GUIDE LEAFLET
GEOLOGICAL SCIENCE FIELD TRIP

Sponsored by
ILLINOIS STATE GEOLOGICAL SURVEY, URBANA

FREEPORT AREA

Stephenson County
Freeport, Lena, and Pecatonica Quadrangles

Leaders
William E. Cote, David L. Reinertsen, Myrna M. Killey
Urbana, Illinois
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GUIDE LEAFLET 1970 C
HOST: Freeport High School
TO THE PARTICIPANTS:

The Geological Science Field Trip program is designed to acquaint Illinois residents with the landscape, the rock and mineral resources, and the geological processes that have led to their origin. With this program, we hope to stimulate a general interest in the geology of Illinois and a greater appreciation of the state's vast mineral resources and their importance to the over-all economy.

We encourage you to ask the tour leaders any questions that may occur to you during the trip. Discussion often clarifies points that otherwise would remain confused to many of the participants. We also invite your written comments upon the conduct of the trips so that we might improve them as much as possible.

Additional copies of this guide leaflet, as well as itineraries for field trips that have been held in the past, may be obtained free of charge by writing to the Illinois State Geological Survey. The itinerary maps for each field trip can be purchased for 10 cents each.

Several of the stops along this itinerary are located on private property whose owners have graciously given us permission to visit their lands. Please obey the instructions of your trip leaders and conduct yourselves in a manner that will show respect for the property owners' cooperation. Please do not litter, or climb on fences, and leave all gates as found, so that we may be welcome to return on future field trips. These simple rules of courtesy also apply to public property as well. For the convenience of those persons who may use this itinerary at some future time, the names and addresses of every private property owner are listed for the respective stops on a page at the back of this guide leaflet.

ALWAYS OBTAIN PERMISSION WHEN VISITING PRIVATE PROPERTY.

We hope that you enjoy today's field trip and will attend others in the future.

THE STAFF
EDUCATIONAL EXTENSION SECTION
ILLINOIS STATE GEOLOGICAL SURVEY
INTRODUCTION

General Geology of the Freeport Area

The Freeport area lies within the scenic Rock River Hill Country of the Till Plains Section. The area was covered by continental glaciers during two of the major glacial invasions of the Pleistocene Epoch—the Illinoian and the Wisconsinan. Each of these glacial invasions was brief, and as a result, ice-laid deposits on the uplands are thin. Prior to glaciation, the topography of the Freeport area was maturely dissected and fairly rough. Topographic relief was higher than at present. Erosion by the Illinoian and Wisconsinan glaciers and the deposition of thin glacial deposits have subdued the preglacial landscape, but the present-day topography strongly reflects the shape of the bedrock surface. Severe crushing of the bedrock by the action of the glaciers is evident in many places.

The Pecatonica River, which flows eastward toward the Rock River, is the major stream in the Freeport area, and all other streams are tributaries to it. Although most of the stream valleys are at least partially filled with glacial drift, the glaciers caused only minor changes in the preglacial drainage pattern. The Pecatonica and its major tributaries, Richland and Cedar Creeks, essentially follow their preglacial valleys.

Bedrock in the Freeport area consists of about 2,400 feet of Paleozoic sedimentary rocks which rest on a Precambrian granitic basement (fig. 1). The exposed sedimentary rocks total about 500 feet in cumulative thickness and range from Champlainian (middle Ordovician) to Alexandrian (lower Silurian). They include the dolomite formations of the Ordovician Platteville and Galena Groups, shale of the Ordovician Maquoketa Group, and dolomite of the Silurian Edgewood and Kankakee Formations. These rocks were deposited in the ancient, shallow seas which covered Illinois and the Midwest from 400 to 500 million years ago. Approximately 400 feet of older middle Ordovician sandstone and 1,500 feet of Croixan (upper Cambrian) dolomite and sandstone are not exposed.

The general upland level in the Freeport area is a drift-mantled erosion surface developed upon dolomite of the Ordovician Galena and Platteville. This erosion surface occurs at elevations of about 900 to 940 feet and is the eastward extension of the Lancaster Peneplain, which is prominently developed in the Driftless Area farther west. Remnants of a higher erosion surface, called the Dodgeville Peneplain, are represented just to the west of Freeport by the tops of Silurian bedrock knobs at about 1,100 feet elevation.

The widespread occurrence of near-surface dolomite formations makes the Freeport area an important producer of roadstone and agricultural lime. Outwash sand and gravel deposits along the major stream valleys are valuable sources of concrete aggregate and roadstone. Groundwater is abundant throughout the Freeport area, and excellent local water supplies are obtained from the valley trains of the Pecatonica River and its tributaries. Large groundwater supplies have been found by drilling to the Ordovician St. Peter Sandstone and to the deeper Cambrian sandstones. Many good water wells have also been completed in the shallow dolomite formations.

Glacial History of Illinois

During the Pleistocene Epoch, commonly referred to as "The Great Ice Age," an extensive continental ice cap developed in the northern hemisphere during the
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<thead>
<tr>
<th>SYSTEM</th>
<th>SERIES</th>
<th>GROUP, STAGE</th>
<th>FORMATION, SUBLAGE</th>
<th>COLUMN</th>
<th>THICKNESS (feet)</th>
<th>DESCRIPTION</th>
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<td>CENOZOIC</td>
<td>PLEISTOCENE</td>
<td>Recent</td>
<td>Woodfordian</td>
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<td>Alluvium, dune sand</td>
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<td>Farmdalian</td>
<td>0-8</td>
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<td>Altonian</td>
<td>0-100</td>
<td>Till, outwash, lake sediments, loess</td>
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<td></td>
<td></td>
<td>Illinoian</td>
<td>0-50</td>
<td>Till, outwash</td>
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<tr>
<td>SILLURIAN</td>
<td>ALEXANDRIAN</td>
<td>Kankakes</td>
<td>5-25</td>
<td>Dolomite, argillaceous, cherty</td>
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<td></td>
<td></td>
<td>Edgewood</td>
<td>25-50</td>
<td>Dolomite, argillaceous, thin shale beds at bottom</td>
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<td></td>
<td></td>
<td>Maquoketa</td>
<td>90</td>
<td>Shale, green; with thin dolomite beds</td>
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<td></td>
<td>Dubuque</td>
<td>25</td>
<td>Dolomite, argillaceous</td>
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<td></td>
<td></td>
<td>Wise Lake</td>
<td>75</td>
<td>Dolomite, pure, massive; <em>Receptaculites</em> in upper half</td>
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<tr>
<td></td>
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<td>Galena</td>
<td>130</td>
<td>Dolomite, very cherty, abundant <em>Receptaculites</em> in zones; shaly, thin-bedded at bottom</td>
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<td>Dunleith</td>
<td>8</td>
<td>Dolomite, red shale beds</td>
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<td>Guttenberg</td>
<td>75-110</td>
<td>Dolomite, argillaceous, cherty</td>
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<td>Platteville</td>
<td>2-55</td>
<td>Sandstone, shale, dolomite</td>
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<td>Glenwood</td>
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<td>Ancell</td>
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<td>Dolomite, glauconitic, sandy</td>
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<td></td>
<td></td>
<td>St. Peter</td>
<td>(undifferentiated)</td>
<td>1500</td>
<td>Sandstone, shale, some dolomite</td>
<td></td>
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<tr>
<td>PRECAMBRIAN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Granite; other igneous and metamorphic rocks</td>
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Fig. 1 - Generalized sequence of sedimentary strata in the Freeport area.
times when the mean annual temperatures were a few degrees cooler than they are now. The portion of the ice cap that intermittently covered northern North America has been named the Laurentide Ice Sheet. Beginning about 1 million years ago and ending only 5,000 years ago, southward expansions of the ice sheet caused four major glacial invasions of Illinois and the Midwest. The ice that covered Illinois came from centers in central and eastern Canada (fig. 2). Each of the four major glacial advances were followed by long, warm, inter-glacial intervals during which the glaciers melted completely away (see attached Pleistocene Time Table). During these intervals, the deposits left by the glaciers were eroded and weathered. Each of the glacial advances produced significant changes in the topography and drainage of the glaciated areas. In order of occurrence, the glaciations of the Midwest have been named the Nebraskan, the Kansan, the Illinoian, and the Wisconsinan (fig. 3). The names are derived from the states where glacial deposits of these ages are best developed or were first described. The last glacier, the Wisconsinan, melted from northeastern Illinois a mere 12,000 years ago.

The Pleistocene glaciers profoundly modified the landscape of Illinois. They transported vast amounts of rock and soil debris that were eroded from the areas over which they moved. As the glaciers advanced and later melted back, these materials, known as drift, were deposited. The areas that were covered by the ice are underlain by extensive surficial deposits of ice-laid material called till. Till is an unsorted, unstratified mixture of all sizes of rock debris that generally has the consistency of pebbly clay. Areas that were covered several times by glaciers may have more than one layer of till.

Numerous arcuate till ridges called end moraines were formed at the margin of the Wisconsinan glacier in northeastern Illinois (see Glacial Map of Northeastern Illinois). Each end moraine represents an advance of the glacier and a line along which the ice margin maintained a temporary fixed position. The moraines were built up by accumulation of rock debris carried forward to the melting ice front. Thinner deposits of till that form gently undulating plains between the end moraines are known as ground moraines or till plains.

Sorted and stratified water-laid materials known as outwash, consisting of clay, silt, sand, and gravel, were also deposited as a result of the glaciations. Outwash sediments were deposited by debris-laden meltwater flowing away from the ice fronts during both the advances and retreats of the glaciers. Near the glacial margins, where meltwater was often not confined to definite channels, the outwash was laid as thin blanket-like deposits called outwash plains. In some places, elongated ridges of sand and gravel represent channel deposits of meltwater streams that flowed on or under the glaciers. Conical mounds of outwash called kames were formed where meltwater plunged through crevasses in the ice or into ponds along the edge of the glacier. Glacial lakes formed by the ponding of meltwater in valleys, in low areas on till plains, and behind end moraines were also the sites of deposition of the finest outwash sediments. Outwash deposits were often overridden by the advancing glaciers, so that the drift deposits typically consist of interstratified layers of till and outwash. There is also lateral interfingering of these materials.
River valleys, such as the Mississippi, Illinois, and Ohio, provided major channelways for escaping meltwaters. These valleys were greatly widened and deepened in the bedrock during times of greatest meltwater floods. When the floodwaters were waning, the valleys were partially filled with outwash far beyond the ice margins. The outwash deposits, consisting largely of sand and gravel, are known as valley trains. Along much of their lengths, the valley trains of the Mississippi and Illinois Valleys are more than 150 feet thick. In the Freeport area, the Pecatonica Valley contains 100 to 200 feet of till, outwash, and lake sediments from the Illinoian and Wisconsinan glaciations. Many former river valleys in areas covered by the glaciers are completely filled and buried by glacial deposits. The meltwaters also cut new valleys and caused numerous changes in the drainage system, some temporary and some permanent.

Deposits of wind-blown silt, called loess, which form the surface materials over most of Illinois, are also the result of glaciation. The silt was blown from floodplains of the valley trains. Most loess deposition occurred in the fall and
winter seasons, when colder conditions caused meltwater floods to recede, exposing the surfaces of the valley trains and permitting them to dry out. During Pleistocene time, as now, the winds prevailed westerly, and as a result, the loess deposits are thickest on the east sides of the source valleys. The loess is as much as 100 feet thick in many places on the east bluffs of the Mississippi Valley, but it thins rapidly away from the valleys. The loess in the Freeport area was derived mainly from the valley train of the Mississippi Valley and is only a few feet thick.

Itinerary

0.0 0.0 Assemble in the east parking lot of Freeport High School on the southwest corner of West Empire and South Locust Streets. Proceed east on West Empire Street and cross South Locust Street.

CAUTION. 4-WAY STOP.

0.3 0.3 4-WAY STOP. South Walnut Avenue. Continue ahead.

0.2 0.5 4-WAY STOP. South Chicago Avenue. Continue ahead.

0.4 0.9 STOP. South Galena Avenue and U. S. 20. CAUTION. SOUTH GALENA AVENUE TRAFFIC DOES NOT STOP. Continue ahead (east) on Empire Street.

0.4 1.3 SLOW. Dead end. Turn left on South Armstrong Avenue.

0.1 1.4 STOP. Turn sharply right on South Adams Avenue.

0.1 1.5 Alcan Cable Corporation on left.

0.1 1.6 SLOW. One-lane wooden bridge over railroad.

0.1 1.7 SLOW. Turn left on South Arcade Avenue.

0.4 2.1 Bear right.

0.1 2.2 STOP. East Shawnee Street. Continue ahead (northeast) under railroad overpass to South Hancock Street. Bear left on South Hancock Street at triangular intersection alongside the Inter-City Box and Plastic Company.

0.2 2.4 Turn hard left and then right.

0.1 2.5 Turn left.

0.1 2.6 Sewage treatment plant on right.

0.1 2.7 CAUTION. UNGUARDED RAILROAD CROSSING. Cross Pecatonica River on double-lane concrete bridge.

0.1 2.8 SLOW. Factory area. Watch for trucks and pedestrians.

0.2 3.0 STOP. East Stephenson Street and Illinois Route 75. Turn right (east) on East Stephenson Street. Taylor Park on left.

1.5 4.5 Quarry on left side of highway in the Dunleith Formation of the Ordovician Galena Dolomite Group.
0.2 4.7 SLOW. Route 75 turns to the left. Bear right off Route 75 on blacktop.

0.8 5.5 On the right note the well-developed oxbow lake in the floodplain of the Pecatonica Valley.

0.7 6.2 Descend valley wall to Pecatonica floodplain.

0.8 7.0 SLOW. Prepare to turn right.

0.1 7.1 Crossroads. Dakota Road and River Road. Turn right (south) on gravel road marked "Dead End."

0.4 7.5 Turn right and then left and cross railroad tracks. CAUTION.

Ascend hill. The roadcut at the top of the hill reveals several feet of very coarse till, an ice-laid deposit of the Altonian glacier that occupied the Pecatonica Valley just to the south at its maximum extent (see Itinerary Map). The till is orange-brown to brown in color and contains much coarse, very angular dolomite rubble that the glacier eroded locally from the bedrock. The matrix of the till is silty and sandy, as is typical of the Altonian till in the Freeport area. The coarseness of the till and the chaotic jumble of cobbles and boulders is somewhat atypical of till and suggests that the rock debris was literally dumped off the ice front which stood near this locality.

0.2 7.7 The series of hills on the left are composed principally of glacial sand and gravel. They form part of a small area of hummocky topography on the north side of Pecatonica Valley in this vicinity. These hills are constructional features that were deposited by meltwater from the Altonian glacier, and are known as a kame complex, or kame field. The road crosses parts of several kames in this area and the gravel which forms them is exposed in roadcuts.

0.5 8.2 T-road intersection from left. Turn left (east) and STOP.

Park on right shoulder. Walk south along road for about 1,700 feet to abandoned gravel pit in narrow east-west ridge. Cross cattle guard and enter private drive to reach pit on left. DO NOT DRIVE VEHICLES ACROSS CATTLE GUARD ONTO PRIVATE PROPERTY.

Stop 1. Abandoned gravel pit in esker ridge (SW 1/4 NW 1/4 SW 1/4, Sec. 36, T. 27 N., R. 8 E.).

The gravel exposed in this abandoned pit was deposited by meltwater from the Altonian glacier which advanced into this region during the early part of the Wisconsinan glacial interval, about 60 to 70,000 years ago (fig. 3). The Altonian advance was the first of two major glacial invasions of Illinois during the Wisconsinan. The second advance, the Woodfordian, which began about 22,000 years ago, did not cover the field trip area. The Woodfordian ice passed about 20 miles south of Freeport and extended westward into Rock Island County and southward as far as Shelby County at its maximum extent. The Woodfordian ice built the numerous end moraines that occur farther to the south in northeastern Illinois (see Glacial Map of Northeastern Illinois).

The Altonian glacier advanced into Illinois from the northeast. In north-central Illinois the ice moved almost due west along the lowland formed by the deep
Fig. 4 - Part of northwestern Illinois showing the area of Illinoian drift and the extent of the Altonian glacier at its maximum line of advance. Arrows indicate direction of ice movement. The area covered by glacial Lake Silveria (stippled pattern) and its outlet through Plum River are shown.

pre-Altonian Pecatonica Valley. A narrow, finger-like projection of ice reached up the valley as far as Freeport (fig. 4), 15 miles beyond the main mass of the glacier. This extension of the Altonian glacier has been named the Pecatonica Lobe. The extent of the Pecatonica Lobe in the field trip area has been determined by study of the distribution of till and ice-contact drift in Pecatonica Valley and on the adjacent uplands. The ice mounted the upland south of the valley, but apparently its northern margin stood just south of the bluff line (see Itinerary Map).

Kames and eskers are ice-contact drift bodies composed of stratified outwash, principally sand and gravel, that was deposited by glacial meltwater. Their preservation indicates they must have been formed during the late melting stages of a glacier's existence, when the glacier had become stationary or stagnant. Any movement of the ice after their formation would certainly have destroyed these unconsolidated deposits.

Eskers are the channel deposits of meltwater streams that flowed in valleys cut in the surface of a glacier. Undoubtedly some of the streams plunged into crevasses or holes in the ice and continued their courses within or under the glacier. After the ice had completely melted away, the channel deposits of these streams were often left standing as ridges on the till plain. Usually only segments of eskers are preserved because of post-glacial erosion, but some eskers are quite long and are sinuous and meandering, as are modern terrestrial streams. Some are joined by tributaries.

Kames are mounds of outwash that formed where the meltwater streams plunged through crevasses into subglacial ponds or into meltwater lakes along the ice margin. Kames are frequently found at the terminations of eskers. The meltwater streams entering lakes, which had ponded against the ice, formed small deltas that later were left standing as mounds of outwash after the ice completely melted. Whatever the situation, the deposition of the sand and gravel that forms kames was caused by abrupt changes in gradient of the meltwater streams.
This gravel pit is excavated in a short esker segment of Altonian outwash. The esker forms a low, narrow ridge that can be traced for about half a mile in this vicinity. It trends east-west for most of its length but turns northwestward near its western end. At its greatest height it stands about 45 feet above the level of the Pecatonica floodplain. This esker segment was deposited by a meltwater stream on the Altonian glacier, which had stagnated soon after it advanced into the Freeport area. Numerous kames, including the small complex of kames just to the north, were also deposited within the area covered by the Pecatonica Lobe. Many of these were deposited by meltwater that poured off the glacier into a lake that had formed in the Pecatonica Valley along the north side of the glacier. This lake will be discussed more fully at Stop 7.

Much of the gravel that forms this esker is very coarse and poorly sorted. It includes many cobbles and boulders, indicating the meltwater currents that transported the gravel were swift-flowing. The outwash is also crossbedded and stratified due to fluctuations in the direction and velocity of the currents. The gravel is badly slumped so that these features are not well-exhibited, but bedded gravel can be seen at the top of the pit at its east end. The beds are tilted down to the northeast.

A high percentage of dolomite, both in the sand and gravel fractions of the outwash, reflects the strong influence of local Ordovician bedrock formations as source materials. This dolomite was eroded by the Altonian glacier as it moved across the bedrock surface. The Ordovician dolomite fragments make up most of the coarsest gravel and many are quite angular. These facts are evidence that they were not transported very far by the meltwater stream, because the Ordovician dolomite is soft and easily abraded.

Many dolomite fragments in the gravel are of Silurian age and came from outside the Freeport area. These are well-rounded and lighter tan in color than the Ordovician dolomite, which is more orange-tan. The Silurian dolomite was eroded by the Altonian glacier from the Chicago area where Silurian formations form the bedrock surface. The Silurian dolomite is very fossiliferous and some interesting specimens can be collected. The gravel also contains numerous white, gray, and tan chert pebbles derived from the Ordovician and Silurian dolomite formations. There is also a variety of igneous and metamorphic rock fragments that were eroded from areas in eastern Canada. In a short time an excellent collection of many kinds of rocks can be made.

Glacial outwash is an important source of commercial sand and gravel. In 1968, 40.2 million tons of sand and gravel valued at $38.7 million was produced in Illinois, mainly from outwash. Northern Illinois, with its vast deposits of glacial outwash, accounted for more than half of this total production. Sand and gravel are widely used in the construction industry, in building and maintaining roads and highways, as ballast for railway roadbeds, and for many other uses.

Leave Stop 1 and proceed east on gravel road.

0.15 8.35 Abandoned gravel pits on left and right. The depth of the pit on the right is at least 40 feet and indicates that the thickness of the Altonian outwash in this area extends below the level of the Pecatonica River floodplain.

0.15 8.5 On the right, the east end of the esker seen at Stop 1 can be seen along the distant ridge line which passes in front of the blue silos.
Road turns left (north).

Again, to the left, note the kame tract that was just crossed.

Cross railroad tracks.

STOP. Crossroads. Turn right (east) on blacktop.

Cross railroad tracks. Turn right (south) and cross bridge over Pecatonica River.

Enter village of Ridott. Cross UNGUARDED RAILROAD TRACKS.

Crossroads at south edge of Ridott. Turn left (east).

Crossroads. Turn right (south) onto gravel road.

STOP. Intersection with Route 20. Turn right (west) on Route 20.

CAUTION.

SLOW. Prepare to turn right.

Turn right into drive of abandoned quarry. Bear left just after leaving highway.

Stop 2. Abandoned quarry in dolomite formations of the Galena Dolomite Group (NE 1/4 SE 1/4 SW 1/4, Sec. 4, T. 26 N., R. 9 E.).

About 60 feet of the Ordovician Galena Dolomite is exposed in the upper and lower benches of the quarry. In the Freeport area, the Galena consists of 4 formations—Dubuque, Wise Lake, Dunleith, and Guttenberg (fig. 1). This exposure includes the Dunleith and Wise Lake Formations, both consisting predominantly of dolomite. All of the lower bench and about 12 feet of the upper bench are in the Dunleith Formation. Above the Dunleith about 18 feet of the Wise Lake Formation is exposed.

The Dunleith consists of medium- to thick-bedded, gray-brown, tan-mottled, cherty dolomite, which becomes thin-bedded at the top. Some zones in the Dunleith are also quite argillaceous (clayey). The chert is light gray and brown in color and occurs as distinct bands of irregular nodules along bedding planes. The Wise Lake is more pure and consists of thin- to medium-bedded, gray-brown, tan-mottled, noncherty dolomite. The lack of chert in the Wise Lake distinguishes it from the highly cherty Dunleith. The Dunleith is softer and less dense, more massive, and less evenly bedded than the Wise Lake.

In many exposures, the contact between the Wise Lake and Dunleith Formations is a prominent chert band which marks the top of the Dunleith. In other places, the lower beds of the Wise Lake are also cherty, and the sharp transition from cherty to noncherty beds cannot be used to separate the formations. The upper part of the Dunleith is usually argillaceous below the overlying, more pure dolomite beds in the Wise Lake, and the top of this argillaceous zone is used as the contact between the formations. This is the case here at Stop 3 where the top of the Dunleith is about 2 feet below the highest cherty beds. The contact occurs along a prominent, even bedding plane which is emphasized by a slight re-entrant formed by weathering in the uppermost argillaceous beds of the Dunleith.
The Wise Lake and Dunleith Formations are fossiliferous, but dolomitization of the strata, which were originally limestone, has largely destroyed the fossils. The Wise Lake is more fossiliferous than the Dunleith, and many fossil molds give the formation a finely porous aspect. For the most part, only poorly preserved specimens, mostly internal casts and molds of brachiopods and gastropods, can be collected, but with patience some good specimens can be found. Fairly good specimens of the fossil sponge Receptaculites are abundant in the upper part of the Wise Lake Formation and in the middle and upper part of the Dunleith Formation.

A thin residual soil in Wisconsinan loess occurs above the Wise Lake Formation in this quarry. The loess is thin and the soil zone is partly developed in the top of the dolomite. In places, the upper beds of the Wise Lake are crushed, tilted, and bent, and glacial drift with igneous rock fragments is mixed into the crushed rock. This deformation was caused by ice-drag as the Altonian glacier moved across the bedrock surface. Similar "ice-shove" features are widespread throughout the Freeport area and north central Illinois. They will be discussed more fully at Stop 3 where they are better developed.

The formations of the Galena Dolomite Group are extensively exposed throughout north central and northwestern Illinois. West of here in Jo Daviess County, the Dunleith and Guttenberg Formations contain the principal mineralized zones in the zinc-lead mining district near Galena. In the Freeport area, the chert-free Wise Lake Formation is a valuable source of high purity dolomite which is used as agricultural lime. The Dunleith is also quarried, but the abundant chert renders it less valuable. The chert is also very hard and is destructive to mining and crushing equipment. In 1968, commercial quarry operators in Illinois produced 52.7 million tons of crushed limestone and dolomite valued at $77.2 million. The extensive deposits of limestone and dolomite in Illinois are among the state's most valuable mineral resources. The total value of all mineral products produced in Illinois in 1968 was $670.6 million. The combined value of crushed stone, sand, and gravel produced in Stephenson County in 1968 was $664,817, ranking the county 78th among the 99 mineral-producing counties in Illinois.

Origin of the Dolomites

Most geologists believe that dolomites were originally deposited as limestones by the chemical precipitation of calcium carbonate from sea water and by the accumulation of the calcareous remains of marine plants and animals. There is considerable evidence that the limestones were changed or dolomitized to dolomites at some time after their deposition.

During dolomitization, magnesium ions replace calcium ions in the atomic structure of the mineral calcite (CaCO₃). Based upon the degree of dolomitization, a carbonate rock is classified as limestone (0-10% dolomite), dolomitic limestone (10-50% dolomite), calcitic dolomite (50-90% dolomite), or dolomite (90-100% dolomite). In pure dolomite, the calcium-magnesium ratio is about 1 to 1. Small amounts of ferrous iron usually replace some of the magnesium in dolomite, resulting in the characteristic light brown color of most weathered dolomite formations. Recrystalization also takes place during dolomitization, in many cases producing a sucrosic (sugary) texture that is also characteristic of many dolomites. Because of this recrystallization, primary sedimentary structures, such as current features and fossil remains, are destroyed or are poorly preserved.

Geologists do not agree on the origin of the dolomites. Some geologists believe that dolomitization takes place soon after deposition, when the unconsolidated
limy sediments are still in contact with the sea water. Magnesium in the sea water is exchanged for calcium in the sediments by a reaction with the sea water that bathes the upper part of the sediments. Other geologists believe that dolomitization takes place after the limy sediments have been consolidated to limestone, by a reaction with magnesium-rich formation water (connate water) that was trapped in the limy sediments or in associated sandstones and shales during deposition. Still another theory holds that dolomitization is accomplished by ground water that becomes charged with magnesium from the zone of weathering at the earth's surface. The magnesium-rich ground water percolates through the pores and cracks (joints) in the limestones altering them to dolomite. There is evidence that dolomite is precipitated directly from sea water under certain specialized environmental conditions, and that many dolomites are primary in origin, rather than secondary alteration products of limestone. However, the special conditions required for primary precipitation of dolomite generically are not found in most regions of present limestone deposition in the seas. Space does not permit an evaluation of all the various theories that have been proposed to explain dolomitization. Suffice it to say that the problem is a complex one.

**Origin of Chert**

The origin of the chert, like the origin of dolomite, is not completely understood by geologists. The chert was apparently not deposited in its present form at the same time as the dolomite. Evidence for this is the fact that the chert is fossiliferous and also exhibits many of the sedimentary structures that are in the dolomite. Thus the chert appears to have replaced the dolomite. Colloidal and finely-divided silica were probably deposited as the siliceous hard parts of sponges and microscopic plants and animals. Later, after solidification of the dolomites (or the limestone which later changed to dolomite), this disseminated silica was dissolved, concentrated by solution, and redeposited as the irregular bands and nodules that are now present.

Leave Stop 2 and return to highway.

0.1 16.6 STOP. Intersection with Route 20. Turn right (west) on Route 20.

CAUTION.

0.5 17.1 SLOW. Intersection of Ridott-German Valley Road with U. S. 20.


2.4 19.5 SLOW. Prepare to turn left.

0.1 19.6 Crossroads. Turn left across the east-bound lanes of Route 20.

CAUTION!! Proceed south on gravel road.

0.7 20.3 **Stop 3.** Abandoned quarry in Wise Lake Formation (S 1/2 SE 1/4 NW 1/4, Sec. 12, T. 26 N., R. 8 E.). Cross fence and walk west along lane to quarry.

The dolomite that was quarried here belongs to the Wise Lake Formation. The quarry face is several hundred feet long and affords an excellent opportunity to examine the Altonian glacial drift and its relationship to the bedrock surface. Of particular interest at this exposure is the extreme deformation of the upper 10 to
20 feet of the bedrock. This deformation was caused by the drag of the Altonian glacier as it advanced over the Freeport area. The enormous weight of the moving ice severely eroded the dolomite bedrock—gouging, shattering, thrusting, and folding the dolomite. Large blocks of the dolomite are displaced and tilted, and near the eastern end of the quarry there is a small ice-shove anticline. Glacial drift is intimately mixed with the crushed dolomite, and in places, large pieces of dolomite have been thrust over till. In the central part of the quarry, a thin sheet of thin-bedded dolomite, 4 to 6 feet thick and about 200 feet long, has been thrust over the Altonian till, attesting to the tremendous erosive power of the glacier.

The highly disturbed character of the bedrock in the region of Altonian drift is further evidence for early stagnation of the glacier. The gradations from till through mixed till and crushed rock to normal bedrock which characterize the drift-bedrock contacts indicate that the erosive activity of the Altonian glacier was abruptly interrupted. In areas where the glaciers were active for longer periods, the bedrock surface was planed smooth by the movement of the ice. This is true in the part of Illinois that was covered by the Woodfordian glacier farther to the south. In the Freeport area, the early stagnation of the Altonian glacier did not permit its erosive activity to reach such an advanced stage.

Another possible explanation for the disturbed bedrock may be that the thin peripheral portion of the Altonian glacier (the Pecatonica Lobe) was pushed ahead as a rigid mass by the main body of the glacier. Such rigid ice would have plowed up the bedrock as it moved forward instead of flowing over the bedrock surface in typical glacier fashion. Based on the thinness of the Altonian till in the Freeport area, the Pecatonica Lobe is estimated to have been only about 500 feet thick at its maximum during its initial advance.

A third factor which contributed to the development of ice-shove features, which are also widespread in the area of Illinoian drift in this part of Illinois, was the rugged topography of the region. A closely spaced preglacial drainage pattern with narrow, sharp divides presented a rough surface to the advancing glaciers. Divides oriented at an angle to the direction of ice movement were especially susceptible to excessive dislocations of the bedrock. Weakening of the bedrock by weathering was undoubtedly another contributing factor.

Till deposited by the Altonian glacier in this exposure varies in thickness from a few feet to about 20 feet. The till is light brown, very sandy, and loose in texture. It contains much dolomite, both as the coarse fraction and as silty, sandy matrix material. Scattered boulders, cobbles, and pebbles of igneous and metamorphic rocks eroded from eastern Canada are also present in the till. The Altonian till is massive and unstructured as is typical of most till deposits.

Till is an ice-laid material, deposited while a glacier was still moving. It was deposited by a kind of plastering action as rock debris was released by melting at the base of the glacier. Till is characterized by its massive, unstratified structure and by its unsorted texture, consisting of a random mixture of clay, silt, sand, gravel, and larger-sized rock debris. Boulders are common because glacial ice has virtually unlimited transporting power. Tills consist of rock debris eroded from the areas over which the glaciers moved. In addition to locally derived rock debris, the tills in Illinois contain a large variety of igneous and metamorphic rocks that were eroded from areas in Canada and carried hundreds of miles by the glaciers. The Altonian till contains many pebble- and cobble-size rock fragments. Many of these are faceted (flattened on one or more sides) and striated (scratched) because of abrasion during transport by the ice. The rocks were held firmly by the ice and were ground against each other and dragged along the frozen ground over which the glacier moved.
Leave Stop 3. Continue south.

0.3 20.6 Railroad underpass. CAUTION.

0.3 20.9 Crossroads. Turn right (west).

2.6 23.5 STOP. Crossroads. Continue ahead (west).

1.1 24.6 T-road intersection from left. Continue straight ahead over wooden railroad bridge.

0.5 25.1 STOP. Crossroads. Continue ahead (west).

1.0 26.1 T-road from left. Continue ahead and cross narrow bridge over Crane Creek.

UNGUARDED RAILROAD CROSSING just beyond bridge. CAUTION.

Crane Creek occupies the lower part of the partially buried, pre-Illinoian bedrock valley of Yellow Creek. The bedrock valley, which is much wider and deeper than the present Yellow Creek Valley, was completely filled along much of its length by drift of the Illinoian glacier, which covered this region during two advances (fig. 3). West of here for several miles it is completely buried and was abandoned by Yellow Creek as a result of the Illinoian glaciation. In this immediate vicinity, the old valley is only partially filled, and it retains some topographic expression (see Itinerary Map). The Illinoian drift that fills the old valley from here to Pearl City is 100 to 150 feet thick. The upper part of this valley fill also includes lake sediments and loess of Wisconsinan age, which will be discussed at later stops.

From Pearl City eastward to Freeport, the present Yellow Creek has cut a new valley, much of it little more than a narrow bedrock gorge, about 2 miles north of the old valley. At Krape Park, in southeast Freeport, the creek turns eastward along the course of one of its former tributaries to join Crane Creek about 3/4 mile northeast of here. It then follows its old valley northeastward to the Pecatonica River. Northwestward from Pearl City to its headwaters near Stockton in Jo Daviess County, Yellow Creek closely follows the course of its former bedrock valley. That part of the valley was not completely buried, and the creek has cut its present valley in the easily eroded valley fill.

Just beyond the railroad crossing is a T-road intersection from the right. Turn right (north) on blacktop.

0.6 26.7 T-road from left. Turn left (west).

0.2 26.9 Entrance to Fair Grounds on right.

0.4 27.3 STOP. Intersection with Illinois Route 26. Jog to the left slightly and cross Route 26. CAUTION. Continue (west) on blacktop.

1.1 28.4 Turn right (north).

0.2 28.6 Turn left (west).
0.5 29.1 Turn right (north).

0.2 29.3 Cross narrow bridge over Yellow Creek.

0.1 29.4 T-road intersection from left. Continue straight ahead. Ascend hill.

0.3 29.7 Stop 4. Exposure of Illinoian till in roadcut (NW 1/4 SE 1/4 SW 1/4, Sec. 2, T. 26 N., R. 7 E.).

The Illinoian glacier covered the Freeport area in two separate advances, the Liman and the Jacksonville (fig. 3), sometime between 250,000 and 200,000 years ago. A third advance passed about 20 miles south of Freeport. The Nebraskan and Kansan glaciers, the first and second of the Pleistocene glaciers to invade Illinois, also passed south of the field trip area.

Several feet of gray-brown till that was deposited during the Jacksonville advance is exposed in this long roadcut. As noted earlier, glacial till consists of an unsorted mixture of sand, silt, and clay, and is characterized by its massive structure and lack of stratification. The Jacksonville till contains more clay and is more compact and firm than the Altonian till seen at Stop 3. Similar to the Altonian till, most of the rock fragments are dolomite (about 70%), reflecting the strong contributions from the dolomite bedrock over which the Illinoian glacier moved.

About 5 feet of soft, brown, very fine, homogeneous silt immediately overlies the Jacksonville till in this exposure. The silt is the Peoria Loess of Wisconsinan age, deposited between 22,000 and 12,000 years ago during the advance and retreat of the Woodfordian glacier. The loess was eroded by the wind from the outwash sediments in the Mississippi Valley to the west. The wind carried the silt eastward and deposited it as a thin layer over upland areas. The Peoria Loess forms a thin surficial veneer over much of the Freeport area, averaging about 3 1/2 feet in thickness. Although the Woodfordian ice did not cover the field trip area, the loess records the influence of this glacier beyond its margins.

An older loess of Altonian age, called the Roxana Silt, occurs above the Illinoian drift and below the Peoria Loess in many places on the upland in the Freeport area. However, it was extensively eroded during the interval between the Altonian and Woodfordian glaciations and is rarely exposed.

The modern soil at the surface extends through the Peoria Loess into the Illinoian till, and the upper 3 to 4 feet of till has been leached of carbonate minerals. The depth of leaching can be quickly determined by applying dilute acid which causes the unleached till below to bubble (release of carbon dioxide) due to reaction with the carbonate minerals calcite and dolomite. The depth of leaching is dependent upon the length of exposure and weathering and is sometimes useful in estimating the age of a till deposit. Buried weathered zones, such as the Sangamon Soil, found in glacial drift can also be detected by the acid test.

However, not all of this leaching is due to the weathering that has formed the modern soil. The leached zone in the top of the till represents an ancient buried soil zone called the Sangamon Soil. This old soil was formed during the warm interglacial interval that followed the Illinoian glaciation. This interval of weathering, called the Sangamonian, lasted from 200,000 to 70,000 years ago and ended with the advance of the Altonian glacier. In this exposure the Sangamon Soil has been truncated by erosion which preceded the deposition of the Peoria Loess. The B-horizon of the soil forms a conspicuous reddish brown zone in the north half
of the exposure, but it is missing in the south half. Below the red zone the weathered till is heavy and clayey and is oxidized to a yellowish brown color.

Leave Stop 4. Continue north.

0.5 30.2 STOP. Intersection with blacktop. Turn right (east) past Oakland Cemetery.

0.7 30.9 SLOW. Enter Freeport residential area.

0.2 31.1 4-WAY STOP. Turn right and enter Krape Park.

0.6 31.7 Bear left at fork in road.

0.1 31.8 SLOW. Cross bridge over Yellow Creek and bear left at fork in road by totem pole. Observe one-way traffic signs. Follow the traffic pattern that loops around the concession area.

0.2 32.0 Stop 5. Lunch.

Leave Stop 5. Return to north.

0.2 32.2 Y-intersection near totem pole. Bear right and cross bridge.

0.1 32.3 T-road on right from park entrance. Continue straight ahead. Turn left at the "left only" sign.

0.1 32.4 Cross culvert and follow the one-way sign that points to Flagstaff Hill. The waterfall on the right along the road flows over a cliff in the Dunleith Formation.

0.3 32.7 Y-intersection. Bear left toward Twin Caves.

0.1 32.8 Stop 6. Twin Caves and Natural Bridge developed in the Dunleith Formation (SE 1/4 SE 1/4 SE 1/4, Sec. 2, T. 26 N., R. 7 E.).

The natural bridge and the caves are erosional features that have developed along joints or fractures in the dolomite bedrock. The joints are zones of weakness in the rock which are readily enlarged by the abrasive and solutional activity of running water. The bedrock exposed here occurs along the outside of a meander of Yellow Creek where the stream is cutting against its outer bank and currents can scour the bedrock, especially during periods of flooding. The caves are still within reach of high water stages and will gradually be enlarged. The small arch or natural bridge is a remnant of a former cave that has been breached by erosion from above. It is well above the present floodplain of the stream and was formed when Yellow Creek flowed at a higher level. Since then the stream has deepened its valley.

Leave Stop 6. Continue ahead.

0.1 32.9 Y-intersection. Bear right.

0.1 33.0 Y-intersection. ONE-WAY up hill. Continue ahead to the left.

0.5 33.5 Steep grade. SLOW.
0.1 33.6  Turn left at intersection. Cross culvert and turn right.  
ONE-WAY TRAFFIC.

T-road intersection with road from bridge. Turn left before bridge and follow the exit to Freeport.

0.6 34.2  STOP. South Park Boulevard and West Empire Street.  Continue straight ahead (north).

0.6 34.8  STOP. West Stephenson Avenue.  Continue ahead (north).

0.6 35.4  STOP. Intersection with Route 20.  Turn right (east).

1.0 36.4  Intersection of Routes 20 and 26.  Turn left (north) toward Cedarville.

0.4 36.8  Cross Pecatonica River.

4.3 41.1  Descend into abandoned valley of Cedar Creek.  On the Itinerary Map note the present steep-walled gorge of Cedar Creek one mile to the north.

0.3 41.4  Enter village of Cedarville.  SLOW.  Prepare to turn right.

0.2 41.6  Turn right (east) on Cedarville Road.

0.9 42.5  T-road from left (Henderson Road).  Turn left (north) and STOP.

Stop 7.  Altonian lake sediments in roadcut (SE 1/4 SE 1/4 SE 1/4,  
Sec. 31, T. 28 N., R. 8 E.).

This roadcut exposes 9 feet of homogeneous, sandy silt deposited in a
glacial lake that formerly occupied this area during the stand of the Altonian gla-
cier.  The upper 4 feet of the lake sediments are leached and weathered to a tan-
brown color.  The unweathered silt below is yellow-tan and calcareous.  Figure 4  
shows the approximate extent of this glacial lake named Lake Silveria.

Glacial Lake Silveria began to form when the advancing Altonian glacier  
dammed the mouth of the Pecatonica Valley at its junction with the Rock River Valley
30 miles to the east, near Rockton, in Winnebago County.  The lake, fed by meltwater,
backed up the Pecatonica Valley and its tributaries as the Pecatonica Lobe advanced  
into the Freeport area.  It flooded a large area in Stephenson County at its maximum  
extent and reached northward into Wisconsin and westward to the Jo Daviess County
line.  At its highest level the lake stood at an elevation of about 870 feet above
sea level.  At this level it overflowed through an outlet into East Plum River
2 miles northwest of Pearl City (see Itinerary Map).  As the Altonian ice melted,
an outlet was opened farther east along the present valley of Silver Creek.  The
water poured over a divide at German Valley and the lake was lowered to an elevation
of about 855 feet.  Further melting of the glacier opened an outlet to the Rock River
Valley across the upland northwest of the present site of Rockford in Winnebago
County and the lake was lowered to 805 feet.  When the Rock River Valley finally
became free of ice, the lake was completely drained.

Lake Silveria lasted for only a short time.  Sediments that were deposited in
the lake are thin in the Freeport area, usually less than 15 feet in thickness,
and are preserved mainly along the larger valleys.  Since the lake was short-lived,
no beaches or other shore line features are preserved.
Leave Stop 7. Continue ahead (north). Enter valley of Cedar Creek.

0.3 42.8 Stop 8. Discussion of abandoned valley of Cedar Creek (NE 1/4 NE 1/4 SE 1/4, Sec. 31, T. 28 N., R. 8 E.).

One-half mile west of here, Cedar Creek turns away from its pre-Illinoian bedrock valley and enters a sharp gorge cut into Ordovician dolomite (see Itinerary Map). The eastern end of this narrow gorge can be seen as a notch in the west wall of the valley directly ahead from here. The creek follows the gorge for about one mile around the north side of Cedarville and then enters the lower part of a former tributary valley at the northwest edge of town. The gorge represents a diversion channel that was cut as a result of the Illinoian glaciation. The creek was forced to abandon the segment of its pre-Illinoian bedrock valley that trends as a broad lowland to the southwest from here. This part of the bedrock valley, which is largely filled by drift, passes beneath Cedarville. The city water well penetrated 150 feet of drift before reaching bedrock at the bottom of the valley.

Although the Freeport area was completely covered by the Illinoian glacier on two occasions, the Pecatonica River and its major tributaries still essentially follow their pre-Illinoian bedrock valleys, which had been cut 100 to 300 feet below the bedrock surface. The diversion of Yellow Creek (briefly discussed earlier) was one of the most drastic drainage changes. Because the stands of the Illinoian glacier were brief, the drift on the uplands is relatively thin. The valleys of Pecatonica River, Richland Creek, and Cedar Creek, three of the area's largest streams, were only partially filled with glacial deposits. After each of the Illinoian glaciers had melted, these streams resumed their pre-Illinoian courses, except for a few minor changes as the one by Cedar Creek in this locality.

Most of the drainage changes which occurred in the Freeport area took place during the melting stages of the Jacksonville glacier, the second of the Illinoian glaciers. As the stagnant ice melted, a landscape developed which consisted of an irregular surface of ice, drift, and protruding bedrock. The meltwater streams which flowed over this surface escaped through temporary valleys, some of them across pre-Illinoian bedrock divides. As melting continued, a stage was reached at which ice remained only in low areas over the bedrock valleys, probably as isolated blocks. Some of the ice blocks, standing higher than the adjacent upland, became dams for meltwater lakes. Overflow from many of these lakes also spilled through temporary valleys across former divides. A few of the ice dams persisted long enough for the outlets to be deeply incised, causing the abandonment of the dammed segments of the bedrock valleys.

The ice block which forced Cedar Creek to cross the divide and cut the present gorge probably filled most of the depression over the abandoned valley segment from here past Cedarville. Although the lake which formed behind the dam was only temporary, a large amount of meltwater poured over the divide and rapidly cut the gorge. By the time the ice had melted, the new diversion channel was cut below the bottom of the old valleys, so it was permanently abandoned. Similar ice-block diversions of Richland Creek occurred at Buena Vista. Pecatonica River also abandoned part of its pre-Illinoian valley 3 miles east of Cedarville (see Itinerary Map). This diversion will be discussed at Stop 10.

Leave Stop 8. Continue ahead.

0.3 43.1 Lake sediments exposed in the roadcut on right.

0.3 43.4 Cross Cedar Creek.
0.2 43.6 Crossroads. Turn left (west).

1.0 44.6 STOP. Intersection with Route 26. Turn right (north) on Route 26 to Orangeville.

5.0 49.6 Entering village of Orangeville.

0.1 49.7 Route 26 turns right. Bear left off highway and proceed north on Main Street to downtown Orangeville.

0.6 50.3 STOP. Turn left (west) on High Street.

0.1 50.4 Cross Richland Creek and railroad crossing.

0.3 50.7 Crossroads. Entrance to Priewe Busjahn Community Park on left. Park on shoulder just past park entrance.

Stop 9. Abandoned quarry in dolomite formations of the Platteville and Galena Groups (SE 1/4 NE 1/4 SE 1/4, Sec. 35, T. 29 N., R. 7 E.). Enter field through gate and walk south along grass lane to old quarry (about 1,000 feet from road).

Approximately 25 feet of the oldest exposed rocks in the field trip area are found here. A slight dip to the south-southwest of about 20 feet per mile has brought the older rocks to the surface in the northwestern part of the Freeport Quadrangle. Ordovician Platteville Dolomite of the Nachusa and Quimbys Mill Formations are overlain by the Guttenberg Formation of the Galena Dolomite. Some 12 to 15 feet of rocks is exposed in a vertical quarry face, with the remainder being exposed further up the slope. However, rocks are not easily differentiated and contacts are not clear, largely because quarry operations were conducted on a small scale here and thus the rocks are not continuously well-exposed.

The dolomite is light brown to cream-colored to gray and usually finely mottled. The rock is fine-grained, argillaceous, fossiliferous, thin- to medium-bedded with some beds dense, and laminated in part. Dolomitization is not complete, as some fossils are still well-preserved. Some units are porous because large numbers of fossils have been weathered out.

Some units exposed here are extremely fossiliferous, almost like coquina or shell-beds. Most fossils, however, are not well-preserved. Fossils include brachiopods, gastropods, cephalopods, corals, crinoids, and rare trilobites. Some forms occur mainly as molds in the rock. Fucoids, which are irregular, rounded, silty to sandy, branching objects, are found abundantly in some zones. There is disagreement among geologists as to their origin. Some have attributed them to marine algal remains even though no plant structures have ever been discovered. Others believe that they were formed by some burrowing organism (perhaps worms or pelecypods) living in the upper few inches of sediment on the sea floor. The peculiar branching habit of many of the fucoids here lends support to the theory that at least some of these markings may be the remains of some type of coral or perhaps some form of marine plant.

Living conditions in the sea that covered this region varied from time to time favoring one type of organism over another, since some beds contain predominantly 1 or 2 types of fossil remains. Although the sea was shallow, the water was fairly quiet much of the time. Most of the fossils are unbroken, indicating that vigorous wave-generated currents did not sweep over the sea bottom. Long segments of fragile
crinoid stems (one was noted here that was over 12 inches long), occasional crinoid calyces, and clusters of solitary corals occurring in upright position, indicate that deposition of these sediments took place in a relatively quiet, sheltered environment.

Leave Stop 9. Continue ahead (west).

0.5 51.2 Crossroads. Turn left (south) on gravel road (Bellevue Road).

0.5 51.7 T-road intersection. Turn left (east) to Route 26.

0.7 52.4 Railroad crossing, unguarded.

0.2 52.6 STOP. Intersection with Route 26. Turn right (south).

5.3 57.9 Descend into valley of Cedar Creek.

0.1 58.0 Cross Cedar Creek. Notice the steep-walled bedrock gorge through which Cedar Creek is flowing. This gorge was discussed at Stop 7. The sheer walls of the gorge are cut into the Galena Dolomite and rise vertically as much as 80 feet on both sides of the creek.

0.3 58.3 Enter Cedarville.

0.3 58.6 Intersection with Washington Street (Lena Road). Turn right (west) toward Lena.

0.7 59.3 Exposure of Dunleith Formation on the left. Cross Cedar Creek.

1.2 60.5 Railroad crossing. CAUTION.

0.1 60.6 Cross Richland Creek. Note how wide the floodplain is here at the junction of Richland and Cedar Creeks in comparison to the small streams that occupy the valley. At this locality, these streams occupy their partially buried, pre-Illinoian bedrock valleys.

0.8 61.4 Note the excellent view of the upland surface in all directions from this vantage point.

0.3 61.7 Descend into abandoned valley of the Pecatonica River.

0.1 61.8 Stop 10. Abandoned channel of Pecatonica River (SE 1/4 SE 1/4 SE 1/4, Sec. 33, T. 28 N., R. 7 E.).

The broad lowland which trends toward the north from here is an abandoned segment of the Pecatonica bedrock valley. This abandonment also occurred at the close of Illinoian glaciation when ice blockage of the Pecatonica forced the river to cut the narrow rock gorge in which it now flows about a mile to the west (see Itinerary Map).

The ice dam which caused this diversion occupied the abandoned valley segment. The lake which formed behind the dam must have backed up into the Pecatonica Valley for several miles. The overflow poured over a low spot in the divide along the west side of the pre-Illinoian valley and rapidly cut an outlet channel. At the same time that the diversion channel was being cut, the floor of the old valley was being raised by the accumulation of outwash released into the lake from the melting
ice block. When the ice dam was finally breached and the lake drained, the diversion channel had been cut below the bottom of the old valley, and the old channel was permanently abandoned.

Leave Stop 10. Continue (west) toward Lena.

0.9 62.7 Cross Pecatonica River.

0.5 63.2 Abandoned gravel pit in Illinoian outwash on left. The distinct red zone in the top of the gravel is the Sangamon Soil. The soil is overlain by several feet of sandy silt that was deposited in Lake Silveria.

2.5 65.7 SLOW. Prepare to turn left.

0.1 65.8 Turn left (south) on gravel road (Unity Road).

0.9 66.7 Notice the small conical hill on the right. The hill is an erosional knob of Silurian dolomite.

0.2 66.9 Crossroads. Continue ahead (south).

0.2 67.1 The high ground to the right is underlain by Silurian dolomite.

1.1 68.2 Enter village of Eleroy.

0.1 68.3 STOP. T-road intersection with Salem Road. Bear left.

0.2 68.5 STOP. Railroad crossing. Continue straight ahead.

STOP. Intersection with Route 20. Turn left (southeast).

0.2 68.7 SLOW. Prepare to turn right.

0.1 68.8 Turn hard right (west) on Mound Road.

0.2 69.0 T-road intersection from left. Continue ahead (west).

0.7 69.7 Stop 11. Discussion of the physiography of the Freeport area (NE 1/4 SE 1/4 SW 1/4, Sec. 14, T. 27 N., R. 6 E.).

This vantage point affords an excellent view of the upland for many miles to the north and west.

The geomorphic (physiographic) history of the Freeport area is primarily erosional. At the end of the Paleozoic Era the region was permanently raised above sea level, and for the next 225 million years, erosion stripped away an estimated 1,500 to 2,000 feet of Silurian, Devonian, Mississippian, and Pennsylvanian sedimentary strata. A fairly rugged land surface was developed with deeply incised stream valleys. This land surface was only slightly modified and subdued by the deposition of glacial drift on the uplands and the aggradation of the valleys during the late Pleistocene Altonian glaciation.

The topography of the Freeport area is largely controlled by bedrock. The higher hills and knobs at elevations of about 1,100 feet are held up by Silurian bedrock and are remnants of an ancient erosion surface, the Dodgeville Peneplain. This ancient land surface was formed late in the Tertiary Period during the Pliocene
Epoch between 11 million and 1 million years ago. It is well developed in the Driftless Area to the west and extends westward into Iowa and northward into Wisconsin and Minnesota (see fig. 4 and attached map of Physiographic Divisions of Illinois). The accordant (even-crested) summit levels in the distance at the tops of the Silurian bedrock knobs are the remnants of the Dodgeville surface. The hill over which the itinerary passes between Eleroy and Stop 11 (see Itinerary Map) is one of these Silurian knobs, the top of which is probably a part of the Dodgeville Peneplain.

The sloping surface in the immediate foreground is developed on Maquoketa Shale. The soft, easily eroded shale typically forms gentle slopes. The upland level beyond, toward the northwest between 900 and 940 feet elevation, is the eastward extension of another erosion surface, the Lancaster Peneplain, which closely coincides with the top of the Galena Dolomite. This lower and younger erosion surface is also very prominently developed in the Driftless Area. The Lancaster Peneplain is believed to have formed in late Tertiary or early Pleistocene time following uplift of the Dodgeville Peneplain. The Lancaster Peneplain, mantled by glacial drift, is not notably flat but is characterized by undulating, dissected terrain, as seen here. Rejuvenation of streams with renewed downcutting of valleys and erosion of the glacial deposits, as a result of slight uplift following the melting of the last glacier, has produced this topography.

Leave Stop 11. Continue ahead.

0.5 70.2 T-road intersection from right. Continue ahead (west).

0.3 70.5 Stop 12. Exposure of Silurian Edgewood Dolomite and shale of the Ordovician Maquoketa Group (NE 1/4 NW 1/4 NE 1/4, Sec. 22, T. 27 N., R. 6 E.).

This stop is the highest point along the itinerary and has an elevation of about 1,050 feet.

Sedimentary rocks of the Silurian and Ordovician Systems are exposed in the roadcut. About 20 feet of the Silurian Edgewood Dolomite is exposed above road level at the crest of the hill. This level marks the approximate contact with the underlying Maquoketa Shale. The Edgewood consists of thin-bedded, slabby, grayish to greenish tan, fine-grained dolomite. The dolomite is slightly fossiliferous, but most of the fossils are poorly preserved. Numerous tubular corallites of solitary corals are especially abundant in a thin 6-inch zone about 2 feet above the base of the formation. The bed that contains the corals is orange-tan in color. Most of the fossil corals are molds or impressions in the dolomite, but some hard parts are preserved. Apparently for a short time, conditions in the Silurian sea were especially favorable for the growth of the corals.

Only a few feet of Maquoketa Shale is exposed at the east and west ends of the roadcut. In the Freeport area, the Maquoketa has a maximum thickness of about 90 feet and consists of gray-green, thin-bedded, dolomitic shale with thin beds of argillaceous dolomite and dolomitic limestone. In the limestones, most of the fossils have not been dolomitized and many are very well-preserved. Some of the limestones are extremely fossiliferous. One of these thin limestones is exposed just below the Edgewood at the east and west ends of the cut, and excellent specimens of brachiopods, corals, gastropods, and bryozoans can be collected. The following brachiopod genera are especially abundant: Rhynochotrema sp., Dinorthis sp., Hebertella sp., Rafinesquina sp., and Strophomena sp. Fragments of the trilobite Isotelus can also be collected.
The contact between the Edgewood Dolomite and the Maquoketa Shale is an unconformity, or erosion surface, and represents a major interruption in deposition at the close of the Ordovician Period. Uplift of the region caused the Ordovician sea to withdraw, exposing the Ordovician strata to erosion. The Silurian sea advanced into the Freeport area over an irregular erosion surface developed on the Maquoketa Shale. The lower beds of the Edgewood are shaly because of mud that was eroded from the Maquoketa.

Leave Stop 12. Continue ahead (west).

0.8 71.3 Crossroads. Continue straight ahead.

1.0 72.3 STOP. Illinois Route 73. Turn left (south) toward Pearl City.

3.8 76.1 SLOW. Enter Pearl City.

0.6 76.7 Turn left (east) on Freeport Road.

0.3 77.0 Cross Yellow Creek.

1.8 78.8 Crossroads. Continue ahead (east).

0.4 79.2 Stop 13. Fossil collecting in beds of the Maquoketa Shale Group (S 1/2 NE 1/4 NW 1/4, Sec. 11, T. 26 N., R. 6 E.). Park completely off the highway on the grass shoulder. CAUTION. HIGH SPEED TRAFFIC.

The Maquoketa beds exposed on both sides of the roadcut are slightly lower stratigraphically than those at Stop 10. The exposure is poor and has become grassed over. Fossiliferous rubble of thin dolomitic limestones is scattered over the slopes of the roadcut, and fossil collecting is much better than at Stop 10. Many specimens are extremely well-preserved.

The Maquoketa Shale in northern Illinois consists predominantly of gray, brown, and green dolomitic shales, indicating that the late Ordovician sea was very muddy. The middle and upper parts of the shale contain some limestones that were deposited at times when the sea had cleared somewhat. For the most part, the shales are quite barren of fossils, but many of the limestones are extremely fossiliferous. The evenly bedded, laminated shales suggest that conditions on the sea floor were calm, but too muddy for most marine animals to survive. The limestones probably represent intervals of shallowing, when conditions were less muddy, permitting a rich fauna of marine animals to develop.

"The geology of Stephenson County is of a very simple character"

End of field trip. Thanks for coming!

FREEPORT AREA PROPERTY OWNERS:

Stop 1 - Mr. Arthur Meier, R. R. 1, Ridott, Illinois 61067. Home located at end of lane beyond cattle guard at Stop 1. Stop 2 - Mr. Lester Matter, R. R. 1, German Valley, Illinois 61039. Home located one-half mile west of quarry at southwest corner of Route 20 and Ridott-German Valley Road intersection. Stop 3 - Mr. Walter H. Kroeger, R. R. 1, Freeport, Illinois 61032. Home located 0.6 mile northwest of Stop 3, on south side of Route 20. Stop 9 - Mr. Daryl Sweetwood, R. R. 1, Orangeville, Illinois 61060. Home located one-quarter mile west of Stop 9 on south side of blacktop road.
## TIME TABLE OF PLEISTOCENE GLACIATION

<table>
<thead>
<tr>
<th>STAGE</th>
<th>SUBSTAGE</th>
<th>NATURE OF DEPOSITS</th>
<th>SPECIAL FEATURES</th>
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<tr>
<td>RECENT</td>
<td>Years Before Present</td>
<td>Soil, youthful profile of weathering, lake and river deposits, dunes, peat</td>
<td></td>
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<tr>
<td></td>
<td>5,000</td>
<td>Valderan Outwash</td>
<td>Ice withdrawal, erosion</td>
</tr>
<tr>
<td>WISCONSINAN</td>
<td>11,000</td>
<td>Two creekan Peat and alluvium</td>
<td>Glaciation, building of many moraines as far south as Shelbyville, extensive valley trains, outwash plains, and lakes</td>
</tr>
<tr>
<td>(4th glacial)</td>
<td>12,500</td>
<td>Woodfordian Drift, loess, dunes, lake deposits</td>
<td>Ice withdrawal, weathering, and erosion</td>
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<tr>
<td></td>
<td>22,000</td>
<td>Farmdalian Soil, silt, and peat</td>
<td>Ice withdrawal, weathering, and erosion</td>
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<tr>
<td></td>
<td>28,000</td>
<td>Altonian Drift, loess</td>
<td>Glaciation in northern Illinois, valley trains along major rivers, Winnebago drift</td>
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<tr>
<td></td>
<td>50,000 to 70,000</td>
<td>SANGAMONIAN Soil, mature profile of weathering</td>
<td></td>
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<tr>
<td>SANGAMONIAN</td>
<td>70,000</td>
<td>Buffalo Hart Drift</td>
<td>Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois</td>
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<tr>
<td>(3rd interglacial)</td>
<td></td>
<td>Jacksonville Drift</td>
<td></td>
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<tr>
<td>ILLINOIAN</td>
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<td>Liman Drift, loess</td>
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<tr>
<td>(3rd glacial)</td>
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<td>YARMOUTHIAN Soil, mature profile of weathering</td>
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<tr>
<td>(2nd interglacial)</td>
<td></td>
<td>KANSAN Drift Loess</td>
<td>Glaciers from northeast and northwest covered much of state</td>
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<tr>
<td></td>
<td></td>
<td>AFTONIAN Soil, mature profile of weathering</td>
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<tr>
<td>(1st interglacial)</td>
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<td>NEBRASKAN Drift</td>
<td>Glaciers from northwest invaded western Illinois</td>
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GLACIAL MAP OF NORTHEASTERN ILLINOIS

George Ekblaw
Revised 1960
PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

Ozark Plateaus Province
Interior Low Plateaus Province
Central Lowland Province
Coastal Plain Province

Reprinted 1970

ILLINOIS STATE GEOLOGICAL SURVEY
GEOLOGIC MAP OF ILLINOIS
showing
BEDROCK BELOW
THE GLACIAL DRIFT
1961