is more siliceous.

Based upon the studies of Collinson and Scott (1958), the Sylamore
Sandstone and the Alto Limestone are Devonian in age, whereas the Springville
Shale is of Mississippian Age. Further north three additional formations which
are missing here intervene between the Sylamore and the Springville Formation.
The regional relationship is illustrated below (after Collinson and Scott, 1958).
(See Figure 1)

0.1 26.6 Continue straight ahead. Leave blacktop road.
0.2 26.8 Shaly limestone of the Alto and Lingle Formations outcrops on left.
0.2 27.0 CAUTION. Bridge.
0.7 27.7 T-road. Continue ahead.
0.6 28.3 "Big inch" pipeline crosses road.
2.3 30.6 Crossing Lingle Creek.
0.0 30.6 Stop 6. Fault.
Fig. 3. - Cross section showing principal outcrops of the Springville Formation and illustrating the relationships of the formation with overlying and underlying formations.
A few small anticlines, synclines, and faults are the major geologic structures in this area. This an excellent outcrop of one of the larger faults.

On the north (right side) of the fault zone, the Mississippian Springville Shale is overlain by chert of the Burlington-Keokuk Formation. On the south side of the fault only the greenish Springville Shale is exposed. Thus the strata on the north side of the fault have dropped relative to those on the south side. This fault appears to be an extension of a large north-south trending fault mapped by Weller (1940).

The strata on the south dip steeply southward near the fault, but within a short distance they are nearly horizontal. The strata on the north side dip northward but have been dragged to a nearly horizontal attitude close to the fault.

The fault zone is about three feet wide and is filled with blocks of shale and chert (fault gouge). The shale in the vicinity of the fault has been oxidized to bright colors by solutions moving down along the fault zone. The Springville Shale south of the fault has sparsely distributed fossils including brachiopods (Productella) and ostracods (paired shells of minute crustaceans). On the north side of the fault the Springville Shale is very siliceous and is mottled brown and red. This material is called "calico rock." Dense, massive beds make good polishing material.

0.2 30.8 T-road. Turn right.
0.1 30.9 "Calico Rock" outcrops in the bank on left.
0.3 31.2 Note steep dip of shales and cherts on left in creek. This dip is a reflection of the same fault observed at the last stop.
2.4 33.6 T-road. Turn left (east).
0.3 33.9 T-road. Continue straight ahead.
0.2 34.1 Note the loess outcrop on left. These hills are mantled by thick accumulations of loess.
0.3 34.4 Ford Creek.
0.4 34.8 Note severe erosion on left.
0.4 35.2 Note outcrop on left.
0.6 35.8 Limestone and shale outcrops on left.
0.4 36.2 CAUTION. Railroad crossing.
0.0 36.2 Turn right (south) on Route 127.
2.1 38.3 Tertiary gravel exposed in bank on left.
0.2 38.5 Chert and siliceous shales of the Springville Formation.
0.2 38.7 Note chert high in the bank on left. This is the Burlington-Keokuk Chert.
0.2 38.9 Town of Elco on right.

0.8 39.7 Entering the ancient valley of the Ohio River. This abandoned valley now is occupied by the Cache River.

0.5 39.2 Note the very flat floor of the ancient Ohio Valley.

0.2 39.4 To the left note the north wall or side of the ancient valley.

0.4 39.8 Turn right (west) on gravel road. CAUTION. Railroad crossing.

0.3 40.1 Stop 7. Quarry in Clear Creek Chert.

This is a good exposure of the intensely altered Devonian Clear Creek Chert. The powdery tripoli is used in preparing abrasives, paint fillers and other miscellaneous uses. Extensive deposits of chert and tripoli are known in Alexander County.

At the east end of the quarry large blocks of iron stained Dutch Creek Sandstone can be seen. Fossils are abundant in the Clear Creek Chert and in the Dutch Creek Sandstone. The following genera are present: brachiopods - Leptostrophia, Schuchertella, Amphigenia, Spirifer, Delthyris, Anoplia, Eodevonaria, Leptocoelia and Centronella; pelecypods - Grammysia and Aviculopecten; gastropods - Platyceras; trilobites - Cornoura; and numerous kinds of corals.

End of Trip
GEOLOGICAL HISTORY OF ANNA-JONESBORO AREA

Precambrian Basement

The bedrock which lies at the surface in the field trip area was deposited during the Devonian and Mississippian Periods (see geological column). Deep wells drilled in the region, however, encounter older strata of Silurian and Ordovician age. Geologists know from studies elsewhere that below these are Cambrian strata which come to the surface to the west in the Missouri Ozarks. All of these deeply buried layers originated as sediments, mainly in marine seas that invaded the continent from 500 million to 300 million years ago.

These sedimentary rock layers lie upon still older rocks called the "granite basement." These oldest of all rocks (from 500 million to 2 billion years old) had a complicated history, difficult to read because of the great amount of folding, crushing, and remelting that they have undergone. Such rocks can be seen at the surface in the interior of the St. Francis Mountains in Missouri, but here in Union County they lie several thousands of feet below the surface.

Devonian Period

The Devonian in this area contains a large quantity of silica (chert and tripoli), the origin of which is problematical. The theory favored by most geologists is that the original deposits were silica-rich, lime carbonates or limestone. Later the soluble lime carbonate was replaced by silica forming thick beds of white chert. Even later, the chert was further altered along fractured zones to powdery tripoli.

Toward the end of the Devonian time and continuing into early Mississippian time, there seems to have been an influx of mud and a shoaling of the sea. Much shale was formed in which fossils are few compared with the abundance of fossil shells and corals in the limestone below.

Mississippian Limestones

In time the waters cleared and great thicknesses of limestone strata were again laid down including the ground-up fragments of the shells and corals that thrived in these seas. These Mississippian limestones supply agricultural lime, roadstone, and building stone.

During late Mississippian time from 1,000 to 2,000 additional feet of alternating sandstone and limestone-shale beds accumulated. These beds were deeply eroded before several thousand feet of Pennsylvanian "Coal Period" formations were deposited.

Disturbance of the Strata

Following Pennsylvanian time, the earth's crust exhibited considerable instability. The Ozark area was uplifted several thousand feet and the Illinois Basin depressed by a similar amount. As a result, the layers in the Jonesboro region do not lie horizontal but slope perceptibly eastward in their descent from the Ozark Dome to the Illinois Basin.
Long Erosion Interval

Following these crustal movements, the land for a long time lay at a moderate distance above sea level. In time the work of the wind, the weather, and the streams eroded thousands of feet of strata and beveled the irregular surface down to a nearly level plain. In western Union and Alexander counties, however, low hills continued to rise above the plains where the hard chert resisted erosion.

In Cretaceous and early Tertiary time, when the Gulf of Mexico extended to the southern tip of Illinois, the Jonesboro region was low enough so that patches of sand and clay from the weathering of the rocks have been preserved in some parts of the area (Anna Kaolin).

Ice Age Events

Although the glaciers of the Ice Age (Pleistocene) did not extend as far south as the Jonesboro area, they nevertheless effected the region. Early in the Pleistocene, the Ohio River was formed by streams diverted and combined in a westerly course south of the ice front. This was the river that flowed through Cache Valley.

By late in the Pleistocene time, the Mississippi and Ohio Rivers had built up their channel floor about two hundred feet. During an interval of unusually high water, believed to be about 15,000 years ago, the Ohio River flowed over a low divide into the valleys of the Cumberland and Tennessee and abandoned the Cache Valley.

Chocked with sediment and exposed to the winds of late autumn and early spring, the Ice Age river flats were the source of dust storms. Settling over the bluffs and uplands, the dust formed the deposit of loess which is the parent material for many rich soils.

In the time since the glaciers melted away, man has accelerated the work of the erosive agents by clearing, plowing, and over-grazing the surface. The geologist of today sees much more bedrock than his predecessor 50 years ago.
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<tr>
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<th>System</th>
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<td>Burlington-Keokuk Limestone</td>
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<tr>
<td>Tertiary</td>
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<td>Upland gravels</td>
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## TIME TABLE OF PLEISTOCENE GLACIATION
*(after J. C. Frye and H. B. Willman, 1960)*

<table>
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<th>SUBSTAGE</th>
<th>NATURE OF DEPOSITS</th>
<th>SPECIAL FEATURES</th>
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<td>5,000</td>
<td>Outwash</td>
<td>Outwash along Mississippi Valley</td>
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<td>Valderan 11,000</td>
<td>Peat and alluvium</td>
<td>Ice withdrawal, erosion</td>
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<td>Twocreekan 12,500</td>
<td>Drift, loess, dunes, lake deposits</td>
<td>Glaciation, building of many moraines as far south as Shelbyville, extensive valley trains, outwash plains, and lakes</td>
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<td>WISCONSINIAN</td>
<td>Woodfordian 22,000</td>
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<td>Ice withdrawal, weathering, and erosion</td>
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<td>Farmdalian 28,000</td>
<td>Drift, loess</td>
<td>Glaciation in northern Illinois, valley trains along major rivers, Winnebago drift</td>
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<td>SANGAMONIAN</td>
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<td>(3rd interglacial)</td>
<td>Buffalo Hart</td>
<td>Drift</td>
<td>Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois</td>
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<td>Jacksonville</td>
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<td>(2nd interglacial)</td>
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<td>Soil, mature profile of weathering, alluvium, peat</td>
<td>Glaciers from northeast and northwest covered much of state</td>
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<td>(1st interglacial)</td>
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<td>Soil, mature profile of weathering, alluvium, peat</td>
<td>Glaciers from northwest invaded western Illinois</td>
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<td>(1st glacial)</td>
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PHYSIOGRAPHIC DIVISIONS OF ILLINOIS
