STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION
STATE GEOLOGICAL SURVEY DIVISION

M. M. Leighton, Chief

Rock Island - Moline Area

Rock Island County

Guide Leaflet for Illinois Academy of Science

by

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ITINERARY

0.0	0.0	Assemble on Augustana College campus and head south on 38th Street.
2.6	2.6	Descend hill and STOP. Turn right (W) on Route 2.
1.0	3.6	STOP. Turn left (S) on Route 67.
0.3	3.9-4.6	Cross Rock River (here divided by Van Druff Island), and Illinois and Mississippi Canal, and enter Milan. Note ledges of Devonian, Wapsipinicon limestone in river bed. Rock River here clearly is not flowing in a pre-glacial valley.
0.7	4.6	Follow Route 67, curving east in Milan.
0.3	4.9	Turn right (S) at junction of Routes 67 - 92, in Milan.
0.7	5.6	Turn right (W) on pavement.
1.4	7.0	Gravel pits in river terrace deposits. Gravels consist in part of pebbles derived from the local rock formations, but more common are pebbles of igneous and metamorphic rocks brought down from the far north. Especially common are ancient lavas ("trap rock"), jaspers and taconites, with an occasional agate. These are the dominant rocks around the western end of Lake Superior and southward along the St. Croix River. The sand and gravel is sucked from the floor of the pit by huge "sand hog" dredges and sorted according to size.
5.8	12.8	Fancy Creek, flowing over upper layers of Devonian, Cedar Valley limestone.
0.5	13.3	Inter ANDALUSIA
1.1	14.4	STOP No. 1. Wilkens Quarry on north side of road exposes upper beds (Coralville Member) of Devonian, Cedar Valley Formation. These beds outcrop under the road bridge. A few rods upstream at the same elevation, cross-bedded Pennsylvanian Sandstone is present. This sandstone mass includes a coal bed with accompanying underclay. In the stream bed are huge blocks of brown sandstone washed down from higher elevations and marked by thick roots (Stigmaria) of giant club moss trees which penetrated there in Pennsylvanian Time. Also washing down stream are large boulders of crystalline rocks, such as granite, gneiss, and greenstone, that were brought down from the Lake Superior Region and Canada by the Illinoian and Kansan ice sheets.
1.0	15.4	Greenbush School. Turn around and retrace route east. Along route basal Pennsylvanian sandstone can be seen in places in the bluffs, but the creeks across the flat commonly flow on top of the old pre-Pennsylvanian surface of Devonian limestone.

9.8 25.2 STOP. Cross Route 67 - 92 and continue east.

0.2 25.5 Turn right (S) onto gravel road to quarry.

0.3 25.8 STOP No. 2. Collinson Bros. Quarry (Milan). This large quarry exposes a vertical thickness of over 85 feet of Devonian strata. The Devonian is divided into two formations, the Wapsipinicon below and the Cedar Valley above.

In the lower part of the quarry, 33 feet of Mapsipinicon Limestone is exposed. The formation is made up of thick layers of a grayish white, cream, or gray brown, very fine-grained to dense rock, which in places shows fine, wavy laminations, in others is brecciated (broken into fragments and re-cemented). This brecciation is confined within individual layers, and is believed to be a consequence of the hardening and crystallization of the lime sediment, rather than a result of shattering earth movements. No fossils are present in these layers, which presumably formed as a chemical precipitate in waters other than normal sea water.

The top of the Wapsipinicon Formation in the quarry is somewhat broken and irregular, and the sediment of the overlying Cedar Valley Formation has penetrated along joints and cracks in the lower limestone. This indicates a lapse of time between the deposition of the two limestone formations. Such a structure is called on unconformity.

The limestone layers of the Cedar Valley Formation are present chiefly in the south face of the quarry, to a thickness of over 52 feet. All of these layers carry marine fossils, although the types change at various levels.

The lowest Cedar Valley unit is a light bluegray rather coarse limestone which breaks into hugh blocks under quarrying action. It is about 5 feet thick and notable for the abundance of corals.

Above this coral layer is about a 35 foot thickness of dull bluish gray earthy limestone containing considerable shale, especially in the middle portion, where it is weakest. At some levels brachiopods and other fossils weather out. In the fresh rock, pelecypods (clams) are common at some levels.

Forming the rim of the quarry are about 8 feet of buff-colored limestone in thin layers that are jammed with crinoid columns. Beautiful lacy bryozoa occur at some levels, and many other types of fossils reward the patient collector.

Above the crinoidal layers, is a hard grayish layer made up almost entirely of corals, and still higher, in patches upon the stripped bedrock surface above the quarry are remnants of a layer studded with large brachiopod-shells.

This quarry exposes the finest Devonian section in northwestern Illinois. In spite of this, all of the Devonian layers are not exposed here. Lower layers (Wapsipinicon) occur along the Mississippi at Rock Island and the arsenal. Higher layers (Cedar Valley) were seen earlier today near Andalusia.

PENNSYLVANIAN SINK HOLES At a number of levels and places in the quarry, the Devonian layers are weathered and altered and in contact with patches of sandstone, conglomerate, shale and coal.

These "invading" rock masses are of much later (Pennsylvanian age. To explain them, it is necessary to digress to a bit of geological history.

Throughout the immense amount of time represented by the Silurian Devonian, and Mississippian Periods, the Earth's crust under the Tri-City Area underwent little disturbance and most of the time was covered by the waters of shallow inland seas. Near the end of the Mississippian time, however, the crust here was tilted so that the once horizontal layers were inclined to the south. At the same time the area was lifted to a considerable height above the sea.

Erosion and solution immediately began attacking this new upland area carving the surface into hills and valleys and dissolving a part of the soluble limestones. In the Tri-City Area, erosion cut down into the Devonian limestone, wearing away all of the once overlying Mississippian beds in the process. Surface waters moving down through joint crevices in the Devonian Limestone, dissolved out small caverns, and formed sink holes. These later filled with fallen rock from the walls and with sands and clays from the waters of the advancing Pennsylvanian sea. The Pennsylvanian layers were deposited in a blanket over all of the Tri-City Area and far to northward. Today most of these Pennsylvanian rocks have been removed in their turn by later erosion, and only a few patches remain as evidence of the former extent of the coal-bearing layers.

0.3 26.1 STOP and turn left (W) on pavement.

0.3 26.4 STOP; turn right (N) on Route 67 and recross Rock River at Milan.

2.0 28.4 Turn right (E) on Route 2.

1.0 29.4 Turn right into Black Hawk State Park picnic ground.

0.1 29.5 STOP No. 3. LUNCH. The "island" upon which is built Rock Island, Moline, and East Moline is an upland remnant completely cut off from the main upland by river flood plains. On the north and west is Mississippi River, on the east and south is Rock River, and to northeast is the now streamless Pleasant Valley. The base of the island is Devonian Limestone, its core is Pennsylvanian sandstone and shale including the Rock Island Coal, and the heights are overlain by a blanket of windblown loess of Pleistocene age. Less commonly exposed, but intervening between the loess and the Pennsylvanian bedrock, are irregular thicknesses of glacial deposits of Illinoian and probably also of Kansan age.

The Rock Island coal was very important in the early industrial development of the Tri-City Area, but is now largely worked out.

In the park, all the elements of Rock Island geology are present. Low ledges of Devonian limestone may be seen along the river just below the picnic ground and the cliff to the west is in Pennsylvanian beds, but largely concealed by wash of glacial drift, loess, and soil down the slope.

0.3 25.8 Leave parking area.

0.3 29.6 STOP. Turn right (E) on Route 2.

3.6 33.2 CAUTION. Highway Junction. Turn left (N) on Route 2-6-92-150.

1.1 34.3 Highway Junction. Turn right (E) on Route 2-80.

0.5 34.8 CAUTION. Stop Light. Continue ahead (E) on Route 2-80.

3.3 38.1 Turn left (N), following Route 2-80.

1.6 39.7 STOP No. 4. Up small lane entering road from west.

Glacial and Interglacial Deposits. According to the measured section of M. M. Leighton and P. R. Shaffer (1949), lowest material is 8½ feet of Illinoian glacial till showing gradation from fresh till at base to leached till upward. The leaching took place after the retreat of the Illinoian ice front, chiefly between the long mild interval (Sangamon Interval) that separated the Illinoian glacial stage and the Wisconsin glacial stage that followed. During this same interval of time, the three feet of Farmdale loess which overlies the till was deposited as dust picked up from the flats of the Mississippi by westerly winds. The dark color and carbonaceous flakes suggest that vegetation cover existed at that time.

The silts and loesses that follow and make up the rest of the section are doubtless related to the complex events that began in this region with the Sangamon Interval, and continued as the early divisions of the Wisconsin Stage (Iowan and Tazewell) reached within a few miles of this region and as the later advances (Cary and Mankato) poured their melt waters down the Mississippi. The glacial history of the Quad-City region is one of the most complex known.

The detailed section follows:

Unit 4. Loess. 10 feet, plus.
Yellow buff, fossiliferous in lower portion. At base, a rusty brown sandy streak 2" - 3" thick, representing ground water oxidation.

Unit 3. Silts. 6½ feet.
Gray and blue gray; many diffusion bands; pinkish gray to lilac at bottom.

Unit 2. Farmdale loess. 3 feet.
Brownish-chocolate; flakes of carbonaceous material at top; vertical concretions of limonite.

Unit 1. Illinoian Till. 8½ feet, plus.
(Surface of till slopes south, south of main cliff face).
Zone 1. - 1' approx. Has lime concretions.
Zone 2. - 2' approx. A few small pebbles.
Zone 3. - 3' approx. Pebbles more numerous and larger.
Zone 4. - 2½' exposed. Fresh limestone pebbles.

0.3	40.0	Stop Light. Continue ahead (N) on Route 2-80-92 and cross railroad
1.1	41.1	Highway junction in WATERTOWN. Continue ahead (N) on Route 80.
0.2	41.3	Forks; follow Route 80 (right fork).
1.4	24.7	Enter HAMPTON. Note terrace beginning here and running north to dam. This terrace is considered to represent the river flood plain level at time of Wisconsin glaciation. Enter "The Narrows" of the Mississippi. This obviously is not the original valley of that river.
1.4	44.1	Mississippi Lock and Dam No. 14. The Federal project of the Mississippi River locks and dams from the mouth of the Illinois River to the "Twin Cities" area is designed primarily to establish a permanent 9-foot navigation channel throughout this 635 mile stretch of waterway.
2.1	46.3	Enter RAPIDS CITY, built on the Wisconsin Terrace.
1.8	48.1	Enter PORT BYRON. Ledges in and near the city are of Guelph dolomite of Silurian age, and have yielded many fossils, especially small cephalopods.
4.5	52.6	Turn left, onto gravel road to stone quarry and CROSS Railroad.
0.3	52.9	STOP No. 5. Cordova Quarry of Collinson Bros. Stone Co. This quarry is in Racine Dolomite of Silurian Age. Note absence of stratification in some places and irregular stratification in others. This structure and the abundance of fossil corals indicate that formation represents a group of small coral reefs. Oldest true coral reefs are found in Silurian beds. Abundance of other types of sea life among the reefs is attested by numerous fossil crinoids (sea-lilies), gastropods (snails), pelecypods (clams), cephalopods, and brachiopods.
0.3	53.2	STOP, and turn left (N) on Route 80.
1.5	54.7	Enter CORDOVA. End of "The Narrows". Note broad valley extending to the east.
0.1	54.8	Turn right (E) onto gravel road at Standard filling station.
0.3	55.1	STOP No. 6. Old lime kiln to south marks place where Silurian dolomite was formerly quarried and burnt for lime. Rock cliffs toward base of hill form the south side of Meredosia Valley. They are projecting tops of what were once high Mississippi bluffs at a time when the "pre-Glacial" Mississippi flowed eastward through this great valley. Today, the old valley floor lies over 300 feet below this plain and has been filled to its present level by river alluvium and glacial deposits.

In historic times, the present river has flowed through this valley during flood stages. Before recent drainage and reclamation work, Meredosia Slough existed as a nearly continuous water channel through the valley.

End of Conference. Bon Voyage!

In the Tri-City Area the bed-rock formations exposed at the surface are very old, but still older beds underlie them as shown from deep wells drilled in the vicinity. The deepest of these goes down 3270 feet below the surface, and for the last 800 feet is drilled in red sandstone. No sign of the presence of once-living organisms has been found in these Fond du Lac sandstones, and many think them to belong to the Pre-Cambrian (most ancient) divisions of Geologic Time.

Above the red Fond du Lac sandstones are lighter colored sandstones, shales, and magnesian limestones of Cambrian Age. These Cambrian formations are nearly 900 feet thick. They contain the oldest fossils, remains of ancient sea life, found in the Middle West.

Above the Cambrian beds in turn, are Ordovician strata-magnesian limestones, sandstones and shales--about 1150 feet thick. Whereas the Cambrian comes to the surface at only one place in the state, the Ordovician rocks outcrop widely in northern Illinois in a triangular area from Galena to Starved Rock to Belvidere. Some of the limestone and shale layers are crowded with the remains of marine life. The rich lead and zinc deposits of the Galena Region are in Ordovician Rocks.

Above the Ordovician formations, Silurian rocks are present close to the surface at Rock Island and Moline; and outcrop a short distance upstream, from Port Byron to Savanna. They are 300 feet thick in the wells, and are wholly magnesian limestone (dolomite). The Silurian is noteworthy as containing the first corals that built extensive reefs. It makes an excellent agricultural limestone.

The sea left the Tri-City Area before the end of Silurian Time and did not return until late in Devonian Time. In the interval the region appears to have been a low land area, where the Silurian rocks underwent a limited amount of erosion and solution.

The Devonian Period is called the Age of Fishes, because these vertebrates first became common at this time. Fish remains are rare, however, in the Devonian beds of the Tri-City Area. Much more common are corals and coral-like forms, bryozoa, crinoids (sea lilies), brachiopods, snail-, clam-, and squid-like mollusks, and the venerable trilobite. The Devonian formations in the area are over 150 feet thick, of which the upper, or Cedar Valley Formation accounts for 85 feet. Higher Devonian beds were once present, but were eroded away before Pennsylvanian Time. The Devonian Limestones are quarries for crushed rock and agricultural limestones.

The Mississippian Period followed the Devonian. Mississippian seas once extended across the region and deposited fossiliferous limestones and shales. Uplifting and tilting of the Earth's crust in this region followed. The tilting inclines the rock layers to a southerly dip; the uplift raised the land above the sea; and the forces of erosion and solution began to attack the rock layers. In the Tri-City Area, the Mississippian beds were entirely removed and erosion cut into the Devonian layers. Further north, these in turn were entirely worn away, so that the Silurian dolomites were once again uncovered and exposed.

Early in Pennsylvanian Time, the crust again subsided, and the region became a low coastal swamp and delta terrain, subject to occasional inundations by the sea. In this environment coal beds formed among layers of sandstone, shale and some marine limestone. The Pennsylvanian sediments blanketed the old eroded surface and penetrated deep into the older formations along sink holes and crevices.

Today most of the Pennsylvanian strata of the region have, in their turn, been worn away during the long interval of time between the Coal Period and the Ice Age of the Pleistocene. But patches and remnants still remain here and there, far out among the Devonian and Silurian rocks, as witness of the former extent of the Pennsylvanian layers.

Land life, for the first time in Earth's history became widespread and varied during Pennsylvanian Time. Coal swamps were vastly extensive and harbored early insects, spiders, and centipedes, as well as large and small amphibians and reptiles. In the seas, life was not greatly different in general from that in Mississippian, Devonian, and Silurian Time, except that the trilobite was becoming scarce.

After Pennsylvanian Time, there is no evidence of the region's having again been covered by the sea. The Tri-City Area, along with all but the southern tip of Illinois, existed as a rather low land area, probably much as it is today. Sediments instead of being deposited were removed by erosion, so that we do not have much local evidence as to the events which transpired during this long interval of geologic time. Only a few patches of highly polished preglacial gravel, lying between the bedrock and the glacial drift, remain as a record, probably of late Tertiary Time. These are stream gravels including a few pebbles from the far north, but made up dominantly of local materials. They show no sign of glacial markings; the high polish suggests the effect of wind action in a dry climate. Often they are cemented together by limonite (hydrous iron oxide).

To discuss the Ice Age history of this complex region would require a sizeable volume, and in fact the story has not yet been fully worked out. During the Pleistocene (Ice Age), North America experienced not one glacial invasion but four, separated by some hundreds of thousands of years of warm climate between the disappearance of one ice sheet and the advance of the next. There is no assurance that we are not today living in such an interglacial interval.

Some of the ice advances came from the northwest, some from the north, some from the northeast. Not only did each of them profoundly affect the landscape by dumping huge quantities of glacial debris over the surface, but each turned the Mississippi out of its channel and caused it to seek a new course. The Tri-City Area is so especially complex because at least three ice fronts halted within or close to the area, and one (possibly two) passed completely across it. Each partially obliterated the deposits of its predecessor, and caused the river to find or cut a new channel. It will be a long time before the full and detailed story can be told. Accordingly, the following is merely a summary of the highlights of the story:

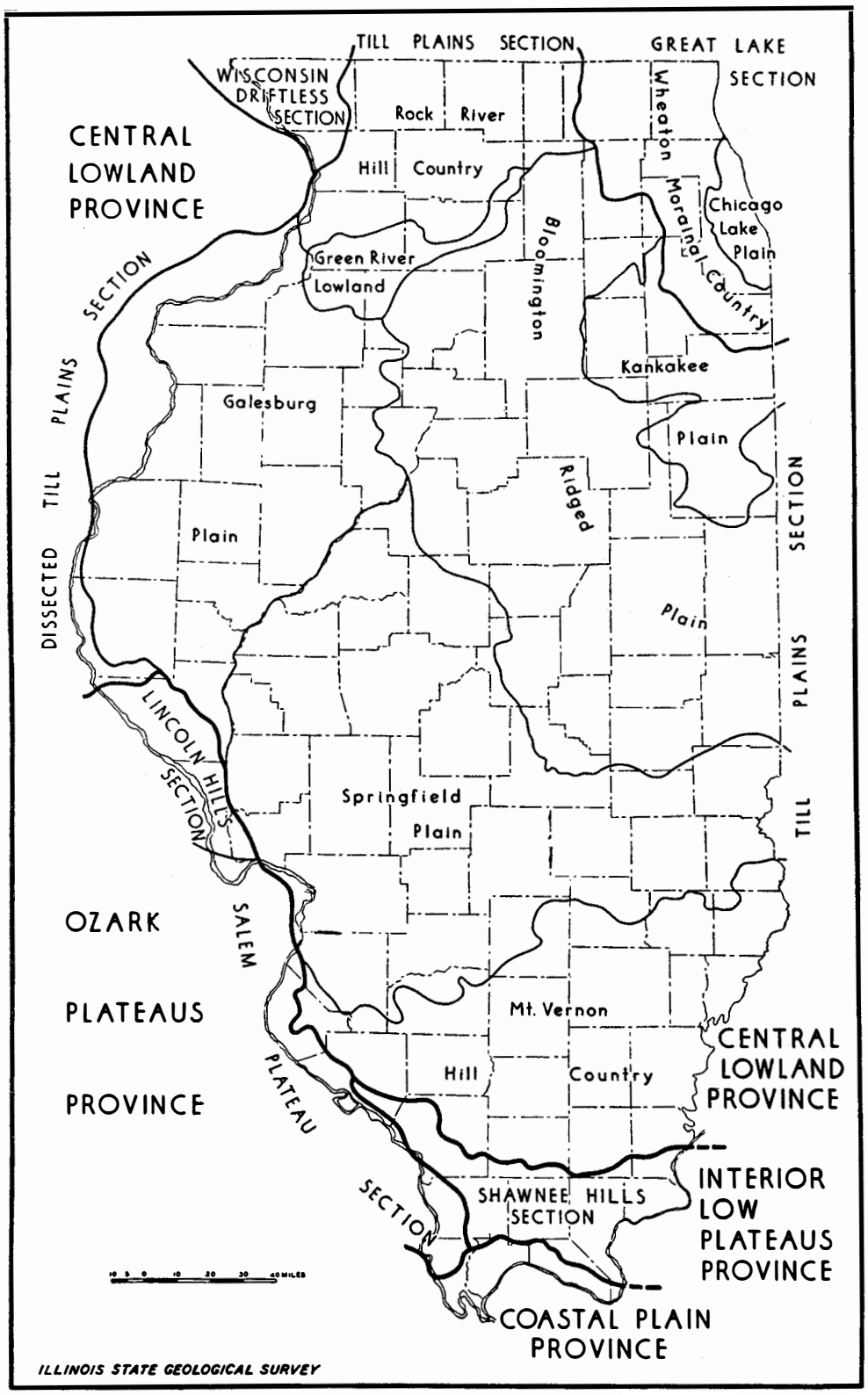
GLACIAL STAGES AND THE TRI-CITY REGION

NORTH AMERICA	DIRECTION OF APPROACH	TRI-CITY REGION
Wisconsin Stage		
Mankato Substage	From Northwest	Closest: Central Iowa
Cary Substage	From North	Closest: N. E. Illinois
Tazewell Substage	From Northeast	Crossed Miss. above Tri-City Area
Iowan Substage	From Northwest	Reached Miss. at Camache, Iowa
Illinoian Stage	From Northeast	Reached Miss. at Albany and crossed above Cordova
Kansan Stage	From Northwest	Passed over entire area
Nebraskan Stage	From Northwest	Probably passed over area

Even those glaciations which halted a long distance short of the Tri-City Area influenced its geology considerably. When glaciers melt away, they liberate great amounts of water which carry with them large quantities of mud, sand, gravel, and boulders. These wash down the streams and into the great rivers that flow away from the ice. Such streams as the Mississippi thus became choked with sediment, which built up higher and higher until the river flowed hundreds of feet above its former level. Winds blowing across the sand and mud flats picked up the dust and sand, deposited the sand as dunes along the valley sides, and the dust as loess over the uplands on the lee side of the valley.

GENERALIZED GEOLOGIC COLUMN
FOR THE TRI-CITY AREA
Prepared by the Illinois State Geological Survey

ERAS		PERIODS	EPOCHS	FORMATIONS
Cenozoic	Age of Mammals	Quaternary	Pleistocene	Recent post-glacial stage Wisconsin glacial stage Sangamon interglacial stage Illinoian glacial stage Yarmouth interglacial stage Kansan glacial stage Aftonian interglacial stage Nebraskan glacial stage
		Tertiary	Pliocene Miocene Oligocene Eocene	Stream gravels
Mesozoic	Age of Reptiles	Cretaceous		Present in extreme southern Illinois only
		Jurassic		Not present in Illinois
		Triassic		Not present in Illinois
Paleozoic	Age of Amphibians and Early Plants	Permian		Not present in Illinois
		Pennsylvanian		Sandstones, limestones, shales, clays, & coal beds
		Mississippian	Upper	Not present in Tri-City area
			Lower	Removed by erosion in Tri-City area
	Age of Fishes	Devonian		Cedar Valley Limestone, 85 feet; Wapsipinicon Limestone, 70 feet
	Age of Invertebrates	Silurian		Middle and Lower Silurian Dolomite -- over 300 feet
		Ordovician		Dolomites, sandstones, and shales lying approximately 400 feet to 1600 feet below the surface
		Cambrian		Sandstones and dolomites lying approximately 1600' - 2500' below the surface
Proterozoic Archeozoic		Referred to as "Pre-Cambrian" Time		Pre-Cambrian? Fond du Lac red sandstone lying approximately 2500 feet to over 3270 feet below the surface



PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

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