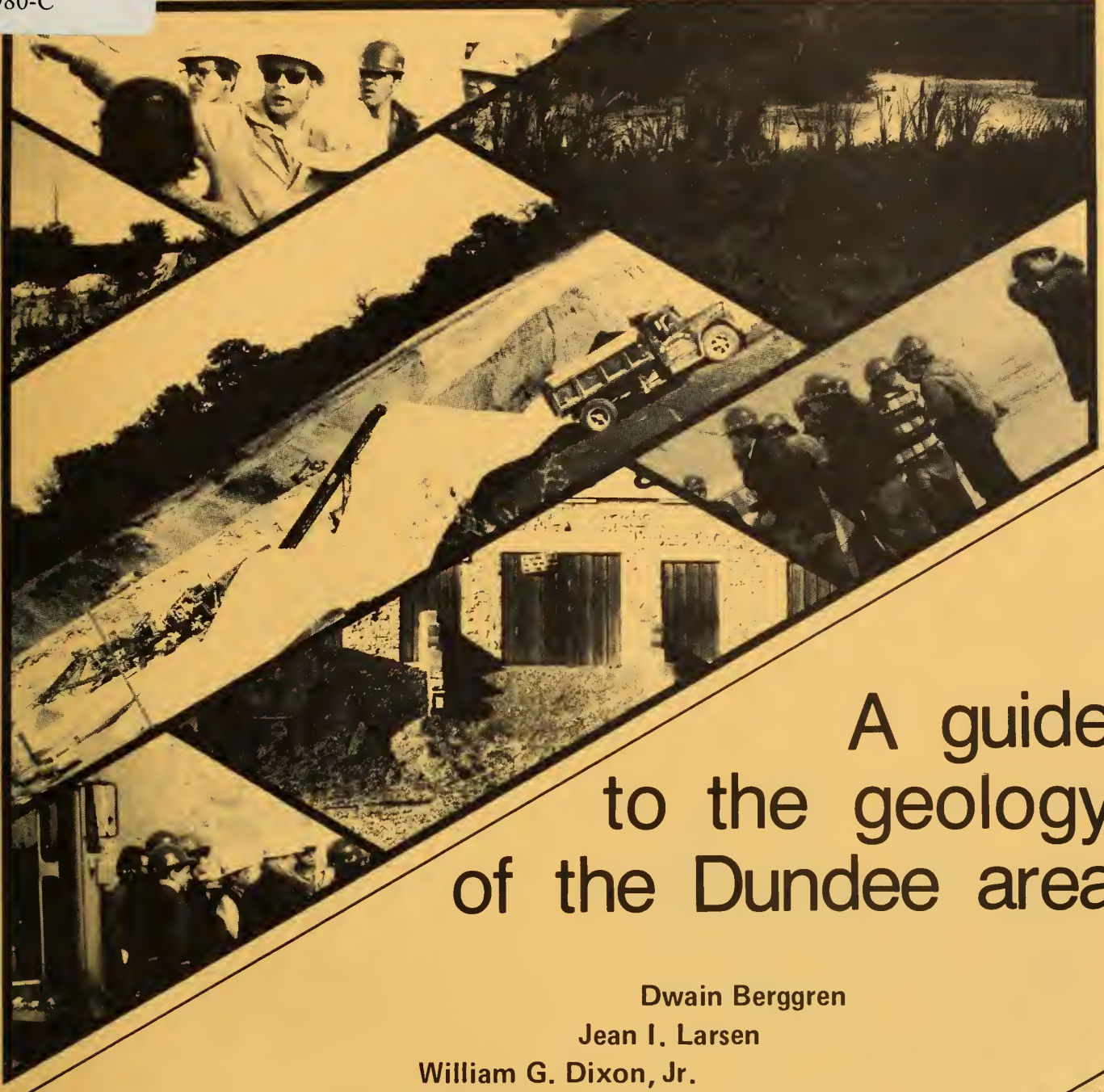


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A guide to the geology of the Dundee area

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Field Trip Guide Leaflet 1980 C
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Illinois Institute of Natural Resources
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Commemorating the 50th Field Trip Season and the Survey's 75th year.

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1980...75 YEARS OF THE SURVEY

50 YEARS OF FIELD TRIPS

In 1930 the Geological Survey was 25 years old and the new Educational Extension Section was conducting its first field trips. Dr. M. M. Leighton, the Survey's third Chief, had created the section and its program "...to cooperate with the science teachers of the state and furnish them information regarding geology, such as will be helpful in their teaching of earth history and the development of life."

Part of the Section's work was to start a series of six annual "earth history field trips." More than 250 teachers and laymen attended the first year's trips near Dundee, La Salle-Starved Rock, Charleston-Mattoon-Effingham, Harrisburg-Shawneetown, Quincy, and Rock Island. In its 50 years (except for the war years 1942 to 1945), Ed. Extension has conducted more than 290 field trips. In 1979, 367 people from all walks of life attended the Survey's four field trips.

Right. Dr. Leighton (in the suit) and Don Carroll, the first Section Head, pose on the Peoria field trip, May 2, 1931.



TO THE READER:

Welcome to the Dundee field trip. As part of the 75th anniversary celebration of the present Illinois Geological Survey, we are pleased to revisit the same area where the newly formed Educational Extension Section of the Survey conducted one of its first field trips in 1930. Unfortunately, no guide books were printed for that trip and no record remains of the itinerary. We are certain, however, that the trip participants in 1930 examined some of the same materials and discussed some of the same geologic conditions that we will observe today, even though time has brought many changes to the area over the past 50 years.

During the trip we will discuss the physical geology of the region and try to explain the nature, origin, and structure of some of the earth's features that we will see. We will also consider how the people who have chosen to live here have accommodated themselves to the natural environment, and how they are using the earth's resources in the area.

Our itinerary will cover parts of two counties—southeastern McHenry and northeastern Kane. A brief review of the social and economic 50-year history of this area reveals that the area's history is similar to that of many other parts of the United States with similar geologic and geographic settings; indeed, past and present trends here could represent, in microcosm, the flow of events in other areas of the country.

In the depression year of 1930, all of the towns in this region (with the exception of Elgin) were quiet, small, well dispersed, and rural in character; woodlands, fields, and farms occupied the rest of the region. In addition, summer cottages of Chicago residents lined the banks of the Fox River in McHenry County. Chicago lies only 40 miles southeast of this area, however, and the post-World War II population explosion that started the classic "flight to the suburbs" inevitably brought many newly affluent residents to this area. As a result, what used to be quiet country towns in 1930 were well on their way to becoming burgeoning suburbs 30 years later. Where once there were unbroken stretches of quiet fields and hills, there were numerous subdivisions scattered randomly throughout the countryside.

By the late 1960s and early 70s, residents and planning officials of both counties became very concerned with the problems of never-ending, unplanned growth. Such growth would diminish the countrylike charm of the area, require great expansions in municipal services, and severely tax the environmental resources.

Nevertheless, the most serious problem that was developing in this area was unrecognized for many years. This was the gradual but continual conversion of farmland for other than agricultural uses. Some of the most productive agri-

cultural land in the United States is located in Illinois. A portion of this fertile land stretches across Kane and McHenry Counties, and agricultural products contribute significantly to the health of each county's economy and to the food supply of our nation.

Because the farms of Kane and McHenry Counties lie only 40 to 60 miles from a major urban center, they have been intensively developed for subdivisions. By the late 1970s, each county had become sufficiently concerned about its disappearing farmland to adopt general planning policies designed to stop, or at least slow, this trend. Because the growth pattern in each county had differed, due to dissimilar geography, each had to adopt a different plan to cope with this problem.

In Kane County the greatest percentage of agricultural acreage lies west of the Fox River. The river flows north-south, near the eastern boundary of the county. The Fox Valley area is closer to Chicago than any of the agricultural land west of it, and since its earliest settlement in the 1830s, the valley has always been a natural corridor for industrial, commercial, and residential development. The commuter rail lines that reach Kane County terminate in the Fox Valley towns. This situation has been somewhat fortuitous in slowing suburban expansion into the western agricultural areas, because relatively few citizens are willing to commute such long distances. To slow the trend of subdivision development, the county has adopted policies endeavoring to confine additional subdivisions to within 5 miles west of the Fox River, or approximately to Randall Road, which runs north-south throughout the county. As part of today's itinerary, we will cross Randall Road twice.

The southeastern part of McHenry County had experienced considerable development by 1970, since it was within 40 to 45 miles of Chicago. Commuter rail lines ran almost across the entire width of McHenry County, and residential and subdivision development was becoming widely dispersed. This situation jeopardized the number of farms in the county and taxed the ability of public works agencies to supply services such as water and sewer lines to outlying residents. As a result, McHenry County adopted policies that encouraged residential development only in areas contiguous to the existing towns and villages, where municipal services were more readily available and where subdivisions would be less likely to carve up larger areas of existing farmland.

As we proceed with our itinerary, we hope that you will enjoy the geologic discussions and take the time to notice the results of 50 years of development in the area. The pressures that suburban growth have exerted on the glacially derived prime agricultural land is apparent throughout much of the region.

the geologic framework

A picture of the area

If a long, deep trench were dug between West Dundee on the east to near the village of Hampshire on the west, we could see in its sides the layers of earth and rock that lie beneath the land surface. Figure 1 shows roughly the trenchlike view of the earth that we would see between these two towns. This kind of drawing is called a geologic cross section, and the layers with differing patterns represent, in a general way, the variety of rock and earth materials that would be encountered in such a trench.

Across most of Kane County deposits of glacial drift—layers of unconsolidated clay, gravel, and gravelly mud—cover the consolidated rock layers of Silurian dolostone and Maquoketa Shale. At the surface of the county a wide, glaciated plain occupies the central part; the deep valley of the Fox River is on the east, and the high Marengo Moraine is to the west. All of these topographic features trend generally north-south. The Marengo Moraine is almost 150 feet higher than the plain east of it, and the floor of the Fox River valley lies 150 feet below the plain; therefore, there is a total of approximately 300

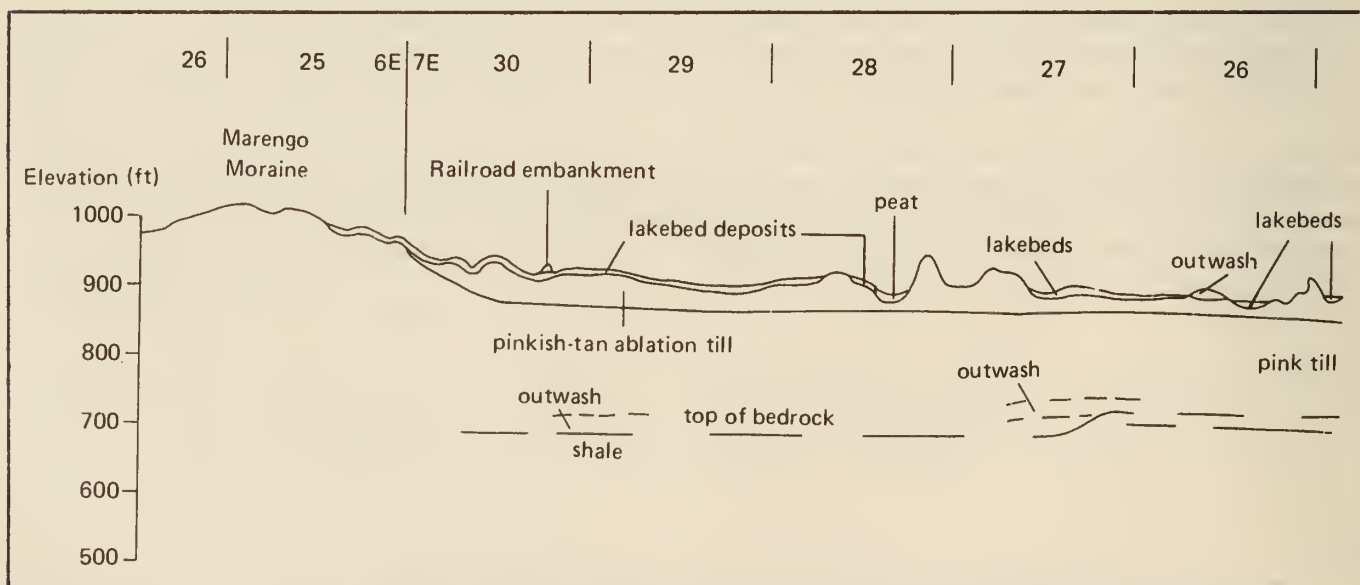


Figure 1. Cross section of land extending from southwest of Allen's Corner eastward to southeast of East Dundee.

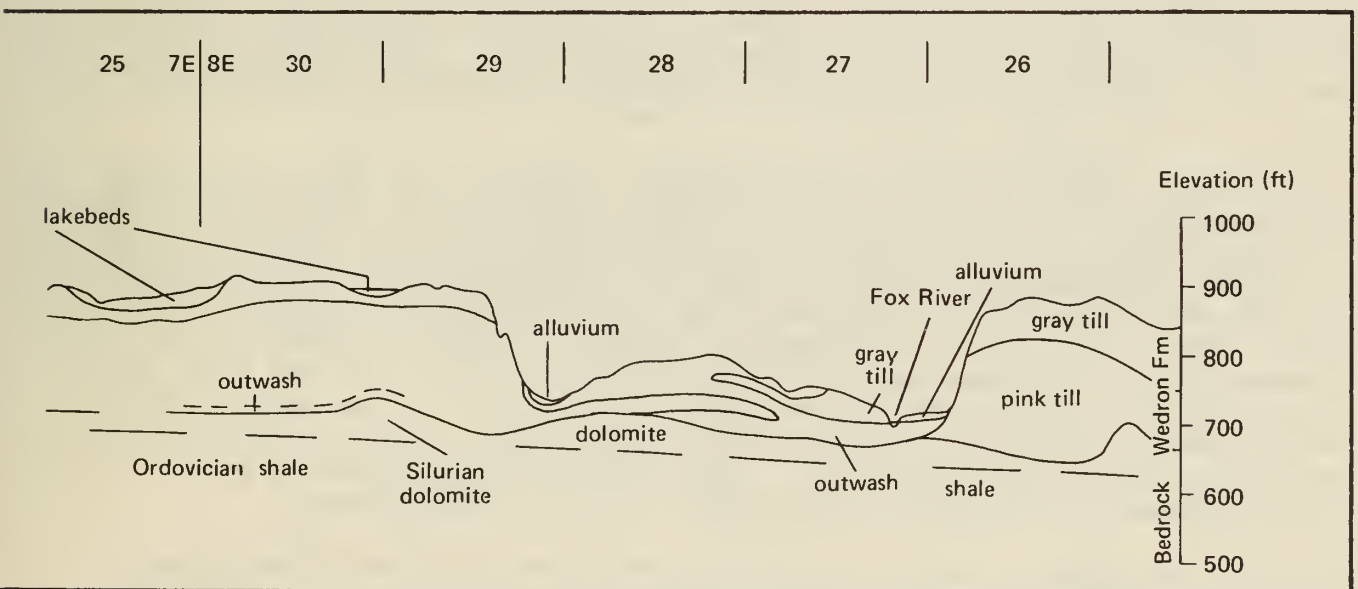
feet of relief in the cross section from the floor of the Fox River valley to to the top of the Marengo Moraine.

Between 22,000 and 14,000 years ago, glaciers deposited the drift material that now shapes the land surface. The glaciers flowed west and south across Kane and McHenry Counties from Wisconsin and from the basin that now holds Lake Michigan. The deep, north-trending Fox River valley was cut by meltwaters flowing along several ice fronts that had formed to the east. This is still a youthful land surface; the land has remained essentially unaltered since the final retreat of the glaciers.

In the eastern part of Kane County, strata of dolostone form the solid rock (or bedrock) under the surface deposits of glacial drift. Although no bedrock crops out at the surface of our cross section, the bedrock lies only 50 feet below the floor of the Fox River. Away from the river it is generally covered by 150 to 200 feet of glacial drift. The dolostone beds are solidified layers of shells, shell sands, and chalky muds that accumulated on the bottom of a warm sea that covered the Midwest during the Silurian Period—the interval of geologic time between 435 and 395 million years ago.

In the western part of Kane County, the Maquoketa Shale Group forms the bedrock under the surface deposits of glacial drift. The shale beds are solidified layers of clayey, limey mud that also formed on the bottom of a warm sea during the Ordovician Period—the geologic time interval that preceded the Silurian.

Dolostone is an important mineral in Illinois because it is a hard, dense, tough material that has many uses in the construction industry. Shale, how-



ever, was important in the past to the construction in this area, since it was used to make bricks and tiles.

In the counties that lie east of Kane and McHenry, the Silurian dolostone strata are important sources of ground water, since these beds thicken in that direction to an average of 200 feet or more. In Kane and McHenry Counties, however, the Silurian dolostone strata quickly "wedge out" toward the west so that they are only 50 feet or less in thickness. Because these strata are so thin in this area, they are incapable of yielding much water. The Maquoketa Shale strata underlying the dolostone are rarely good sources of water.

Till is the kind of glacial drift that is deposited directly by glacial ice, either beneath it or on its melting surface. It is typically a compact, sandy or silty clay that has pebbles, cobbles, and boulders mixed throughout; none of these materials are sorted by size in a till mass. Each glacier left its distinctive till sheet, and in some of the areas that we will visit, we will see two very different types of till (fig. 1). The Tiskilwa Till Member of the Wedron Formation is a sandy, clayey material that always has a characteristic pinkish to reddish cast; the Yorkville Till Member of the Wedron Formation is always gray in the unweathered state and has a much lower sand-to-clay ratio than the Tiskilwa. Till deposits form either sheetlike plains called ground moraines (present throughout central Kane County), or morainic ridges, which are upland hills of till. The Marengo Moraine, composed of Tiskilwa till, forms the highest and most conspicuous ridge in Kane and McHenry Counties. It is a terminal moraine marking the edge of the ice front, where till material that was continually being carried forward by the flowing ice was subsequently released at the edge of the front. The longer an ice front stabilized, or remained in one position, the higher the moraine would be.

Ablation till, shown in the top of the pink till on figure 1, began to form when the ice lost its forward motion and stagnated. The ice mass began to melt in place, and ground-up rock material that had been frozen into the ice and had formed the parent material of the till was released onto the underlying ground surface and was no longer carried forward to the edge of the ice. All of this ice melting in place produced large quantities of water, and some of the till material became sorted and size segregated. Many small patches and lenses of sand and gravel became intermixed in the mass of unsorted till. We will see some typical ablation till at one of our trip stops.

In the final melting stage in Kane and McHenry Counties, the last remnants of glacial meltwater formed shallow, widespread lakes over the low-lying areas of ground moraine. This meltwater became ponded because drainage channels to the Fox River were dammed up by glacial debris. These lakes were shortlived but their former existence is evidenced by the thin, widespread lakebed deposits (Carmi Member of the Equality Formation) present throughout the area. The lakebed deposits are composed of alternating beds of thin clays and silt, with some sand and gravel layers. As we travel along our route, you will notice a large number of scattered, very flat-lying areas; these are the former beds of the old, shortlived, glacial lakes. These lakes eventually drained when natural channels were finally cut through by free-flowing streams.

Whenever and wherever glacial ice began to melt, the released waters sorted the huge quantities of earth debris that were left behind by the ice. These streams of meltwater washed and sorted materials—roughly by size—and then

deposited them in the channels and water courses passing through the ice fields and draining away from them. These deposits are called glacial outwash and consist mostly of sand and gravel. Sand and gravel deposits may occur at ground surface or beneath. Those beneath the surface are most commonly below older, over-ridden till sheets. Large quantities of sand and gravel were deposited along glacial drainageways such as the Fox River. Other large deposits of sand and gravel form extensive plains called outwash plains, where this material was deposited in thick, widespread sheets in front of a melting glacier. In McHenry County we will travel across one of the largest sheets of outwash found in northeastern Illinois and visit one of the sand and gravel pits dug into this outwash.

Glacial sand and gravel deposits are important resources not only because they supply construction materials, but also because they may yield large quantities of ground water. McHenry County contains vast quantities of glacial outwash and is abundantly endowed with both mineral aggregate and ground-water resources.

Since the glaciers have melted away, small quantities of materials have been, and are still being, deposited. Peat has accumulated in small, undrained depressions left by the glaciers, and flood plain deposits of alluvium have accumulated in stream valleys. In addition, loess has been spread over most of the landscape. This dustlike material was blown off the barren, glaciated landscape before vegetation became re-established. In some instances, loess was deposited many miles from its place of origin. In the area we will visit, the loess deposits are 2 to 3 feet thick and can be seen just beneath the ground surface in the soil profile. The loess can be identified by its flour-like consistency and its lack of pebbles.

Mineral resources

In 1978, mineral materials mined in Illinois totaled approximately \$1,637,000,000 in worth. Crushed stone and sand and gravel are the mineral materials produced in Kane and McHenry Counties. Sixty Illinois counties having 271 quarries produced about 62,456,000 tons of crushed stone valued at \$160,475,000. Fifty-nine counties having 197 operations owned by 172 companies produced 37,700,000 tons of sand and gravel valued at \$83,694,000.

Kane County ranks 24th out of Illinois' 100 mineral-producing counties in total value of mineral materials mined, having a value of \$17,714,000; in addition, some mineral materials were processed and manufactured in the county. McHenry County ranks 27th among the counties with a total value of \$18,308,000 of mineral materials produced; no mineral materials were reported to have been processed or manufactured there.

guide to the route

The field trip begins in West Dundee at the Administrative Office Building of Dundee Community Unit School District 300. The address is 405 North Sixth Street, 3 blocks north of Main Street, which is Illinois Route 68/72.

STOP ①

Administrative office building (SE¼NW¼SE¼ Sec. 22, T. 42 N., R. 8 E., 3rd P.M., Kane County; Elgin 7.5-minute Quadrangle). The text for Stop 1 is taken from material assembled by Chet Hollister, Earth Science Instructor, Algonquin Middle School.

A walk along a street or around a building can provide many lessons in geology. Among other things, it illustrates the extent to which we depend on the most ordinary kinds of earth materials; that these materials are involved in our aesthetic activities; and that when exposed to the surface elements, earth materials are continually being changed.

Follow the guide map (fig. 2) and proceed at your own pace through this "field trip." We suggest you use a 10X hand lens or a small magnifying glass to examine some of the material and features.

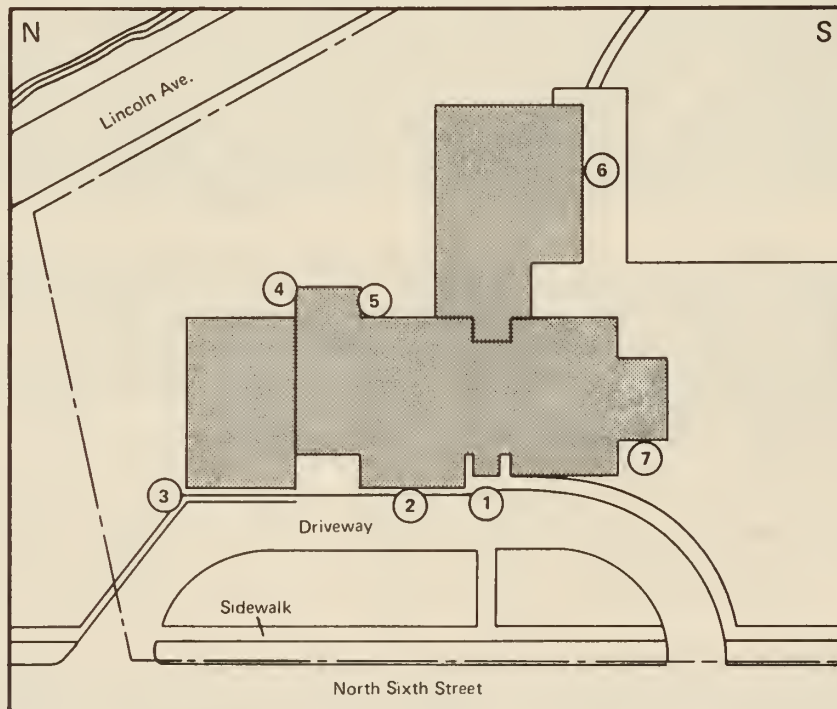


Figure 2. Guide map for Stop 1.

Point 1

Examine the concrete pavement along the front of the building. From what materials would you say the concrete is made? What evidence can you see to determine if it formed from a fluid or solid mass?

Concrete is made by mixing certain proportions of sand, gravel (or crushed stone), water, and cement to make a slurry that hardens some hours after it is mixed. The cement that binds the solid parts together is made by pulverizing the clinker that forms when limestone is fused with clay or shale at red heat. Cement mixed with water hardens because the minerals made by burning the rock combine with water to form new minerals that grow crystals; the crystals interlock to bind themselves and the other solids (the aggregates) into a rocklike mass.

Concrete resembles a kind of sedimentary rock called conglomerate. Closely studying a piece of concrete will help one to recognize the natural rocks that contain sand, gravel, or rock fragments. Wet concrete is also like mud and the soft sediments in that it often preserves traces of living things on its surface. Traces and remains of prehistoric life preserved in rock are called fossils, but such features in concrete are not old enough to be true fossils. The tool marks in the cement patch near the front door are like trace fossils in natural rocks, being traces of a life activity, but are not body fossils (the remains or impressions of the remains of a plant or animal).

The cracks in concrete, like joints in rock, are nearly vertical fractures along which there has been no apparent movement. Concrete, like rock, is brittle and can break by flexing or impact.

The pock-marked and scaling patches on the older sidewalk are caused by salt-fretting. Salt (NaCl) scattered on the walk to melt ice dissolved in the meltwater and soaked into the concrete. As the sidewalk dried, salt crystals began to grow between the particles in the concrete, thrusting the particles apart and finally breaking loose chips from the surface.

Examine the bricks in the wall closely. Bricks are made by molding a clay-rich mud into blocks and firing them in a kiln until the very fine quartz grains and clay mineral grains in the material fuse. Firing causes the original materials to combine to some extent and form new minerals.

Brick is a synthetic stone that resembles some natural metamorphic rocks: for example, shales that are fired underground over burning coal beds, or rocks baked by contact with molten rock. The colors and marks on the surfaces of a brick often show how it was formed and handled. Decorated textures are applied to some bricks.

Examine the mortar between the bricks. How is the sand in the mortar different from and like the sand in the bricks, or in the concrete? What is the shape and surface texture of most sand grains? How many different kinds of sand grains do you find?

Mortar is a bonding material that holds the bricks in a wall together. Mortars today are made by mixing cement, sand, and water. Cement makes a much stronger mortar than lime, which was generally used in masonry before this

century. See if you can find any evidence of 19th century lime mortar in this building.

Examine the large blocks of stone on each corner of this part of the building. The blocks are a marine sediment called dolostone. Dolostone is rarely used as building stone any more; this stone was quarried locally. Notice that the blocks seem to be peeling off in layers. This type of weathering is called exfoliation. In places the blocks are splitting along the natural layering or bedding of the rock.

Point 2

Examine the windowsills in this part of the building and compare them with the sills in the gymnasium addition to the north. The sills are made of Indiana Limestone, which is composed of fossil grains; it is a shell sand deposit. The looping, ribbonlike workings are the burrow traces of wormlike animals that lived in the sand.

The sills in both places are limestone, the same sedimentary rock that makes up the rough blocks in the foundation. Compare and contrast the two limestones in this part of the building. Why is one a better building stone than the other? Notice also that the windowsills seem to be covered with a cement wash. Why would this be necessary? Is there any evidence under the wash of how these blocks were prepared for use?

Point 3

Compare the large blocks on the building corners with what you saw at the first two points. Is the gymnasium part of the original building, or was it added at a later date? How can you tell?

Examine the flagstones near the northwest corner of the building. What kind of rock are the stones? Is there any evidence of life (fossils) in these rocks?

Point 4

Examine the concrete foundation wall at this point. The concrete here shows a wood grain pattern. How is this possible? What type of "fossil" would this be? By this time, it is apparent that not all parts of the building are of the same age or even the same era of construction.

Point 5

Notice the pieces of flagstone near the base of the fire escape. You should be able to find some fossils that will help you determine how limestone is formed. Examine the rock with a hand lens to see the individual grains.

Examine the dolostone blocks in the old foundation in the main building. You will see one main feature of sedimentary rocks: they are laid down in layers or beds. It is along such bedding surfaces or planes that fossils are usually found. Are the bedding planes oriented any particular way in the construction of the building? What effect would there be if the bedding planes were placed vertically?

The windowsills in the kitchen and in the multi-purpose addition to the south of this point are shown on the blueprints to be "Indiana" or "Bedford" Limestone. This stone is Mississippian in age, having been deposited perhaps nearly 335 million years ago at the bottom of a sea that covered much of what is now the central United States. It has been a very popular cut stone for many years, so pieces of it are easy to find in midwestern buildings. Limestone deposits of the same age occur in Illinois.

Return to point 3 and compare the stone you saw there with the sills here. Are they in fact the same kind of limestone?

Notice the wood grain in the foundation of the gymnasium addition to the south of point 5. How are these imprints different from those you saw at point 4? You can see how building methods and materials change; even forms for poured concrete change over the years.

Point 6

Compare the windowsills on the south side of the gymnasium with those near point 6 on the north side. How are they different? Why is the amount of weathering of the building stone different? Are the bricks being affected the same way?

Examine the sand and gravel in the parking area near this point. What kind of rock is most of the gravel? Is the sand the same material? What is the source of the sand and gravel used for construction in this area?

Point 7

The builder's plate on the fire escape tower (above the double sheet doors) provides another way of dating part of the construction of the building. How closely can you establish when the fire escape was installed? Was it part of the original building or was it added later?

Notice the erosion in the corner behind the fire escape tower. What is causing this erosion? Is it affecting the brick, stone, or mortar to the greatest extent? What role is the moss playing here? How would you explain this moss on the south and west wall of a building to someone who believes moss grows on the north side?

The history of the buildings starts with the construction of the original three-story building in 1885. Inside the present foundations are remains of the foundation for a pre-Civil War building that burned. The two-story gymnasium to the north was added in 1916, and the multi-purpose room on the east was added in 1954. The entire structure was converted for use as the administrative office in 1972.

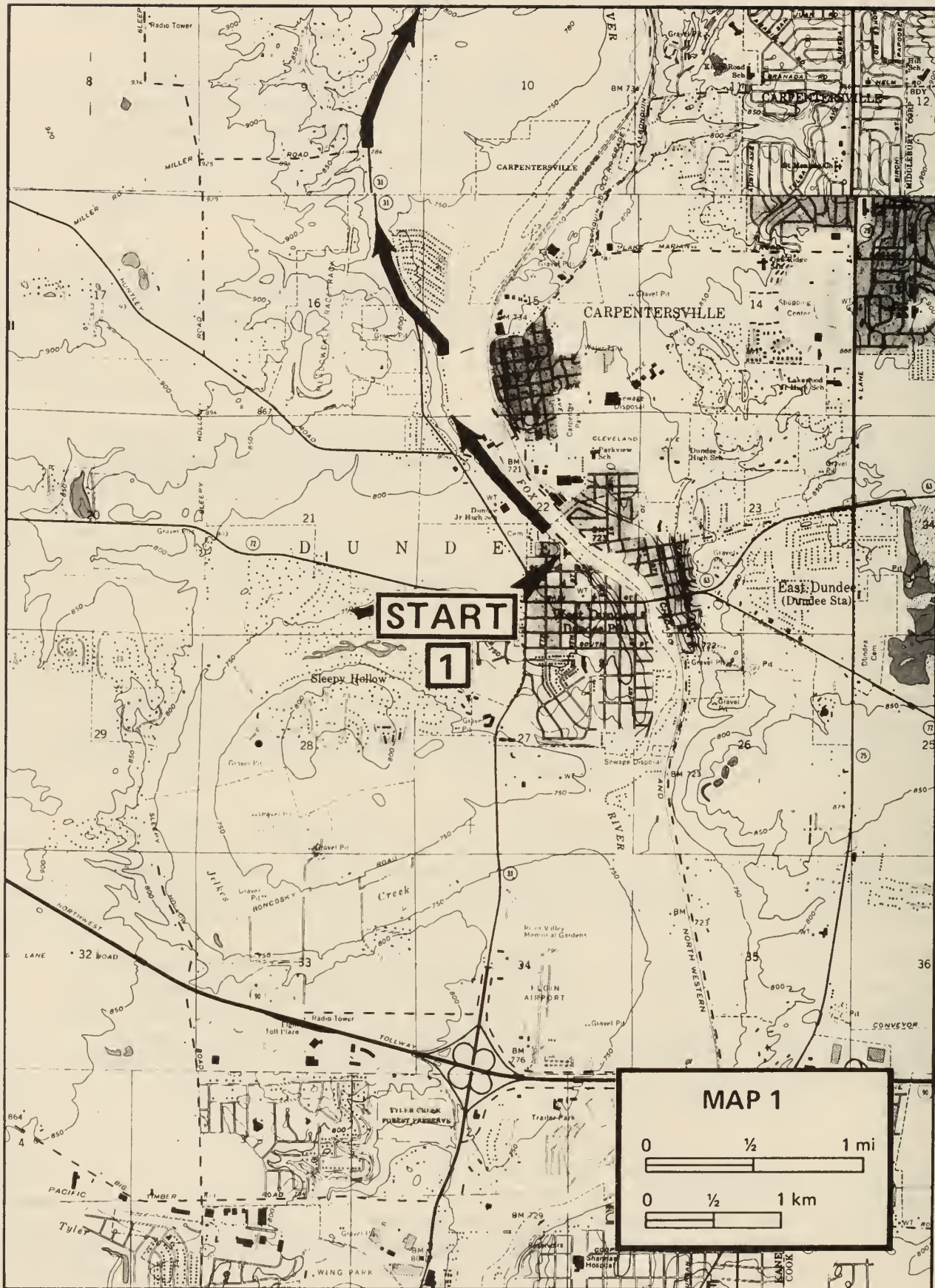
Miles to next point	Miles from starting point
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0.0	0.0	CAUTION: leave the parking lot and TURN RIGHT (north) onto Sixth Street.
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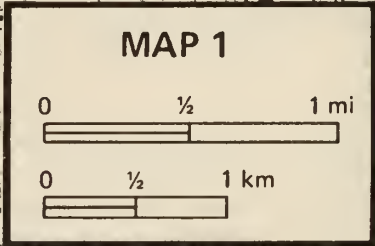
R 8 E

T 42 N

T 41 N



START
1



Miles to next point	Miles from starting point	
0.15	0.15	STOP at the sign. BEAR LEFT and CONTINUE AHEAD (northward) on Lincoln Avenue and enter Carpentersville. For the next mile, we drive along the west bank of the Fox River and the west side of the Fox Valley, which glacial meltwater rivers cut into glacial deposits and bedrock late in the last glaciation, about 15,000 years ago.
0.45	0.6	STOP at sign. CONTINUE AHEAD (northerly) across Main Street.
0.75	1.35	STOP at sign. TURN RIGHT (north) on State Route (SR) 31 and go to Algonquin Road in Algonquin.
3.35	4.7	CAUTION: Chicago & Northwestern Railroad (C&NW) grade crossing.
0.3	5.0	CAUTION: traffic light at intersection with SR 62 (Huntley/Algonquin Road). TURN LEFT (northwest) onto Huntley/Algonquin Road.
0.5	5.5	Go under the C&NW Railroad overpass.
0.4	5.9	BEAR RIGHT (northerly) onto Pyott Road. Prepare to pull off the road and stop opposite the concrete silo ahead.
0.3	6.2	CAUTION: pull off the road to the right close to the reddish earth banks. Narrow shoulder is soft when wet—park carefully. FAST TRAFFIC both ways, so get out of the car on the ditch side.

STOP **②**

Gravel outwash over pink till: the deposits left by two glaciers (east side of the SE¼NE¼NW¼ Sec. 28, T. 43 N., R. 8 E., 3rd P.M., McHenry County; Crystal Lake 7.5-minute Quadrangle).

Exposed along the east side of the road and in the abandoned gravel pit are layers of glacial till, outwash, and loess. These sediments were deposited during the Woodfordian Substage, the last glaciation, which occurred between 22,000 and 12,500 years ago. The till layer at the base of the exposure is part of the blanket of "pink" Tiskilwa Till, which was the earth and rock material mixed in the ice of the glacier that deposited the Marengo Moraine. This glacier and the ones that followed it across this region were parts of a lobe of ice that flowed from an ice cap in central Canada, southward through

the basin that holds Lake Michigan and westward across Illinois. During the Woodfordian Substage, the lobe advanced and melted back repeatedly in this part of the state, leaving a shinglelike accumulation of overlapping till blankets, represented in figure 3. The cross-hatched layer is the Tiskilwa Till.

The outwash layer above the till of this stop consists of sand and gravel carried here by meltwater flowing away from the glacier that deposited the West Chicago Moraine, which is the upland to the east. Figure 4 shows the glacier and its outwash fan. The path of the meltwater was evidently southward, parallel to the glacier front.

Figure 5 is an exaggerated view of the present outcrop. The uppermost layer at this exposure is a thin deposit of windblown silt that was blown off the barren floodplains of glacial sluiceways that dried up in the cooler seasons when the ice melting slowed.

Figure 6 shows the thicknesses, positions, and other characteristics of the units exposed at this outcrop.



Figure 3. Accumulation of overlapping till blankets.

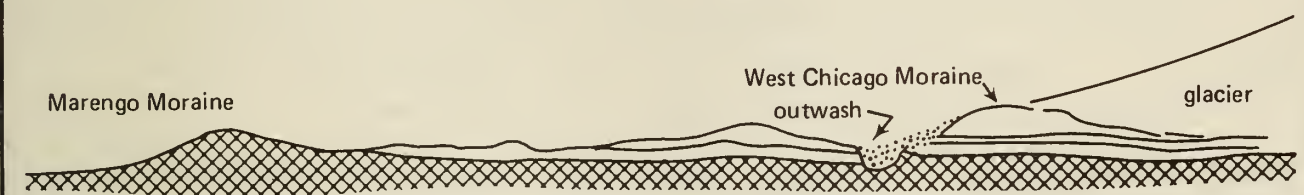


Figure 4. Glacial outwash on top of till.

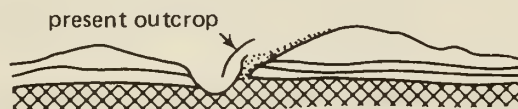


Figure 5. Exaggerated view of the present outcrop. Postglacial stream erosion has cut through the outwash and exposed the till.

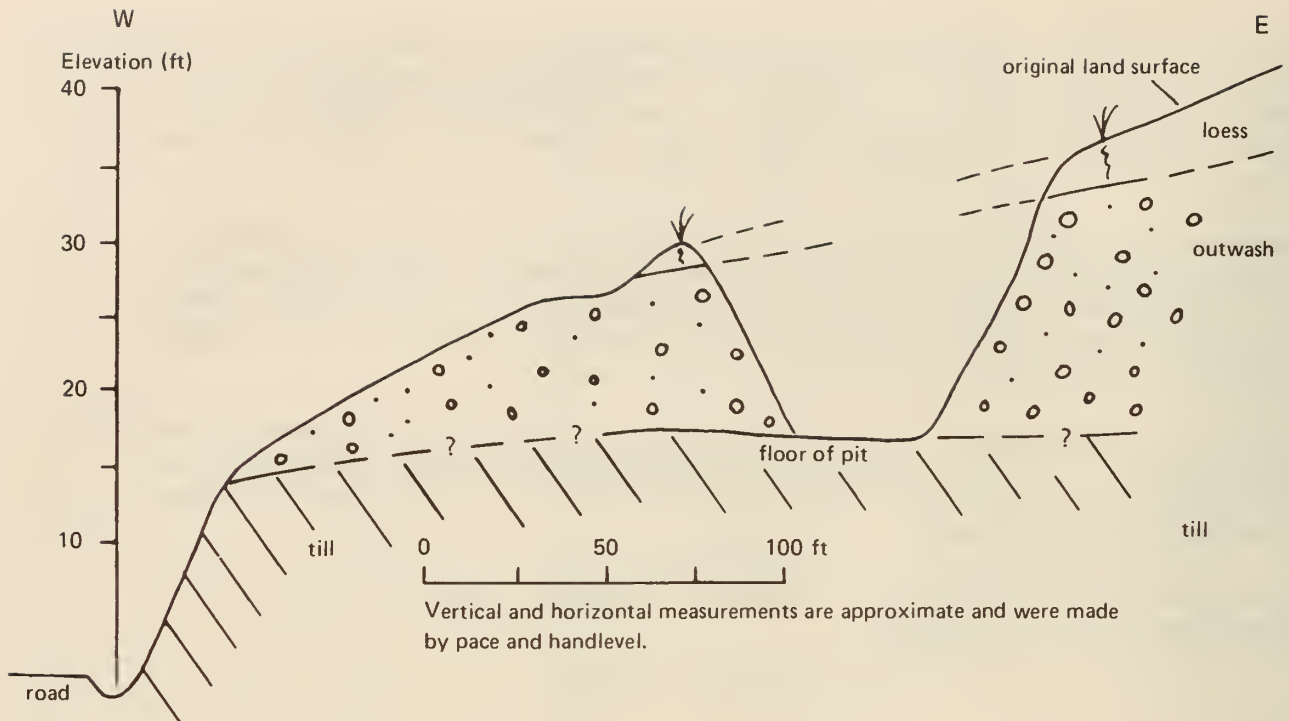


Figure 6. Cross section showing the Pleistocene deposits exposed in the roadcut and abandoned gravel pit. West end of section begins opposite the telephone pole north of the concrete silo.

Miles to next point	Miles from starting point	
0.0	6.2	LEAVE STOP 2. GO STRAIGHT (north). CAUTION: As you pull onto the road, watch out for cars rounding the curve behind you. From this point until we reach Stop 3, look for the many gravel pits that are shown on the route map and are visible from the road.
2.65	8.85	STOP. TURN RIGHT (southeast) onto Virginia Road (Cutoff Road on the map).
2.3	11.15	STOP. TURN RIGHT (south) onto Illinois Route 31.
0.4	11.55	TURN RIGHT (west) into the entrance of the Algonquin Plant of Material Service Corporation. (Near Center East Line NE $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 22, T. 43 N., R. 8 E., 3rd P.M.; McHenry County; Crystal Lake 7.5-minute Quadrangle.
		NOTE: Proceed west through gate toward office area and Stop 3. Resume mileage from this entrance gate.

A little over 0.1 mile to the west, as you descend the plant road, look to your right. This is an area of sequential land use owned by Meier Material

Company. Originally, the land surface here was some 30 to 40 feet higher and was used for farming. For a long time it was known to be underlain by thick sand and gravel deposits. When the demand became high, the area was mined for this construction material; however, underlying the outwash deposits here is the Tiskilwa Till. When this till was reached, mining ceased, and the area was returned to cultivation. Corn was planted; however, the till is quite alkaline and a different crop would do much better, especially alfalfa, which would build up humus in the till more rapidly than most other crops.

Algonquin Pit of Material Service Corporation (office in
W½SE¼ SE¼SE¼ Sec. 21, T. 43 N., R. 8 E., 3rd P.M.,
McHenry County; Crystal Lake 7.5 minute Quadrangle).



Survey records indicate that sand and gravel was mined in this immediate vicinity as early as the first part of this century. The Algonquin Pit was formerly owned by the Chicago and Northwestern Railroad, which used the gravel for railroad ballast. Material Service Corporation bought the property and built the present screening plant in 1954-1955.

The sand and gravel deposits here are approximately 90 feet thick. This mining operation uses front-end loaders to mine the deposit, which averages about 35 feet in thickness above the water table. Another 20 feet of sand and gravel has been removed from below the water surface by using a dragline. The company has used a small dredge in the lake also to a depth of about 20 feet.

The Pleistocene sand and gravel here is fairly well sorted and is in the Batavia Member of the Henry Formation. It is underlain by the Tiskilwa Till Member of the Wedron Formation, which was deposited with a very hummocky surface (compare the corn field surface noted earlier with the approximate elevation of the till here—perhaps 40 to 45 feet below where we are standing). The hummocky topography was filled in and subdued by deposits of sand and gravel flushed away by meltwater from the waning glaciers.

The Algonquin Pit yields a variety of products: (1) general fill material, (2) base fill material, (3) gravel road material, (4) asphalt paving aggregate (fine gravel and sand), and (5) concrete aggregate (a coarser mixture of sand and crushed gravel). Even relatively fine gravelly material goes through the crusher, which yields an angular end product. Sand products probably contain about 20 percent crushed material.

In a new pit opened to the east of Pingree Road by Material Service Corporation, the Haeger Till Member of the Wedron Formation consists of till overlying outwash sand and gravel.

Fifteen companies operated 18 sand and gravel pits in McHenry County during 1978. These operations produced some 8,337,000 tons of common sand and gravel valued at about \$18,308,000. McHenry County ranks first among the 59 sand and gravel producing Illinois counties.

Leave Stop 3 and return to the entrance to resume mileage figures.

Miles to next point	Miles from starting point	
0.0	11.55	From the gravel pit entrance, TURN RIGHT (south) onto Route 31.
1.35	12.9	Traffic light at the junction of Routes 31 and 62. TURN RIGHT (west) onto the Huntley-Algonquin Road. Until we reach the intersection with Hanson Road (1.45 miles ahead), this road is situated in a valley that must have been cut by a more powerful current of water than that of the stream now flowing in the small channel along the southwest side of the flat valley floor. This is the downstream portion of the same valley seen at Stop 2. Torrents of meltwater from the glacier filled and overflowed depressions in the ice surface and till plain, and in many places cut valleys that drain into the Fox Valley. This steep-sided valley was eroded about 100 feet below the adjacent uplands, which are composed primarily of clayey till to the southwest and outwash and gravelly till to the northeast. The western fork of this valley has been damned to create Lake in the Hills, around which there is a community with the same name.
0.95	13.85	CAUTION: BEAR LEFT (westerly) at Pyott Road intersection.
1.55	15.4	STOP. CONTINUE STRAIGHT (west) across Randall Road. A little over half a mile ahead we cross a fork of the valley we travelled in west of Algonquin.
1.0	16.4	CAUTION: Pull off the road to the right and park opposite the T-intersection with the road from the south.



Crest of the Barlina Moraine (SE_{cor}NE¼ Sec. 25, T. 43 N., R. 7 E., 3rd P.M., McHenry County; Crystal Lake 7.5-minute Quadrangle).

Note the size range of particles in the till exposed in different parts of this roadcut. From Algonquin, the route has passed along the valley cut into pinkish Tiskilwa Till and onto a till plain generally underlain by Yorkville Till, upon which small deposits of an ablation phase are present. The ablation till in the top of the Yorkville was deposited during a time when the

rate of melting exceeded the rate of advancement of ice moving outward from the Lake Michigan Lobe. Because the Barlina Moraine is low and irregular in height, it could not dam what could be described as a glacial lake; however, it was high enough to retard the escape of much of the "soupy" material that accumulated above the till plastered down at the sole of the glacier. An ablation till contains nearly the same range of particle sizes as its associated underlying till, but a higher degree of sorting is evident in ablation till because of the action of water in the upper material.

Note that many pebbles in the till have flattened, faceted surfaces. This condition was caused by abrasion when pebbles imbedded in the ice were scraped over the frozen ground by the moving ice.

A wide variety of rock types is found in the till because the glacier picked up materials as it moved along. Igneous, metamorphic, and sedimentary rocks from many formations of widely separated and distant areas to the north can be found in any till deposit.

The profile of weathering that developed here is as follows:

	<u>Thickness (ft)</u>	
Zone A - Dark silty, humic soil	1	top layer
Zone B - Weathered till, brownish, grading to yellow, noncalcareous	2	middle layer
Zone C - Till, yellow-gray, very calcareous with many limestone pebbles	5	bottom layer

Rocks and minerals undergo changes when they are exposed to the weather. These physical and mineralogical changes, though slow, become evident when deposits remain undisturbed for long periods of time, and soils are formed.

The zonal effect is caused by four processes that affect soil weathering at different rates. These processes, listed according to their rate of progress, beginning with the most rapid, are (1) oxidation, (2) leaching of carbonates, (3) decomposition of more resistant minerals, and (4) accumulation of humus.

In the A zone, where the humus material derived from decaying plants has accumulated, the minerals are oxidized, leached, and decomposed. In the B zone, they are oxidized and leached, and enriched by clay from decomposition of silicate minerals. The upper part of the C zone is leached and oxidized and overlies material that is oxidized but not leached. The oxidation zone is shown by the reddish or yellowish color resulting from the oxidation of iron materials. The leached zone is determined by the absence of carbonates, as revealed by tests with a solution of hydrochloric acid.

Miles to next point	Miles from starting point	
0.0	16.4	LEAVE STOP 4. CONTINUE STRAIGHT (west).
0.45	16.85	T-intersection with Frank Road to the right (Felgenhauser Road on the map).

Miles to next point	Miles from starting point
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In the next one-half mile we pass the southern end of a large bog. In general, continental glaciers leave behind a smooth terrain that is a little pitted in places and only a little roughened by low mounds and ridges. Recently glaciated terrain such as this is poorly drained: water accumulates in low places that form ponds and lakes, bogs, and swamps. Only after thousands of years do rain and snowmelt gradually cut a network of streams across the glacial plain and drain it.

Approaching Huntley, 3 miles ahead, we cross the low hill line that is the Huntley Moraine.

3.25	20.1	STOP. TURN LEFT (south) onto Illinois Route 47. Follow Route 47 through Huntley.
0.5	20.6	CROSS the Huntley Dundee Road. (The turn ahead is 0.7 mile beyond the creek bridge south of town.)
1.05	21.65	Enter Kane County at T-road intersection from left. CONTINUE STRAIGHT (south).
0.6	22.25	TURN LEFT (east) onto the gravel road, Powers Road.
0.25	22.5	TURN RIGHT (south), following the road. STOP at the corner ahead.
0.1	22.6	Park along the right shoulder.

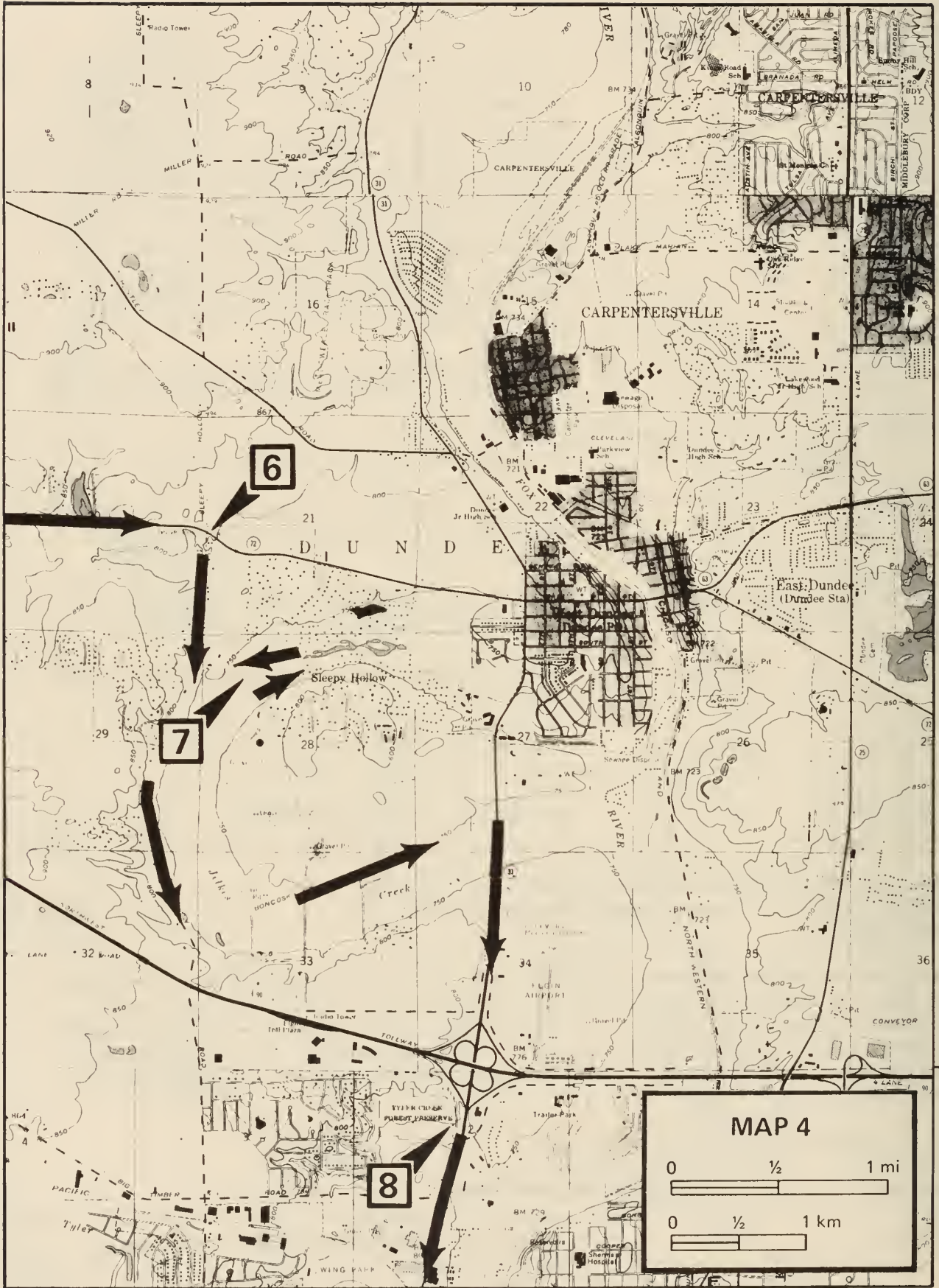
View of the Marengo Moraine (center of the SW¼ Sec. 4, T. 42 N., R 7 E., 3rd P.M., Kane County; Huntley 7.5-minute Quadrangle).

STOP **5**

The prominent ridge on the western horizon is the Marengo Moraine, named after the town of Marengo, which is located on the moraine about 15 miles to the northwest. The Marengo Moraine is the oldest in the area and one of the most striking glacial landforms in Illinois. The glacier that built the Marengo Moraine deposited the pink, sandy Tiskilwa Till exposed in the road cut and gravel pit at Stop 2.

Miles to next point	Miles from starting point
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0.0	22.6	LEAVE STOP 5 and follow Powers Road to Freeman Road.
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Miles to next point	Miles from starting point	
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Powers Road skirts the east side of the Gilberts Moraine between Route 47 and Freeman Road. It crosses the moraine between Freeman Road and the Northwest Tollway. This part of the route crosses a landscape that was made when mud and gravel from the glacier slumped and settled to the ground as ice melted. This is knob and kettle terrain: small moundlike hills alternate with basinlike depressions that hold bogs and lakes.

2.3	24.9	STOP. CROSS Freeman Road and GO STRAIGHT ahead on Powers Road.
-----	------	--

1.1	26.0	CROSS the overpass over the Northwest Tollway. Notice the excellent view of the boggy, flat till plain to the right and left. Note to the left (east) where the Tollway is cut through the hills. These hills are the south end of the moraine segment we have travelled since leaving Stop 5.
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0.5	26.5	STOP. TURN LEFT (southeast) onto Big Timber Road.
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0.55	27.05	STOP. TURN LEFT (northeast) onto Illinois Route 72.
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1.1	28.15	CROSS the Northwest Tollway Overpass and enter Gilberts. Follow Route 72 east.
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2.45	30.6	STOP. Cross Randall Road and continue ahead east.
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CAUTION: In a mile, where the road curves to the right, prepare to make two sharp right turns.

1.05	31.65	TURN RIGHT (south) onto Sleepy Hollow Road AND IMMEDIATELY TURN RIGHT AGAIN into the parking area of the Dundee Township Highway Department.
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Gravel pit behind township highway garage (NW¼NW¼SW¼ Sec. 21, T. 42 N., R. 8 E., 3rd P.M., Kane County; Elgin 7.5-minute Quadrangle).



This small pit, revealing about 2 feet of silt and 20 feet of sand and gravel; was dug at the western edge of the deposits associated with the glacial

sluiceway through which the Fox River now flows. The succession of geologic materials mapped at this location, from the surface to a depth of 20 feet, is:

1. Glacial lakebed deposits—Carmi Member of the Equality Formation
2. Sheetlike glacial outwash—Batavia Member of the Henry Formation
3. Pinkish till—Tiskilwa Member of the Wedron Formation

If you look at your route map, you will see that the high terrace to the northeast, the top of the meander core within the old abandoned channel, and the high, broad, flat depression extending to the southwest from the bottom of the loop, are all remnants of an outwash plain that was associated with one or more glacial advances. In the last phase of melting, the outlet became blocked and a small lake formed, in which a thin layer of fine-grained material was deposited. Later the meander channel was cut through the lake deposits and outwash and into the underlying till. The southern side of the loop coincides with the northern extent of the Minooka Moraine, which is composed of gray clayey till.

Miles to next point	Miles from starting point	
0.0	31.65	LEAVE STOP 6. TURN RIGHT (south) onto Sleepy Hollow Road and go to the stop sign.
0.55	32.2	STOP. TURN LEFT (easterly) onto Thorobred Lane, which is a short distance beyond the stop sign.
0.2	32.4	TURN RIGHT (southeast) onto Winmoor Road and park.
0.05	32.45	Park along the right side of the road.



Abandoned meander loop of the glacial Fox River (SE corner of the NW¼NW¼ Sec. 28, T. 42 N., R. 8 E., 3rd P.M., Kane County; Elgin 7.5-minute Quadrangle).

As the West Chicago glacier ended, the Fox River valley became so filled with sediment that the river meandered across the uneven surface of the deposits and formed a great loop. Possibly near the end of this phase of valley filling, the narrow neck in the Fox River was cut through to form the present channel.

Miles to next point	Miles from starting point	
0.0	32.45	LEAVE STOP 7 and GO STRAIGHT on Winmoor Road. CIRCLE the park and return to Sleepy Hollow Road by TURNING LEFT onto Willow, Bullfrog; and Thorobred Lanes.

Miles to next point	Miles from starting point	
0.9	33.35	STOP. TURN LEFT (south) onto Sleepy Hollow Road.
1.35	34.7	TURN LEFT (east) onto Boncosky Road.
1.5	36.2	STOP. TURN RIGHT (south) onto Illinois Route 31.
1.1	37.3	Pass under the Northwest Tollway. Prepare to turn right at the traffic light ahead.
0.35	37.65	TURN RIGHT at the traffic light. After turning, BEAR LEFT into the entrance of the Tyler Creek Forest Preserve.

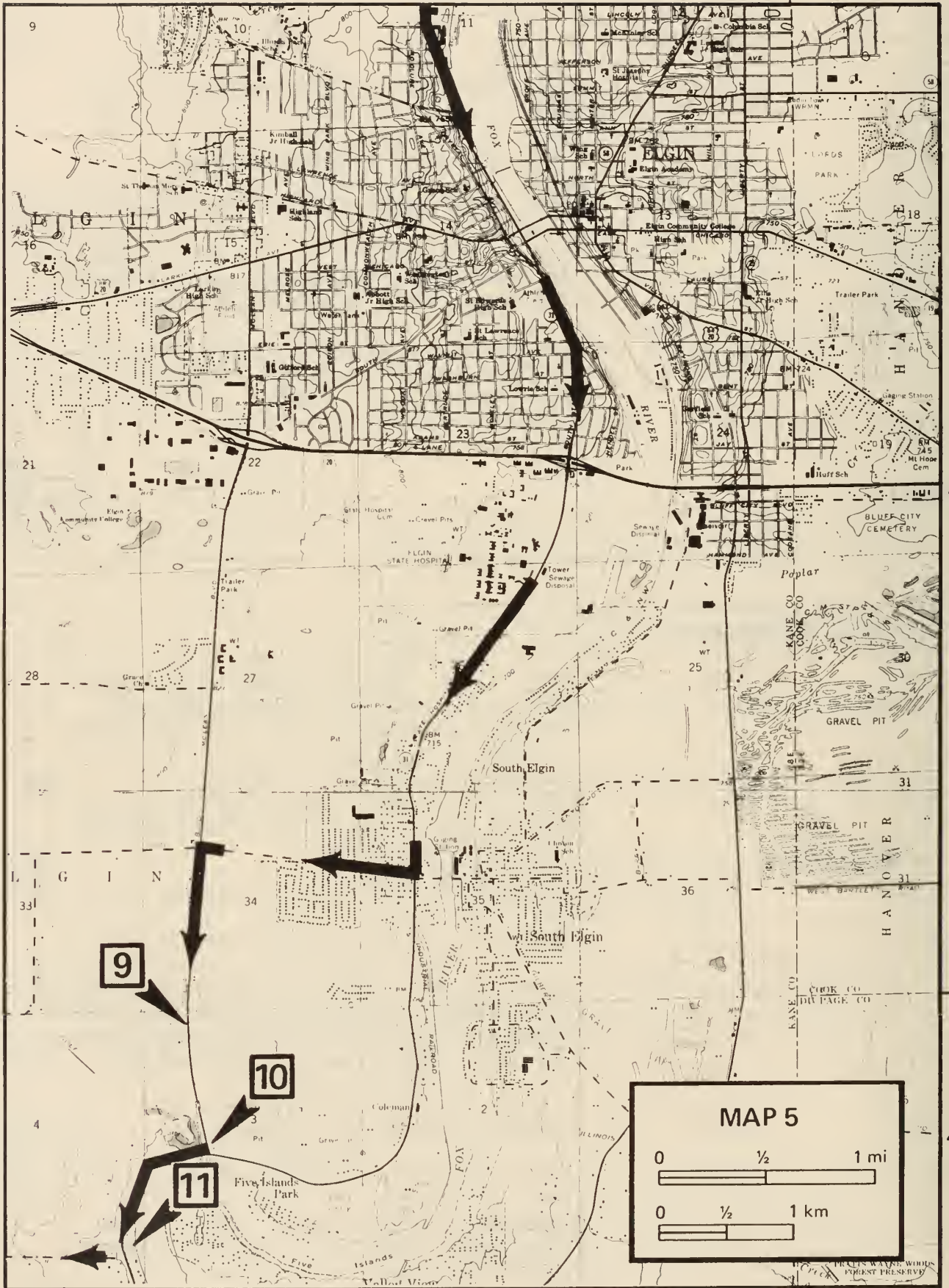
LUNCH



Miles to next point	Miles from starting point	
0.0	37.65	LEAVE STOP 8. Return to the traffic light on Route 31 at the Forest Preserve entrance. TURN RIGHT (south) onto Route 31 and follow it south through Elgin.
2.95	40.6	CROSS U.S. Highway 20 on the overpass. Entering South Elgin ahead, prepare to turn left on Melrose Street.
1.55	42.15	TURN LEFT (east) onto Melrose Street.
0.1	42.25	TURN RIGHT (south) onto Water Street. As you pass Beach Street ahead, look to the right between the houses and trees and catch glimpses of the lake. The lake fills the pit created by a large quarry that mined the Silurian dolostone here.
0.2	42.45	BEAR RIGHT onto Quarry Street.
0.15	42.6	STOP. TURN LEFT (south) onto Route 31.
0.3	42.9	TURN RIGHT (west) onto West Spring Street (Hopps Road). The turn is one block before the traffic light.

R 8 E

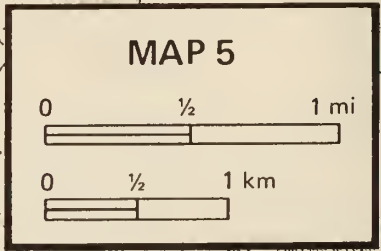
R 9 E



9

10

11



Miles to next point	Miles from starting point	
1.0	43.9	STOP. TURN LEFT (south) onto McLean Blvd.
0.8	44.7	Near the farm lane, pull off to the right and park.

View of the Fox River valley where it cuts through the Minooka Moraine (center of NE¼NW¼NW¼ Sec. 3, T. 40 N., R. 8 E., 3rd P.M., Kane County; Geneva 7.5-minute Quadrangle).



From this point, look down the road (south) and to the left (southeast) toward the opposite side of the Fox River valley. The high ground across the valley and the upland we are standing on is the Minooka Moraine (fig. 7). The Fox River runs in a valley cut through the Minooka Moraine from the point where it bends sharply to the west at Valley View to Novak Park downstream. The valley was cut through the moraine after the Minooka glacier front melted back eastward from this part of the moraine.

The Fox River valley came into existence during the Marseilles-Barlina glaciation, which occurred about 15,000 years ago. Meltwaters draining off the glacier were confined between the ice front on the east and the rising ground of the older moraines on the west. From near Dundee, the meltwater torrents ran southward along the glacier front, depositing a great volume of sand and gravel in the upper Fox Valley, then emptying into the Illinois Valley at Ottawa. The valley cut during the Marseilles-Barlina glaciation is generally followed by the present-day river.

The Minooka glaciation, which followed the Marseilles-Barlina glaciation, evidently shifted the water course somewhat between Elgin and Aurora. Finally, the Valparaiso glaciation, which occurred between 13,000 and 14,000 years ago, cut the modern course of the Fox River valley north of Dundee and partly filled the valley with large sand and gravel deposits.

Miles to next point	Miles from starting point	
0.0	44.7	LEAVE STOP 9. GO STRAIGHT (south) on McLean Blvd.
0.5	45.2	TURN RIGHT (west) into the entrance of the Fox River Stone Company Quarry, Stop 10.

Quarry of the Fox River Stone Company (NW¼NE¼SW¼ Sec. 3, T. 40 N., R. 8 E., 3rd P.M., Kane County; Geneva 7.5-minute Quadrangle).



Please observe these safety rules during our visit to the quarry.

1. Stay away from the quarry walls—broken rock falls from them without warning.
2. Stay away from drop offs whether they are 2 or 40 feet above the quarry floor.
3. Stay away from quarry machinery.
4. When you hammer rock, wear safety glasses and work where rock chips can't hit anyone.

Our Stone Age

Few of us think of stone as an essential mineral resource. Presently, coal and petroleum command our interest. If stone mining (quarrying) comes to our attention at all, it is likely to be as the subject of a local controversy: between the quarry and its neighbors. Few people, however, realize that our society is built solidly on a stone foundation.

In 1978, 286 Illinois quarries produced 62.5 million tons of stone, an amount sufficient to supply each of the more than 11 million Illinois residents with about 5.6 tons of stone apiece; 5.6 tons of stone will fill about 66 cubic feet of space, the volume of a small closet.

In 1978, three stone quarries in Kane County produced 1,396,830 tons of crushed stone valued at about \$3,591,513. In addition, one quarry produced the only dimension stone for building purposes in the state. Kane County ranked ninth among the 60 Illinois counties producing stone.

In any year about 80 percent of this production is construction aggregate used to make public roads, buildings, and other structures.

How much does the stone we buy cost? Stone is relatively inexpensive; the average value of a ton of stone mined in our state is only about \$2.50. However, the actual price we pay at a given place depends on the cost of moving the stone from the quarry to the place where it is used.

About 92 percent of the stone quarried in Illinois is trucked from the quarries to the buyer. Within short distances, the cost of trucking equals the price of the stone at the quarry. For example, a study by Survey geologist J. H. Goodwin demonstrates that the average cost of trucking a ton of agricultural lime more than 35 miles exceeds the \$3.25 cost of a ton of agricultural lime at the quarry. The marketing regions of quarries, therefore, are usually small: in most cases they sell almost all their stone within a few tens of miles of their operations.

This has interesting implications. First, the cost of stone will increase as the cost of fuels used for mining and hauling increase. Second, it is an ad-

vantage to urbanizing areas to have sources of stone close by. The problem is, however, that suburban areas like the counties around Chicago are settled by people who are trying to move away from industry and who do not wish to have quarries as neighbors. Eager for living space, people in developing suburbs often build over stone resources, thereby rendering them unavailable for commercial use. Zoning that excludes quarries, and urban sprawl that covers stone reserves result in higher costs for construction aggregates.

Quarrying

This quarry is a surface mine, or "strip mine," and is typical of quarry operations in the Midwest. Soil and earth are scraped or "stripped" off the surface of the dolostone to expose it for mining. Next, rows of holes are drilled down into the rock in certain patterns and loaded with explosive. When the explosive is detonated, the "shot" rock falls into the quarry, largely broken into manageable sizes. The broken rock is conveyed to the processing plant, which crushes and screens the rocks into the particle sizes that make the different products sold.

In many places in the Fox Valley, the Silurian dolostones are composed of evenly layered, thin, solid strata that can be hewn easily into flagstones and blocks. In earlier times many small local quarries produced the distinctive light yellow-brown stone we see in older buildings and grounds. The stone in the old building across the road was almost certainly quarried at this site. Notice that the color of fresh dolostone is gray, like the deeper rock in the quarry. Exposure to weather oxidizes the traces of iron in the rock and turns it yellow-brown.

Stratigraphy

Survey geologist, H. B. Willman (1973), described the rocks exposed in this quarry and at nearby Silver Glen, the next stop.

The South Elgin Section

<i>Silurian System</i>	
<i>Kankakee Formation (25'3")</i>	
Dolomite, gray and pinkish gray, fine- and medium-grained; in 1-2" wavy beds with thin green clay partings; contains a few scattered chert nodules and silicified corals.....	9' 6"
Clay, light gray to white; makes prominent reentrant; 0 to.....	1"
Dolomite, as above, but in thicker beds; strong green shale partings at base.....	1'
Dolomite, as above; contains white chert nodules in 2" band 3" above base; strong shaly partings at base.....	1' 8"
Dolomite, as above but thinner bedded and more shaly; 2-4" layers of white chert 1'6" below top; base concealed in quarry, but shale of the Maquoketa Group was encountered in dump only a few feet lower.....	9'
The above unit with the chert layer near the top forms the upper 9' of the exposure at Silver Glen School, where it overlies dolomite, as above but containing several 6-8" beds and a few thin laminated beds.....	4'
<i>Ordovician System</i>	
<i>Maquoketa Group</i>	
<i>Brainard Shale</i>	
Shale, greenish gray; contains beds of fossiliferous limestone up to 6" thick; base concealed.....	10'

Examine the rain-washed surfaces of the greenish-gray Brainard Shale and the platy limestone fragments in the heaps dug out of the quarry sump. Some good fossils wash out of it. The brachiopod genuses *Hebertella*, *Rynchotrema*, *Strophomena*, and *Sowerbyella* are common.

Miles to next point	Miles from starting point	
0.0	45.2	LEAVE STOP 10. TURN RIGHT (south) onto McLean Blvd.
0.1	45.3	STOP. TURN RIGHT (west) onto Illinois Route 31.
0.65	45.95	Cross the bridge over Silver Glen Creek. Prepare to turn right ahead.
0.1	46.05	TURN RIGHT (west) onto Silver Glen Road. Pull off the road and park as close to the corner as possible.
		To go to Stop 11, walk back to the highway, cross it, and go through the pasture gate. Walk downhill to your left, toward the creek.
		NOTE: Permission to enter this property must be obtained from Mr. Don VanThournout, 36W172 Silver Glen Road, St. Charles, IL 60174. He lives in the first house on the right, west of the highway.

The rocks and falls of Silver Glen (NE¼NE¼NE¼ Sec. 9, T. 40 N., R. 8 E., 3rd P.M., Kane County; Geneva 7.5-minute Quadrangle).



Walk down to the creek through the pasture and then upstream to the highway bridge. Here the creek falls over the top of the dolostone outcrop. About 12 feet of the lowermost Silurian dolostone strata we saw at Stop 10 are exposed in this valley. The underlying greenish-gray Brainard Shale of the Ordovician System (which we saw in the quarry's sump at Stop 10) crops out about 40 yards and 90 yards downstream from the bridge. In both places, the dolostone strata have slumped down and covered the contact between the two units.

At the bridge, rounded spongy masses of tufa, resembling lumps of brown moss, cover parts of the rock face. Tufa (pronounced T00-fa) forms where ground water seeps out of the rock and evaporates, leaving behind an ever-thickening porous crust of minerals. The minerals, chiefly calcite (calcium carbonate) were dissolved from the dolostone layers as the water trickled through them. Ground water containing calcium, magnesium, iron, and other elements dissolved from rock and earth is commonly called "hard" water.

Silver Glen's little falls and rock-rimmed valley are good models of the great Niagara Falls and the Niagara Gorge. Both the Niagara River and Silver Glen's stream fall over dolostone beds that resist the streams' downcutting; however, underlying the dolostone beds in both localities are weak shale beds that are easily washed away and broken up by running water. As a consequence, at the bottom of both falls, the plunging water erodes the soft shale bed, thereby undercutting the dolostone units. As the undercut lips of the falls collapse, the falls retreat upstream and the narrow rock-rimmed gorges below the falls grow longer.

Like Niagara Falls, the falls of Silver Glen began at the downstream end of its gorge. In a rough way, therefore, one could calculate the rate of retreat of Silver Glen falls by dividing the time elapsed since the last glacier melted off it by the length of the gorge. Silver Glen's falls retreat slowly, probably because the stream is small and a rock fall protects the shale from erosion until the stream can wash it away.

At the outcrops of Brainard Shale look for fossils on the surfaces of the thin limestone beds it contains.

End of field trip

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PLEISTOCENE GLACIATIONS IN ILLINOIS

Origin of the Glaciers

During the past million years or so, the period of time called the Pleistocene Epoch, most of the northern hemisphere above the 50th parallel has been repeatedly covered by glacial ice. Ice sheets formed in sub-arctic regions four different times and spread outward until they covered the northern parts of Europe and North America. In North America the four glaciations, in order of occurrence from the oldest to the youngest, are called the Nebraskan, Kansan, Illinoian, and Wisconsinan Stages of the Pleistocene Epoch. The limits and times of the ice movement in Illinois are illustrated in the following pages by several figures.

The North American ice sheets developed during periods when the mean annual temperature was perhaps 4° to 7° C (7° to 13° F) cooler than it is now and winter snows did not completely melt during the summers. Because the cooler periods lasted tens of thousands of years, thick masses of snow and ice accumulated to form glaciers. As the ice thickened, the great weight of the ice and snow caused them to flow outward at their margins, often for hundreds of miles. As the ice sheets expanded, the areas in which snow accumulated probably also increased in extent.

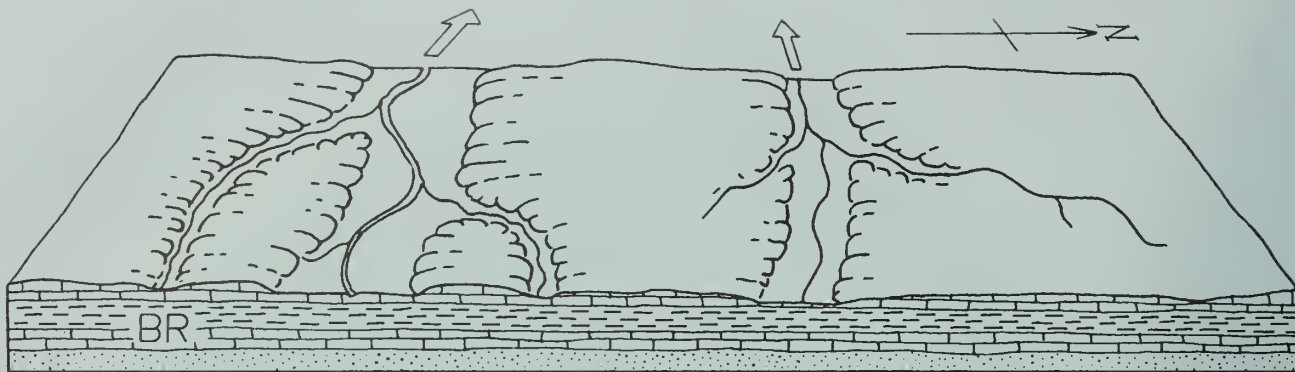
Tongues of ice, called lobes, flowed southward from the Canadian centers near Hudson Bay and converged in the central lowland between the Appalachian and Rocky Mountains. There the glaciers made their farthest advances to the south. The sketch below shows several centers of flow, the general directions of flow from the centers, and the southern extent of glaciation. Because Illinois lies entirely in the central lowland, it has been invaded by glaciers from every center.




Effects of Glaciation

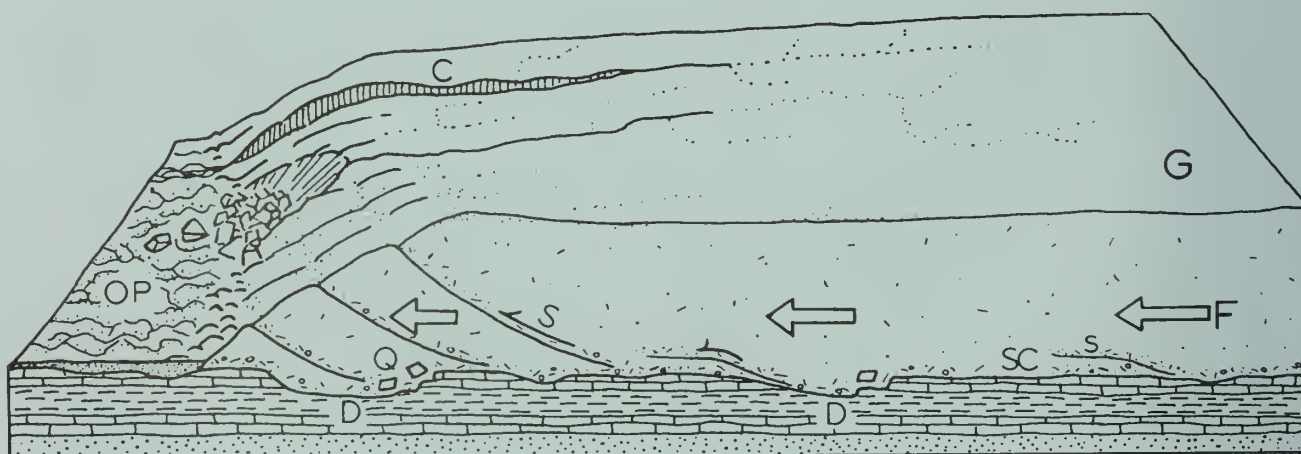
Pleistocene glaciers and the waters melting from them changed the landscapes they covered. The glaciers scraped and smeared the landforms they overrode, leveling and filling many of the minor valleys and even some of the larger ones. Moving ice carried colossal amounts of rock and earth, for much of what the glaciers wore off the ground was kneaded into the moving ice and carried along, often for hundreds of miles.



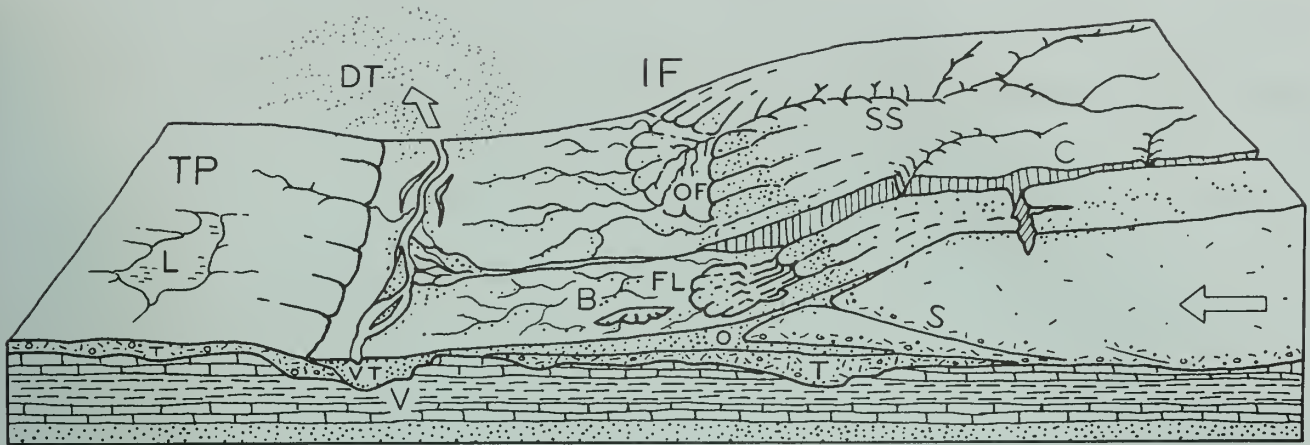
The continual floods released by melting ice entrenched new drainageways, deepened old ones, and then partly refilled both with sediments as great quantities of rock and earth were carried beyond the glacier fronts. According to some estimates, the amount of water drawn from the sea and changed into ice during a glaciation was probably enough to lower sea level more than 300 feet below present level. Consequently, the melting of a continental ice sheet provided a tremendous volume of water that eroded and transported sediments.



1. The Region Before Glaciation - Like most of Illinois, the region illustrated is underlain by almost flat-lying beds of sedimentary rocks--layers of sandstone (), limestone (), and shale (). Millions of years of erosion have planed down the bedrock (BR), creating a terrain of low uplands and shallow valleys. A residual soil weathered from local rock debris covers the area but is too thin to be shown in the drawing. The streams illustrated here flow westward and the one on the right flows into the other at a point beyond the diagram.



2. The Glacier Advances Southward - As the glacier (G) spreads out from its snowfield, it scours (SC) the soil and rock surface and quarries (Q)--pushes and plucks up--chunks of bedrock. These materials are mixed into the ice and make up the glacier's "load." Where roughnesses in the terrain slow or stop flow (F), the ice "current" slides up over the blocked ice on innumerable shear planes (S). Shearing mixes the load very thoroughly. As the glacier spreads, long cracks called "crevasses" (C) open parallel to the direction of ice flow. The glacier melts as it flows forward, and its meltwater erodes the terrain in front of the ice, deepening (D) some old valleys before the ice covers them. Meltwater washes away some of the load freed by melting and deposits it on the outwash plain (OP). The advancing glacier overrides its outwash and in places scours much of it up again. The glacier may be 5000 or so feet thick, except near its margin. Its ice front advances perhaps as much as a third of a mile per year.



3. The Glacier Deposits an End Moraine - After the glacier advanced across the area, the climate warmed and the ice began to melt as fast as it advanced. The ice front (IF) is now stationary, or fluctuating in a narrow area, and the glacier is depositing an end moraine.

As the top of the glacier melts, some of the sediment that was mixed in the ice accumulates on top of the glacier. Some is carried by meltwater onto the sloping ice front (IF) and out onto the plain beyond. Some of the debris slips down the ice front in a mudflow (FL). Meltwater runs through the ice in a crevasse (C). A supraglacial stream (SS) drains the top of the ice, forming an outwash fan (OF). Moving ice has overridden an immobile part of the front on a shear plane (S). All but the top of a block of ice (B) is buried by outwash (O).

Sediment from the melted ice of the previous advance (figure 2) was left as a till layer (T), part of which forms the till plain (TP). A shallow, marshy lake (L) fills a low place in the plain. Although largely filled with drift, the valley (V) remained a low spot in the terrain. As soon as its ice cover melted, meltwater drained down the valley, cutting it deeper. Later, outwash partly refilled the valley--the outwash deposit is called a valley train (VT). Wind blows dust (DT) off the dry floodplain. The dust will form a loess deposit when it settles.



4. The Region after Glaciation - The climate has warmed even more, the whole ice sheet has melted, and the glaciation has ended. The end moraine (EM) is a low, broad ridge between the outwash plain (OP) and till plains (TP). Run-off from rains cuts stream valleys into its slopes. A stream goes through the end moraine along the channel cut by the meltwater that ran out of the crevasse in the glacier.

Slopewash and vegetation are filling the shallow lake. The collapse of outwash into the cavity left by the ice block's melting has made a kettle (K). The outwash that filled a tunnel draining under the glacier is preserved in an esker (E). The hill of outwash left where meltwater dumped sand and gravel into a crevasse or other depression in the glacier or at its edge is a kame (KM). A few feet of loess covers the entire area but cannot be shown at this scale.

TIME TABLE OF PLEISTOCENE GLACIATION

STAGE	SUBSTAGE	NATURE OF DEPOSITS	SPECIAL FEATURES
HOLOCENE	Years Before Present	Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
	7,000		
WISCONSINAN (4th glacial)	Valderan	Outwash, lake deposits	Outwash along Mississippi Valley
	11,000		
	Twocreekan	Peat and alluvium	Ice withdrawal, erosion
	12,500		
	Woodfordian	Drift, loess, dunes, lake deposits	Glaciation; building of many moraines as far south as Shelbyville; extensive valley trains, outwash plains, and lakes
	22,000		
	Farmdalian	Soil, silt, and peat	Ice withdrawal, weathering, and erosion
SANGAMONIAN (3rd interglacial)	28,000		
	Altonian	Drift, loess	Glaciation in northern Illinois, valley trains along major rivers
ILLINOIAN (3rd glacial)	75,000		
	175,000		
	Jubileean	Drift, loess	Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois
	Monican	Drift, loess	
Liman	Drift, loess		
YARMOUTHIAN (2nd interglacial)	300,000	Soil, mature profile of weathering	
KANSAN (2nd glacial)	600,000	Drift, loess	Glaciers from northeast and northwest covered much of state
AFTONIAN (1st interglacial)	700,000	Soil, mature profile of weathering	
NEBRASKAN (1st glacial)	900,000		
	1,200,000 or more	Drift	Glaciers from northwest invaded western Illinois

SEQUENCE OF GLACIATIONS AND INTERGLACIAL DRAINAGE IN ILLINOIS



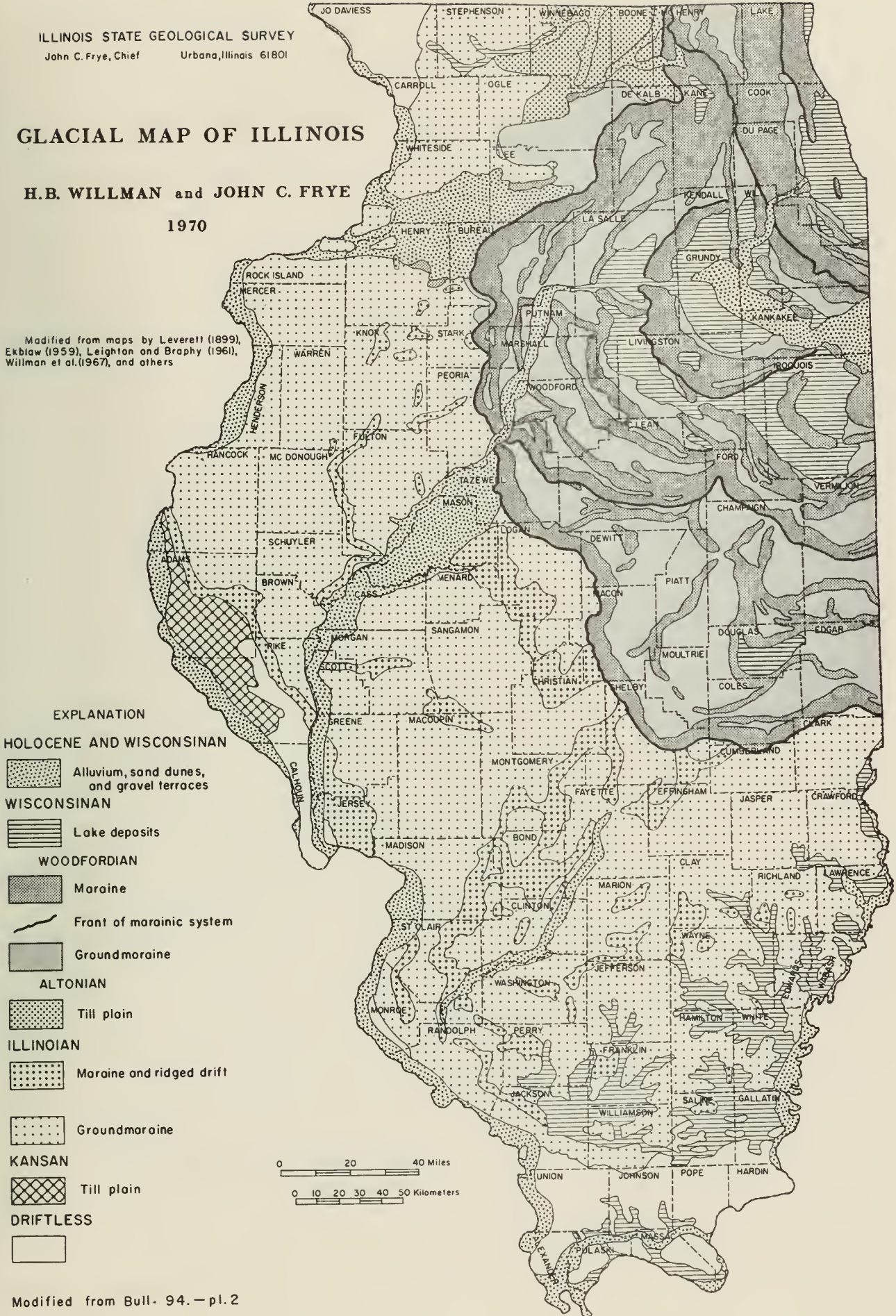
(From Willman and Frye, "Pleistocene Stratigraphy of Illinois," ISGS Bull. 94, fig. 5, 1970.)

GLACIAL MAP OF ILLINOIS

H.B. WILLMAN and JOHN C. FRYE

1970

Modified from maps by Leverett (1899),
 Ekblaw (1959), Leighton and Braphy (1961),
 Willman et al. (1967), and others



EXPLANATION

HOLOCENE AND WISCONSINAN

Alluvium, sand dunes,
and gravel terraces

WISCONSINAN

Lake deposits

WOODFORDIAN

Maraine
 Front of marainic system

Groundmoraine

ALTONIAN

Till plain

ILLINOIAN

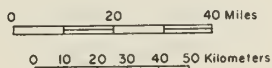
Maraine and ridged drift

Groundmoraine

KANSAN

Till plain

DRIFTLESS

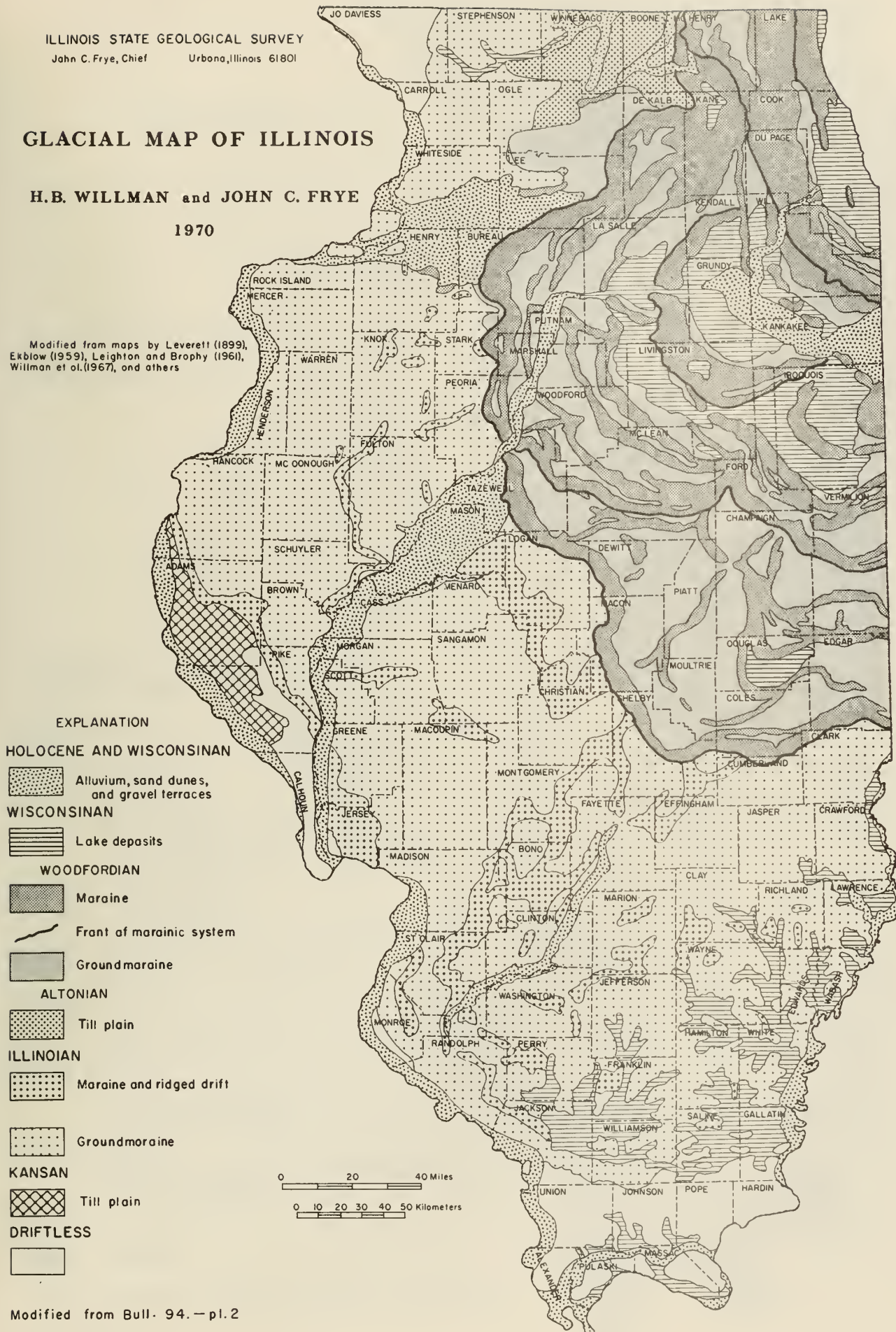


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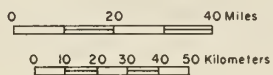
Maraine and ridged drift

Groundmaraine

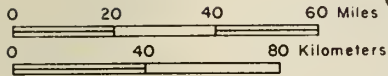
KANSAN

Till plain

DRIFTLESS



GEOLOGIC MAP



Pleistocene and Pliocene not shown



TERTIARY



CRETACEOUS



PENNSYLVANIAN
Bond and Mattoon Formations
Includes narrow belts of older formations along La Salle Anticline



PENNSYLVANIAN
Carbondale and Modesto Formations



PENNSYLVANIAN
Caseyville, Abbott, and Spoon Formations



MISSISSIPPIAN
Includes Devonian in Hardin County



DEVONIAN
Includes Silurian in Douglas, Champaign, and western Rock Island Counties



SILURIAN
Includes Ordovician and Devonian in Calhoun, Greene, and Jersey Counties



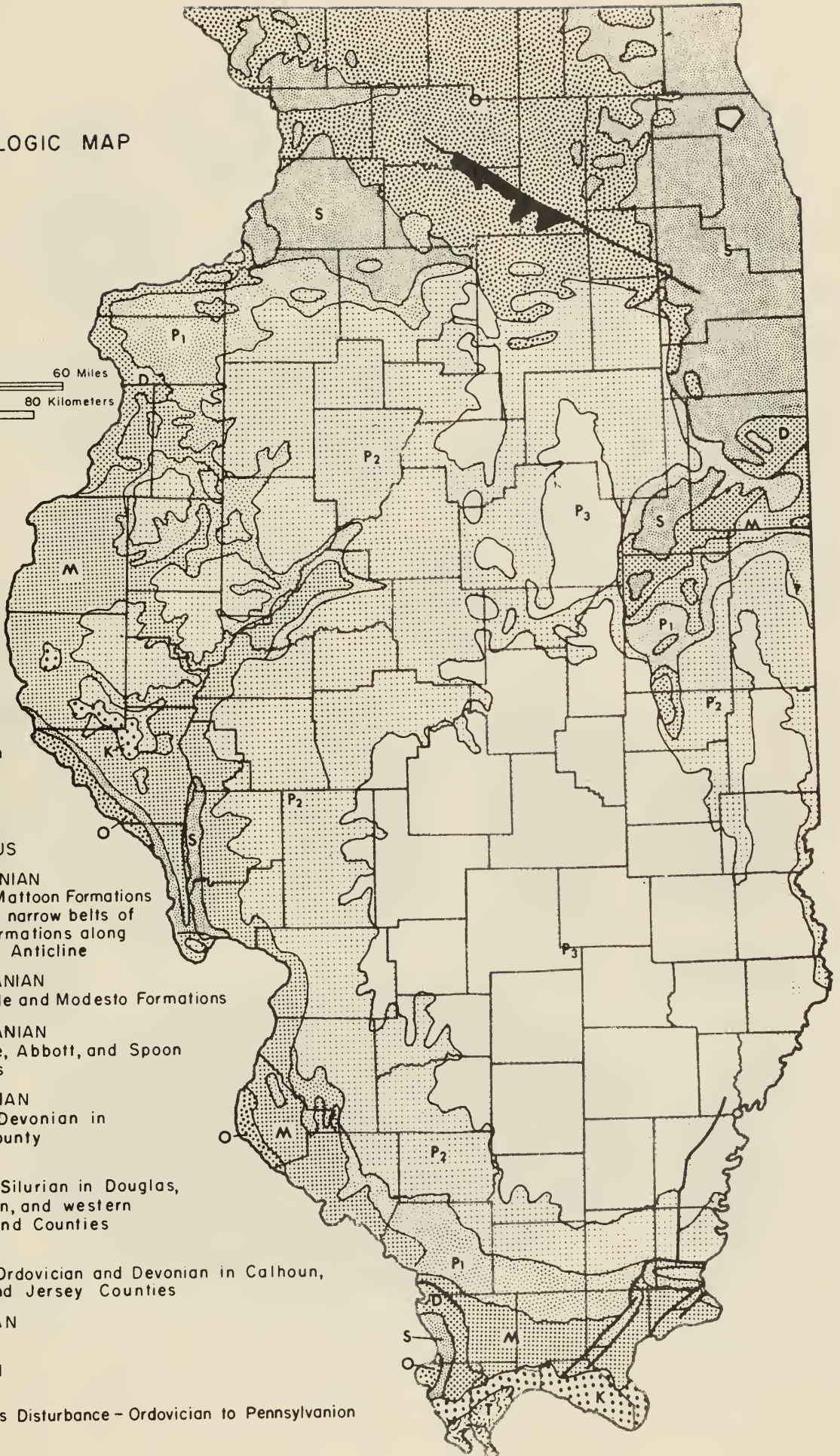
ORDOVICIAN



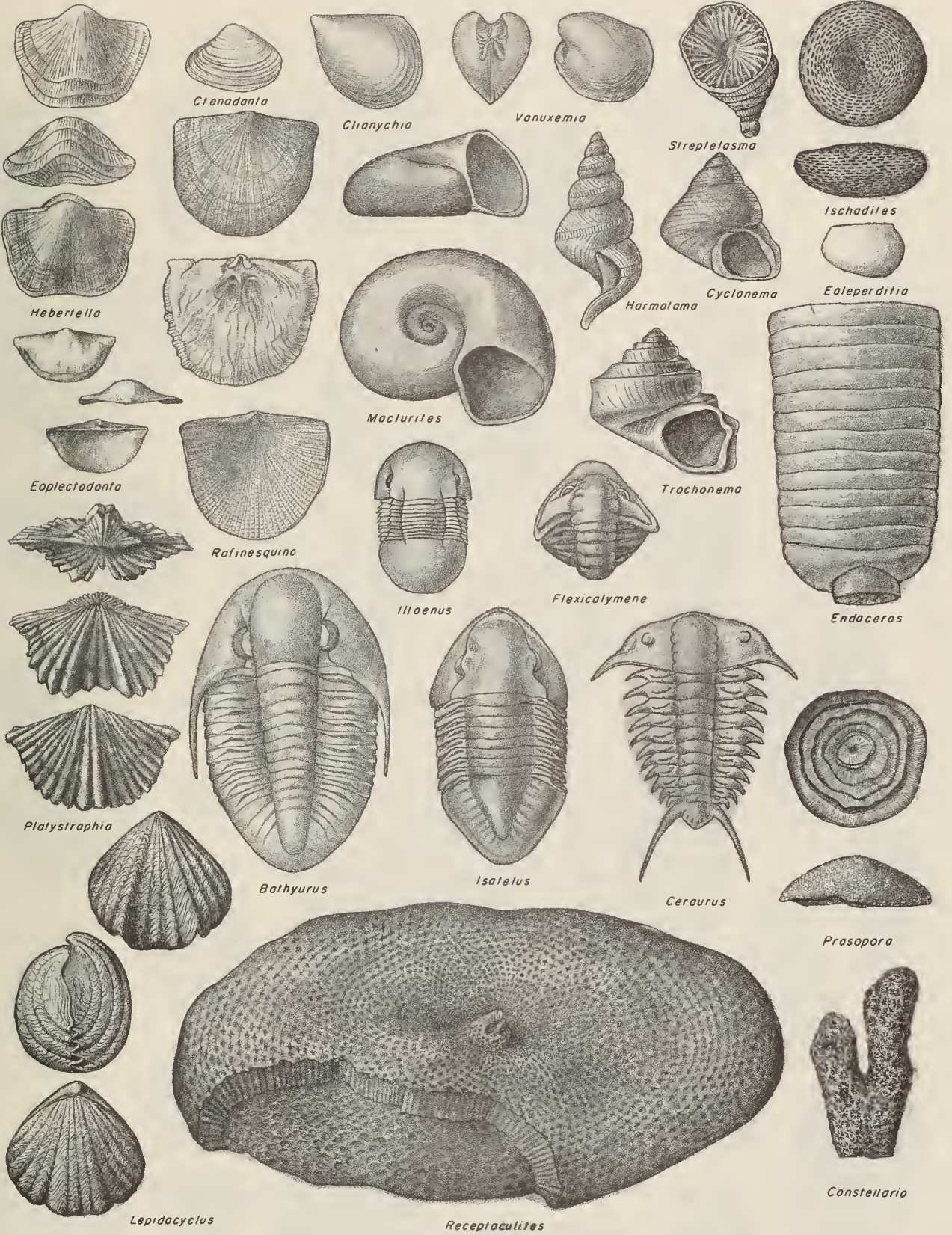
CAMBRIAN



Des Plaines Disturbance - Ordovician to Pennsylvanian Fault



ORDOVICIAN FOSSILS



REPRESENTATIVE SILURIAN FOSSILS FROM NORTHWESTERN ILLINOIS



Caryacrinites



Holocystites



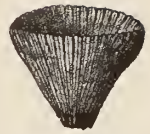
Eucalyptocrinites



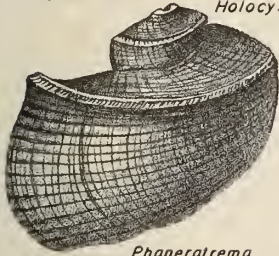
Siphocrinus



Laurelocrinus



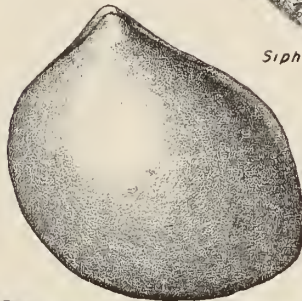
Neozaphrentis



Phanerotrema



Loxonema



Ambonychia



Pisocrinus



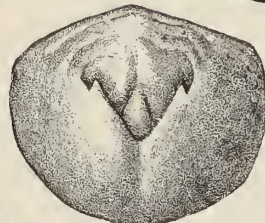
Ascoceras



Dawsanoceras



Raphistamina



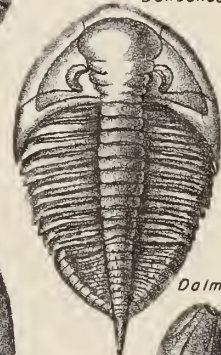
Dinabolus



Trimerella



Calymene



Dalmanites



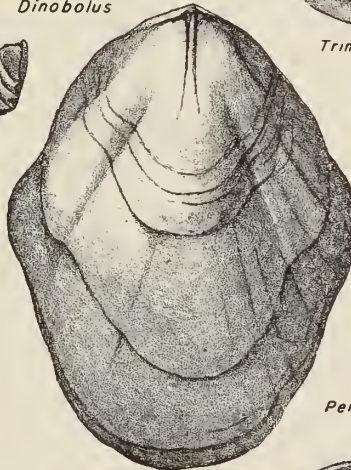
Hesperorthis



Rhynchotrema



Platymerella



Pentamerus



Stricklandia



Halysites



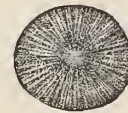
Astylospongia



Pycnostylus



Astraeospongia



Hindio



Favosites

ILLINOIS
GEOLOGICAL SURVEY | 75
YEARS

Geologic research and service for the citizens of Illinois since 1905

