State of Illinois
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Illinois Department of Natural Resources
Illinois State Geological Survey

Guide to the Geology of the Kickapoo State Park and Surrounding Area, Vermilion County, Illinois

Wayne T. Frankie

Field Trip Guidebook 2005A

April 16, 2005
May 7, 2005

Cover photo: *Middle Fork of the Vermilion River, looking south from bridge at Kickapoo State Park (photo by W. T. Frankie).*

Geological Science Field Trips The Illinois State Geological Survey (ISGS) conducts four tours each year to acquaint the public with the rocks, mineral resources, and landscapes of various regions of the state and the geological processes that have led to their origin. Each trip is an all-day excursion through one or more Illinois counties. Frequent stops are made to explore interesting phenomena, explain the processes that shape our environment, discuss principles of earth science, and collect rocks and fossils. People of all ages and interests are welcome. The trips are especially helpful to teachers who prepare earth science units. Grade school students are welcome, but each must be accompanied by a parent or guardian. High school science classes should be supervised by at least one adult for each ten students. Preregistration is required.

A list of guidebooks of earlier field trips for planning class tours and private outings may be obtained by contacting the Geoscience Outreach Coordinator, Illinois State Geological Survey, Natural Resources Building, 615 East Peabody Drive, Champaign, IL 61820-6964. Telephone: (217) 244-2427 or 333-4747. This information is on the ISGS home page: http://www.isgs.uiuc.edu.

Four USGS 7.5-minute Quadrangle maps (Collison, Danville NW, Danville SW, and Oakwood) provide coverage for this field trip area.

This field guide is divided into three sections. The first section serves as an introduction to the geology of central Illinois and in particular the geology of the field trip area. The second section is a road log for the trip, and the third section provides detailed stop descriptions.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

1905-2005 ISGS Illinois State Geological Survey

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Printed by authority of the State of Illinois 3/05 - 0.6 M

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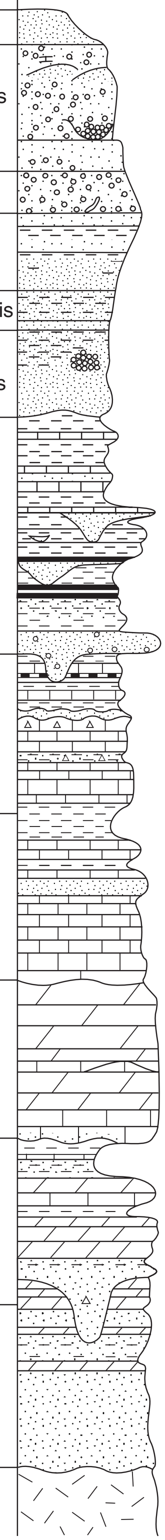
CONTENTS

Era		Period or System and Thickness	Epoch	Age (years ago)	General Types of Rocks
CENOZOIC "Recent Life"	Age of Mammals	Quaternary 0–500'	Holocene	10,000	Recent; alluvium in river valleys
			Pleistocene Glacial Age	1.8 m	Glacial till, glacial outwash, gravel, sand, silt, lake deposits of clay and silt; wind deposits of loess and sand dunes. Deposits cover nearly all of state except northwest corner and southern tip
		Tertiary 0–500'	Pliocene	5.3 m 33.7 m	Chert gravel, present in northern, southern, and western Illinois
			Eocene	54.8 m	Mostly micaceous sand with some silt and clay; present only in southern Illinois
			Paleocene	65 m	Mostly clay, little sand; present only in southern Illinois
MESOZOIC "Middle Life"	Age of Reptiles	Cretaceous 0–300'		144 m 290 m	Mostly sand, some thin beds of clay, and, locally, gravel; present only in southern and western Illinois
PALEOZOIC "Ancient Life"	Age of Amphibians and Early Plants	Pennsylvanian 0–3,000' ("Coal Measures")		323 m	Largely shale and sandstone with beds of coal, limestone, and clay
		Mississippian 0–3,500'		354 m	Black and gray shale at base, middle zone of thick limestone that grades to siltstone chert, and shale; upper zone of interbedded sandstone, shale, and limestone
	Age of Fishes	Devonian 0–1,500'		417 m	Thick limestone, minor sandstones, and shales; largely chert and cherty limestone in southern Illinois; black shale at top
	Age of Invertebrates	Silurian 0–1,000'		443 m	Principally dolomite and limestone
		Ordovician 500–2,000'		490 m	Largely dolomite and limestone but contains sandstone, shale, and siltstone formations
		Cambrian 1,500–3,000'		543 m	Chiefly sandstones with some dolomite and shale; exposed only in small areas in north-central Illinois
		Precambrian			Igneous and metamorphic rocks; known in Illinois only from deep wells



Generalized geologic column showing succession of rocks in Illinois.

INTRODUCTION

The Kickapoo State Park field trip area is geographically located on the east side of the central portion of Illinois and geologically located along the northeastern rim of the Illinois Basin. Physiographically part of the Bloomington Ridged Plain, the area is dominated by the effects of the Wisconsin Glacial Episode. Pleistocene glacial deposits have buried the bedrock surface, except where streams have cut into the bedrock. The Wisconsin Episode glaciers left a series of low, broad moraines across the surface of this part of the state. Bedrock in this area consists of shale, limestone, coal, siltstone, sandstone, and shale deposited in shallow seas and swamps some 290 million years ago during the Pennsylvanian Period. Coal, shale, and sand and gravel deposits have been extensively mined for energy sources and construction materials, respectively.

GEOLOGIC FRAMEWORK

Precambrian Era

Through several billion years of geologic time, the area surrounding Kickapoo State Park has undergone many changes (see the rock succession column, facing page). The oldest rocks beneath the field trip area belong to the ancient Precambrian basement complex. These ancient rocks consist mostly of granitic and rhyolitic igneous, and possibly metamorphic, crystalline rocks formed about 1.5 to 1 billion years ago. From about 1 billion to about 0.6 billion years ago, these Precambrian rocks were exposed at the surface. During this long period, the rocks were deeply weathered and eroded and formed a barren landscape that was probably quite similar to the topography of the present Missouri Ozarks. Beginning about 500 million years ago, movement of crustal plates (plate tectonics) began to rip apart the Precambrian North American continent. In southernmost Illinois, near what is now the historic Kentucky–Illinois Fluorspar Mining District, rift valleys like those in east Africa formed. These rift valleys in the midcontinent region are referred to as the Rough Creek Graben and the Reelfoot Rift (fig. 1).

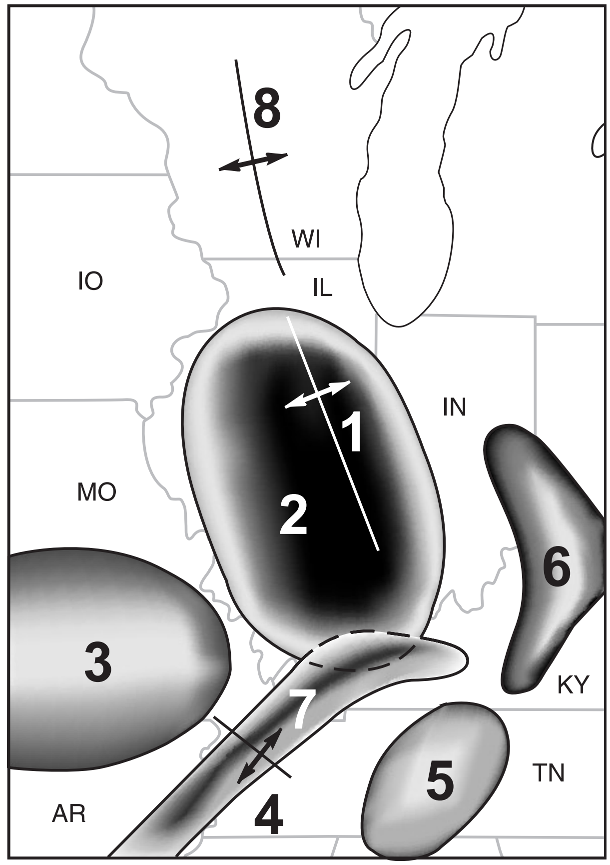


Figure 1 Location of some of the major structures in the Illinois region: (1) La Salle Anticlinorium, (2) Illinois Basin, (3) Ozark Dome, (4) Pascola Arch, (5) Nashville Dome, (6) Cincinnati Arch, (7) Rough Creek Graben–Reelfoot Rift, and (8) Wisconsin Arch.

Paleozoic Era

About 520 million years ago, during the late Cambrian Period, the rifting stopped, and the hilly Precambrian landscape began to sink slowly on a broad regional scale, allowing the invasion of a shallow sea from the south and southwest. During the subsequent 290 million years, the area that is now called the Illinois Basin continued to accumulate sediments that were deposited, layer by layer, in and near the ancient shallow seas that repeatedly covered this subsiding basin. These inland seas connected with the open ocean to the south during much of the Paleozoic, and the area that is now the Illinois Basin was an embayment. During the Paleozoic and Mesozoic Eras, the Earth's thin crust was periodically flexed and warped in places as stresses built up in response to the tectonic forces associated with the collision of continental and oceanic plates and mountain building. Throughout the Paleozoic Era, these movements caused repeated invasions and withdrawals of the seas across the region. When the seas advanced, sediments were deposited, and, when the seas withdrew, sediments were weathered and eroded. As a result, there are gaps in the sedimentary record.

The southern part of Illinois and adjacent parts of Indiana and Kentucky sank more rapidly than did areas to the north, allowing a greater thickness of sediment to accumulate. By the end of the Paleozoic Era about 250 million years ago, more than 20,000 feet of sedimentary strata were deposited in the deepest part of the Illinois Basin, located in the Rough Creek Graben area of southeastern Illinois and western Kentucky.

Underlying the field trip area is about 6,000 feet of sedimentary bedrock strata, ranging in age from more than 520 million years (the Cambrian Period) to less than 320 million years old (the Pennsylvanian Period).

The oldest Paleozoic rocks exposed in the field trip area are Pennsylvanian age strata (fig. 2) consisting of sandstone, siltstone, shale, limestone, coal, and underclay. These rocks were deposited as sediments in shallow seas and swamps between about 323 and 290 million years ago. Today many are exposed in stream cuts and in abandoned surface mines. The geologic map (fig. 3) shows the distribution of the rock systems of the various geologic time periods as they would appear if all the glacial, windblown, and surface materials were removed.

The rocks immediately beneath the glacial deposits belong to the Pennsylvanian System, which contains the economically valuable coal seams. From 300 to 400 feet of Pennsylvanian strata underlie the field trip area and include two principal coal seams of minable thickness—the Danville Coal and the Herrin Coal seams—both of which have been extensively mined in the area. Approximately 70 to 80 feet of these strata are exposed in the Kickapoo State Park area. The Pennsylvanian Livingston Limestone has been extensively mined in southwestern Vermilion County near Fairmount. Mississippian strata, mainly shales and limestones, underlie the Pennsylvanian strata in the field trip area.

Mesozoic Era

During the Mesozoic Era (290 to 65 million years ago), the Pascola Arch (fig. 1) rose in southeastern Missouri and western Tennessee, producing a structural barrier that, for the first time, separated the Illinois Basin from other basins and the open sea to the south. The Illinois Basin is a broad, subsided region covering much of Illinois, southwestern Indiana, and western Kentucky and located between the Ozark Dome and the Cincinnati Arch (fig. 1). Development of the Pascola Arch, in conjunction with the earlier sinking of the deeper portion of the basin in southern Illinois, gave the basin its present asymmetrical, spoon-shaped configuration (fig. 4).

Structural Features A number of faults, synclines, and anticlines occur within the field trip area. Many of these were formed during a major episode of folding and faulting that began at the end of the Pennsylvanian Period about 270 million years ago. A fault is a fracture surface or zone in earth materials along which there has been vertical and/or horizontal displacement or movement of the strata on both sides relative to each another. A syncline is an asymmetrical fold in which the bedrock layers have been bent downward by compres-

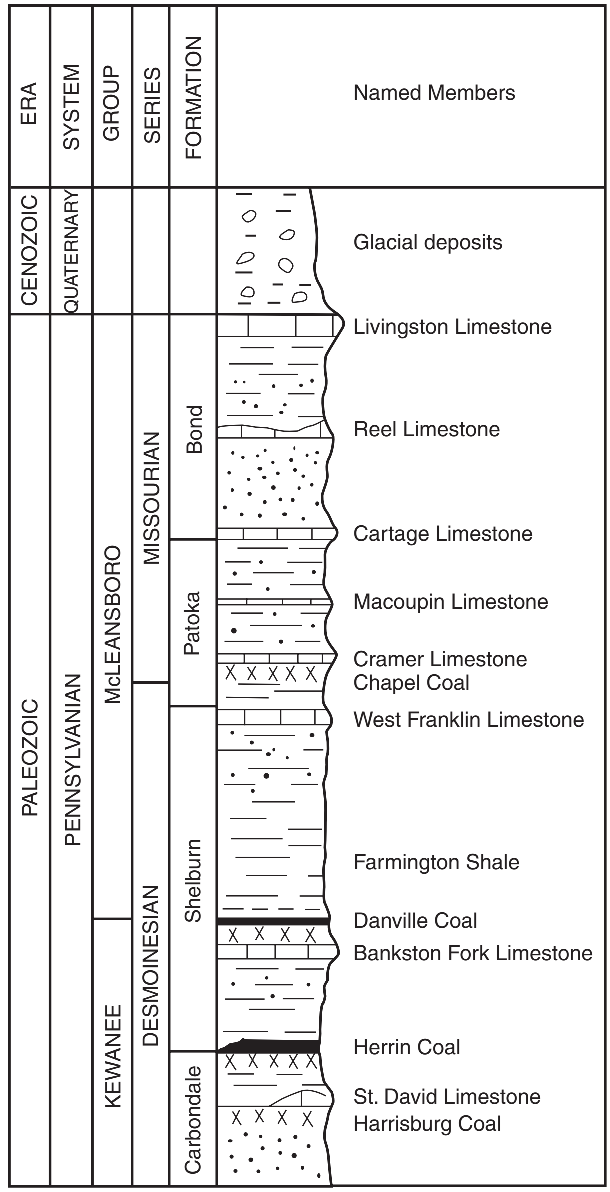


Figure 2 Generalized stratigraphic column (modified from Jacobson and Bengal 1981).

sive forces acting within the Earth's crust. The strata on both sides or limbs of a syncline tilt inward toward the axis or lowest part of the fold. Along the axis or central part of an eroded syncline the youngest folded rocks are exposed. The strata of an anticline bend upward into an arch.

The bedrock strata in the field trip area structurally form a broad, gentle, elongated north-south–trending depression, or downwarp, known as the Marshall-Sidell Syncline (fig. 5). This syncline is located between the La Salle Anticlinal Belt to the west and the east flank of the Illinois Basin. The west flank of the syncline is marked by relatively steep but irregular dips; dips on the east flank are gentler. Strata on the east flank rise onto a broad uplift known as the Cincinnati Arch. The Marshall-Sidell Syncline can be traced in a north-south direction from northern Vermilion County southward to central Crawford County. The northern end of the syncline merges with the La Salle Anticlinal Belt. The Marshall-Sidell Syncline syncline plunges gently southward along its axis and terminates to the south in Crawford County (Nelson 1995, Reinertsen 1981).

GLACIAL HISTORY

Cenozoic Era

During the Pleistocene Epoch—the "Great Ice Age"—the Kickapoo State Park area was covered several times by large continental glaciers. The accumulation of glacial sediments, deposited during the pre-Illinois, Illinois, and Wisconsin Episodes, range from a few feet to more than 100 feet thick over the bedrock surface in the field trip area.

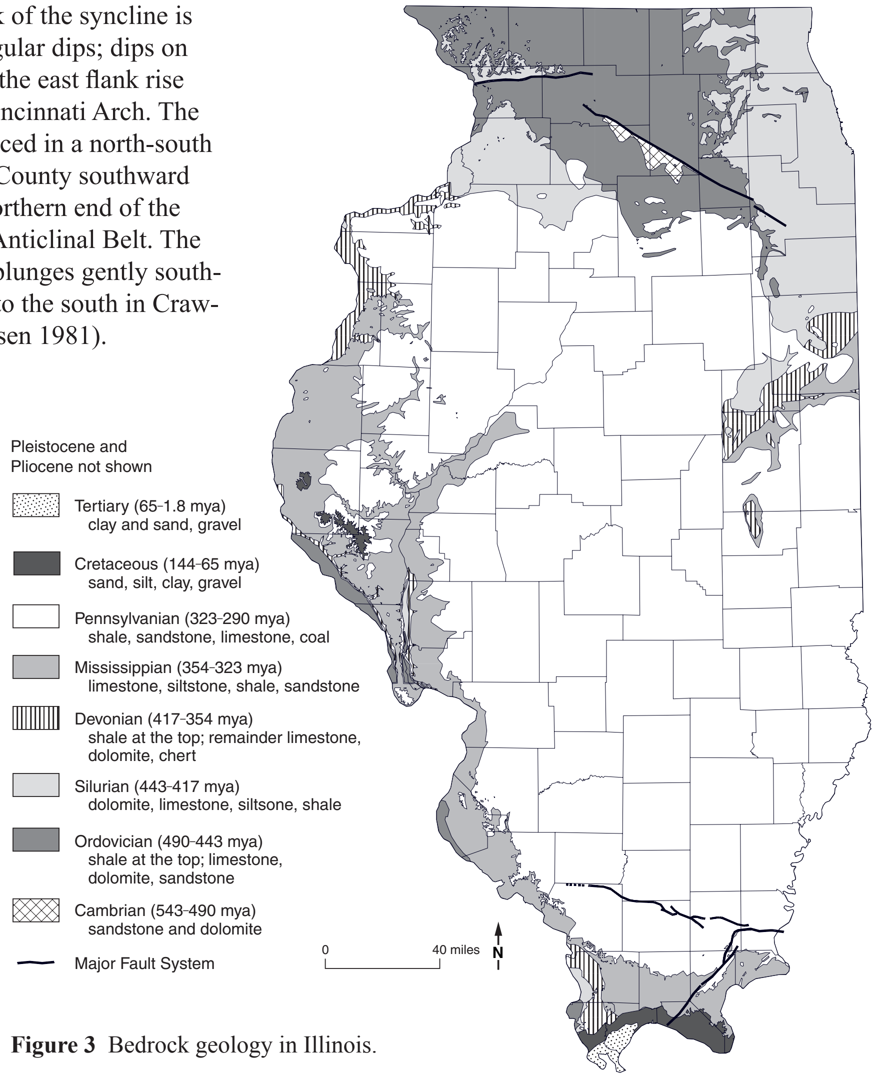


Figure 3 Bedrock geology in Illinois.

About 1.8 million years ago, during the Pleistocene Epoch, massive sheets of ice thousands of feet thick began to flow slowly southward from Canada. Approximately 300,000 years ago, the Illinois Episode of glaciation began. During its 175,000 year time span, the ice advanced three times out of the northeastern center of accumulation. Although ice sheets covered Illinois several times during the Pleistocene Epoch, North American continental glaciers reached their southernmost extent during the Illinois Glacial Episode around 270,000 years B.P. They advanced as far south as northern Johnson County in southern Illinois (fig. 6).

Wisconsin Episode moraines were deposited in northeastern Illinois from approximately 25,000 to 13,500 years ago (fig. 7). Although Illinois Episode glaciers probably built morainic ridges similar to those of the later Wisconsin Episode glaciers in northeastern Illinois, the earlier moraines apparently were not as numerous and have been exposed to weathering and erosion for approximately 280,000 years longer than their younger Wisconsin Episode counterparts. For these reasons, Illinois Episode glacial features generally are not as conspicuous as the younger Wisconsin Episode features. Very thin drift in southern Illinois seems to indicate that the ice covered the region for a relatively short time.

Throughout much of Illinois, the topography of the bedrock surface is largely hidden from view except along major streams and in the driftless areas of northwest and southern Illinois. In many areas, glacial drift is thick enough to mask the underlying bedrock surface completely. The preglacial bedrock surface in the field trip area was completely modified and subdued by a thick mantle of glacial deposits.

Thick deposits of sand and gravel called valley trains were laid down along the major river drainage systems during all of the glacial episodes, from the earliest pre-Illinois glacial episode (approximately 1.8 million years ago) to the Wisconsin Episode (approximately 25,000 to 13,500 years ago). During the severe winters, as meltwater streams diminished, the valley trains dried

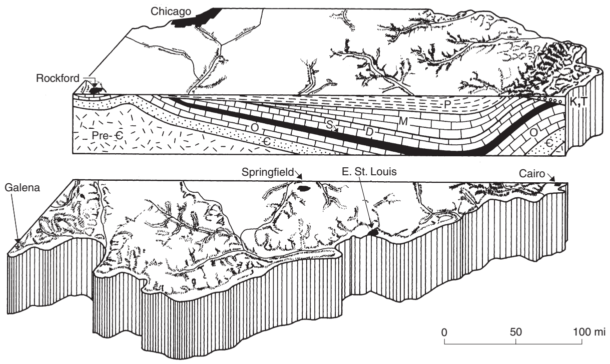
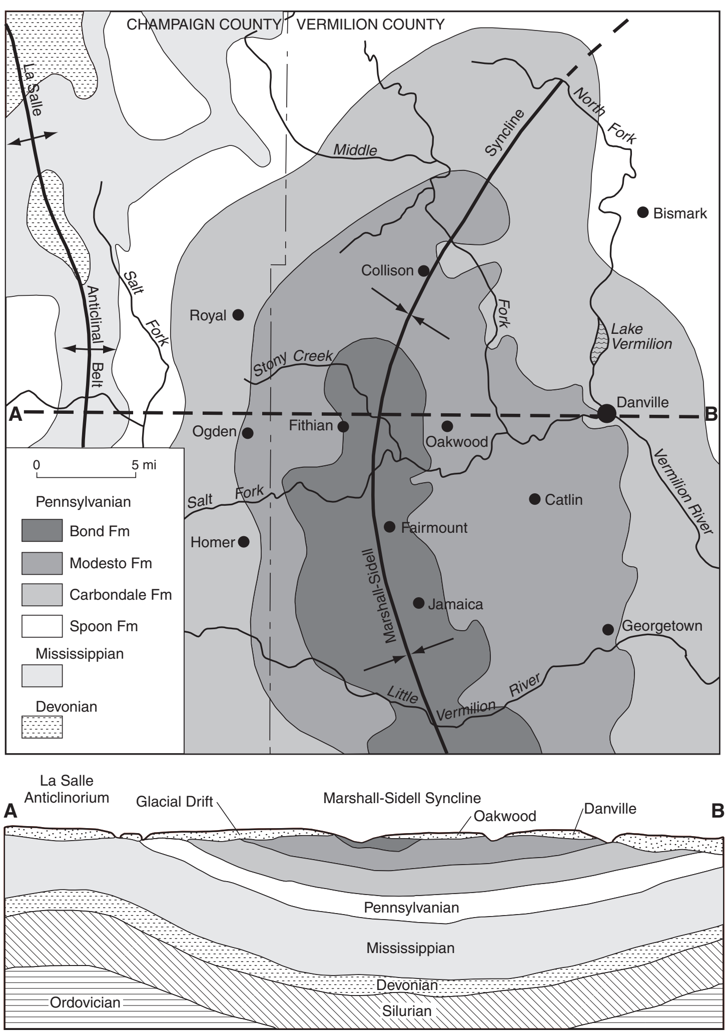


Figure 4 Stylized north-south cross section shows the structure of the Illinois Basin. To show detail, the thickness of the sedimentary rocks has been greatly exaggerated, and younger, unconsolidated surface deposits have been eliminated. The oldest rocks are Precambrian (Pre-Є) granites. They form a depression filled with layers of sedimentary rocks of various ages: Cambrian (Є), Ordovician (O), Silurian (S), Devonian (D), Mississippian (M), Pennsylvanian (P), Cretaceous (K), and Tertiary (T). Scale is approximate.

out. The harsh, bitter, northwest winds swirled across these deposits winnowing out and carrying the fine-grained sand, silt, and clay eastward to deposit them across the upland. These windblown (eolian) deposits called loess were laid down adjacent to the major rivers. The loess deposits are more than 50 feet thick along the Mississippi River, but the thickness diminishes rapidly toward the east. Yellowish brown loess deposits in the field trip area range from 0 to 5 feet and occur everywhere in the area except where they were removed by erosion. The loess deposits form one of the parent materials from which the modern soils have developed.

The field trip area is covered by three prominent, east-west–trending, low hummocky ridges, the Gifford, Newtown, and Urbana moraines (fig. 7). The areas between the moraines are generally flat except where cut by stream valleys. Streams draining the area flow southeastward to the Wabash River. The principal stream, the Vermilion River, developed when the Chatsworth glacier covered the area a little more than 20 miles to the north less than 15,000 years ago.



In general, glacial deposits consist primarily of (1) till —pebbly clay, silt, and sand, deposited directly from melting glaciers; (2) outwash—mostly sand and gravel, deposited by the rapidly flowing meltwater rivers; (3) lacustrine deposits—silt and clay that settled out in quiet-water lakes and ponds; and (4) loess—windblown sand and silt. Within the field trip area, glacial deposits range from a few feet to more than 100 feet. However, in several localities where bedrock is exposed, the glacial deposits have been completely removed by erosion.

GEOMORPHOLOGY

Physiography

Physiography is the study and classification of the surface features of the Earth based on a number of factors and conditions, including bedrock surface topography, extent of the various glaciations, differences in glacial topography, differences in age of the uppermost

Figure 5 Generalized geologic map of the bedrock strata below the glacial drift in the field trip area. The cross section shows the configuration of the bedrock strata in the Marshall-Sidell Syncline. The edge of the La Salle Anticlinorium Belt rising toward the west in Champaign County is shown on the left. The vertical scale of the cross section is greatly exaggerated (Cote et al. 1967, Reinertsen 1981).

glacial drift, effects of erosion on the surface, similarities in geologic structure and history of geologic changes. A physiographic province is a region in which the relief or landforms differ markedly from those in adjacent regions. The field trip area is located within the Bloomington Ridged Plain, a division within the Till Plains Section of the Central Lowland Physiographic Province (fig. 8). The present gross topographic features of the Till Plains Section are largely determined by the underlying preglacial topography.

The Bloomington Ridged Plain consists of a gently rolling terrain crossed by many glacial end moraines. This topography was produced by the Woodfordian glacier during the mid-Wisconsin Glacial Episode about 15,000 years ago and has been only slightly modified by post-glacial erosion and the action of modern streams.

The Wisconsin moraines are characterized by low, broad morainic ridges with intervening wide stretches of relatively flat or gently undulatory ground moraine. In many places the major moraines rise with gentle slopes; although they are conspicuous from a distance, the minor moraines become less noticeable near at hand, whereas the major moraines are prominent locally. Within the Bloomington Ridged Plain, more than in any other division, the grass-covered stretches of rolling prairie and extensive swamps, described by early settlers, were most typically and extensively developed.

The glacial deposits are relatively thick throughout the area and completely conceal the bedrock topography, except locally. Illinois and older drift are present below the Wisconsin in most places. The levelness of present drift plains is due largely to the presence of the older drift sheets, which filled in and covered the irregularities of the bedrock surface.

Drainage is generally in the initial stages of development, and most streams follow and erode in constructional depressions, many of which cross morainic ridges. The valleys of principal streams are large and have floodplains bordered by valley-train terraces. The Vermilion River, the master stream within the field trip area, has a broad, flat-bottomed valley with steep walls and is bordered by numerous narrow valleys with steep gradients. The relatively young glacial topography, lack of dissection, and poor drainage of the region reflect the fact that this topography has only been subjected to erosion for approximately 15,000 years.

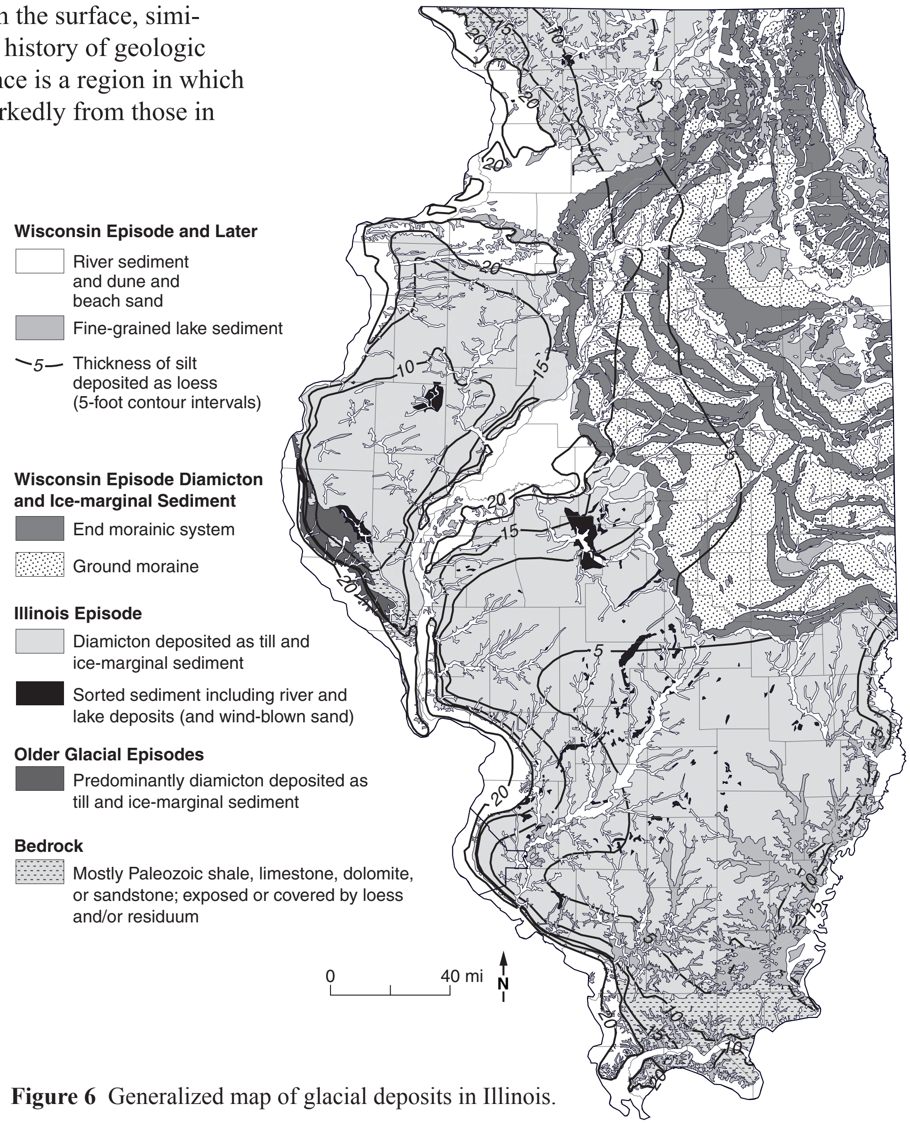


Figure 6 Generalized map of glacial deposits in Illinois.

NATURAL RESOURCES

Brick Manufacturing

A number of brick manufacturing companies were located in the Danville area during the early 1900s. Some of the more famous companies include Danville Block, Grape Creek, Fairchild, and Western Brick.

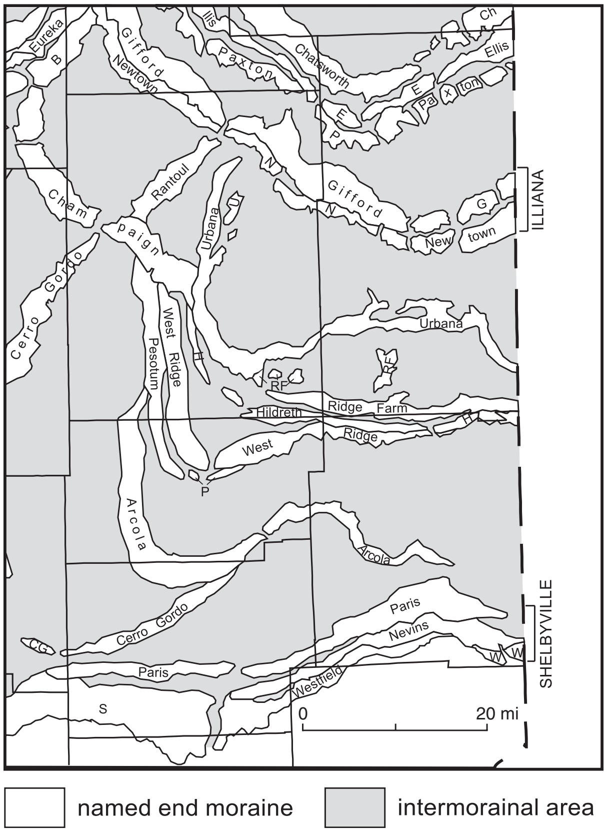


Figure 7 Areal distribution of Wisconsin Glacial Episode moraines of the Wedron Group in the study area (modified from Hansel and Johnson 1996).

Unfortunately very little information is known about most of these companies. The Western Brick Company, in operation from 1911 to 1973, produced bricks that were used in many structures, including the Chicago Hilton Hotel, the Illinois Pavilion at the 1964–1965 World's Fair, and many University of Illinois buildings, including Memorial Stadium.

Coal Mining

Over 150 different coal mining operations—from one-man mines to large operations—have been identified in Vermilion County. Historic cumulative coal production in the county as of 1998 was 167,438 million tons. A new slope mine (Riola Mine) about 6 miles south of Catlin began production in April 1996 by the Catlin Coal Company now owned by Black Beauty. The Vermilion Grove mine was opened by Black Beauty in 2000.

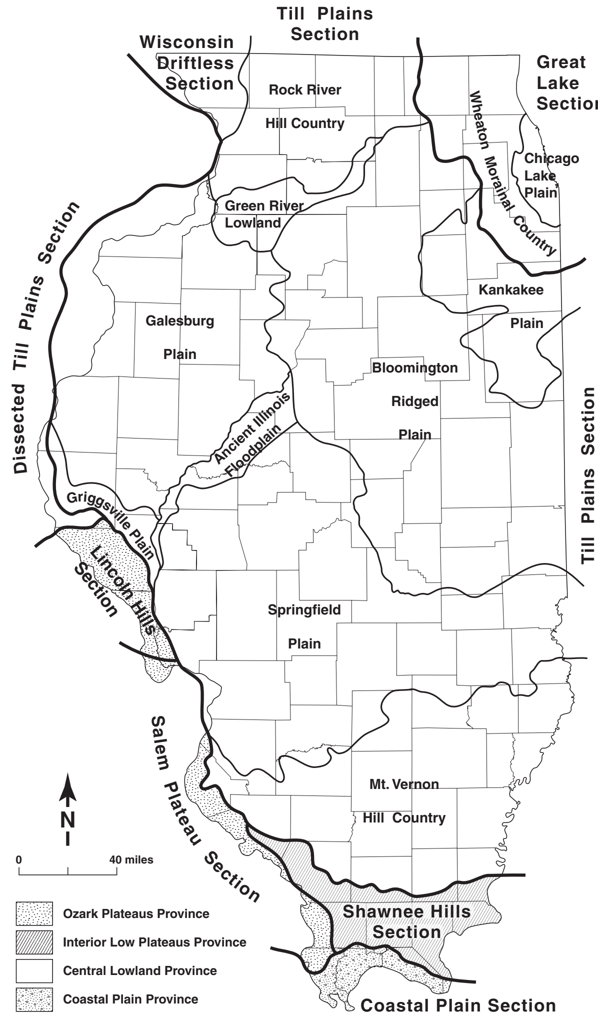


Figure 8 Physiographic divisions of Illinois (modified from Leighton et al. 1948).

Salt Works

European settlers were drawn to the area by the presence of salt springs, called salines, which were discovered in 1819. Wells were dug to obtain salt brine, which was then boiled down to obtain salt. The salt works were operated by a variety of operators until 1848, producing at the height of operation about 120 bushels of salt per week. It is ironic that while wood was cut at great expense to provide fuel to extract the salt, coal was exposed above ground less than 200 feet away. Ultimately, coal was to become Vermilion County's greatest mineral asset, long after the "Salt Works" were forgotten (Post 2000).

GUIDE TO THE ROUTE

We'll start the trip at the Pavilion in Kickapoo State Park (NW, SW, NE, SW, Sec. 4, T19N, R12W, 2nd P.M., Danville NW 7.5-minute Quadrangle, Vermilion County). Mileage will start at the exit of the parking lot.

You must travel in the caravan. Please drive with headlights on while in the caravan. Drive safely but stay as close as you can to the car in front of you. Please obey all traffic signs. If the road crossing is protected by an Illinois State Geological Survey (ISGS) vehicle with flashing lights and flags, please obey the signals of the ISGS staff directing traffic. When we stop, park as close as possible to the car in front of you and turn off your lights.

Some stops are on private property. The owners have graciously given us permission to visit on the day of the field trip only. Please conduct yourselves as guests and obey all instructions from the trip leaders. So that we may be welcome to return on future field trips, follow these simple rules of courtesy:

- Do not litter the area.
- Do not climb on fences.
- Leave all gates as you found them.
- Treat public property as if you were the owner—which you are!
- Stay off all mining equipment.
- Parents must closely supervise their children at all times.

When using this booklet for another field trip with your students, a youth group, or family, remember that you must get permission from property owners or their agents before entering private property. No trespassing, please.

Four U.S. Geological Survey 7.5-minute Quadrangle maps (Collison, Danville NW, Danville SW, and Oakwood) provide coverage for this field trip area.

Miles to next point	Miles from start	
0.0	0.0	Set your odometers to 0.0 at the exit of the Pavilion parking lot. TURN RIGHT onto main park road.
0.1	0.1	Allhands Cemetery on the left.
0.2	0.3	T-intersection from the right (park road leading to High Pond and No Name Pond). CONTINUE AHEAD.
0.4	0.7	Deep Pond to the left.
0.2	0.9	Cross over Interstate 74. The large lake to the right, on both sides of Interstate 74, is Long Pond.
0.3	1.2	T-intersection from the right. CONTINUE AHEAD. Peelman Pond to the left.
0.1	1.3	Cross Middle Fork of the Vermilion River. Note the gravel bars upstream and downstream from the bridge. The gravel bars contain a mixture of locally derived bedrock, including coal, and a variety of glacially derived erratics, including igneous, metamorphic, and sedimentary rocks. This spot is a good collecting locale when the water is low.
0.2	1.5	Enter loop parking lot for No. 6 Lake. Park vehicles, and cross pedestrian bridge leading to Slope Mine No. 6.

STOP 1: Slope Mine No. 6, Kickapoo State Park (NE, NW, SE, Sec. 8, T19N, R12W, 2nd P.M., Danville SW 7.5-minute Quadrangle, Vermilion County).

0.0	1.5	Leave Stop 1. Retrace route back to bridge over Middle Fork of the Vermilion River.
0.2	1.7	Cross Middle Fork of the Vermilion River.
0.2	1.9	T-intersection from the left (park road to Clear Pond). TURN LEFT.
0.1	2.0	Overbank sand deposits along the floodplain of the Middle Fork of the Vermilion River on the left.
0.1	2.1	Pass under Interstate 74.
0.1	2.2	Boat ramp for Long Pond on the right. To the left, a small creek flowing into the Middle Fork of the Vermilion River has formed a sand and gravel alluvial fan (delta) into the main course of the Middle Fork along the river's west bank.
0.4	2.6	Entrance to Redear Campground on the right.
0.2	2.8	Rock Point fishing access on the right.
0.2	3.0	STOP (two-way). Crossroad intersection with main park road. TURN RIGHT.
0.2	3.2	Entrance to Brian Plawer Campground on the right.
0.3	3.5	STOP (three-way). T-intersection from the left (Kickapoo Park Road). TURN LEFT.
0.2	3.7	T-intersection from the left. Entrance to The Meadow day use area. CONTINUE AHEAD. Park office is on the right.
0.4	4.1	T-intersection from the left. Park road to Emerald Pond. TURN LEFT.
0.3	4.4	Pennsylvanian age, Farmington Shale overlain by Pleistocene glacial tills in the bluffs on the right. The bluffs mark the limit of surface mining in this area of the park.
0.2	4.6	Exposure of Farmington Shale and overlying glacial tills in the bluffs at the south end of Emerald Pond on the right. Follow park road around the loop at end of road.
0.2	4.8	Boat ramp to Inland Sea at end of the turn-around loop.
0.1	4.9	After completing the loop, notice the V-shaped ravine in bluff along the east edge of Emerald Pond, located on the left. The mining in this area has left a picture perfect cross section profile of erosion and stream development in a youthful stage of development.
0.1	5.0	Exposure of Farmington Shale and overlying glacial tills in bluffs on the left. Pull into parking lot on the right.

STOP 2: Emerald Pond, Kickapoo State Park, Farmington Shale (NW, SW, SW, Sec. 33, T20N, R12W, 2nd P.M., Danville NW 7.5-minute Quadrangle, Vermilion County).

0.0	5.0	Leave Stop 2. CONTINUE AHEAD.
0.5	5.5	STOP (one-way). T-intersection with Kickapoo Park Road. TURN LEFT.
1.0	6.5	T-intersection from the left (1200E). CONTINUE AHEAD.
1.0	7.5	STOP (one-way). T-intersection (Henning Road and Kickapoo park road). TURN LEFT.
0.2	7.7	Looking north, the ground surface rises gently toward the front of the Newtown and Gifford Moraines. The Gifford Moraine is a prominent topographic feature, rising to elevations as high as 730 feet in this area. The older Newtown Moraine is located directly in front of the younger Gifford Moraine. The Newtown Moraine was dissected by erosion, from the fluvial glacial outwash flowing from the melting glacier that formed the Gifford Moraine. The general extent of these moraines in this area can be inferred by using the 700-foot elevation contours on the 7.5-minute topographic maps. These moraines mark the southernmost extent of a readvance of the Woodfordian glacier about 15,000 years ago, after it had melted back from the Urbana Moraine. These moraines were deposited following readvances of the glacier. It is not known exactly how far the glacier melted back after the building of each of the Wisconsin Episode end moraines. However, the discordant and overlapping relationships of the Newtown and Gifford moraines suggest that, after building the Newtown Moraine, the Woodfordian glacier front melted back a considerable distance before readvancing to the position of the Gifford end moraine. The moraines were formed by the accumulation of rock debris that was carried forward to the margin of the glacier. The two moraines occur as parallel ridges separated by a low sag extending into Indiana. Initially during the wasting away (melting) of the Newtown glacier, meltwater was not generally confined to definite valleys because no drainage had been established on the Urbana till plain. As a result, the meltwater flowed away from the glacier as a series of meandering braided streams that deposited an apron or thin wedge of outwash sand and gravel along the front of the moraine. This outwash gradually thinned away from the moraine and formed a gentle southward sloping surface. Later, starting with the Gifford glacier, the meltwaters became confined to definite channels when the amount of outwash decreased, and the valleys of the Salt Fork, Middle Fork, and North Fork of the Vermilion River were eroded into the outwash plain. These valleys were later deepened by meltwater from the Chatsworth and other glaciers located to the north (Cote et al. 1967).
0.4	8.1	Crossroad intersection (2000N). CONTINUE AHEAD.
1.0	9.1	Crossroad intersection (2100N). CONTINUE AHEAD.
1.0	10.1	Crossroad intersection (2200N). CONTINUE AHEAD. Prepare to turn left.
0.3	10.4	T-intersection from the left. Entrance to Kennekuk County Park, Vermilion County Conservation District. TURN LEFT. Enter Kennekuk County Park. The 3,000-acre Kennekuk County Park was founded in 1974. The main habitats include an oak and hickory forest and native tallgrass prairie areas. Lake Mingo is a 170-acre lake within

the park. Kennekuk County Park is located on top of the Gifford Moraine and has many native prairie areas. In addition to the tallgrasses, Kennekuk has a very large colony of little bluestem and rough blazing star. The Windfall Prairie Nature Preserve has side-oats grama and swamp white oak.

0.6	11.0	Pass through a prairie restoration project along both sides of the road. Further up on the left is an upland wildlife habitat demonstration plot, a cooperative effort with the Vermilion County Conservation District and the Vermilion County Pheasants Forever. Management of the open roadside fields is resulting in an extensive oak savanna. Native prairie grasses are spreading due to the west winds, and the Maximillian's sunflower is advancing rapidly. Because the areas are burned, the oak trees are the only hardwoods to survive the fire (http://www.vccd.org/prairies.html).
0.5	11.5	T-intersection from the left. TURN LEFT, heading toward White Oak Barn and Nature Center. The Cedar Hill Visitor Center and District Headquarters is on the right after the turn.
0.3	11.8	T-intersection from the left (road to Lookout Point). CONTINUE AHEAD.
0.2	12.0	T-intersection from the left (road to Oak Bluff picnic area and Lookout Point Trail). CONTINUE AHEAD.
0.1	12.1	Enter loop and parking lot of White Oak Barn Complex.
0.1	12.2	Marsh Road (a gravel road) on the right at end of loop. TURN RIGHT onto the gravel road.
0.1	12.3	Farm lane to the left. Park the vehicles along Marsh Road. On the day of the field trip, follow the farm lane to the left. Once you reach the field, follow the trail along the north side of the field toward the Middle Fork of the Vermilion River.

STOP 3: Middle Fork of the Vermilion River, Kennekuk County Park (NW, NW, SW, Sec. 16, T20N, R12W, 2nd P.M., Danville NW 7.5-minute Quadrangle, Vermilion County). On the day of the field trip, we will hike along the farm lane, approximately 1,500 feet to the west, toward the Middle Fork of the Vermilion River.

0.0	12.3	Leave Stop 3. CONTINUE AHEAD.
0.1	12.4	Wetland to the right. Can you see a Beaver lodge?

The Vermilion County Conservation District maintains a vast system of wetlands called the "Kennekuk Marshes," a cooperative project with the Vermilion County Audubon Society and the Vermilion County Conservation District Foundation. The first system of dikes was constructed in the early 1980s. Since then, a Ducks Unlimited grant was procured to flood more acreage.

Wetlands are one of the most endangered habitats throughout the country. Wetlands continue to be drained to make room for future development. The Kennekuk Marshes are a system of several connecting ponds that inundate nearly 30 acres of water during the spring rainy season. Water levels remain until waterfowl fledge their young in late spring. During the drought months, water levels may be reduced to under 15 acres.

		The Kennekuk Marshes offer excellent wildlife viewing of many duck species, Canada geese, great blue herons, egrets, and hawks. Mammals include raccoons, deers, foxes, muskrats, beavers, and possibly river otters (http://www.vccd.org/preserves.html).
0.1	12.5	Enter old sand and gravel pit area. Notice the large erratic boulders in this area.
0.1	12.6	Pass through second wetland restoration project. The observation blind to the left can seat 25 students, so wildlife may be viewed in seclusion.
0.3	12.9	T-intersection with Bunker Hill road. TURN RIGHT.
		Middle Fork of the Vermilion River, Bunker Hill canoe access area, is to the left. The National Scenic River System is governed by the U.S. Department of Interior, which has stringent rules regarding development on these designated rivers. It is thought that the canoe access and ramp recently constructed at Kennekuk County Park is the only ramp of its kind in the country. Because of flooding, the ramp and access lane were constructed of concrete, but dyed brown with an exposed aggregate surface to blend in with the surrounding environment. This is the only public access on the east side of the National Scenic River. It also serves as an excellent path for handicapped persons to view the Middle Fork National Scenic River (http://www.vccd.org/river.html).
0.2	13.1	Cooley's Winter Sports Area to the right. CONTINUE AHEAD.
0.1	13.2	YIELD. T-intersection with main park road. TURN RIGHT. Mingo Lake is to the left.
0.1	13.3	T-intersection from the left (Adrian's Pond). CONTINUE AHEAD.
0.1	13.4	Bunker Hill Historic Area to the left. CONTINUE AHEAD. This historic area includes the Atwood Home, Laury Barn, Neff Grocery, Red Oak School, a train depot with passenger rail car, a barber shop, and the only original structure—the Vermilion Chapel. All of the other buildings were relocated to this site by the Vermilion County Conservation District.
0.3	13.7	T-intersection from the left (Horseshoe Pond and Lake Mingo Trail). CONTINUE AHEAD.
0.1	13.8	Twin Points Picnic Shelter to the right. CONTINUE AHEAD.
0.1	13.9	T-intersection from the right (Hickory Hollow picnic area). CONTINUE AHEAD.
0.2	14.1	T-intersection from the left (Dodson Cemetery and maintenance shops). CONTINUE AHEAD.
0.1	14.2	T-intersection from the right (Cedar Hill Pond). CONTINUE AHEAD.
0.1	14.3	T-intersection from the right (Road to White Oak Barn). CONTINUE AHEAD.
1.1	15.4	STOP (one-way). (Kennekuk Park entrance/exit and Henning Road.) TURN RIGHT.
0.2	15.6	Crossroad intersection (2200N). CONTINUE AHEAD.
1.0	16.6	Crossroad intersection (2100N). CONTINUE AHEAD.
1.0	17.6	Crossroad intersection (2000N). CONTINUE AHEAD. Prepare to turn right.
0.6	18.2	T-intersection from the right (Kickapoo Park Road). TURN RIGHT.

1.0	19.2	T-intersection from the right (1200E). CONTINUE AHEAD.
0.8	20.0	Enter Kickapoo State Recreation Area.
0.2	20.2	T-intersection from the right (Road to Emerald Pond). CONTINUE AHEAD.
0.3	20.5	STOP (one-way). CONTINUE AHEAD. Park office on the left.
0.05	20.55	T-intersection from the right (Entrance to The Meadow day use area). TURN RIGHT.
0.05	20.6	Follow road around the loop at end of road, and park vehicles in the parking lot in front of the shelter.

STOP 4: The Meadow Day Use Area, Kickapoo State Park, Waterfall above Clear Pond (NE, SW, NE, Sec. 5, T19N, R12W, 2nd P.M., Danville NW 7.5-minute Quadrangle, Vermilion County). Follow trail at the end of turn-around loop in the road to the overlook on the bluffs above Clear Pond.

0.0	20.6	Leave Stop 4. Retrace route to Kickapoo Park Road.
0.2	20.8	STOP (one-way). T-intersection (Kickapoo Park Road). TURN RIGHT.
0.2	21.0	STOP (three-way). T-intersection (Kickapoo Park Road and main park road). TURN LEFT, heading toward the Pavilion.
0.2	21.2	Maple day use picnic area to the left, and Walnut day use picnic area to the right. CONTINUE AHEAD.
0.1	21.3	T-intersection from the right (entrance to Pavilion parking lot). TURN RIGHT. Park vehicles single file in the parking lot. Are you hungry?

STOP 5: LUNCH, Pavilion, Kickapoo State Park (NW, SW, NE, SW, Sec. 4, T19N, R12W, 2nd P.M., Danville NW 7.5-minute Quadrangle, Vermilion County).

0.0	0.0	Reset odometer at the exit to the Pavilion parking lot. TURN LEFT onto the main park road.
0.1	0.1	Maple day use picnic area to the right and Walnut day use picnic area to the left. CONTINUE AHEAD.
0.2	0.3	STOP (three-way). T-intersection from the right (Kickapoo Park Road). CONTINUE AHEAD toward Clear Pond.
0.2	0.5	Entrance to Brian Plawer Campground on the left. CONTINUE AHEAD.
0.3	0.8	Crossroad intersection (park roads). CONTINUE AHEAD and cross bridge over Middle Fork of the Vermilion River.
0.1	0.9	Cypress picnic area to the right. CONTINUE AHEAD.

0.3	1.2	Crossroad intersection (Glenburn Road and 1000E). TURN LEFT. A small gap in the sandstone bluff, just west of this intersection, on the north side of the road was used by a train that serviced an underground mine in the Danville Coal seam, located to the north. The sandstone is approximately 75 feet above the Danville (No.7) Coal. Sportsman Lake is to the right.
0.4	1.6	T-intersection from the left (1815N). CONTINUE AHEAD.
0.4	2.0	Cross over Interstate 74. The overpass offers a good view of the flat topography of the ground moraine (till plain) located between the Newtown and Gifford Moraines to the north and the Urbana Moraine to the south.
0.3	2.3	Crossroad intersection (1760N). CONTINUE AHEAD.
0.9	3.2	STOP (two-way). Crossroad intersection (1000E/Mission Field Road and U.S. Route 150). TURN RIGHT.
0.3	3.5	T-intersection from the left (970E). CONTINUE AHEAD.
0.5	4.0	T-intersection from the right (900E). CONTINUE AHEAD.
0.2	4.2	Enter Oakwood, home of the Comets, population 1,600.
0.3	4.5	STOP (four-way). Crossroad intersection (Oakwood Road/U.S. Route 150 and 850E). TURN LEFT.
0.7	5.2	T-intersection from the left (1575N). CONTINUE AHEAD.
0.5	5.7	Crossroad intersection (1530N). CONTINUE AHEAD.
0.5	6.2	Cross Salt Fork of the Vermilion River.

The new bridge built in 1980 replaces an older steel truss with a steel gridwork floor that became known as the “Singing Bridge”—named because the original bridges steel deck resonated or “sang” as the tires of vehicles rolled across the bridge. The name Singing Bridge still exists on the 7.5-minute topographic map (see route map, p. 22).

Pennsylvanian age bedrock sequence of the West Franklin Limestone to the Trivoli Sandstone of the Shelburn and Patoka Formations is exposed along the north side of the river, near the bridge. The West Franklin Limestone Member of the Shelburn Formation, exposed at river level, is a limestone pebble conglomerate, containing red oxidized carbonate clasts, mixed with medium gray, angular carbonate pebbles. The limestone is well to poorly bedded. Good, fairly unbroken marine fossils are common, especially in the lower unit. The West Franklin Limestone grades upward to a mixed terrestrial and marine clastic zone containing sandstone and sandy limestone, irregularly bedded; carbonized plant impressions; some lenticular limestone; and some fossiliferous limestone. The overlying Trivoli Sandstone Member of the Patoka Formation is argillaceous, irregularly bedded, and contains some shale partings (Langenheim and Mann 1980).The Trivoli Sandstone contains plant impressions, including casts of roots and branches.

The well on the north bank of the river supplies water for the City of Oakwood water system.

The Salt Fork of the Vermilion River received its name from the salt salines along the river just southeast of Kickapoo State Park. The saline was re-discovered in 1819 by settlers.

0.3	6.5	T-intersection from the left (Camp Drake Road). CONTINUE AHEAD.

0.25 6.75 T-intersection from the left (1425N and 850E). CONTINUE AHEAD. Road curves to the right.

0.05 6.8 T-intersection from the right (1425N and 810E). CONTINUE AHEAD. Road curves to the left. Horseshoe Bend of the Salt Fork is located directly north of this intersection (see route map, p. 22).

The Vermilion River and its tributaries came into existence at the end of the Gifford glaciation about 15,000 years ago. Later, during the stand of other glaciers to the north, these streams carried meltwater and deepened their valleys. The Salt Fork flows from west to east across the Urbana till plain to join the southward-flowing Middle Fork and North Fork Vermilion River near Danville. The Vermilion River then flows southeastward to the Wabash River.

The Urbana Moraine is a surface of extremely low relief. Because of this low relief, the Salt Fork has a gentle gradient, and, early in its history, the stream developed a meandering course. The stream begins north of Champaign-Urbana and bends around the inside of the Urbana Moraine, which has largely controlled the position of its channel.

During late Woodfordian time, about 12,000 years ago, when the Wisconsin glacier was melting back from the position of the Valparaiso Moraine, a great deal of meltwater poured down the Wabash Valley. This event occurred at the same time as the Kankakee Torrent, a glacial flood that occurred in the Kankakee and Illinois River Valleys. The meltwater that flowed down the Wabash Valley was overflow from an early stage of glacial Lake Erie that had formed along the front of the Valparaiso glacier. The Wabash rapidly deepened its valley, and in response to this deepening, its tributaries were forced to deepen also. The valley of the Vermilion River, including the Salt Fork, became entrenched below the upland. At this locality, the river has cut its channel 60 feet below the upland into the Pennsylvanian bedrock. The large loop or meander known as Horseshoe Bend is referred to as an entrenched meander. Eventually the river will cut through the neck of the meander and shorten its course by about 1.5 miles.

As a river flows around a meander, the current is forced against the outside bank, and erosion takes place, especially during times of flood or high water. This bank is called the undercut bank. The inside bank is called the slip-off slope, where deposition takes place forming a series of bars. As the meander grows, a spur is formed, which is gradually eroded from two sides at a narrow portion called the neck. The abandoned portion of the channel then becomes an oxbow lake.

The neck at Horseshoe Bend is underlain by Pennsylvanian bedrock, which has slowed erosion and temporarily delayed the cutoff.

0.2 7.0 The rolling landscape is called swell-and-swale topography. This undulating surface developed as the glacier melted back from the ice margin side of the Urbana Moraine, which is located to the south.

0.6 7.6 STOP (two-way). Crossroad intersection (800E and Catlin-Homer Road). CONTINUE AHEAD.

0.9 8.5 CAUTION: Cross dual track (signal lights and guard gate) of the Norfolk and Western Railroad. The plant, located to the left just before the railroad tracks, manufactures pelletized limestone for use in agricultural fields.

0.7	9.2	Crossroad intersection (1200N and 800E). CONTINUE AHEAD. The building located at the southwest corner of the intersection is the old Pleasant View School. It is now the home of the Old Country School Art Glass shop.

Approaching the Urbana Moraine, the gentle rise in the topography ahead (south) marks the ice margin side of the moraine. The 675-foot elevation contours on the 7.5-minute topographic maps generally coincide with the areal extent of the moraine. The Urbana Moraine is weakly developed in this vicinity and is barely distinguishable—in contrast to the well-defined prominent features of the Newtown and Gifford moraines to the north.

Why is the moraine ill-defined here? There are various explanations. First, the lobe of ice that formed the moraine represented a minor readvance of the Woodfordian glacier. Second, the small size of the moraine indicates that the ice may have been relatively thin, perhaps only a few hundred feet thick. Third, the undulating surface and lack of a prominent topographic relief of the Urbana Moraine suggest that the ice front did not stand long at its position of maximum advance. The size difference is most likely a function of the length of time that the glacier remained stationary as the moraine developed. The surface of the Urbana Moraine and associated outwash plain form what is called knob-and-kettle topography, and a number of kames occur in this area.

0.8	10.0	The large hill to the west, before the intersection, is a kame.

This kame is located along the back (ice margin) of the Urbana Moraine. The top of the kame has an elevation of about 725 feet and offers an excellent view in all directions. Toward the north is the gently rolling Urbana ground moraine. Toward the south, the front of the Urbana end moraine slopes gently downward to the Champaign ground moraine.

Several kames that were formed when the glacier melted back are found on the Urbana end moraine and ground moraine. Numerous kames are also present on the Champaign ground moraine further to the south.

Kames are steep-sided, subcircular mounds of outwash sand and gravel that formed where meltwater streams plunged into subglacial pools through crevasses and holes in the ice. Others formed where the water poured off the front of the glacier into temporary meltwater lakes. The abrupt changes in gradient of the meltwater streams caused the deposition of the sand and gravel. The meltwater streams entering ponds along the ice margin formed small steep deltas, which later were left as isolated mounds of outwash after the ice melted away. Several of the kames in this locality probably accumulated in ponds at the edge of the glacier ice as it melted back.

0.2	10.2	STOP (two-way). Crossroad intersection (1100N and 800E). TURN LEFT.
1.6	11.8	Crossroad intersection, unmarked (1100N and 960E). Two-way stop from right and left. CONTINUE AHEAD. At one time, the Pleasant Ridge Church was located at the northwest corner of this intersection.

View of abandoned mine dump gob piles, looking ahead and slightly to the northwest and southwest. Looking far in the distance, to the southeast are two large flat-topped mounds. These are the spoil piles for the active Riola Coal Mine.

0.7	12.5	Abandoned old Shiloh School on the left.

0.5	13.0	T-intersection from the left (1100E and 1100N). CONTINUE AHEAD.
0.3	13.3	T-intersection from the right (1130E). CONTINUE AHEAD.
1.5	14.8	STOP (two-way). Crossroad intersection (1100N and Catlin-Indianola Road). TURN RIGHT.
0.5	15.3	T-intersection from the left (Clingan Lane). CONTINUE AHEAD. Road curves to the right. Prepare to turn right.
0.2	15.5	Road on the right. Entrance to abandoned mine dump gob pile. TURN RIGHT.

STOP 6: Gob Pile, Dering Coal Company (NW, NW, SE, Sec. 15, T18N, R12W, 2nd P.M., Danville SW 7.5-minute Quadrangle, Vermilion County). On the day of the field trip, follow the lead vehicle, and park close to the vehicle in front of you.

0.0	15.5	Leave Stop 6. Retrace route back to Catlin-Indianola Road, and TURN LEFT.
0.2	15.7	T-intersection from the right (Clingan Lane). CONTINUE AHEAD.
0.5	16.2	Crossroad intersection (1100N and Catlin-Indianola Road). CONTINUE AHEAD.
1.0	17.2	Crossroad intersection (1200N/Westville Road). CONTINUE AHEAD. Westville is 4 miles to the right.
0.5	17.7	T-intersection from the right (1250N). CONTINUE AHEAD. Abandoned mine dump gob pile to the left. This gob pile is from the Taylor-English Coal Company, Mine No. 2. This underground room-and-pillar mine operated in both the Herrin Coal and Danville Coal seams between 1917 and 1930.
0.4	18.1	Road cuts through large conical hill. This kame has an elevation of 685 feet on the top. Enter Catlin, home of the Wolverines, population 2,173.
0.5	18.6	CAUTION: Cross dual railroad tracks (signal lights and guard gates) of the Norfolk and Western Railroad. Prepare to turn left.
0.05	18.65	Crossroad intersection (Catlin-Homer Road/Vermilion Street and Catlin-Indianola Road/Paris Street). Two-way stop from right and left. TURN LEFT heading west toward Homer.
0.2	18.85	STOP (four-way). Intersection of Vermilion and Sandusky streets. CONTINUE AHEAD.
0.3	19.15	Catlin High School on the right.
0.8	19.95	T-intersection from the right (1150E). CONTINUE AHEAD
0.5	20.45	T-intersection from the left (1100E). CONTINUE AHEAD.
0.75	21.2	Crossroad intersection (Camp Drake Road/1020E). CONTINUE AHEAD.
0.7	21.9	T-intersection from the right (920E). CONTINUE AHEAD.

1.0	22.9	Mount Vernon Cemetery on the right.
0.2	23.1	Crossroad intersection (800E/Oakwood Road). CONTINUE AHEAD.
0.5	23.6	Crossroad intersection (750E). CONTINUE AHEAD.
0.7	24.3	Crossroad intersection (680E). CONTINUE AHEAD.
0.8	25.1	Crossroad intersection (600E). CONTINUE AHEAD.
0.35	25.45	T-intersection from the left (580E). CONTINUE AHEAD. Fairmount, population 678, is to the left.
0.25	25.7	T-intersection from the left (State Road.). CONTINUE AHEAD.
1.4	27.1	Davis Cemetery on the left.
0.3	27.4	Crossroad intersection (400E). CONTINUE AHEAD. Prepare to turn left.
0.3	27.7	Entrance to Material Services Corp., Fairmount Quarry.
0.35	28.05	CAUTION: Cross single-track railroad (signal lights and guard gates), Norfolk and Western Railroad.
0.05	28.1	Enter Fairmount Quarry operations. On the day of the field trip, follow the lead vehicle into the quarry.

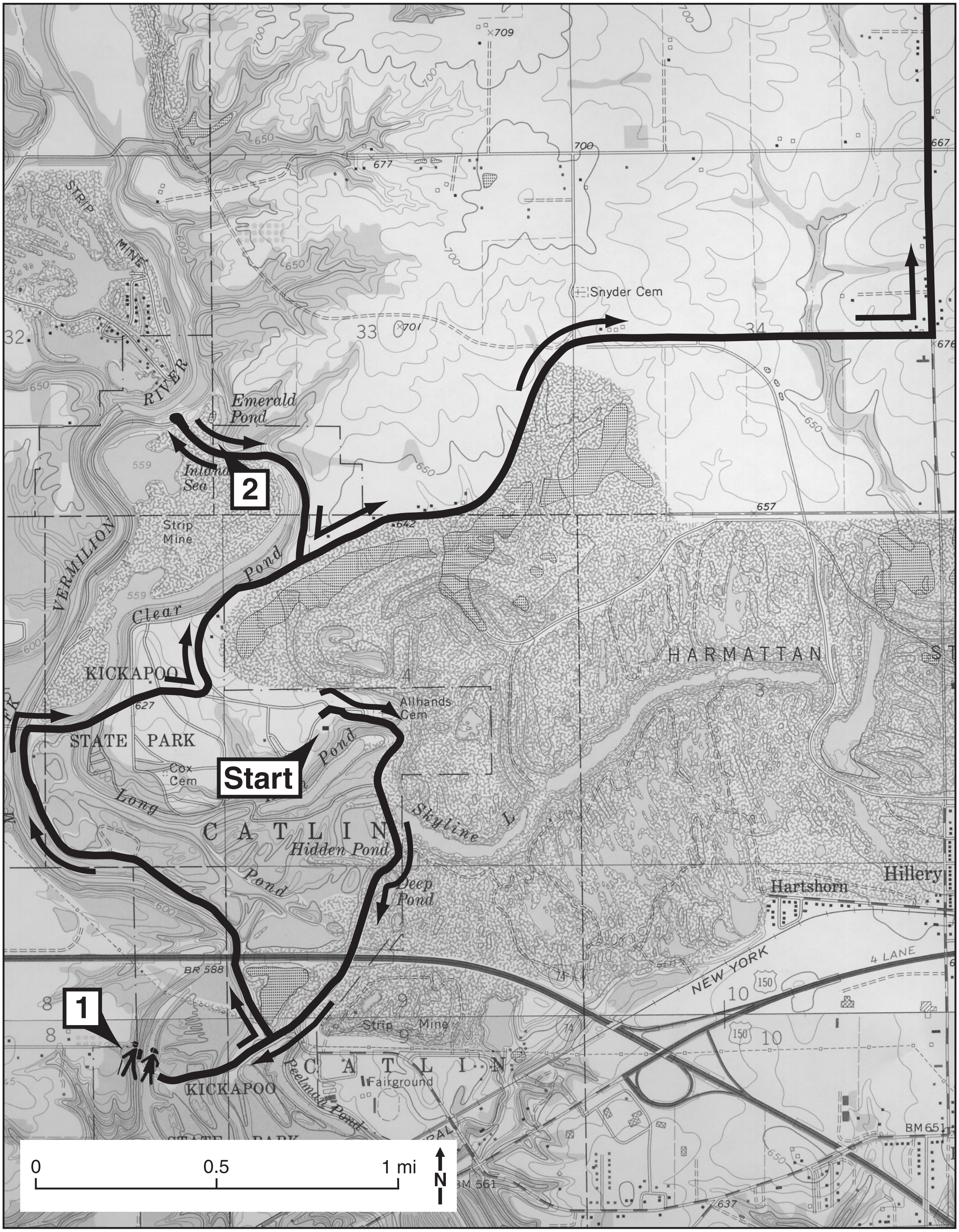
STOP 7: Material Services Corp., Fairmount Quarry (SW, SE, Sec. 6, T18N, R13W, 2nd P.M., Oakwood 7.5-minute Quadrangle, Vermilion County).

0.0	28.1	Leave Stop 7. Retrace the route back to the Homer-Catlin Road.

To return to Interstate 74, turn left and proceed to Homer, approximately 4.8 miles. Turn right (north) at intersection of Main Street and West Second Street. Follow Illinois Route 49 (north) approximately 5 miles to Ogden. Cross U.S. Route 150; the entrance ramp to Interstate 74 is 0.5 miles north of U.S. Route 150.

End of field trip.

Drive carefully on your way home.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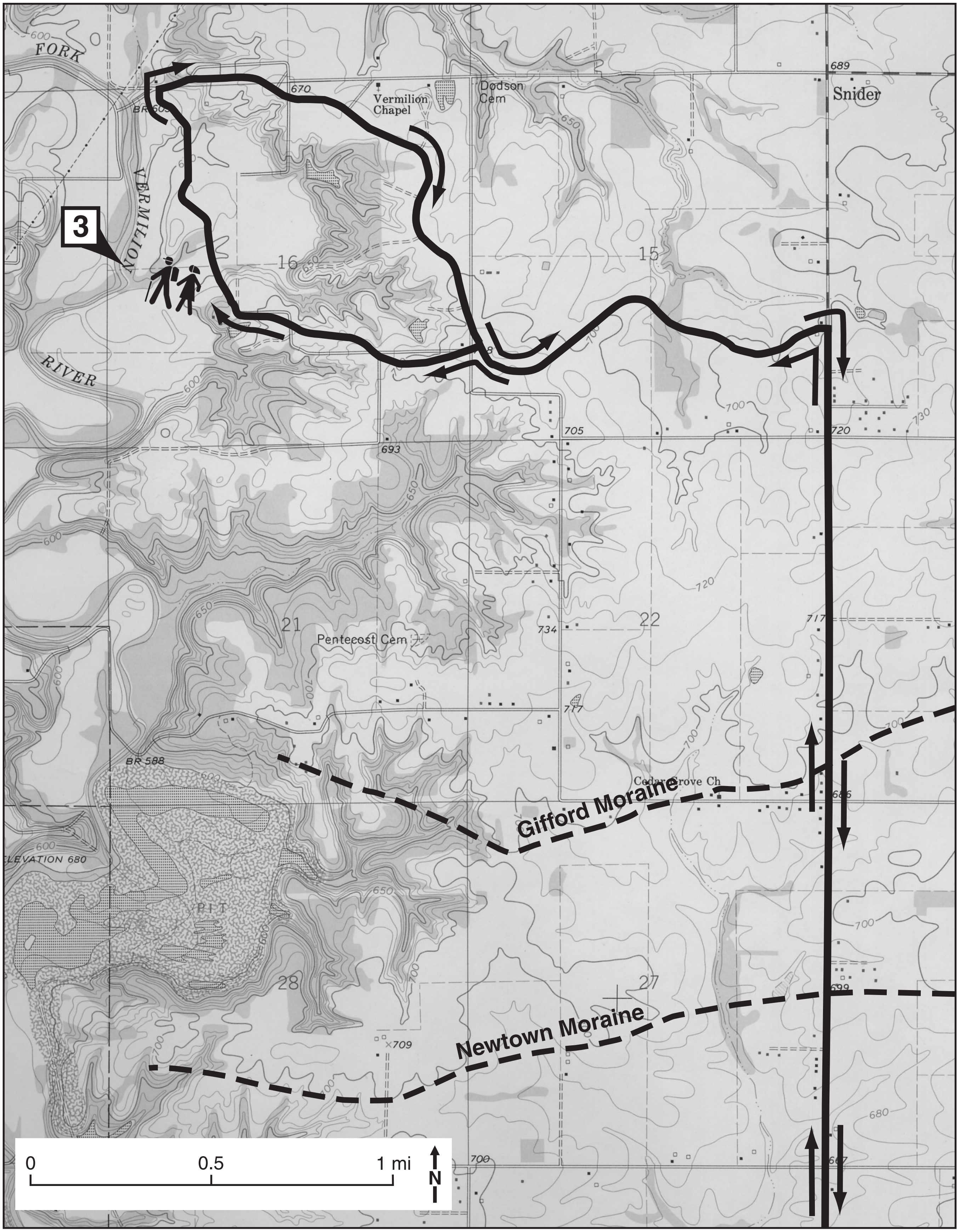
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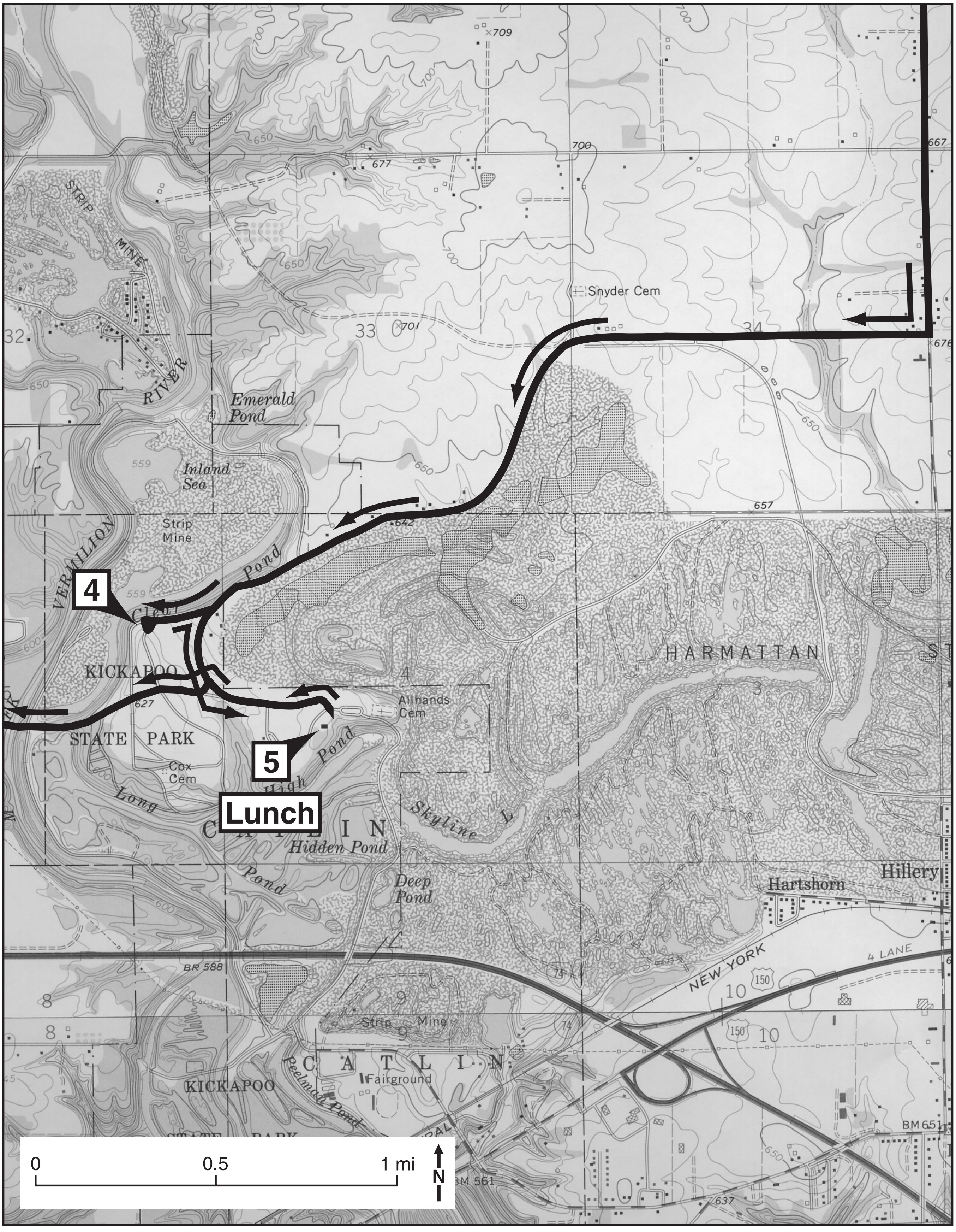
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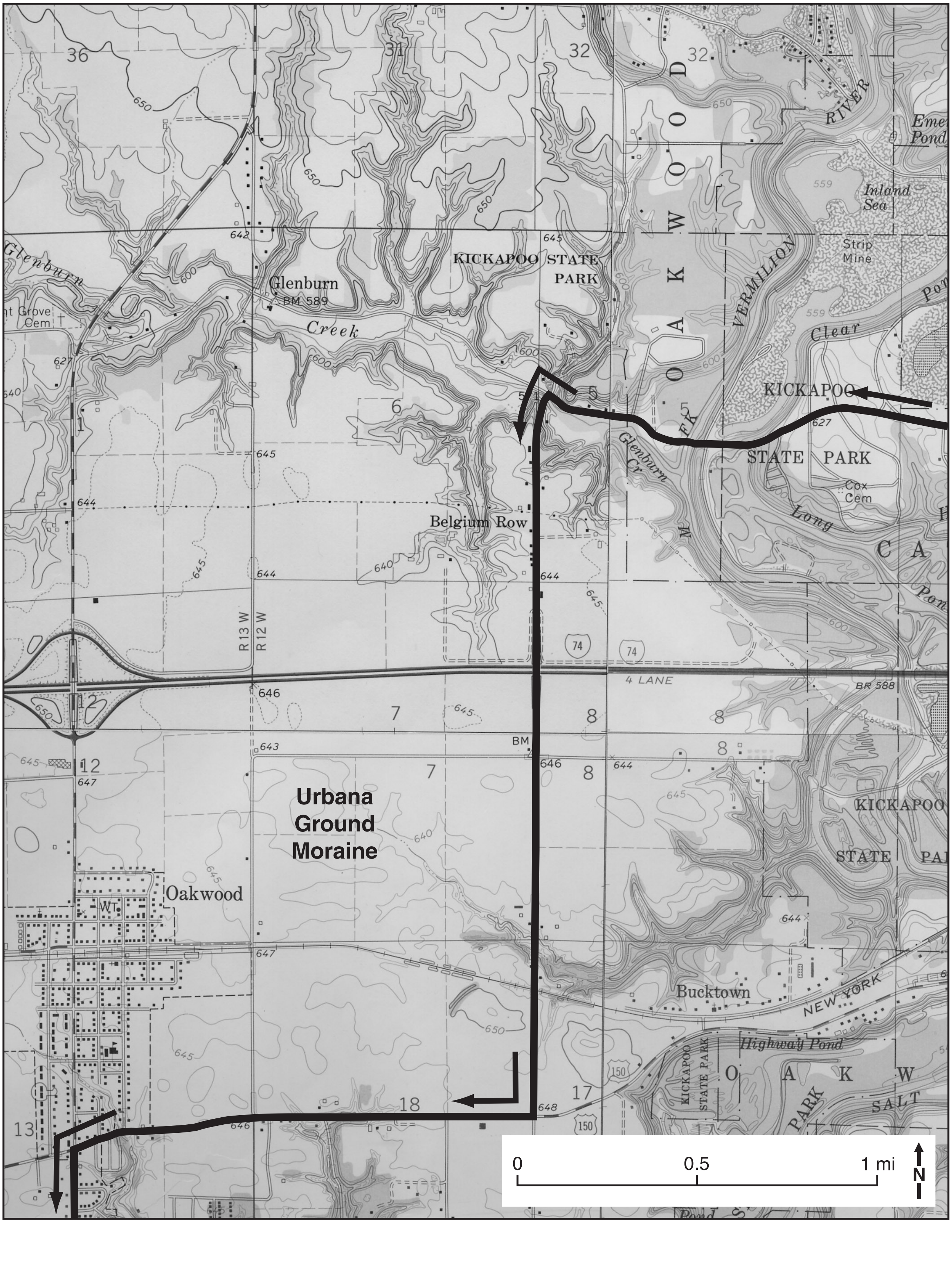
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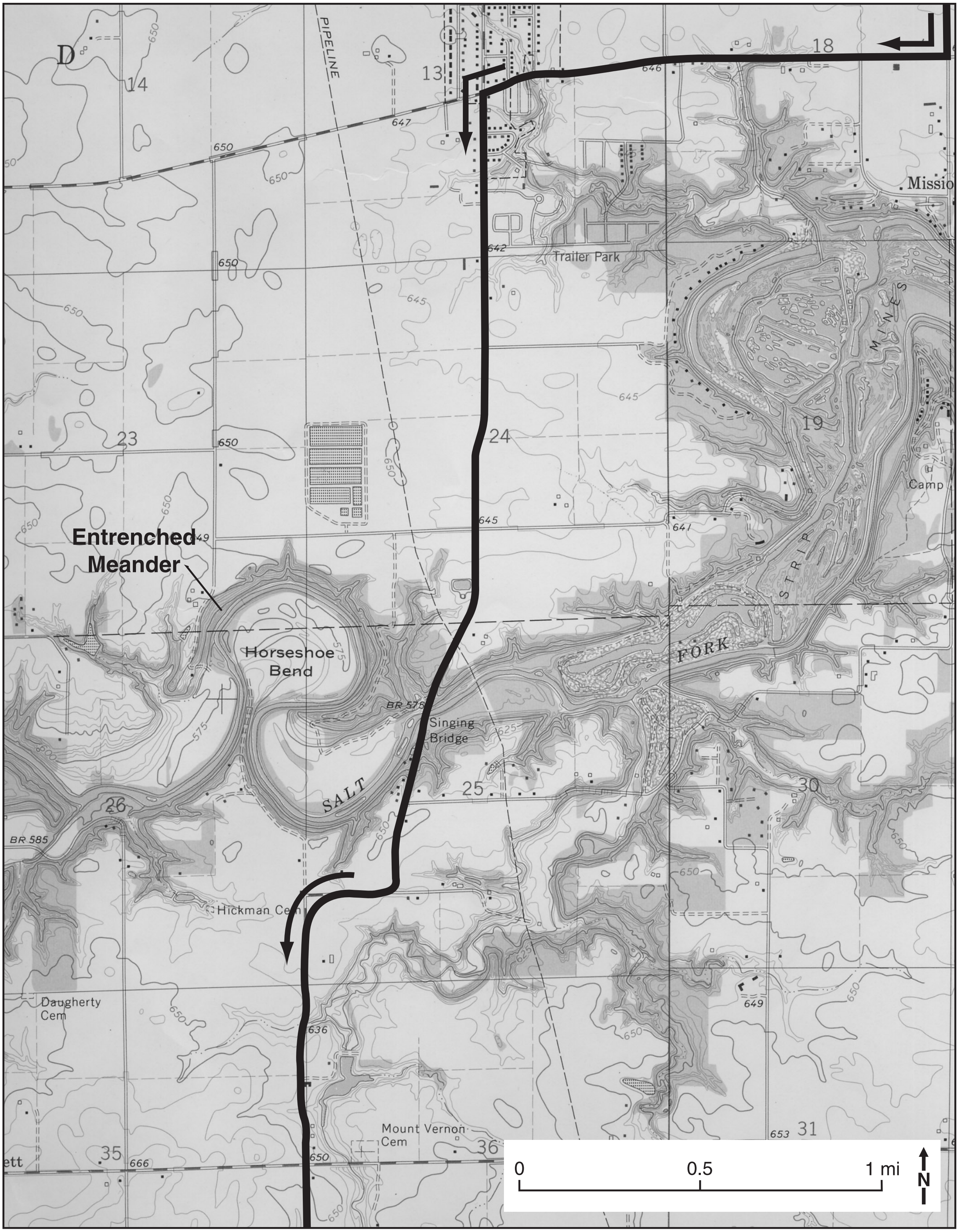
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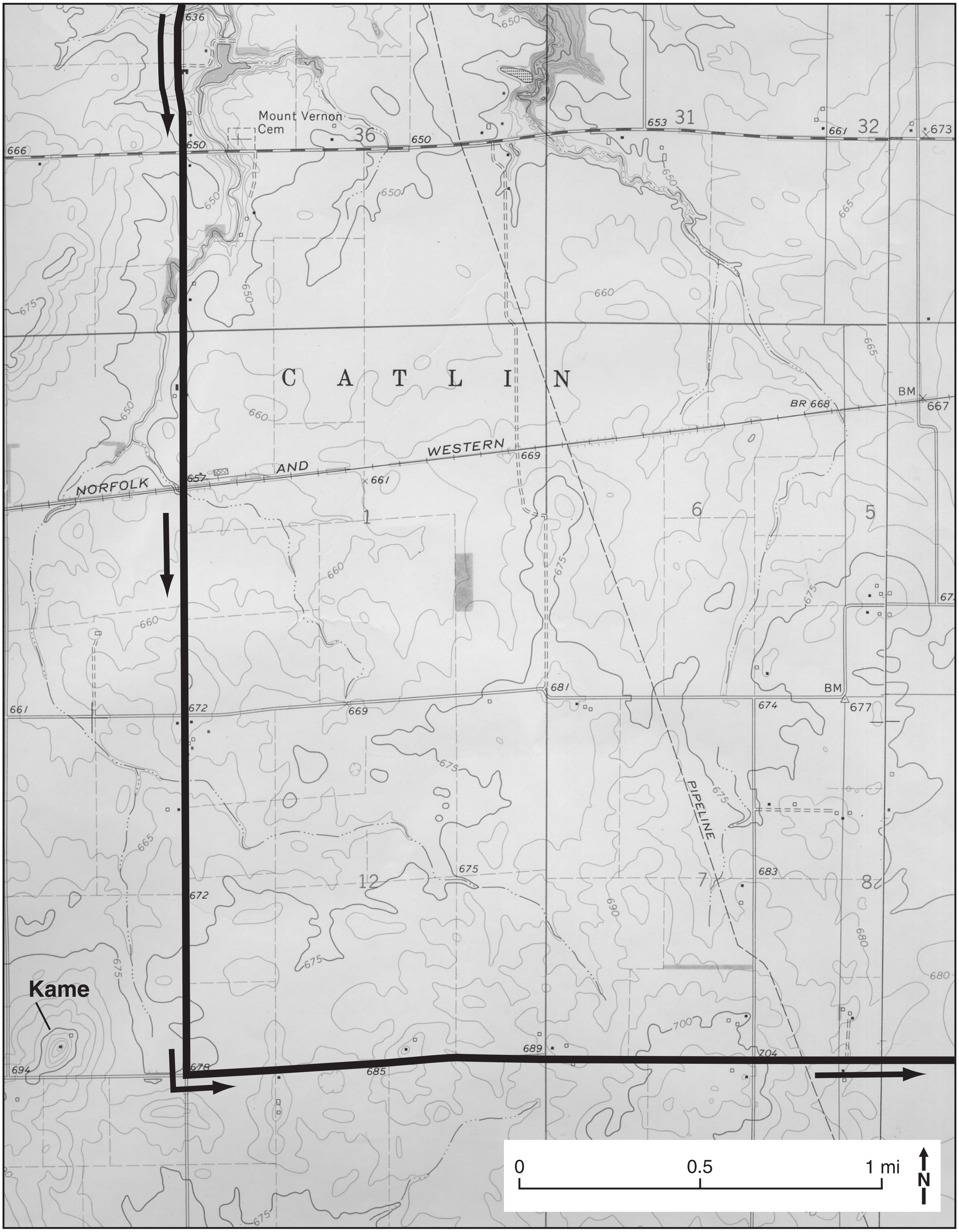

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Catlin
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Rice Lake
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Oak Ridge Cemetery
Gods Acre Cem
Jones Grove Cem
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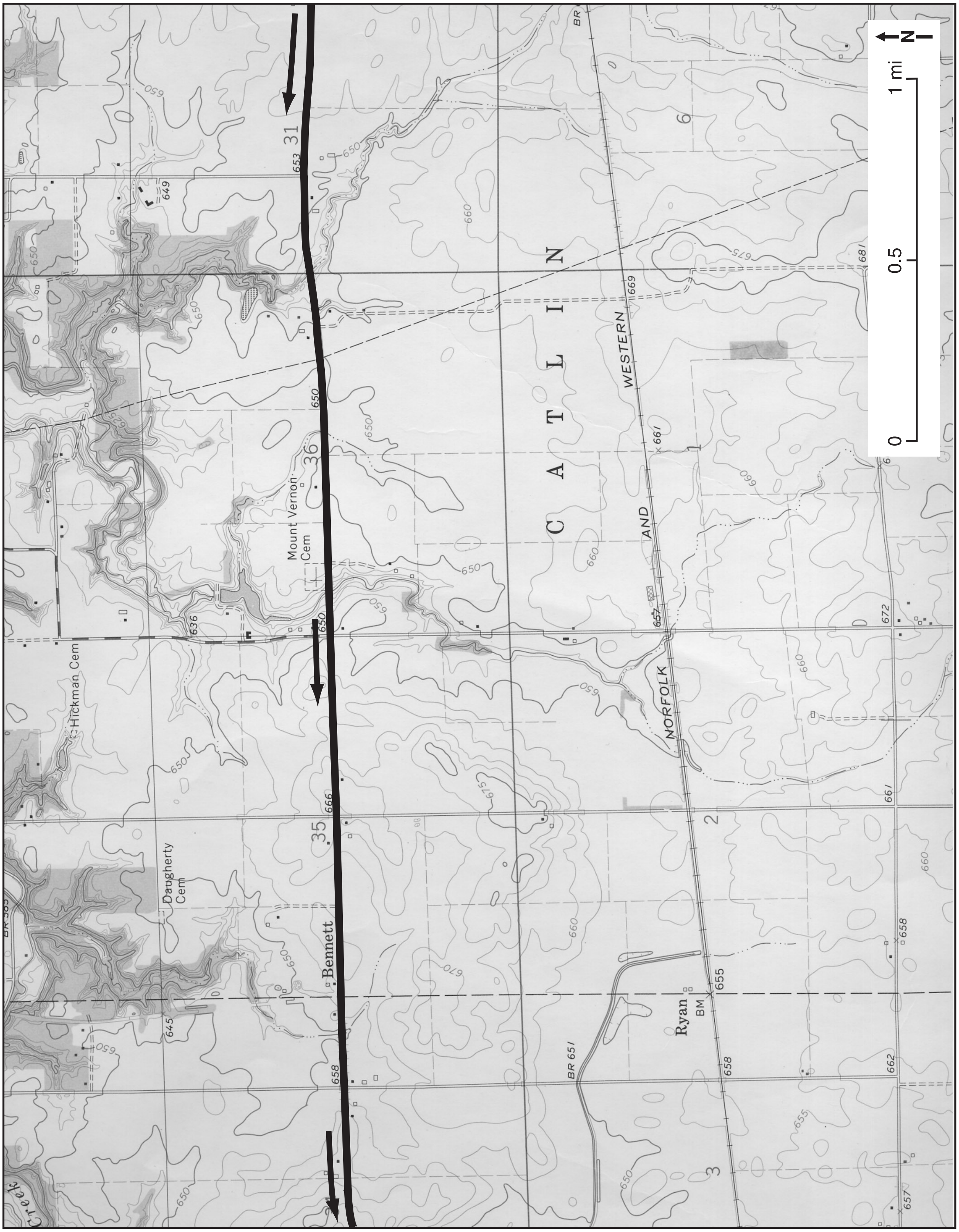

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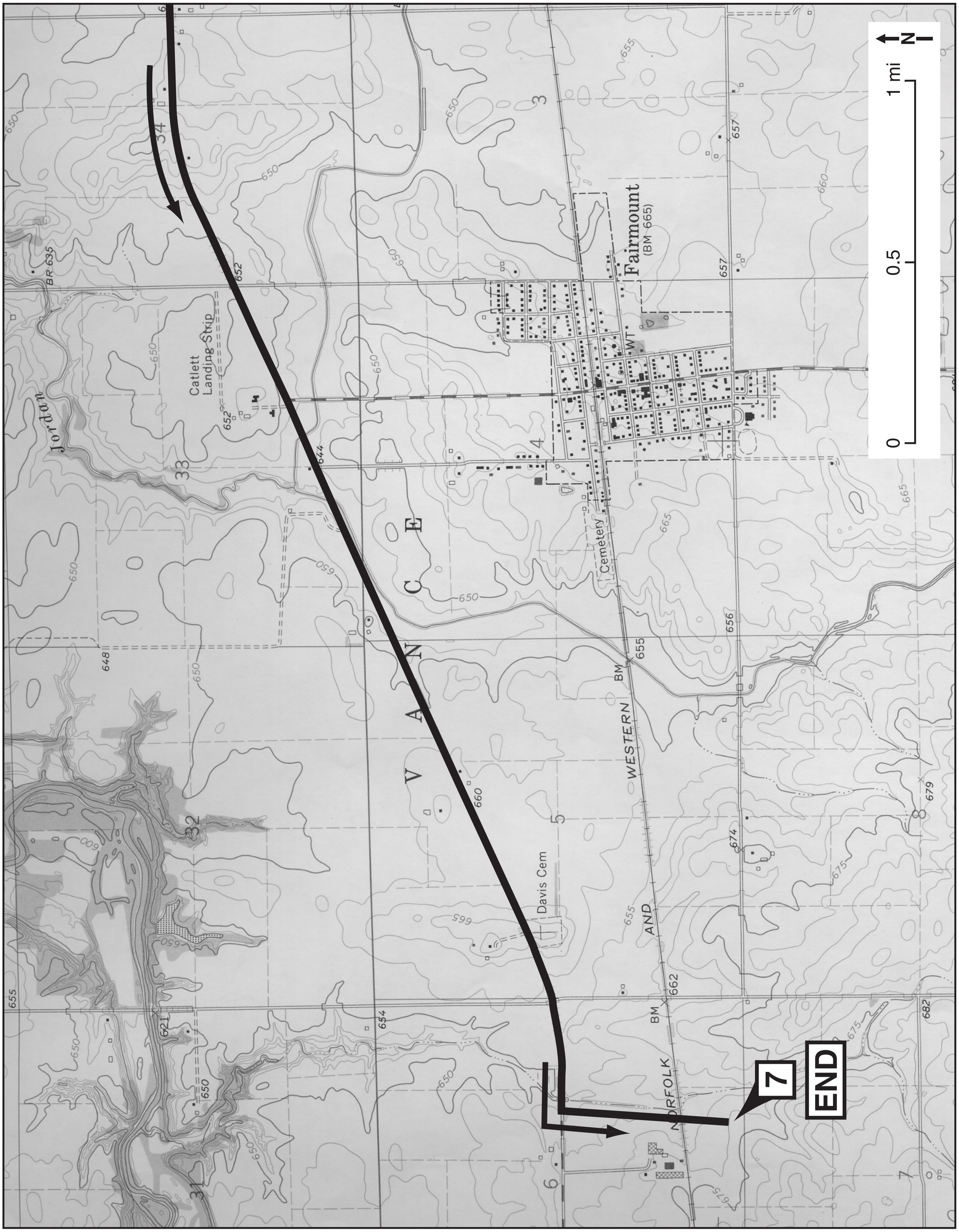
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STOP DESCRIPTIONS

STOP 1: Slope Mine No. 6, Kickapoo State Park (NE, NW, SE, Sec. 8, T19N, R12W, 2nd P.M., Danville SW 7.5-minute Quadrangle, Vermilion County).

Slope Mine No. 6

Some of the following material was obtained from the kiosks located at the entrance of Slope Mine No. 6.

Most slope mines begin at ground level, but the mine entrance at this stop was located 40 to 50 feet below ground level because United Electric's Slope Mine No. 6 was inside another mine, Strip Mine No. 6. In a slope mine, a tunnel angles down through layers of rock to reach a seam, or bed, of coal too deep for surface mining. Underground miners working in the old No. 6 slope mine drilled and blasted the coal free, then hand-loaded coal into rail cars for the trip up the sloped tunnel to the surface. Two rail cars are on display in front of the entrance to Slope Mine No. 6 (fig. 9). Rail cars like the ones on display were generally hauled to the surface by mules.

United Electric opened the No. 6 surface mining operations in 1918 and opened Slope Mine No. 6 in 1919. The two mines produced 832,625 tons of coal from the Danville Coal seam from 1918 to 1924. Records indicate miners abandoned the slope mine in 1924, but the strip mine was worked into the 1930s. In 1995, the Illinois Department of Natural Resources, Mined Lands Reclamation Program, permanently sealed the entrance to Slope Mine No. 6. In the vicinity of Kickapoo State Park, the Danville Coal averages between 5.5 to 6 feet thick and occurs at varying depths up to 100 feet.

Many Illinois miners were immigrants, and the Kickapoo miners represented 48 different ethnic and racial groups. Miners received low pay for dangerous work. Sometimes they paid most of their wages right back to the mining company for ramshackle housing and supplies from the company store.

Coal Mining in America Some historians date the discovery of coal in America to a reported sighting of "charbon de terre" in the Ottawa-Utica area of Illinois along the Illinois River in 1673 by French explorers Louis Jolliet and Jacques Marquette.

The first strip mining for coal in the United States was started in 1866 at Grape Creek, a few miles south of Danville. Teams of horses and mules with slips or wheel scrapers were used to remove the overburden (surface materials) to expose shallow coal deposits. As a result of these rather primitive methods of overburden removal, there were no large-scale strip mining operations, and only a relatively small amount of coal was produced by these means prior to 1910. However, during 1910, power shovels appeared in Vermilion County. The early 1900s brought advances in machines and technology that made surface mining more productive. But these early surface mines devastated the landscape. In the United States, Vermilion County coal fields were the second to use a steam-powered dredge and the first to use rotating steam shovels to remove overburden or surface soil. Modern mining equipment can remove more than 100 feet of overburden to expose deep coal seams. Two-thirds of the coal produced in the United States comes from surface (strip mines). To protect the land, modern mining laws require that the mining com-

Figure 9 Entrance to Slope Mine No. 6, Kickapoo State Park (photo by W.T. Frankie).

panies restore surface-mined areas to their pre-mined conditions.

Coal—The Rock that Burns

A lump of coal consists of carbonized remains of ancient plants. When coal is burned today, it releases solar energy that was absorbed (stored) by plants more than 290 million years ago. The plant fossils found in coal and coal-bearing deposits are the remains of prehistoric plants that carbonized into coal.

Deposition and Formation of Coal-bearing Rocks

A series of tropical swamps at the edge of a vast inland sea covered much of the Midwest during the Pennsylvanian Period more than 290,000,000 years ago. During that time, the area that is now called Illinois was near the equator and had a climate much like that of modern Indonesia. Tropical climates allowed lush vegetation to grow and accumulate. Coal formation began when plants that were growing in ancient swamps died. Instead of rotting completely, the submerged plants became peat, a soft fibrous substance. Over time, as the inlands seas advanced, sediments were deposited over the peat. As the thickness of the sediments increased, they compressed the peat and drove out the moisture. After a long period of geologic time, the peat was converted to lignite, a soft brown coal. Continued deposition of overlying deposits accompanied by greater depths and pressure altered the lignite to bituminous coal. Bituminous coal is harder, blacker, and has a higher carbon content than lignite. Most of the coal in Illinois is bituminous, and Illinois today has the largest bituminous coal deposits in the nation. The coal-forming process repeated itself, many times over millions of years, producing multiple coal seams. Two seams were extensively mined here at Kickapoo State Park, the Herrin and Danville seams.

The coal beds in Illinois are intermixed with shales, sandstones, and thin limestones. These changes in lithology (rock type) indicate various periods of sea-level changes. Shallow seas covered Illinois numerous times during the Pennsylvanian Period. When sea level fell, the seas withdrew to the south, and large rivers snaked across Illinois, forming extensive deltas. In Illinois, the peat swamps formed on large extensive coastal plains. When sea level rose, the peat deposits were covered by muddy marine sediments. As sea level started to lower, coastal plains and small deltas built back over the muddy sea sediments. During the next cycle of low sea level, coastal peat (in swamps) was again deposited over the coastal plain sediments. This cycle of deposition between marine and non-marine sediments and the development of peat is referred to as a cyclothem.

STOP 2: Emerald Pond, Kickapoo State Park, Farmington Shale (NW, SW, SW, Sec. 33, T20N, R12W, 2nd P.M., Danville NW 7.5-minute Quadrangle, Vermilion County).

Every Rock Tells a Story

At this stop, we will examine the exposure of rocks and sediments in the bluff located at the south end of Emerald Pond (fig. 10). A small creek flows along the base of the bluff, which parallels the park road. The exposure consists of 15 to 20 feet of Pennsylvanian age Farmington Shale overlain by Pleistocene age glacial tills and loess.

Glaciation

Within the field trip area, there are numerous opportunities to observe the various types of landforms and deposits left by the glaciers of the most recent Wisconsin Episode. To understand and appreciate the complexity of continental glaciation and the resulting landforms and deposits, it is helpful to know some of the terminology that geologists use in describing these features, deposits, and processes involved in the shaping of the glacial landscape.

Glacial Mechanics Glacial action can be described by four processes:

1. Weathering. As the ice moves over bedrock, it incorporates rocks and other materials, which have become frozen to the moving ice, and gouges into softer sediments.

2. Erosion. The rocks already incorporated into the ice are scraped along the surface of other rocks, eroding both the rocks in the glacier and those on the surface. Additional erosion occurs as rocks within the glacier come into contact with one another.

3. Transportation. As the ice advances, it carries all of the incorporated materials toward the front (the “toe”) of the glacier.

4. Deposition. As the glacier starts to melt, it drops its load of sediment, forming a variety of types and shapes of deposits.

Figure 10 Pennsylvanian age, Farmington shale and Pleistocene glacial tills in bluffs along Emerald Pond, Kickapoo State Park (photo by W.T. Frankie).

Glacial Deposits As a glacier melts, it releases from the ice the clay, silt, sand, and various sizes of rocks (sediment) that it had transported as it advanced. Some of this material (drift)—deposited in place as the ice melts—is a mixture of all kinds and sizes of rocks and is known as till. Some of the glacial drift is washed out and transported from the glacier by meltwaters. The coarsest and heaviest of this water-transported material, called outwash, is deposited near the ice front, and the progressively finer material is carried longer and is deposited farther away. Much of the finer material eventually enters into streams and rivers and is carried (transported) all the way to the ocean. Where the outwash material is widely deposited in front of the glacier, it forms an outwash plain; where it is restricted to a river valley, it forms long strings of coarser deposits called valley trains.

At times, especially in the winter, when melting of the glacier subsides, the sediments in the outwash plains and valley trains are exposed. With little vegetation to hold the sediments in place, the harsh, dry winter winds pick up the silt and fine sand-sized particles from these surfaces and distribute the materials across the country. These small-sized sediments are eventually dropped onto the landscape, forming the deposits known as loess that mantle most of Illinois.

More than 50 successive end moraines were formed by the Wisconsin Glacial Episode in Illinois. An end moraine is formed by the accumulation of drift at the ice margin when the rate of advance and the rate of melting of a glacier are essentially in balance. As more and more material is carried forward to the edge of the glacier, it melts out and piles up to form a ridge—the end moraine. There are large gaps in the moraines in places where subglacial streams presumably carried away (eroded) most of the drift.

If the rate at which a glacier melts is greater than the rate at which it moves ice and debris forward, the glacier recedes. A common misconception is that glaciers flow backwards. The advancement or retreat of the glacier is controlled by the differences between the rates of melting at the margin and the rates of ice accumulation and transport from the centers of ice accumulation located to the north. The Wisconsin glacier advanced and retreated dozens of times across northeastern Illinois. End moraines mark positions where the ice margin stood for hundreds of years.

When melting exceeded the rate of advance, the sediments held within the ice were deposited (dropped) directly onto the landscape. The flatter areas behind (up-ice from) the end moraines are called ground moraines or till plains. They are underlain by till deposited beneath the glacier. The surface of the till plain may be almost level or slightly rolling. The surface relief along the top of the end moraines, which is generally greater than that of the till plains, is commonly referred to as swell-and-swale or knob-and-kettle topography, depending upon the amount of surface relief. If the relief is a gentle rolling surface with small rises and depressions it is swell-and-swale topography. Surface relief marked by large knobby hills and kettle lakes is knob-and-kettle topography. The topography along any of the morainic systems may contain both types of topography, depending upon the location on the moraine.

Geological CSI

It has been said that geology is a science consisting of 90% observation and 10% deduction—the telling of the story. As you examine the exposure and follow the creek upstream from where it empties into Emerald Pond, observe (1) Beaver cut trees, an example of biodiversity; (2) sand bar and overbank deposits near the mouth of the creek where it empties into Emerald Pond; (3) bedrock along bottom of the creek, here known as the Farmington Shale, with a basal load of alluvium (sand, gravel, and boulders) in places; (4) exposure of Farmington Shale along the outside bends (meanders) in the creek; (5) gravel bars formed on the inside of meanders; and (6) types of sediment present in the Farmington Shale and glacial till.

The variety of rocks found within the gravel deposits include igneous, metamorphic, and sedimentary rocks, including chert, pegmatitic quartz, quartzite, jasper, geodes, silicified fossils, and glacially striated pebbles and boulders.

The Farmington Shale contains a number of thin silty shale to siltstone layers, noted near the top of this exposure. These silty shale and siltstone layers include some bioturbation (fossil evidence of organic activity) and sedimentary structures (ripple marks). Some of the siltstone bedding planes contain carbonaceous plant detritus.

The Story of Sediments and Sedimentary Rocks

During the sedimentary rock cycle, rocks generally undergo three processes: (1) rocks are eroded, (2) sediments are transported, and (3) sediments are deposited. Generally this cycle is repeated with further erosion, transportation, and deposition. At Stop 1, the sedimentary cycle can be viewed. The exposed glacial deposits and shales are being eroded, and the small creek at the base of the outcrop is transporting the sediments toward Emerald Lake. Where the creek enters the lake, the coarser-grained sediments are deposited near the mouth of the creek, and the finer-grained sediments, which are held in suspension, are deposited farther out into the lake. Over time, what will the sediments in Emerald Lake look like, and what type of rocks will they form?

As you view the exposed sediments and rocks at this stop, you may ask: What was the origin of these sediments? Where are they going? What type of deposit will they eventually make? The glacial sediments were eroded and transported by glaciers. They originated from deposits of igneous, metamorphic, and sedimentary rocks that originally were located to the north, some as far away as Canada. The origin of the Pennsylvanian shales are from the fine-grained sediments that were eroded from the ancient Appalachian Mountains to the east. Ancient streams transported the sediments and eventually deposited the fine-grained clays into a quiet water environment associated with an ancient deltaic system.

The number and size of the gravel deposits and the size of the erratics increase upstream. The stream is sorting the material as it transports the sediments downstream—from coarse gravels, to medium-grained sands, and finally the finer-grained silts and clays, which are eventually deposited into Emerald Pond. Over time, Emerald Pond will fill in with the fine-grained silts and clays.

Tills Tell a Story

This exposure affords an unusual opportunity to examine several till deposits representing different glacial advances across this part of the state. The exact ages of the individual tills are not known, and no weathered zones (ancient soil profiles) occur on any of the tills. However, about 40 years ago, the tills were tentatively assigned relative ages based on observations of the individual till characteristics and the development of end moraines by Cote et al. (1967). All of the tills are generally not exposed in one location along the bluffs, because of erosion, slumping, and vegetation cover on part of the exposures. Several areas along the full length of the bluff would need to be exposed in order for us to examine all of the tills.

The top yellow-brown till unit (No. 1) is the Gifford-Newtown, the last drift unit to be deposited in this immediate area. This till unit is Woodfordian in age and is quite sandy with numerous lenses of sand and silt.

The brown till unit (No. 2) below the Gifford is also Woodfordian in age and may be the Urbana till. However, it is difficult to distinguish the individual Woodfordian tills. Therefore, till No. 2 may represent an older till associated with any of the older moraines located to the south. The older moraines, however, occur 20 miles or more to the south in the direction of ice flow. Therefore, it is very likely that tills representing these advances were eroded away by each successive readvance. The Urbana would most likely be preserved because the Urbana Moraine occurs 5 miles to the south.

Till units No. 3 and No. 4 are most likely from the Illinois Glacial Episode and probably represent the Liman and Buffalo Hart advances, which covered this part of Illinois more than 200,000 years ago. The lower pinkish till is generally overlain by a gray till containing a good Sangamon Soil zone. However, there is no evidence of the Sangamon Soil at this stop. The soil was most likely eroded away by the Woodfordian glacier. The firmness or compactness of these tills suggests that they are relatively old. The Illinois tills are generally more compact than the younger Wisconsin tills that have not been overridden so many times by heavy ice sheets.

The dark gray-brown till unit (No. 5) below the pink till may be a pre-Illinois till. However, the absence of any weathering to represent the Aftonian interval makes classification of this till uncertain. This till may also be an Illinois Episode till, representing an early advance of the Liman glacier. Till unit No. 5 rests on the Pennsylvanian age Farmington Shale.

Till is an ice-laid deposit characterized by a lack of sorting and a lack of stratification. Note the wide range of particle sizes from clay to boulders in the tills in this exposure. Many of the rock fragments were eroded from the local Pennsylvanian bedrock by the glacier. Many kinds of sedimentary, igneous, and metamorphic rocks are in the till. These rocks were carried into Illinois from areas far to the north and include many Precambrian crystalline rocks from Canada. Many of the rock fragments are faceted (flattened on one or more sides) and striated (scratched) from having been dragged along the frozen ground by the glacier.

Economic Importance The Farmington Shale was extensively mined for the production of bricks in the Danville area. The Pleistocene glacial deposits are a major source of sands and gravels.

STOP 3: Middle Fork of the Vermilion River, Kennekuk County Park (NW, NW, SW, Sec. 16, T20N, R12W, 2nd P.M., Danville NW 7.5-minute Quadrangle, Vermilion County).

At this stop, we will discuss some of the mechanics of river development—erosion, transportation, and deposition. A large gravel bar is exposed at low water levels along this stretch of the river, south of the small creek entering into the Middle Fork from the east bank. There are two distinct levels of floodplains, or terraces, along the river in this area, and a large abandoned meander scar occurs along the east side of the floodplain. A wide variety of erratics and a sample of river-deposited sands can be collected from the gravel bar.

The major rivers within the field trip were originally incised by glacial meltwaters, which is why the rivers in this area are deeply cut into the surrounding landscape. Tributaries entering into these rivers have generally deep, V-shaped profiles. These tributaries are in the process of downcutting to establish equilibrium with their master streams. The main rivers are in mature stages of development, as indicated by their meandering coarse within the river valleys. Most of the stream's energies are focused on widening the former river valleys. Once the tributaries reach equilibrium with the master streams, they will change from a youthful stage to a mature stage and start meandering, which enlarges their valleys. From its mouth (where it empties into the master stream) to the head of the stream, the width of a tributary stream decreases. Stream gradients of the tributaries are greater than the master streams.

Middle Fork of the Vermilion River

The Middle Fork is Illinois' only National Wild and Scenic River, a designation based on the outstanding scenic, ecological, recreational, and historical characteristics of a 17-mile stretch. The U.S. Department of the Interior gave this designation to the river in 1990. The designation was controversial because it essentially doomed any hopes of the long proposed Middle Fork Reservoir project.

The designated stretch begins at the northern boundary of the Middle Fork State Fish and Wildlife Area in the vicinity of Higginsville, extends through Kennekuk County Park, Illinois Power Company property, and on through Kickapoo State Park, where it ends at the park's south boundary. Through a cooperative effort, a 1,000-foot scenic corridor has been established along the river.

The stream is rated Class A and supports the bluebreasted darter, an Illinois endangered species. The Middle Fork offers excellent canoeing and fishing opportunities. Canoe access is available at Kinny's Ford and Higginsville Bridge to the north, the Bunker Hill access areas in the Middle Fork Wildlife Area and Kennekuk Co. Park immediately north of this stop, and at Kickapoo State Park.

STOP 4: The Meadow Day Use Area, Kickapoo State Park, Waterfall above Clear Pond (NE, SW, NE, Sec. 5, T19N, R12W, 2 nd P.M., Danville NW 7.5-minute Quadrangle, Vermilion County).

From the parking lot, follow the trail northwest toward the lookout on the top of the bluffs overlooking Clear Pond. Two waterfalls are located south of the overlook (fig. 11). The deposits exposed here represent part of the Patoka and Shelburn Formations. The upper waterfall is developed in a sandstone (Trivoli Sandstone Member of the Patoka Formation), which is underlain by a gray shale. The second waterfall is developed on an argillaceous marine limestone (West Franklin Limestone Member of the Shelburn Formation), which is underlain by a lower gray shale.

Figure 11 Waterfalls above Clear Lake, access from The Meadow day use area, Kickapoo State Park (photo by W.T. Frankie).

The Danville Coal lies about 25 feet below water level. Normally the thick gray shale that lies above it would be present up to the top of the cliff. However, shortly after the deposition of this shale, a stream or estuary cut a deep channel through it. At some stage, the cut was deep enough to allow sea waters to flow into the channel, as is shown by the presence of mollusks, brachiopods, and crinoids in the argillaceous limestone (West Franklin Limestone) forming the lower falls. The channel was then filled with mud, which most likely represents a terrestrial flood deposit. The mud (now a gray shale) was overlain by stream-deposited sands, gravels, and leaves, branches and logs from ancient trees. The upper sandstone (Trivoli Sandstone Member) contains Pennsylvanian plant fossils including *Sigillaria, Calamites,* and *Neuropteris* fragments (Raasch 1948).

Stratigraphic Section

Glacial till	2.0+ feet
Trivoli Sandstone Member, with plant fossils; forms upper waterfall	2–2.5 feet
Shale, gray	4.0 feet
West Franklin Limestone Member, argillaceous, with fossils; forms lower waterfall	3.0 feet
Shale, gray	20+ feet
Clear Pond water level	

STOP 5: LUNCH, Pavilion, Kickapoo State Park (NW, SW, NE, SW, Sec. 4, T19N, R12W, 2nd P.M., Danville NW 7.5-minute Quadrangle, Vermilion County).

Located behind the shelter is a set of stairs leading to High Pond. The slope between the shelter and High Pond was not mined and contains an undisturbed mature oak, hickory, and birch forest. The short round pillars in front of the pavilion contain excellent examples of the wide variety of glacial erratics that can be found in the creek beds and in the sand and gravel bars within the field trip area. A large gob pile is located north of the Pavilion.

STOP 6: Gob Pile, Dering Coal Company (NW, NW, SE, Sec. 15, T18N, R12W, 2nd P.M., Danville SW 7.5-minute Quadrangle, Vermilion County).

Figure 12 Gob Pile, Dering Coal Company (photo by W.T. Frankie).

The gob pile, an abandoned mine dump, is the accumulation of waste products from an underground mine (fig. 12). The piles are known variously as gob piles, slate dumps, boney piles, and culm banks. The gob pile stands about 150 feet above the general land surface. Excellent plant fossils have been collected from the gob pile at this mine. A second large gob pile, located southeast of this stop on the east side of the road, has been reclaimed.

The Dering Coal Company opened the No. 4 Mine here in 1904 to mine the Herrin Coal, which was reported to range from 4.5 to 10.0 feet thick and averaged 5.75 feet at a depth of 208 feet. Four feet of Danville Coal was reported to occur 100 feet from the surface. The mine shaft was located about 300 feet west of the road at the end of the gob pile. The Dering Coal Company operated the No. 4 Mine from 1904 to 1909, followed by the Brazil Block Coal Company, Brazil No. 4 mine, from 1909 to 1911. The Dering Coal Company once again operated the mine between 1911 and 1916, followed by the Peabody Coal Company, which changed the mine name to the Peabody No. 24 Mine and operated it from 1916 to 1944. The last owner was the Chicago Harrisburg Coal Company, which operated the mine from 1944 to 1946. The mine had a cumulative production of 18,054,349 tons.

The gob pile was created by dumping unwanted rocks that were removed from the mine. The early mining methods were labor intensive. Coal miners dug several inches of underclay by hand from under the coal seam so they could break the coal down and out from what is called the working face. In addition, along their haulage ways, they dug out rock above the coal to make a high tunnel so that mules pulling the mine cars could walk through. Rock that fell and sagged into the haulage ways had to be removed to keep them open. The waste rock that could not be stowed in the underground openings left after the coal was mined was brought to the surface and dumped on the pile.

The composition of the waste rock in the gob pile is from both the underclay, which is a soft gray shale, the rock the miners called "soapstone," and the Energy Shale, the gray shale above the Herrin Coal that formed the roof of the mine and was dug down to heighten the haulage ways. Exposed to weather, the shale softened, and finally turned to mud.

These gob piles contain iron pyrite, sometimes called "fool's gold" because of its yellow metallic luster. Pyrite is iron sulfide, which is stable buried beneath the earth surface. When exposed to water and oxygen, however, pyrite oxidizes and produces sulfuric acid, iron oxides, and hydroxides. The iron oxides and hydroxides, which are similar to common rust, tint these gob piles red. Sulfuric acid, however, pollutes both the water and the soil around the mines.

In addition, some gob piles have been known to spontaneously combust and burn for many years after the old mines were abandoned. This combustion is initiated by the oxidation of the pyrite and the absorption of oxygen. Air leaks through the pile to the coal and shale material and supplies the needed oxygen for combustion. Conditions do not allow heat to dissipate, and temperature rises, which ignites the coal and shale materials. The cooked shale makes hard brick-like chips that clink underfoot. This red deposit is nicknamed "red dog" by miners. Does the red shale remind you of the red bricks that were manufactured in the Danville area?

Less common are the plates of "blistered" black shale. The miners called this rock "slate," perhaps because it is hard and splits into smooth sheets. The black shale generally lies on top of the gray shale above the Herrin Coal. Sometimes, however, the black shale is close enough to the coal to be taken down when heightening the haulage ways. Strewn over the slopes are dark gray and brown ironstone nodules—heavy for their size—which were formed in the gray shale above the coal. Of course, there are a few pieces of coal on the pile.

Located to the south, in Sec. 28, 29, 32, and 33 of T18N, R12W, is the Black Beauty Coal Company, Riola Mine, opened in 1996. This underground slope mine is operating in the Herrin Coal seam. Looking to the south, you can see some of the current mining operations spoil piles. Because of the current mining laws and regulations, these newer spoil piles will be contoured, covered with top soil, and seeded, much like the old reclaimed gob pile across the road from this stop.

STOP 7: Material Services Corp., Fairmount Quarry (SW, SE, Sec. 6, T18N, R13W, 2nd P.M., Oakwood 7.5-minute Quadrangle, Vermilion County)

Do not enter quarry without permission. The Fairmount Quarry is operating in the Pennsylvanian age, Livingston Limestone, the uppermost member of the Bond Formation (fig. 2). The Livingston is the youngest bedrock unit in the field trip area and is 20 feet thick here. In this locality, the limestone has been preserved as an outlier or isolated remnant in a narrow belt of the Bond Formation along the axis of the Marshall-Sidell Syncline (fig. 5). The youngest strata are always exposed along the axis or center line of an eroded syncline.

Quarrying is being accomplished by using two draglines operating simultaneously but in different parts of the quarry. This quarry has an estimated reserve of 70 million tons.

The following descriptions are from the NW, NE, Sec. 20 in the old portion of the quarry, located southeast of the present quarry operations (modified from Langenheim and Mann 1980). The Livingston Limestone is medium blue-gray, weathered medium to light gray; thin bedded 1- to 6-inch beds, some of which have red clay partings; bedding stylolitized throughout, but preferentially on clay partings; very fine grained, brecciated in part; containing whole and fragmentary fossils including fenestrate bryozoans, brachiopods, and crinoidal columnals. The Livingston grades downward to an argillaceous limestone that is medium gray weathered light gray, and medium grained with clasts of black shale. The Livingston Limestone is underlain by a black, moderately fissile shale, containing scattered brachiopodal lenses with *Acrontretidina*, *Productina*, *Composita*, and possibly *Lingula* fossils. The Livingston Limestone probably originated as a carbonate bank deposit on which carbonate mud, largely generated by algal action, was entrapped by algal growth.

The limestone is generally overlain by less than 30 feet of glacial till, which is subsequently overlain by about 3 feet of loess. The limestone surface displays a well-developed polished and striated surface. Striations range in orientation from due north to N40°E; dominant orientations indicate ice movement from N10°E and N30°E. Locally the surface is grooved, and relatively large clasts are concentrated in the till filling the groves.

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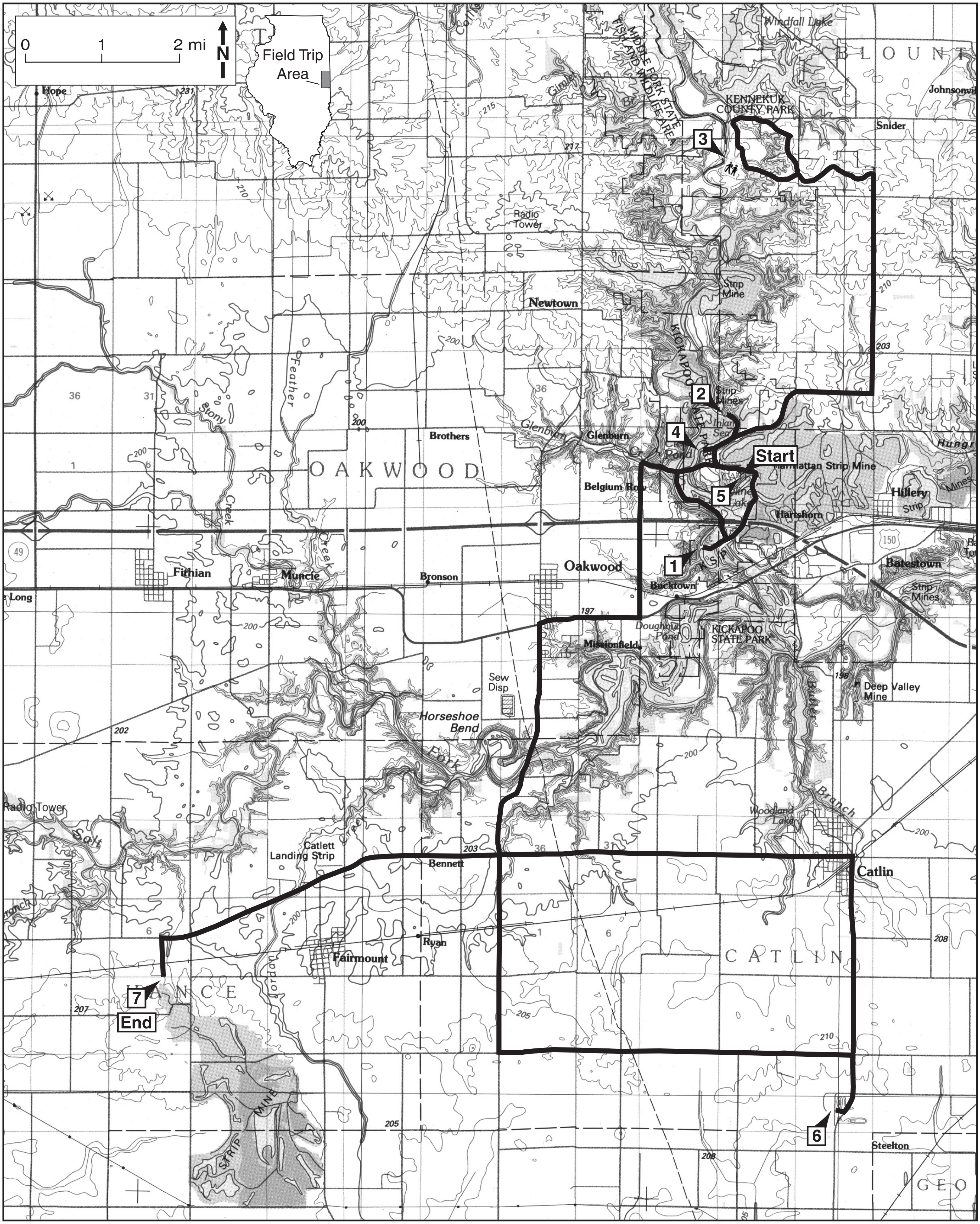

0 1 2 mi
N
Field Trip Area
Start
End
1
2
3
4
5
6
7
Hope
Newtown
Radio Tower
Brothers
Glenburn
Belgium Row
OAKWOOD
Oakwood
Fithian
Muncie
Bronson
Bucktown
Missionfield
Doughnut Pond
KICKAPOO STATE PARK
KENNEKUK COUNTY PARK
MIDDLE FORK STATE FISH AND WILDLIFE AREA
Windfall Lake
BLOUNT
Snider
Strip Mine
Strip Mines
Inland Sea
Clear Pond
Emerald Lake
Harmattan Strip Mine
Hillery
Hartshorn
Batestown
Strip Mines
Deep Valley Mine
Sew Disp
Horseshoe Bend
Fork
Salt
Catlett Landing Strip
Bennett
Ryan
Fairmount
Catlin
CATLIN
Woodland Lake
Butler Branch
Steelton
STRIP MINE
Feather Creek
Stony Creek
Jordan
Radio Tower
Long