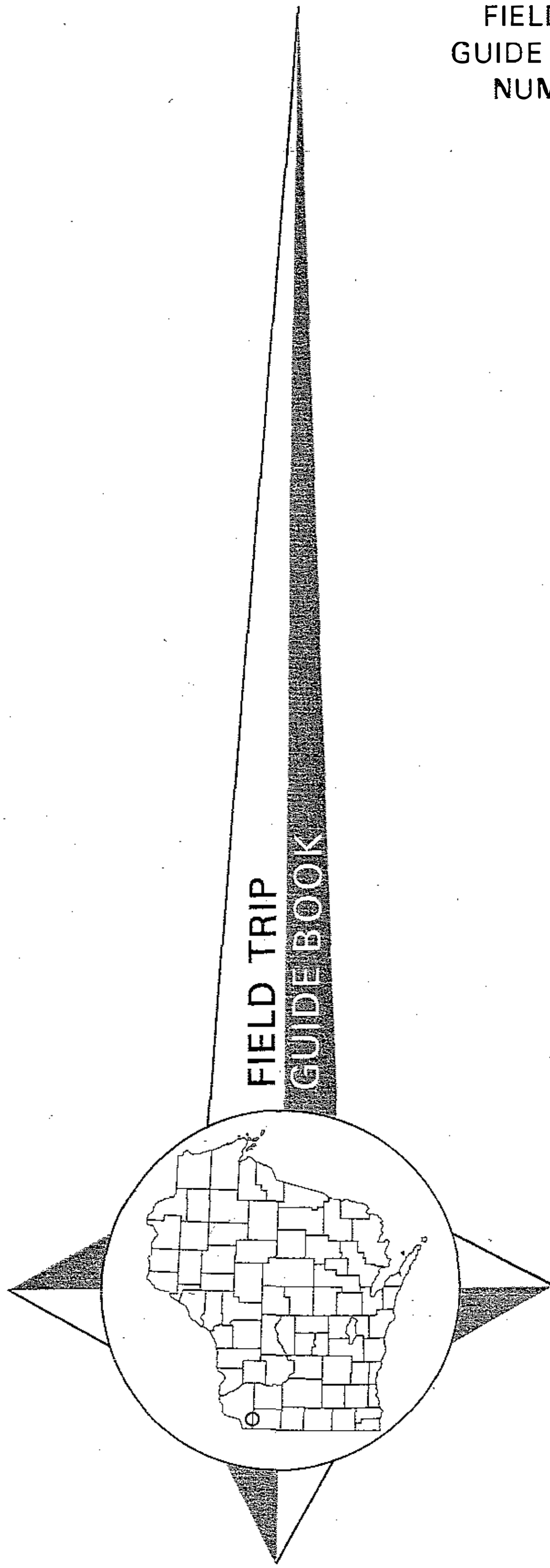
UNIVERSITY OF WISCONSIN-EXTENSION
GEOLOGICAL AND NATURAL HISTORY SURVEY
Meredith E. Ostrom, State Geologist and Director

FIELD TRIP
GUIDE BOOK
NUMBER 1
1978



UPPER MISSISSIPPI VALLEY BASE-METAL DISTRICT

Prepared for:
TWENTY-FOURTH ANNUAL MEETING
INSTITUTE ON LAKE SUPERIOR GEOLOGY
UNIVERSITY OF WISCONSIN-MILWAUKEE
MILWAUKEE, WISCONSIN
MAY 9–14, 1978

Field Trip Guide Book
Number 1

University of Wisconsin-Extension
GEOLOGICAL AND NATURAL HISTORY SURVEY
Meredith E. Ostrom, State Geologist and Director

UPPER MISSISSIPPI VALLEY BASE-METAL DISTRICT
(companion volume to Information Circular Number 16)

With contributions by

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Rachel K. Paull, Richard A. Paull, and W. S. West

Edited by

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Geological and Natural History Survey

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University of Wisconsin, Milwaukee
Milwaukee, Wisconsin

May 9-14, 1978

Richard A. Paull, Chairman, Field Trip Committee
University of Wisconsin-Milwaukee

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Wisconsin 53706

1978

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INTRODUCTION

M. G. Mudrey, Jr.[1]

The zinc and lead mines of southwestern Wisconsin are part of the oldest continuously producing zinc-lead mining district in the United States, the Upper Mississippi Valley District. The largest and most productive parts of this district extend across five Wisconsin counties and into small areas in Illinois and Iowa (Fig. 1). Over 1.2 million tons of zinc and nearly 100,000 tons of lead have been recovered from the Wisconsin portion of the Upper Mississippi Valley district from 1910 to 1974, with a combined value in excess of $267 million. Heyl and others (1959) suggest that an additional 250,000 tons of zinc and 350,000 to 400,000 tons of lead were produced in the Wisconsin part of the district in the period following 1800. The text that accompanies this field trip (Heyl and others, 1970) covers the early history of the region, and the geologic controls on ore mineralization. In addition, West and Weeks (1976) provide additional information on the district and its production.

The field trip commences in Madison, proceeds to Platteville for an overnight stop, examines the formations directly related to the ore horizons, and visits an historic lead mine (St. John Mine) and an operating zinc-lead mine near Shullsburg (Fig. 2). The field trip returns to Madison where private vehicles can be picked up, and terminates in downtown Milwaukee prior to the 25th Annual Institute on Lake Superior Geology.

Geologic stops will be in the Dickeyville, Potosi and Shullsburg 7.5-minute topographic quadrangles. In addition, the route leads through the Platteville, Cuba City, and New Diggings 7.5-minute topographic quadrangles. Geologic quadrangle references are Cuba City, Agnew (1963); Dickeyville, Whitlow and West (1966a); New Diggings, Mullens (1964); Potosi, Whitlow and West (1966b); and Shullsburg, Mullens (1964).

The trip starts with two road cuts and a quarry that include units of the Sinnipee Group (Figs. 3 and 4). The first day ends with a visit to an early lead mine (St. John Mine), that may well have been the first operating mine in Wisconsin. The second day the Shullsburg Mine of Eagle Picher Industries, Inc. will be visited. After a lunch stop in Shullsburg, the route leads back to Platteville via a cultural tour along back roads, and then returns to Madison and Milwaukee.

This year marks the 125th anniversary of the first Wisconsin geological survey. Under an act of the Legislature approved March 25, 1853, a State Geological Survey was created, with an annual appropriation of $2,500 per year for four years. Edward Daniels was appointed State Geologist by Governor Leonard J. Farwell. Daniels' instructions were to "complete his survey of that portion of the state known as the 'lead mines' before commencing the survey of the remainder of the state."

We welcome you to the Zinc-Lead District, and hope that you find the geology, companionship, and tour rewarding!

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[1] Wisconsin Geological and Natural History Survey, Madison

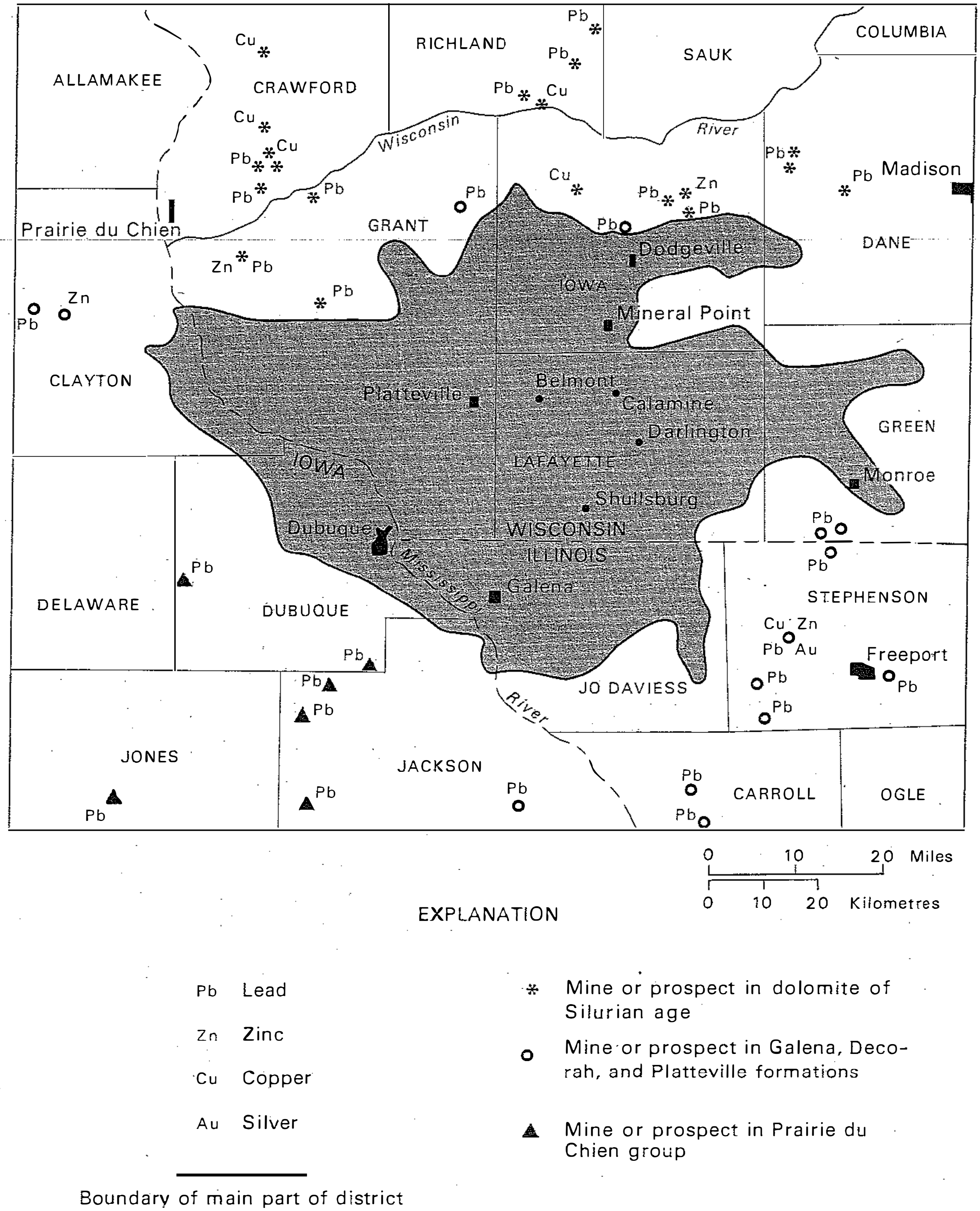

Figure 1. Map of main part of the Upper Mississippi Valley zinc-lead district.

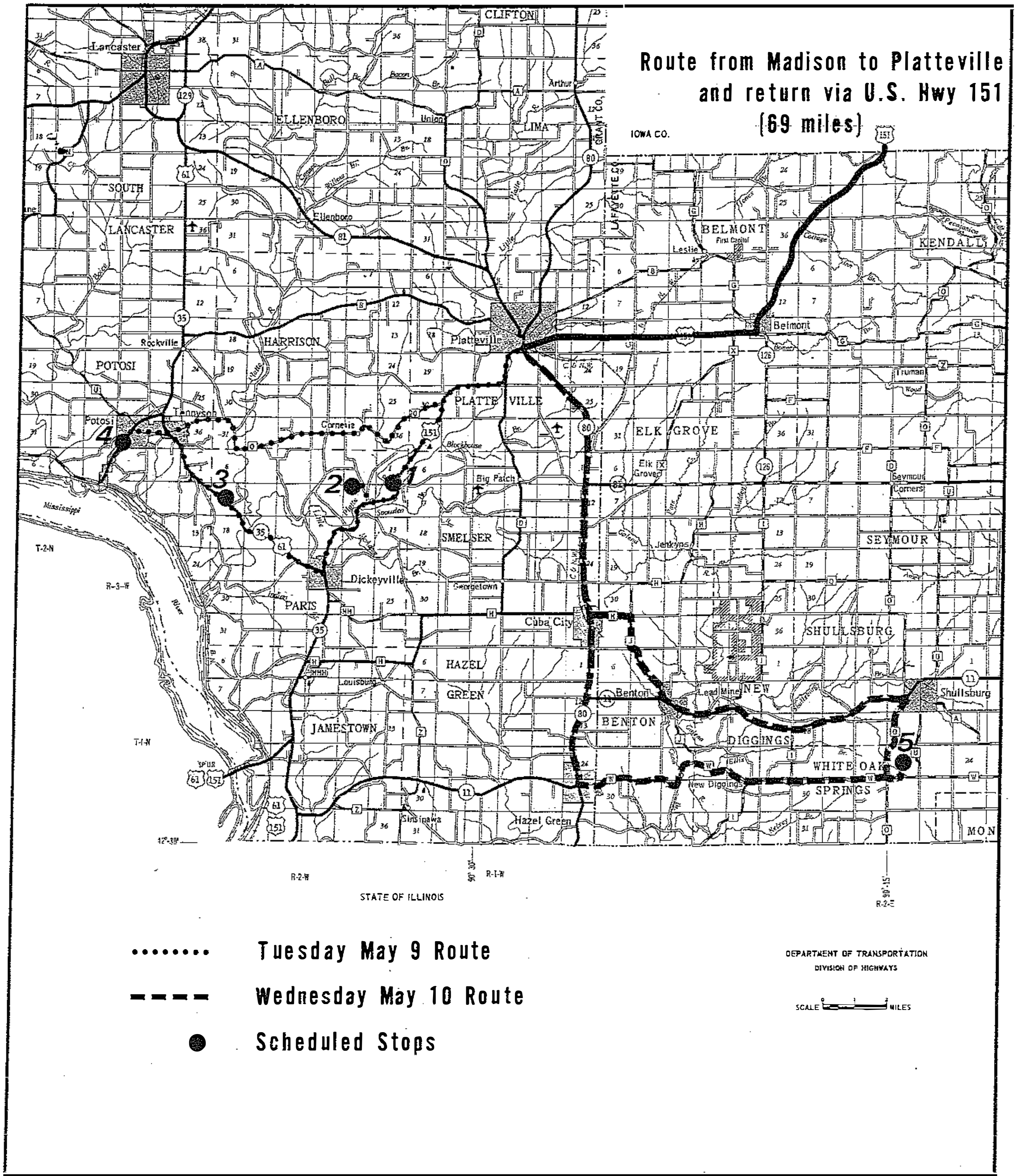

Figure 2. Highway map showing route of field excursion.

System	Series	Group	Formation	Member
Devonian	Upper		Kenwood (55')	
	Middle		Milwaukee (80')	
			Thiensville (65')	
			Lake Church (35')	
Silurian	Cayugan		Waubakee (30')	
	Niagaran		Racine (100')	
			Manistique (150')	
			Hendricks } (110')	
			Byron }	
	Alexandrian		Mayville (175')	
Ordovician	Cincinnatian		Neda (55')	
			Maquoketa (240')	
	Champlainian	Sinnipee	Galena (230')	
			Decorah (25')	
			Platteville (100')	
			St. Peter	Glenwood (13')
				Tonti } (332')
				Readstown }
	Canadian	Prairie du Chien	Shakopee	Willow River (50')
				New Richmond (25')
			Oneota (200')	
Cambrian	St. Croixan	Trempealeau	Jordan	Sunset Point
				Van Oser } (60')
				Norwalk }
			St. Lawrence (50')	Lodi < Black Earth
		Tunnel City (200')	Lone Rock	Reno
			Mazomanie	Tomah
				Birkmose
		Elk Mound	Wonewoc (100')	Ironton (40') Galesville
			Bonneterre (20')	
			Eau Claire (250')	
			Mt. Simon (500')	

Figure 3. Detailed stratigraphic column of Platteville, Decorah, and Galena formations in the Upper Mississippi Valley zinc-lead district.

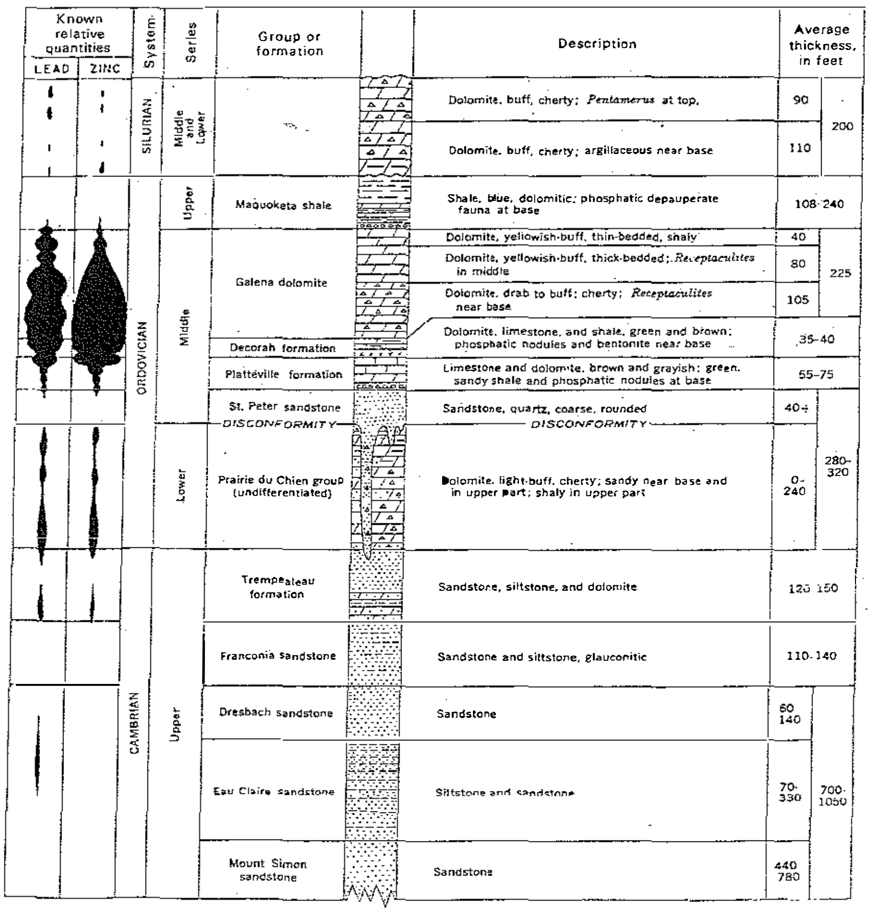

Figure 4. Simplified stratigraphic column showing relative quantitative stratigraphic distribution of zinc and lead in the Wisconsin district.

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Tuesday, May 9, 1978

Geologic Road Log for U.S. 151 from Madison, Wisconsin (U.S. 12 and 14 junction) to Platteville, Wisconsin (Wisconsin 80 and 81 junction)*

Richard A. Paull[1] and Rachel K. Paull[2]

U.S. 151 from Madison to Verona traverses a recently glaciated (Woodfordian) part of the Eastern Ridges and Lowlands physical province. Since the drift in this area was deposited near the ice margin, it is generally thin, and the underlying bedrock exerts considerable influence on the character of the landscape. From the western edge of the Wisconsinan (Woodfordian) terminal moraine just west of Vernoa to the Sugar River, the route crosses a thin sliver of older (Illinoian) drift. The remainder of the route lies within the classic Driftless Area of the Western Uplands physical province.

Between Madison and Mt. Horeb, rock exposures along the highway are mainly dolomite assigned to the Lower Ordovician Prairie du Chien Group. However, some younger rocks are also present. The bedrock from Mt. Horeb to Platteville is predominantly Middle Ordovician limestone and dolomite of the Platteville, Decorah, and Galena formations, although the Middle Ordovician St. Peter Sandstone is also exposed along the highway in a few places. Several isolated mounds (outliers) of Upper Ordovician Maquoketa Shale capped by resistant, Silurian dolomite are present near U.S. 151 in the vicinity of Blue Mounds and Platteville.

Mileages		
0	(69)	Junction U.S. 151 and 18 with U.S. 12 and 14 on the southwest edge of Madison, Wisconsin. Note: The road log from Madison to Milwaukee provided for Wednesday May 10, 1978 also begins at this intersection.
1.5	(67.5)	Gravel pits to the southeast are in glacial outwash that fills a preglacial bedrock valley.
2.5	(66.5)	Rock exposures along the valley sides are red and yellow weathering St. Peter Sandstone capped by Middle Ordovician Platteville-Galena dolomite.
8	(61)	Verona, Wisconsin and junction with Wisconsin 69. The thin drift cover here was deposited near the margin of the Woodfordian ice.
9	(60)	Cross the Johnstown Moraine, the terminal moraine of Wisconsinan (Woodfordian) glaciation in this area.

*This road log is published with permission of Kendall/Hunt Publishing Co., Dubuque, Iowa and it should not be duplicated by any means without written permission.

1 The University of Wisconsin-Milwaukee

2 The University of Wisconsin-Madison and Alverno College, Milwaukee

Mileages

10 (59) Cross the Sugar River. The upper course of the Sugar River, which flows south and southeast to join the Rock River, developed along the western margin of the Woodfordian glacier. This broad, terraced valley once carried great quantities of meltwater and outwash southward from the wasting ice front, which lay immediately east of here.

The Sugar River defines the edge of the Driftless Area here. The outer edge of the Woodfordian terminal moraine forms the partially wooded ridge on the east side of the valley. The deposits between the Sugar River and the terminal moraine probably include a thin strip of Illinoian glacial deposits.

From the Sugar River, the route gradually ascends toward a ridge crest which marks the edge of the Middle Ordovician Platteville-Galena upland surface.

15 (54) Junction County P. Friable St. Peter Sandstone is quarried just north of here at Klevenville. A thin layer of overlying Middle Ordovician Platteville Dolomite is stripped away, and the poorly consolidated quartz sandstone below is mined for foundry and refractory sand.

18 (51) Mt. Horeb, Wisconsin occupies a ridge top. Originally settled by Norwegian and Swiss farmers, its heritage is recalled by commercial establishments along the route.

20.5 (48.5) Junction with County JG. This steep, wooded road descends one mile north to Little Norway, a restored Norwegian pioneer homestead. The side road follows a narrow, deeply-cut, "V"-shaped valley that is typical of the upper reaches of drainages in the Driftless Area. The Tyrol Ski Basin, 2 miles north of Little Norway, takes advantage of these steep valley walls.

20.8 (48.2) Entrance to Cave of the Mounds is north of the highway, off County F. This cave is developed in the Middle Ordovician Galena Dolomite. It had no natural entrance, and was accidently discovered by quarry blasting in 1939. The cave, which features a variety of intricate dripstone deposits, is open for tours during the summer months (Fig. 5). Brigham County Park, on East Blue Mound, is a short distance beyond the cave on County F.

21 (48) The wayside park north of the highway is developed in an old quarry in the Galena Formation.

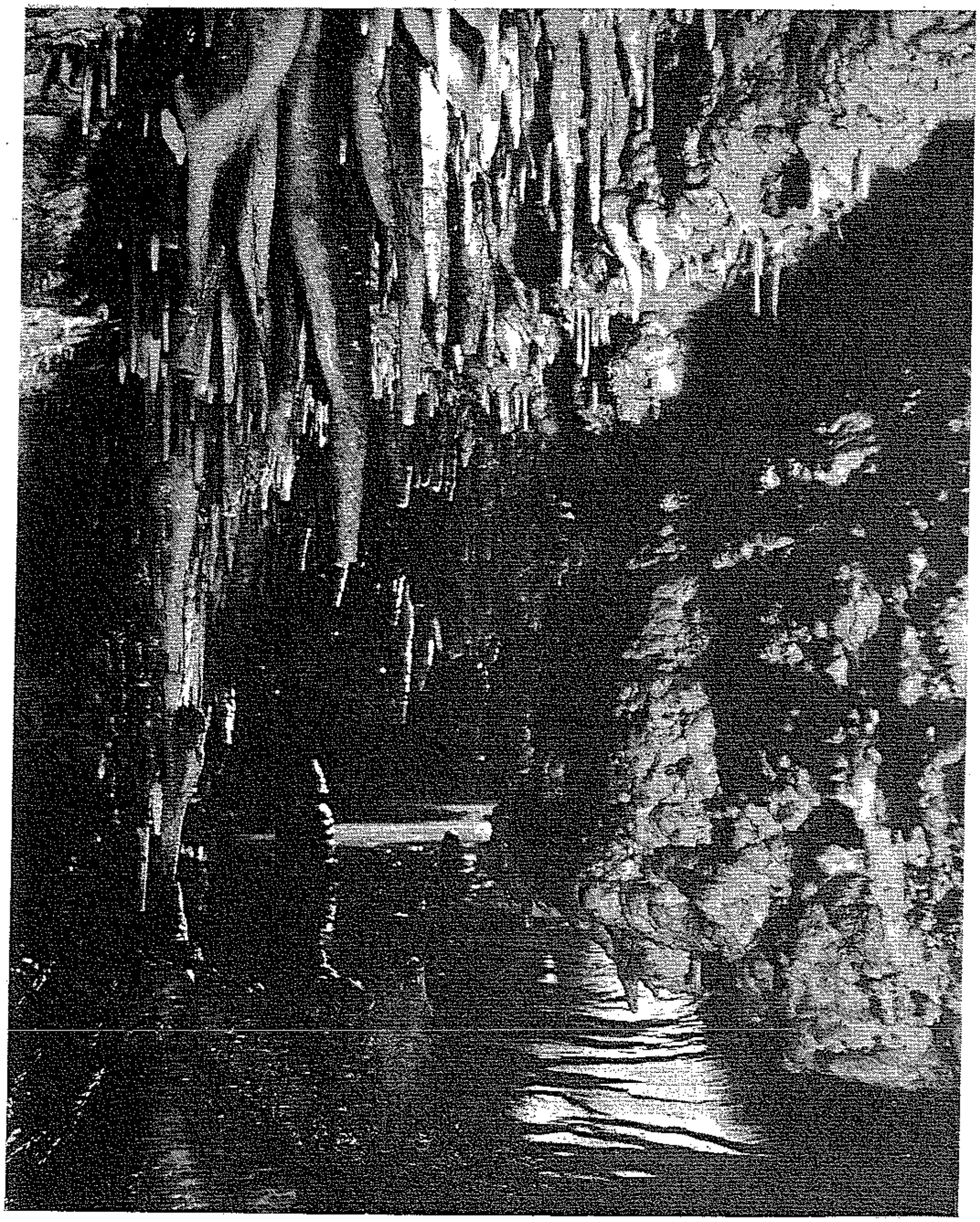

Figure 5. Dripping stalactites hang from the ceiling of this narrow passageway in Cave of the Mounds near Blue Mounds, Wisconsin. Photo courtesy of Cave of the Mounds.

Mileages

22.7 (46.3) Village of Blue Mounds, nestled beneath the west and east summits of the Blue Mounds (Fig. 6).

The summits of East and West Blue Mounds are about 1.6 miles apart (Fig. 6). The East Mound, site of Brigham County Park, has a broad flat top developed on the Upper Ordovician Maquoketa Shale. However a few blocks of silicified Silurian dolomite are found on the crest and flanks. The elevation of the West Mound is 1716 feet, some 230 feet higher than its neighbor to the east. This mound has a smaller, more rounded summit area, and it is capped by 85 feet of silicified Silurian dolomite. Thus, West Mound is an outlier of the Silurian escarpment, which has retreated about 50 miles to the southwest as a result of downdip erosion.

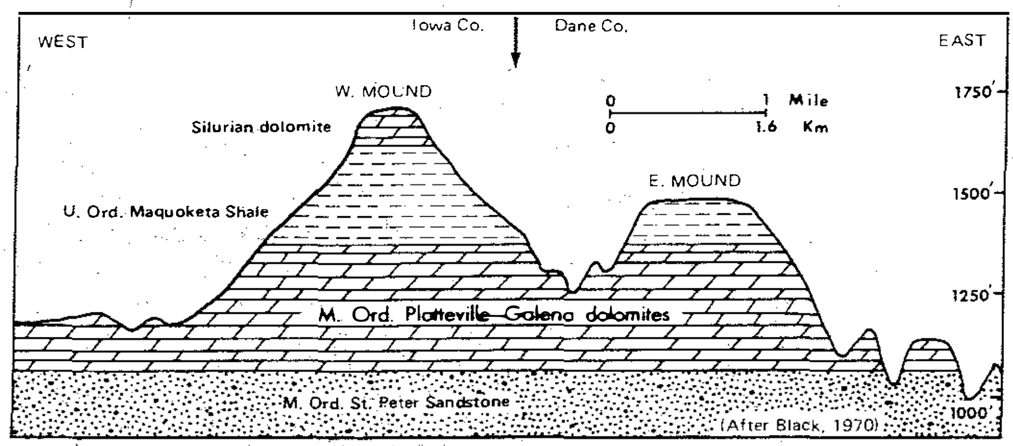

Figure 6. Cross section through Blue Mounds from west to east. Elevation in feet is indicated along the right margin. After Black, 1970.

Blue Mounds State Park, on West Blue Mound, is reached by a well-marked road that goes north through the village. At the mound top, observation towers are located at both the east and west ends of an old racetrack. The towers provide an opportunity to view the Driftless Area to the west, the glaciated countryside toward Madison, and the Precambrian Baraboo Range to the north. Indians reportedly used the mound top as an observation post, and fashioned the silicified cap rock into projectile points. They attributed the blue haze, which often veils these wooded mounds when viewed from below, to the pipe smoke of Wakanda, the Earth-maker.

The Upper Ordovician Maquoketa Shale, which makes up East Mound and underlies the Silurian on West Mound, forms the upper part of the gently sloping sides of these wooded mounds (Fig. 6). The Platteville-Galena formations are the basal foundation for both mounds, which are perched on the edge of the Middle Ordovician cuesta called Military Ridge. To the north, steep drainages flow toward the Wisconsin River valley, about 11.5 miles away. The headwaters of one of these north-flowing streams forms the separation between the two mounds.

22.9 (46.1) Dane/Iowa County line. Enter Iowa County in an area where roadcuts expose thin-bedded, nodular Middle Orcovician dolomite. Several small quarries along the highway between here and Barneveld also provide exposures of the Middle Ordovician Platteville-Galena formations.

Mileages

26 (43) Barneveld, Wisconsin. The Blue Mounds, the most northeasterly of the Silurian outliers, are visible to the east (Fig. 7).

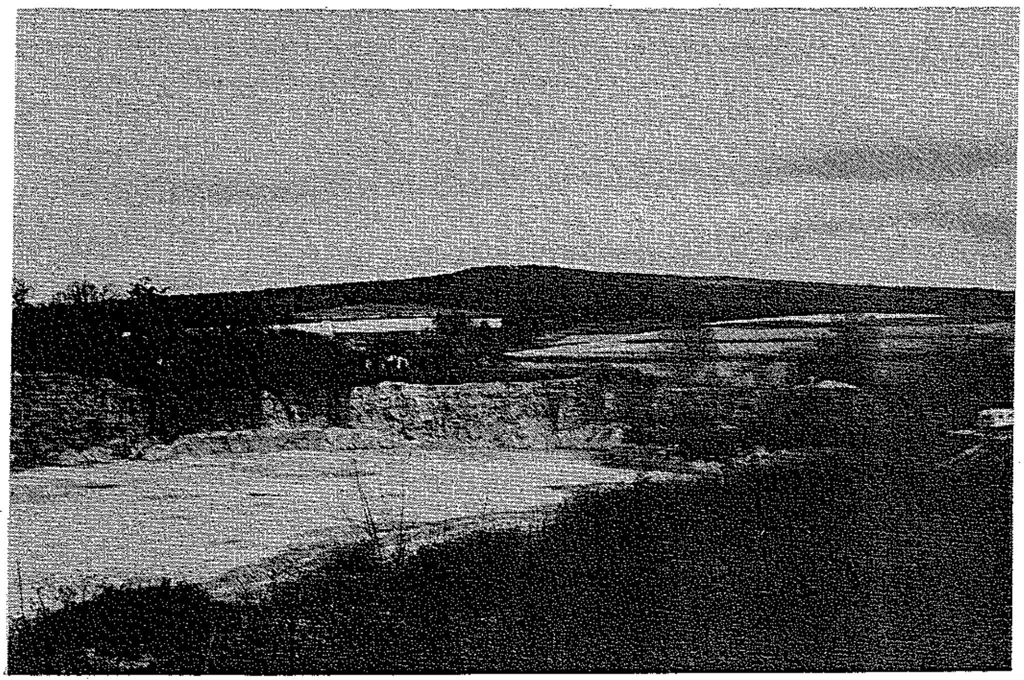

Figure 7. A view east to the gently-sloped, wooded Blue Mound, from a quarry developed in the Middle Ordovician Galena Dolomite.

The route westward from Barneveld to Ridgeway passes numerous roadcuts in the Middle Ordovician Platteville-Galena formations as it traverses Military Ridge.

31 (38) Town of Ridgeway, named for the Middle Ordovician cuesta of Military Ridge, upon which it is perched.

35 (34) Wayside to north of the highway has a historical marker for "Old Military Road". This road was completed in 1835 to link Fort Howard at Green Bay to Fort Crawford at Prairie du Chien. In this area, the route followed the well-defined, broad, treeless ridge crest at the northern edge of the Middle Ordovician Platteville-Galena cuesta. Since this ridge forms the drainage divide between the Wisconsin River to the north and the Platte, Galena, and Pecatonica rivers to the south, it is not dissected by streams. This aided road construction by eliminating the need for bridges.

Besides army traffic, thousands of pioneers passed this way to the booming lead mining area, the early territorial capitol of Wisconsin, and the thriving port cities on the Mississippi River. This same route was utilized later by the Chicago and Northwestern Railroad.

Mileages

39 (30) Junction with U.S. 18 and State 23. U.S. 18, west from here, continues along the route of the historic army road along Military Ridge.

Governor Dodge State Park, located 3 miles north of this intersection along Wisconsin 23, embraces two lakes formed by impounding Mill Creek, a tributary to the Wisconsin River. Bedrock exposures in the park include roadcuts through the Platteville-Galena upland surface, and scenic, natural outcroppings of the underlying Middle Ordovician St. Peter Sandstone along the floor of the valleys.

Turn south on U.S. 151 into Dodgeville, Wisconsin. U.S. 151, from here to Platteville, generally follows an historic cutoff from the Military Road to the lead mines, and the river ports along the Mississippi.

39.5 (29.5) Dodgeville, Wisconsin. The city was named for Henry Dodge, an early lead miner and Indian fighter in this district. Since he was well-liked and an avid supporter of President Andrew Jackson, he was appointed as the first territorial governor of Wisconsin in 1836.

43 (26) Silurian outliers of Belmont Mound and Platte Mound are visible to the southwest, as the highway crosses the rolling, partially-dissected, Middle Ordovician upland surface. Roadcuts provide exposures of Middle Ordovician dolomites along this part of the route.

47 (22) The historical marker north of the highway commemorates the early days of Mineral Point.

48 (21) Mineral Point, Wisconsin. This part of the zinc-lead district was settled in the 1820's and 1830's by miners from other mining regions in the U.S., and by Cornish immigrants. A short side trip into this historic town, with its narrow, steep streets, is interesting. Here, on Shake Rag Street, the Cornish miners built their small homes from local dolomite along the side of a narrow valley across from the mines. The street received its name because the miners' wives waved dish rags to call the menfolk home when dinner was ready. As a carry-over from these days, local restaurants and bakeries still make pasties (meat pies), the traditional, hearty lunch of the Cornish miner.

Part of Shake Rag Street contains a complex of restored Cornish cottages from the 1830's and 1840's, that includes Pendarvis House. This site is operated by the Wisconsin Historical Society for the public. The Mineral Point Historical Society has a museum at Pine and Davis streets that contains excellent mineral samples from local mines.

49 (20) The highway south of Mineral Point follows a narrow ridge that forms a drainage divide overlooking numerous, small, steep-sided valleys on either side.

Mileages

52 (17) The wayside park north of the road provides another view of Platte and Belmont Mounds, as the route traverses the dissected Middle Ordovician highland surface.

54 (15) Iowa/Lafayette county line. Enter Lafayette County. Within one mile the highway has crossed Mineral Point Branch and the upper reaches of the Pecatonica River. The valleys formed by these drainages cut through the Middle Ordovician Platteville-Galena formations into the underlying Middle Ordovician St. Peter Sandstone. The contact between these formations is exposed west of the highway near the county line.

61 (8) Enter Belmont, Wisconsin. Roadcuts expose Middle Ordovician dolomite.

61.5 (7.5) Junction with County G in Belmont. A short side trip along this highway provides access to two interesting state parks. Three miles northwest on County G (and B) is First Capitol State Park, the restored site of the first Wisconsin Territorial Capitol in 1836. This apparently remote location was in the booming lead mining district, and consequently at the population center of this territory when Governor Henry Dodge called the Territorial Legislature to order. They met here for 46 days in 1836 to develop a constitution. Eventually Madison, then essentially uninhabited and undeveloped, was selected as the permanent capitol.

Less than a mile east of First Capitol State Park on County G is Belmont Mound State Park. Here, a scenic parking area is located on the south side of the mound. This is another Silurian outlier, as evidenced by abandoned quarry exposures of thin-bedded Lower Silurian dolomite. An observation tower affords a panoramic view that includes numerous mounds, and the distant edge of the Silurian escarpment to the south and southwest. Both the mounds and the escarpment are capped with resistant Silurian dolomite, and once were part of a continuous bedrock surface that sloped gently to the southwest. There are several old lead and zinc mines in this area.

62 (7) Junction of Wisconsin 126 in Belmont. U.S. 151 turns west here.

66 (3) Platte Mound, north of the highway, rises to an elevation of 1430 feet. Locally, this wooded hill is called "M" Mound, because of the letter formed of white painted stones that is maintained annually by mining engineering students from the University of Wisconsin-Platteville. This feature, and Little Platte Mound to the east, are capped by resistant, cherty Lower Silurian dolomite. The nonresistant Upper Ordovician Maquoketa Shale underlies the Silurian (cap rock), and forms the gradual slopes that rise upward from the Middle Ordovician Galena surface. These isolated hills are remnants (outliers) of an extensive Silurian upland surface, which eroded downdip to the southwest. The edge of this highland is low located in northwestern Illinois and east-central Iowa.

Mileages

67 (2) Lafayette/Grant county line. Enter Grant County.

69 (0) Enter Platteville and pass a large quarry developed in the Middle Ordovician Galena Dolomite to the north of the highway. Junction U.S. 151 with Wisconsin 80 and 81.

The University of Wisconsin-Platteville, with its long history of training mining engineers and geologists, is located in this city. The Mining Museum, on Main Street in Platteville, provides an opportunity for tourists to tour underground in the historic Bevan lead mine, and to view relics from the early days of the lead rush.

END OF U.S. 151 MADISON-PLATTEVILLE LOG

Geologic Road Log for Grant County

M.G. Mudrey, Jr.[1], W.A. Broughton[1,2], A.V. Heyl[3], W.S. West[3]

Continuation of Tuesday, May 9

This leg of the trip visits four localities that illustrate the Middle Ordovician succession of southwestern Wisconsin, and a tour of a vintage 1830 lead mine now operated as a tourist attraction. After the visit to the mine, we will return to Platteville for the evening. Lodging and dinner this evening are covered by the field trip fee. Individual stop descriptions follow the road logs.

Mileages

0.0 Governor Dodge Motel. Leave motel and proceed right (southwest) on U.S. 151

6.1 Stop 1 - Hoadley Hill. Excellent exposure of St. Peter, Platteville, and Decorah formations. Continue west on U.S. 151.

7.4 Right turn onto Church Road (gravel).

7.8 Bear left, at Y in road.

8.1 Stop 2 - Section 2 quarry in upper part of Platteville Formation and Decorah Formation. Quimbys Mill Member of Decorah Formation is especially well exposed. Middle Ordovician fossil locality. Turn around at top of hill, and return to U.S. 151. Continue west on U.S. 151.

1 Wisconsin Geological and Natural History Survey
2 Dept. of Geology, UW-Platteville
3 U.S. Geological Survey

Mileages	
11.7	Enter Dickeyville.
12.0	Right turn (north) onto U.S. 61 and State 35.
15.9	Cross Platte River.
16.1	Base of Potosi Hill roadcut.
16.6	Stop 3 - Potosi Hill. Excellent exposure of upper part of Platteville Formation, Decorah Shale, and lower part of the Galena Formation. Continue north on U.S. 61 and State 35.
18.5	Enter Tennyson.
19.1	Turn left (west) on County O.
19.7	Enter Potosi.
20.3	Stop sign. Proceed straight ahead (south) on State 133.
20.5	Stop 4 - St. John's Mine. Old lead mine from the 1830's. Retrace route to intersection State 133 and County O.
21.9	Intersection with U.S. 61 and State 35. Continue east on County O.
27.6	Enter Cornelia.
31.5	Junction with U.S. 151. Turn left (north) toward Platteville.
34.7	Governor Dodge Motel.

END OF LOG

Wednesday May 10, 1978

Geologic Road Log for Lafayette County

M.G. Mudrey, Jr.[1], W.A. Broughton[1,2], A.V. Heyl[3], W.S. West[3]

This leg of the trip visits the Shullsburg Mine of Eagle-Picher Industries, ~~the only operating zinc-lead~~ mine complex in the Upper Mississippi Valley base metal district. Participants are reminded to wear appropriate safety equipment; including hard hat, light, self-rescuer, safety boots and glasses.

In the afternoon we will return to Platteville, Madison (where private automobiles can be picked up), and Milwaukee. Historical and cultural stops may be made en route. We plan to arrive in Milwaukee about 6:00 P.M.

Morning, May 10

Mileages	
0.0	Leave Governor Dodge Motel and proceed left (east) on U.S. 151.
0.2	Turn right (south) on State 80 and State 81.
6.8	Buildings and tailings pond of abandoned New Jersey Zinc Company's Elmo Mine can be seen in left distance.
9.4	Enter Cuba City.
9.7	Turn left (east) on County H (best route).
10.9	Junction with County J. Turn right, proceed south on County J.
11.9	Vinegar Hill Acid Plant, closed in 1948, was located south of road.
13.6	Enter Benton.
14.0	Join State 11. Turn left (east). Numerous abnadoned mines are along this road.
21.8	Enter Shullsburg.
23.1	Right turn (south) on County O.
24.7	Tailings area of Eagle-Picher Industries, Inc. Shullsburg Mine on left.
25.1	Left turn (east) on County W.

1 Wisconsin Geological and Natural History Survey
2 Dept. of Geology, UW-Platteville
3 U.S. Geological Survey

Mileages

25.8	Left turn (north). Entry to Eagle-Picher property. Stop 5 - Shullsburg Mine. You are reminded to have on hard hat, light, self-rescuer, safety boots, and glasses. Tour mine complex with company geologists.
29.8	About noon; return to Shullsburg for box lunch.

Afternoon, May 10

Scenic return to Platteville. Historical sights en route via County W, include towns of New Diggings, and Hazel Green. Right turn (north) on State 80 and 11 to Cuba City and Platteville.

57.1	Enter Platteville. Return to Madison. Stop to pick up private automobiles. Bus will continue to Milwaukee, arriving about 6:00 P.M.

Geologic Road Log for Madison Beltline, I-90, and I-94 from Madison, Wisconsin (Junction U.S. 12 and 14 with U.S. 18 and 151) to Milwaukee, Wisconsin (Junction I-94 with I-43 and I-794)*.

Rachel K. Paull[1] and Richard A. Paull[2]

This route from Madison to Milwaukee is entirely within the Eastern Ridges and Lowlands physical province, and it trends at right angles to the general strike of the Paleozoic formations. Consequently, the bedrock along the route, although largely obscured by Woodfordian glacial deposits, ranges from Upper Cambrian formations on the west to Silurian dolomite on the east.

The glacial geology encountered along I-94 is spectacular. As shown in Figure 8, the interstate cuts most of these glacial features essentially at right angles. From west to east, these include well-developed drumlin fields, outwash plains, the Kettle Interlobate Moraine with numerous scenic lakes, and recessional moraines of the Lake Border morainic system. Other significant attractions along this route include: the Lapham Peak overlook high in the Kettle Moraine and the subcontinental divide that separates drainage destined for the North Atlantic via the St. Lawrence from that which reaches the Gulf of Mexico via the Mississippi.

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1 University of Wisconsin-Madison & Alverno College, Milwaukee

2 University of Wisconsin-Milwaukee

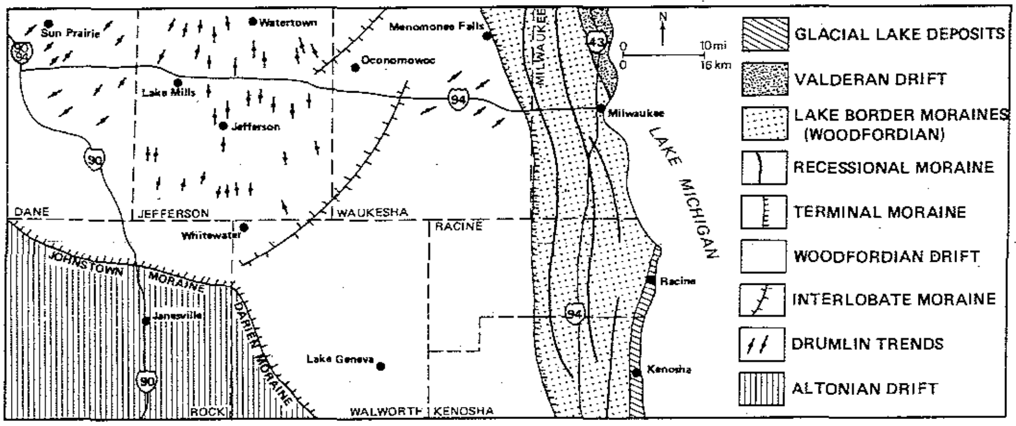


Figure 8. Glacial deposits of southeast Wisconsin, including glacial lake deposits, the Kettle Interlobate Moraine, drumlin patterns, and the Lake Border morainic system. The Altonian drift shown in Rock and Walworth counties, Wisconsin also includes drift that is older than Wisconsinan. Interstates 94, 43, and 90 are also indicated. Generalized from numerous sources, including Thwaites, 1956.

Mileages

0	(83)	Intersection of U.S. 12 and 14 with U.S. 18 and 151 on the southeast edge of Madison, Wisconsin. Turn east on the Madison Beltline (U.S. 12, 14, 18, and 151). Note: This was the starting point for the U.S. 151 Madison to Platteville roadguide provided for Tuesday May 9, 1978.
1	(82)	The wooded tracts on both sides of the highway are parts of the 1,240 acre University of Wisconsin Arboretum. Although primarily a research and study area, hikers are permitted on 24 miles of foot trails. This nature preserve extends north from here to the south shore of Lake Wingra.
3	(80)	Intersection of U.S. 12 and 18 with U.S. 14 and 151. Continue east on U.S. 12 and 18.
4.5	(78.5)	Lake Monona, north of the highway, is the second largest of Madison's four lakes. These lakes are the result of Pleistocene erosion and deposition along the Yahara River drainage.
5.5	(77.5)	The wooded, irregular ridge visible to the south over the flat outwash surface is part of the Woodfordian Johnstown-Milton terminal moraine system.
6.2	(76.8)	Cross the Yahara River, which connects Madison's four lakes. The Yahara flows southeasterly to join the Rock River north of Janesville, Wisconsin. The relatively flat land surface south of the highway is probably an outwash deposit (valley train) formed during the complex Pleistocene history of the Yahara River.

Mileages

7.5	(75.5)	Junction of U.S. 12, 18, and U.S. 51. Continue east on U.S. 12 and 18.
9.2	(73.8)	Junction of U.S. 12 and 18 with I-90. Turn north (left) on I-90.
12	(71)	Interstate 90 traverses rolling, morainal countryside.
13.7	(69.3)	Junction of I-90 with I-94. Turn east on I-94 to Milwaukee. Southeast of this intersection, crushed stone is produced from theMiddle Ordovician Platteville Formation. The underlying St. Peter Sandstone is also exposed in this quarry.
18	(65)	Exit County N to Sun Prairie and Cottage Grove. Well-developed drumlins, trending southwesterly, rise above rolling ground moraine, and are cut by the interstate. The irregular, hilly ridge on the skyline to the south is the Woodfordian Milton-Johnstown terminal moraine system of the Green Bay lobe.
21	(62)	Area of poorly drained, peaty soil in an interdrumlin area. A commercial sod and mint farm is north of the highway. This region is drained by Koshkonong Creek, which crosses beneath the interstate at Baxter Road. This stream flows into Lake Koshkonong to the south, after draining a vast, marshy area.
24	(59)	Exit Wisconsin 73 to Marshall and Deerfield. Southwest-trending drumlins form islands between swamps within the rolling countryside. Just east of this junction, a large number of glacial erratics are present. These are part of the boulder train derived from exposures of the Precambrian Waterloo Quartzite northeast of here.
27	(56)	Goose Lake and the swamp to the south are remnants of a much larger shallow lake that once existed between drumlins in this area. Much of the land here has been ditched for drainage, but some drumlins still rise as wooded islands surrounded by swamps. Fossil remains of a mastodon and a giant beaver dated at 9,000 to 10,000 years B.P. were found in shallow peat deposits nearby.
28	(55)	Dane/Jefferson county line. Enter Jefferson County, and a spectacular array of drumlins. An excellent swarm occurs where County O crosses the interstate. The extensively tiered roadcut at the county line provides a transverse section through a drumlin. Erratic boulders are common in the drift in this area.
33	(50)	Exit Wisconsin 89 to Lake Mills and Waterloo. The rough country immediately west of here consists of pitted outwash between patches of the Lake Mills recessional moraine system. Rock Lake, .25 mile to the southwest, occupies a very large kettle. There are also many small ice stagnation features in this area. Most of these are sandy deposits, some of which lap onto the margins of drumlins.

Mileages

Exposures of Precambrian quartzite exist north and east of Waterloo, where they form low hills and ledges which protrude through thin glacial drift (Fig. 9). Most of these outcrops are polished and striated by glaciation.

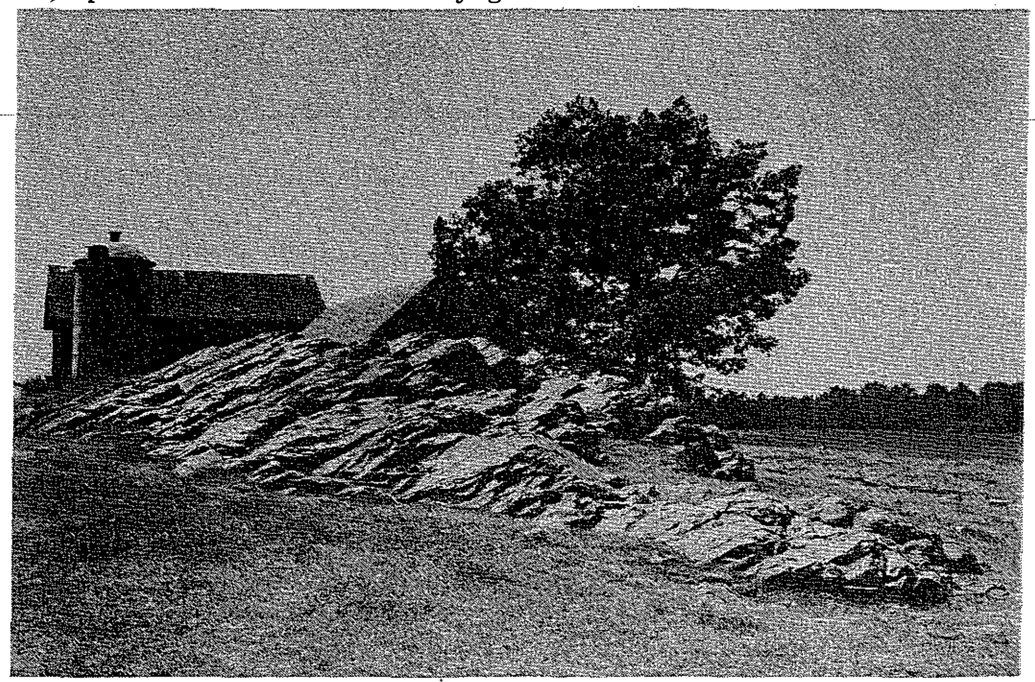


Figure 9. Exposures of glacially polished, gently eastward-dipping, Precambrian Waterloo Quartzite near Hubbleton, Wisconsin. Milwaukee Public Museum photo.

This quartzite is similar to that exposed in the Baraboo-Devil's Lake area. A basal conglomerate is present between the quartzite and the overlying Paleozoic sandstone. Small potholes are scoured on some quartzite surfaces, and bedding planes are occasionally ripple marked.

The main outcroppings of Waterloo Quartzite are about a mile east of Portland, and at the junction of Waterloo Creek and the Crawfish River. These exposures occur on the borders of a connect4d series of marshes, which mark a preglacial valley that was a tributary to the Rock River.

35 (48) Eastbound rest area in an area of rolling ground moraine.

37 (46) I-94 crosses the Crawfish River, a tributary to the Rock. Aztalan State Park is 1.5 miles south on the west bank of this river. In addition to Late Woodland Indian effigy mounds, this park contains a two-tiered pyramidal mound, and a partly restored stockaded village identified with the Middle Mississippi culture. When the site was first described in 1837, it was named Aztalan in the hope that the cultural remains preserved here were those of the Mexican Aztecs. To reach the park, use the Lake Mills exit and then turn east on County B.

38 (45) Westbound rest area, in an area of ground moraine and low-lying drumlinoid hills.

Mileages

39 (44) I-94 crosses the Rock River. The Rock marks a general vegetation divide between native hardwood forests to the east, and oak savannas and prairies to the west. Some think the river formed a barrier to prairie fires, thus preserving the forests on the east.

Jefferson, 6.5 miles to the south at the junction of the Crawfish and Rock rivers, experienced a short-lived, geology-related, land boom about 1840. A federally-assisted project was planned to construct a canal from Lake Michigan at Milwaukee to the Rock River near Jefferson. Some construction was actually accomplished before the million-dollar project was abandoned. Meanwhile, land values had sky-rocketed in Jefferson as the prospect of a connection between the Mississippi River and the Great Lakes seemed imminent. Land promoters arrived, and a steamboat made it up the Rock River from St. Louis. Tracts of swampland were bought by local residents and newcomers at inflated prices, in the hope that great profits would result when the canal was completed. The land promoters left town with well-laden carpetbags, before news of the abandonment of the canal plans reached southern Wisconsin.

40 (43) Exit Wisconsin 26 to Watertown, Johnson Creek, and Jefferson, within the Jefferson County drumlin field. Where the interstate cuts through a drumlin, the roadcuts have been carefully sodded over to conceal the internal character of the sandy and clayey till. However, at the northwest corner of this intersection, behind the service station and restaurant, an excavated drumlin is exposed.

46 (37) Irregular ground moraine assumes symmetry and order as the highway traverses a classical drumlin field, produced by the Green Bay lobe of the Woodfordian ice advance (Fig. 10). These drumlins trend essentially north-south in this area, but nearer to Madison the orientation was southwesterly.

Poorly drained areas and tamarack swamps flank many of the drumlins in this area.

50 (33) Wisconsin 135 exit.

52 (31) Jefferson/Waukesha county line. Enter Waukesha County. The drainage in this rolling countryside is poor, and farm fields must be ditched. Numerous tamarack swamps with red osier dogwood are lingering evidence of the boreal climate of the Pleistocene.

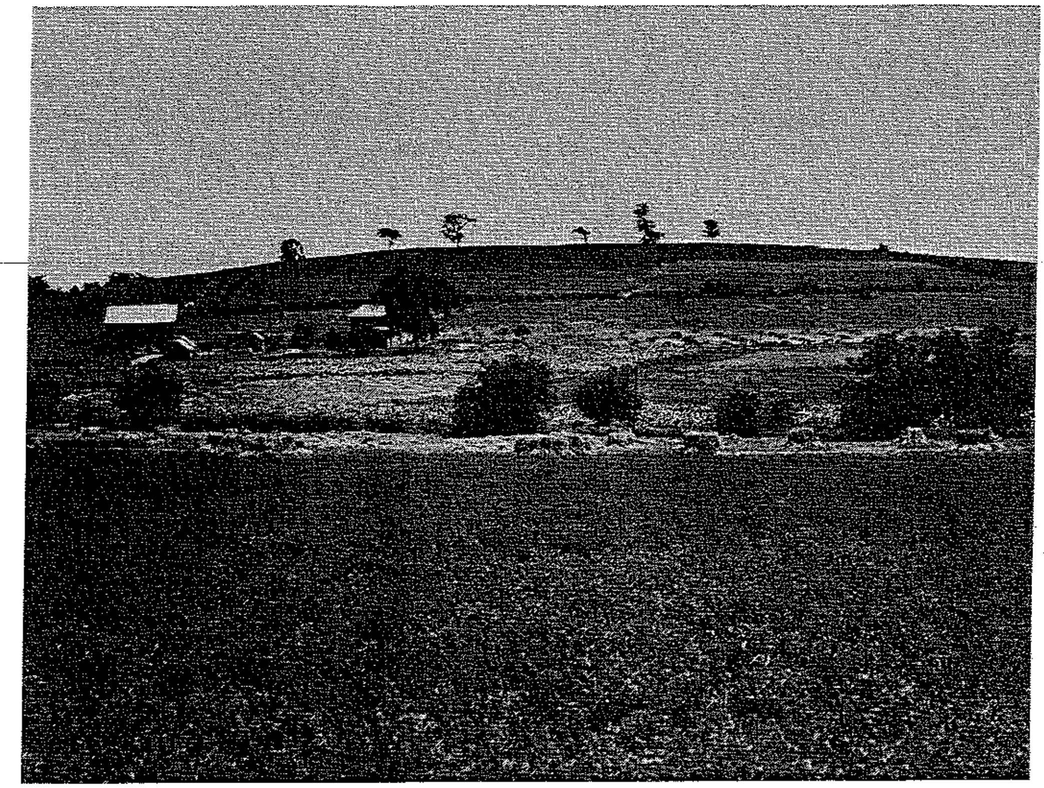


Figure 10. An intensively-farmed, north-south trending drumlin near Sullivan, in Jefferson County, Wisconsin. In this area, these streamlined hills are so numerous that they are termed a drumlin swarm or field. Milwaukee Public Museum photo.

Mileages

55 (28) Wisconsin 67 exit to Oconomowoc and Dousman. The interstate now traverses outwash and proglacial lake sediments in an area once occupied by the Green Bay lobe during the Woodfordian ice advance. To the east, the view of the Interlobate Moraine looming above the flat outwash surface is impressive. A few overgrown kettles are adjacent to the highway on the south side. To the north, rising above the flat outwash plain, is an incongruous landform that resembles the classic moulin kames of the northern Kettle Moraine. This is an artificially-created ski hill near Oconomowoc.

59 (24) An exit on County CC provides a side trip to view the Kettle Interlobate Moraine from the observation tower on Lapham Peak (Fig. 11). This tower provides an excellent overview from the highest vantage point in the southern Kettle Interlobate Moraine. To the west is Genesee Flat. To the east is the glacial spillway described at Mile 61. Several scenic glacial lakes are also visible.

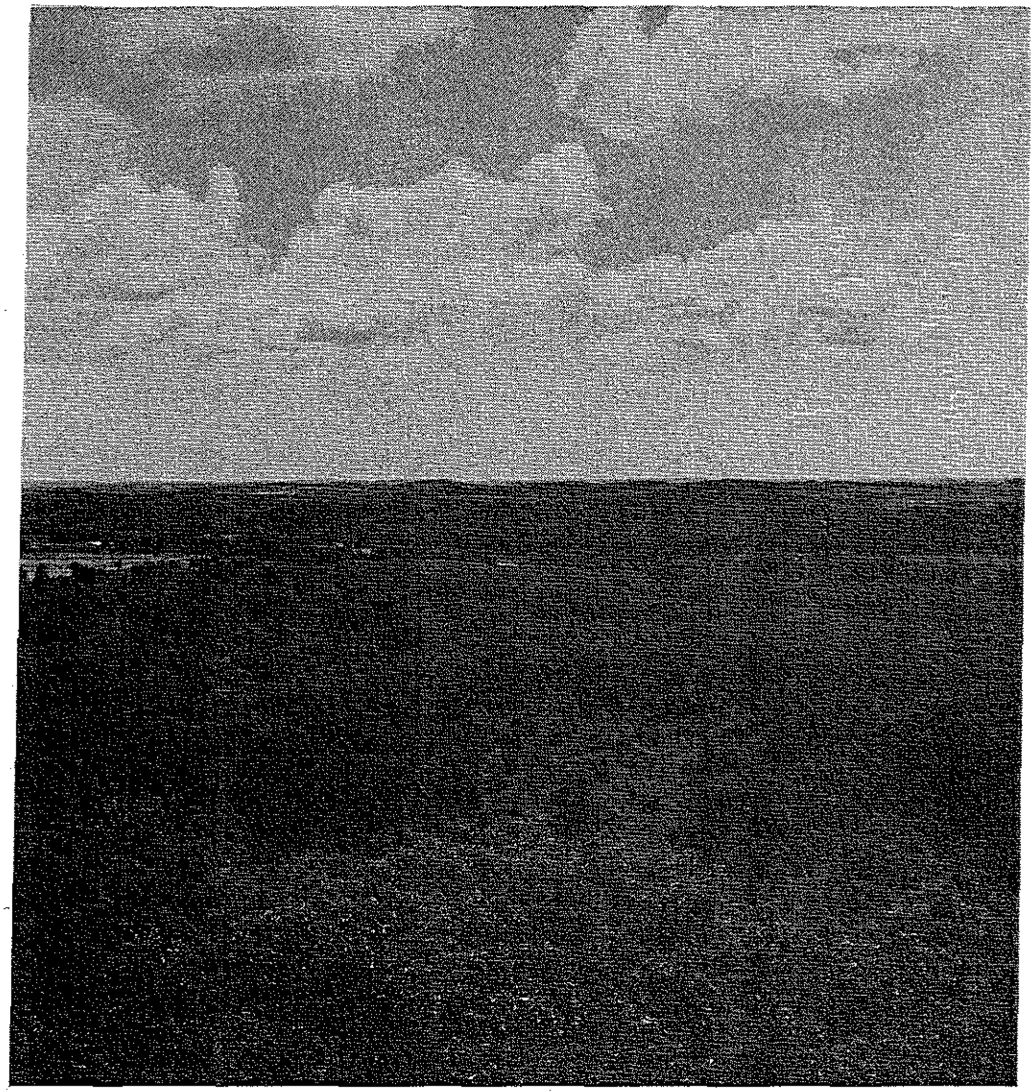


Figure 11. A scenic overview of the southern Kettle Interlobate Moraine from the observation tower on Lapham Peak. Photo by Professor R.F. Black, University of Connecticut.

To reach Lapham Peak, go south on County CC (Kettle Moraine Scenic Drive) about 1.8 miles to a crossroad. Turn left (east) onto Government Hill Road. Continue about 0.7 mile to a small park that includes the Lapham Peak observation tower. The tower for state station WHAD is also located here. A marker at 1233 feet of elevation, on a glacial erratic boulder in the park, is dedicated to one of Wisconsin's earliest geologists and naturalists: "Increase A. Lapham, Eminent scientist and useful citizen".

The route ahead crosses a region of pitted (kettled) outwash deposits, and many kettle lakes dot the landscape. Nagawicka Lake, immediately north of the highway, is such a lake. Other examples are Upper and Lower Nemahbin lakes, which sandwich the

Mileages

interstate about 1 mile west of here. The ice blocks which formed these lake basins were derived from the Green Bay lobe along the western edge of the Interlobate Moraine.

60 (23) The interstate approaches the crest of the Interlobate Moraine. A small ski area south of the highway utilizes part of this slope. From the crest of this ridge, the radio tower and observation tower on Lapham Peak are visible south of the highway.

The Kettle Interlobate Moraine, which trends northeasterly across Wisconsin for about 130 miles, from Walworth to Kewaunee counties is the premier glacial feature in Wisconsin. It is probable that the resistant Silurian dolomite influenced the position of the interlobate deposits in this area, by retarding the spread of the Green Bay lobe.

Within this morainal complex, the country is rolling and rugged, with abundant knobs and kettles. This feature formed during the Woodfordian glacial advance by a juxtapositioning of the terminal moraines of the Green Bay and Lake Michigan lobes. Between these icy walls, complex drainageways developed, and meltwaters reworked some of the morainal materials. The resultant deposits are a mixture of sand, gravel, boulders, and clayey till. Much of the coarser material was derived from the Silurian dolomite, but igneous and metamorphic rock types from far to the north are also present.

61 (22) Wisconsin 83 exit. This highway follows low ground along an agandoned drainage channel which carried the last meltwater that drained southward through this part of the Kettle Interlobate Moraine. Water drained down this .25 mile wide valley until it reached Wales, about 3 miles to the south, where it cut through the Interlobate Moraine to flow west. Gravel outwash terraces flank this drainage, and a remnant of a high terrace is visible on the east side of this valley.

62 (21) Pewaukee Lake lies to the north. The church at Holy Hill, a kame perched high on the Interlobate Moraine, is also visible to the north on a clear day. Pewaukee Lake occupies a preglacial river valley which was scoured into the Upper Ordovician Maquoketa Shale. This ancient valley was blocked by morainal debris deposited along its eastern margins by the Lake Michigan lobe during the Woodfordian ice advance.

63 (20) Ground moraine deposits in this area are thin. North of the highway on the west edge of the Tumblebrook golf course, there is a small quarry in Silurian dolomite. Glacial striae on bedrock in this area indicate that ice movement was west-southwest.

South of the road, the names of a subdivision (Pebble Valley), and a farm (Stoney Hill), bear testimony to the character of the morainal material.

Mileages

65	(18)	Exit County G to Pewaukee. A drumlin field lies south of the highway for the next several miles. These east-west trending drumlins are composed of sandy clay till that contains abundant boulders.
68	(15)	Exit County F. West of this intersection, the route crossed the Pewaukee River, which is tributary to the Fox. This valley is paralleled by outwash terraces, which are commercial sources of sand and gravel in this area.
69	(14)	Exit Wisconsin 164 to Sussex and Waukesha. East-west trending drumlins are north and south of the highway. Colonel Dunbar, while visiting Waukesha in 1869, drank from some of the springs which issue from the glacial drift in this area with high amounts of dissolved calcium magnesium bicarbonate. Upon deciding that the local mineral waters had eliminated his "incurable ailments", he began to advertise his cure nationwide, and Waukesha soon became a fashionable health spa. Although this fad waned after about 30 years, bottled spring water is still a Waukesha product. Waukesha is located on the Fox River. Outwash terraces along this river are important commercial sources for sand and gravel. Since the glacial drift is quite thin in this region, Silurian dolomite is extensively quarried along the valley of the Fox from the Waukesha area northward to Sussex, Lannon, and Menomonee Falls.
71	(12)	Exit U.S. 18 (Blue Mound Road) to Waukesha and Wisconsin State Patrol headquarters.
74	(9)	Exit Moorland Road. The flat terrain here is poorly drained, clay-rich ground moraine. Ditching and channelization were required for the extensive development of the land north of the highway. The golf course to the south represents a more intelligent land use. A few isolated patches of moraine, and several east-west trending drumlins rise above the generally swampy ground. The route ahead descends a prominent ridge, which is part of the Woodfordian Lake Border recessional moraine system. Sunny Slope Road traverses this crest, which forms the drainage divide between Lake Michigan and the drainage basin of the Fox River. The Fox flows southward parallel to the Woodfordian moraines to reach the Illinois River, and ultimately the Gulf of Mexico via the Mississippi.
76	(7)	Milwaukee/Waukesha county line. Enter Milwaukee County.
78	(5)	Exit I-894 (U.S. 45) south to Chicago and U.S. 45 north to Fond du Lac. The Milwaukee County Zoo is northwest of this intersection.

Mileages

79 (4) Exit Wisconsin 181 (84th Street). The Wisconsin State Fair Park grounds and an Olympic-size outdoor ice rink are southeast of this junction. The interstate traverses Wisconsinan (Woodfordian) ground moraine and recessional moraines of the Lake Border system. The highway here is essentially parallel to the east-west direction of ice movement, and consequently the morainic ridges trend north-south. About 100 feet of glacial deposits, primarily a boulder clay till, overlie Silurian dolomite in this area.

81 (2) U.S. 41 exit (north and south). Milwaukee County Stadium, home of the Milwaukee Brewers and also the site of the Milwaukee games of the Green Bay Packers, is just west of this junction. The large hill southwest of the stadium is a Silurian dolomite exposure on the grounds of the U.S. Veterans Administration Hospital.

82 (1) Route parallels the industrial complex along the east-west trending Menomonee River valley. Three large, glass domes in Mitchell Park are visible to the south. One contains a display of vegetation native to a desert environment, another features tropical plants, and the last houses local flora and is often used for special flower shows.

83 (0) Junction I-94 with I-43 (U.S. 141) and I-794. The Milwaukee Harbor is to the woutheast, toward the high-rise Harbor Freeway bridge along the lakeshore.

Three rivers merge at the Milwaukee Harbor, the Menomonee River flows from the north and west, the Milwaukee River comes from the north, and the Kinnickinnic River originates to the west and south.

Milwaukee grew from three settlements that were originally separated by these rivers. Walker's Point, east of the Kinnickinnic River, is now dominated by the towering clock of the Allen Bradley Company. The Milwaukee River flowed between Kilbourntown on the west and Juneautown to the east.

The high smokestack to the east is part of the Jones Island Metropolitan Sewage Plant. Here, sewage sludge is dried and converted to Milorganite, a commercial fertilizer.

Jones Island, an artificially breached peninsula, also contains a tanker pier, cargo terminals and a heavylift wharf, and is headquarters for the Port of Milwaukee. Milwaukee's inner harbor was developed by an enlargement of the lower Kinnickinnic River, and it serves as the service and wintering area for part of U.S. Steel's iron ore carrier fleet.

END OF LOG

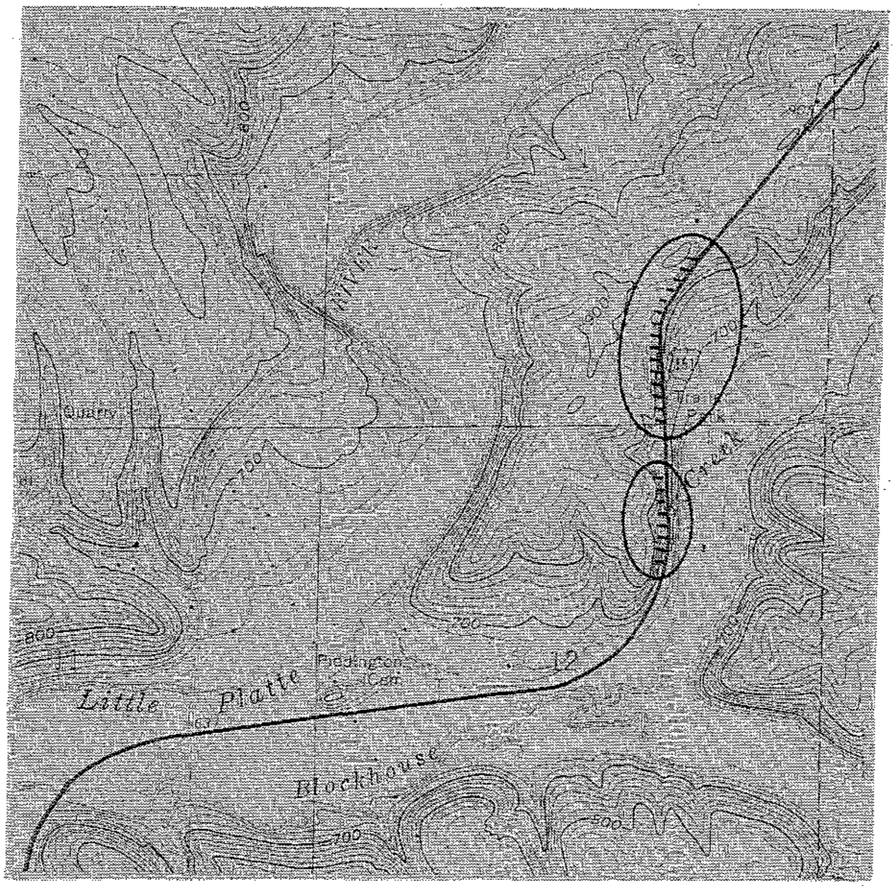
Proceed through downtown Milwaukee to the Pfister Hotel; headquarters for the 24th annual meeting of the Institute on Lake Superior Geology.

We hope you enjoy your stay in Milwaukee!

GEOLOGICAL STOP DESCRIPTIONS

Title: Hoadley Hill

Location: Exposure in roadcut at north side of U. S. Highway 151 about 6.5 miles southwest of Platteville in the NW¼, NW¼, Sec. 12, T.2N., R.2W., Grant County (Dickeyville 7.5-minute topographic quadrangle, 1972).



Author: M. E. Ostrom (modified from Agnew et. al., 1956)

Description: This is the reference section for the Platteville Formation. The strata exposed here are the upper part of the St. Peter Sandstone, the Glenwood Formation, a complete section of the Platteville Formation, and the lower part of the Decorah Formation. Description from Agnew et. al., (1956) is:

ORDOVICIAN SYSTEM

Decorah Formation

Spechts Ferry Shale Member (+1.0 feet)

62.9' - 63.4'	0.5'+	Shale, bluish-green.
62.7' - 62.9'	0.2'	Bentonite, white; weathers orange brown.
62.5' - 62.7'	0.2'	Shale, yellowish-green above to bluish-green below.

62.4' - 62.5'	0.1'	Shale, brown and olive, soft.

Platteville Formation (54.3 feet)

Quimbys Mill Member (0.3 - 0.5 feet)

62.0' - 62.4'	0.4'±	Limestone, dark purple, fine-crystalline, dense, conchoidal fracture; very wavy upper surface; thin, dark-brown to black, fossiliferous platy shale parting at base.

McGregor Limestone Member (30.9 feet)

61.1' - 62.0'	0.9'	Limestone, light-gray, very fine crystalline, very dense, conchoidal fracture like "glass rock" above, fairly massive, ver fossiliferous; wavy upper surface.
60.4' - 61.1'	0.7'	Limestone as next above but less dense, medium-bedded above to thin- bedded below, fossiliferous; wavy upper surface.
58.8' - 60.4'	1.6'	Dolomite, light olive drab, fine crystalline, "sugary", argillaceous, very thin-bedded; molular.
55.8' - 58.8'	3.0'	Dolomite as above but thick-bedded; calcite near middle.
55.2' - 55.8'	2.6'	Limestone, thin-bedded yet stands massively as one unit; light greenish gray brown; weathers brown, with a few argillaceous streaks; sparingly fossiliferous, but with fossils and fucoids on top surface.
51.8' - 55.2'	3.4'	Limestone, thin-bedded as above but the beds are distinct; modular beds and shaly partings; argillaceous is upper 0.3 feet, which is very fossiliferous.
48.2' - 51.8'	3.6'	Limestone, light buffish gray, in medium to thick beds; in places gradational into above unit.
44.3' - 48.2'	3.9'	Limestone, light greenish to bluish gray, in massive beds but composed of thin beds which are not separated; ample shaly material in wavy bands; fairly fossiliferous, argillaceous; a peculiar mottled light gray and darker gray 0.1-foot zone, 1 foot below top.
40.3' - 44.3'	4.0'	Limestone, light gray, very fine crystalline, very dense, sublithographic, in extremely thin and modular beds with thin calcareous shaly partings which become thinner below; the shale beds are light grayish blue, mottled, very fossiliferous; weathers slightly recessed.

36.7' - 40.3'	3.6'	Limestone, as above, but beds are not quite as thin; fossiliferous; poor gastropod zone 1.7 feet above base; shaly zone at base.
33.1' - 36.7'	3.6'	Limestone, dolomite, light-gray, fine crystalline, very slightly argillaceous, very fossiliferous, medium-bedded; indistinct argillaceous partings, not wavy; calcite and limonite, especially in basal 0.6 feet.

Pecatonica Dolomite Member (21.5 feet)

28.3' - 33.1'	4.8'	Dolomite, light grayish brown, very coarse crystalline and vuggy, upper 2 feet a mixture of lithology and a somewhat argillaceous fine crystalline "sugary" laminated dolomite; a 1-foot bed of very vuggy dolomite from 1.8 to 2.8 feet above base; shaly in lower part; stylolitic partings 1 foot above base.
21.4' - 28.3'	6.9'	Dolomite, medium-gray, laminated, somewhat argillaceous, fine-crystalline "sugary", fossiliferous, especially in lower 0.9 feet; medium- to thick-bedded; shaly at top; weathers brownish in lower 2.5 feet.
17.8' - 21.4'	3.6'	Dolomite, medium gray, laminated, argillaceous; very fossiliferous partings.
16.4' - 17.8'	1.4'	Dolomite, light grayish brown, very coarse crystalline and vuggy; thin brownish gritty dolomitic and platy shaly parting at top.
13.6' - 16.4'	2.8'	Dolomite, medium gray, laminated, somewhat argillaceous, fine crystalline.
11.6' - 13.6'	2.0'	Dolomite, medium gray, laminated, argillaceous, silty and sandy with fine to coarse quartz grains similar to those of the St. Peter Sandstone, phosphate nodules abundant (especially in two zones, one at base, the other 1 foot above base).

<u>Glenwood Formation (1.5 feet)</u>

11.2' - 11.6'	0.4'	Shale, sandy with rounded quartz grains, khaki to drab, soft; phosphate nodules.
11.0' - 11.2'	0.2'	Shale, sandy, olive to grayish brown; mottled yellowish brown, friable.
10.4' - 11.0'	0.6'	Shale, sandy, medium- to dark-gray, olive, blocky, very hard.

10.1' - 10.4'	0.3'	Shale, medium-gray, blocky, hard, sandy; streak of carbonaceous material at top.

St. Peter Sandstone Formation (+10.2 feet)

10.0' - 10.1'	0.1'	Sandstone, red and white; rounded; frosted, coarse to medium-grained.
9.8' - 10.0'	0.2'	Sandstone, gray, pinkish, very friable.
9.7' - 9.8'	0.1'	Sandstone, brown, iron-stained, hard.
8.4' - 9.7'	1.3'	Sandstone, yellow to gray, very friable, with irregular lower surface.
8.3' - 8.4'	0.1'	Sandstone, light-gray, very friable.
8.1' - 8.3'	0.2'	Sandstone, yellow to dark-brown, laminated, hard.
7.0' - 8.1'	1.1'	Sandstone, gray and yellow; hard irregular lower surface.
0.0' - 7.0'	7.0'+	Sandstone as above, but medium- to fine-grained; spoils.

BASE OF EXPOSURE

Significance: This is the reference section for the Platteville Formation. The contact relationships and lithologies of the St. Peter, Glenwood, Platteville, and Decorah Formations can be examined.

Note the lithology, mineralogy, and structure of the St. Peter Formation. What direction did it come from? Does it contain evidence of life? How do you account for its mineral homegeniety? What was the environment of deposition? Does it change toward the top? What is the significance of no change? of change? What is the relationship of the St. Peter to the Glenwood? Note the various beds of the Glenwood. What is their significance? If they could be traced for long distances of several hundred miles, what would be the significance? What is the nature and significance of the Glenwood/Platteville contact? Note the variable Platteville lithology, i.e. phosphate nodule beds, fossil beds, sandy beds, etc. What is their significance? What would be the significance if they could be traced several hundred miles?

References: Dapples, 1955; Agnew et. al., 1956; Templeton and Willman, 1963; Ostrom, 1964 and 1970.

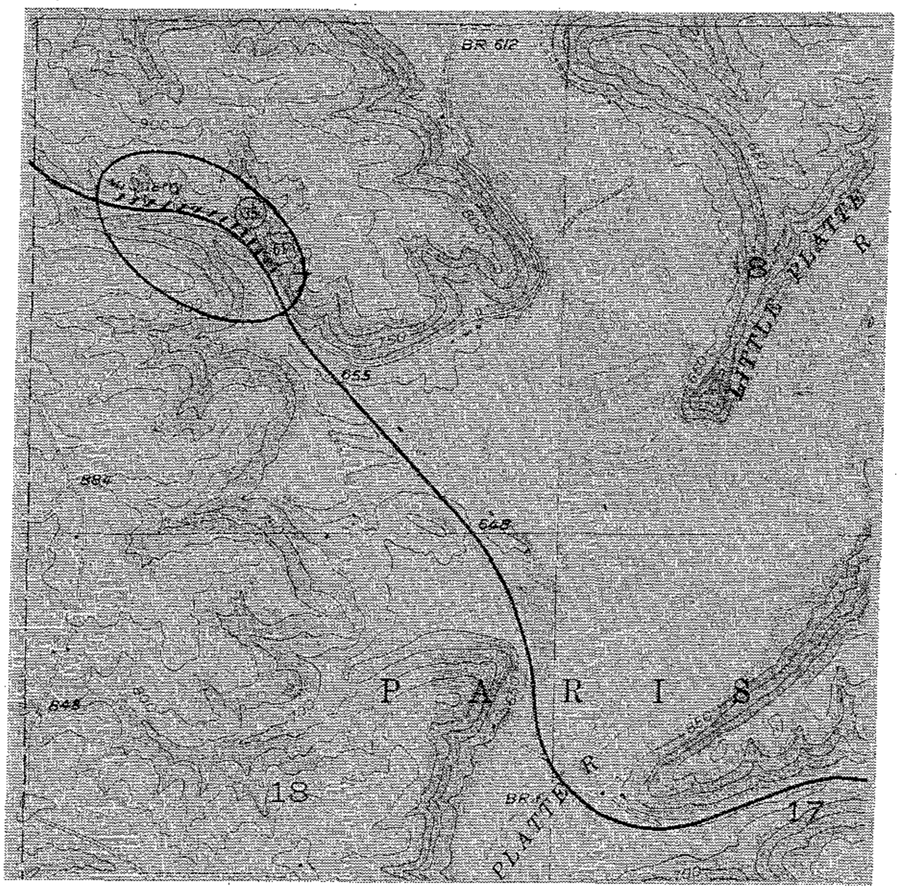
Title: Section 2 Quarry

Location: Abandoned quarry on west side of gravel road about 0.7 miles north of U. S. Highway 151 about 0.3 miles west of Piddington Cementary in the SW$\frac{1}{4}$, SW$\frac{1}{4}$, SE$\frac{1}{4}$, Sec. 2, T. 2 N., R. 2 W., Grant County (Dickeyville 7.5-minute topographic quadrangle, 1972). Map location on Hoadley Hill description.

Description: See Hoadley Hill description. Quimby's Mill Member of Decorah Formation is well exposed. Excellent Middle Ordovician fossil locality.

Title: Potosi Hill

Location: Roadcut at east side of U. S. Highway 61 in the SW$\frac{1}{4}$, NW$\frac{1}{4}$, Sec. 7, T.2N., R.2W., Grant County. (Potosi 7.5-minute topographic quadrangle, 1972).



Author: M. E. Ostrom (modified from Cline et al, 1956, Kruse, 1970).

Description: The lower part of the section exposed here can be examined in closer detail at the Hoadley Hill Stop. The major emphasis here is focused on the upper part which includes the Spechts Ferry, Guttenberg, and Ion Members of the Decorah Shale Formation and the lower part of the Galena Dolomite Formation. The Quimbys Mill Member consists of purplish gray-brown, sublithographic, thick-bedded, conchoidally fractured limestone with uneven upper surface and shale at its base. It is called the "Glass Rock" locally because when broken, and when broken pieces are shaken together, it sounds like broken glass.

The Quimbys Mill is overlain by the Spechts Ferry Member which consists of fossiliferous, gray-brown limestone with green shale interbeds. At this exposure two thin beds of "metabentonite" occur near its base. Metabentonite is believed to be the product of alteration of volcanic ash dust. The metabentonites are orange to light reddish brown and about 2 inches thick.

The Spechts Ferry is overlain by the Guttenberg Limestone Member which consists of hard, finely crystalline, thin-bedded, fossiliferous, light brown, limestone with brown carbonaceous shale interbeds. The presence of these interbeds has led to the member being referred to as the "Oil Rock" in the southwest Wisconsin zinc-lead mineral district.

The Ion Dolomite Member overlies the Guttenberg. It is a gray to blue dolomite, medium-crystalline, and medium-to thick-bedded with green shale interbeds. It is locally called the "Blue".

The Galena Dolomite Formation overlies the Ion. It is a light buff to drab, cherty, thick-bedded, vuggy dolomite with medium to coarse sugary grains. The basal contact is gradational. A zone of Prasopora insularis Ulrich marks the top of the Ion Member in some areas. It is absent here.

Good fossil hunting in the Spechts Ferry and Guttenberg Members.

Near the north end of the roadcut there is a quarry in which can be seen an example of "pitch-and-flat" structure which is the main site of zinc and lead mineralization in the district. Here there is no mineralization.

Description of outcrop follows:

ORDOVICIAN SYSTEM

Galena Dolomite Formation
Cherty Unit

45.8' - 65.8'	20.0'	Dolomite, yellowish-buff, medium-to coarse-grained, vuggy, abundant white chert in upper 10'.

Decorah Formation (43.8 feet)

Ion Dolomite Member (19.5 feet)
(Gray unit)

38.3' - 45.8'	7.0'	Dolomite, buff, thick-to massive-bedded, vuggy, green shale partings throughout, sparry calcite present.
33.8' - 38.3'	5.0'	Covered interval.
32.8' - 33.8'	1.5'	Dolomite, buff, medium-grained, medium-bedded, with green shale partings.

(Blue unit)

27.2' - 32.3'	5.1'	Dolomite, purplish gray, medium-grained, slightly fossiliferous. Green shale present as partings, and as a 0.5' bed 0.8' below the top of the interval, calcite present.
26.3' - 27.2'	0.9'	Shale, green. 0.3 green dolomitic shale in middle of interval.

Guttenberg Limestone Member (15.3' feet)

21.7' - 26.3'	4.6'	Limestone, purplish brown, fine-grained to sublithographic, fossiliferous, upper 1' fine-to medium-grained, brown shale present as partings, calcite and limonite after iron sulfide present in small amounts.
21.6' - 21.7'	0.1'	Metabentonite, brownish orange, crumbly, sticky when wet.
12.0' - 21.6'	9.6'	Limestone, purplish brown, sublithographic, thin-wavey-bedded, fossiliferous, brown carbonaceous shale present as thin beds and partings, calcite and limonite present.
11.0' - 12.0'	1.0'	Limestone, brown-gray, fine-grained, thick-bedded.

Spechts Ferry Shale Member (9.0 feet)

10.2' - 11.0'	0.8'	Shale, orange-gray, calcareous, and limestone, tan-gray, fine-grained, limestone 0.4' to 0.7' from base of unit.
9.6' - 10.2'	0.6'	Limestone, gray, fine-grained, thin-bedded.
6.4' - 9.6'	3.2'	Shale, gray, green, brown, fissle, some beds fossiliferous, limestone present as thin lenses near middle of the interval.
5.6' - 6.4'	0.8'	Limestone, tan, with iron oxide mottlings, fine-grained, thin-bedded.
3.9' - 5.6'	1.7'	Shale, gray-green-brown. Fissle, with thin lenses of gray fine-grained limestone.
3.2' - 3.9'	0.7'	Limestone, dark to light gray, thin-bedded, fossiliferous.
2.7' - 3.2'	0.5'	Shale, brown-green-orange-gray, brown carbonaceous shale parting at top, metabentonite near middle.
2.2' - 2.7'	0.5'	Limestone, purplish-brown, fine-grained, thin-bedded, very fossiliferous, fucoids at base.
2.0' - 2.2'	0.2'	Metabentonite, orange, sticky when wet, with brown shale partings.

Platteville Formation

Quimbys Mill Member (1.2 feet)

0.8' - 2.0'	1.2'	Limestone, purplish gray-brown, sublithographic, thick-bedded, conchoidal fracture, irregular upper surface, shale at base.

McGregor Limestone Member (0.8 feet)

0.' - 0.8'	0.8'	Limestone, purplish gray-brown, fine-to medium-grained, thick-bedded.

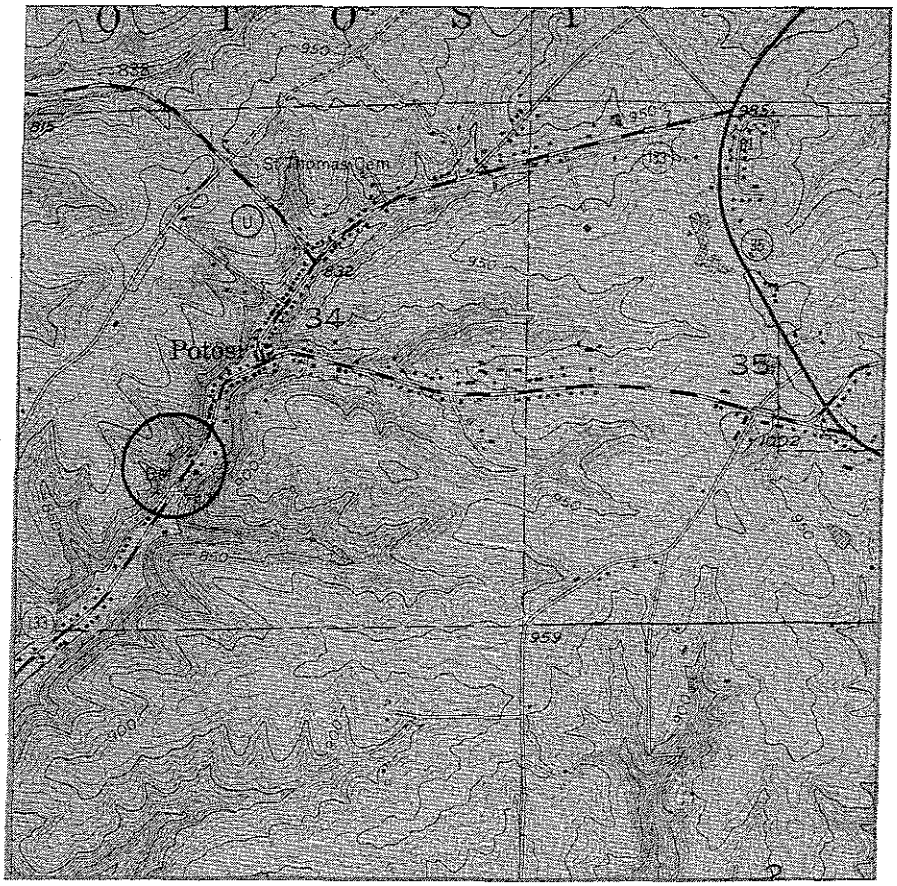
Significance: The Spechts Ferry and Metabentonite beds are not present everywhere. In addition, in the district mineralization it quite often occurs where the Spechts Ferry is thickest.

How could one account for the local absence of the Spechts Ferry Member? The metabentonite beds? How could one account for the thickening of the Spechts Ferry Shale coincident with mineralization? for the location and mineralization of "pitch-and-flat" structures?

References: Cline et al., 1956; Templeton and Willman, 1963; Kruse, 1970.

Title: St. John Mine (Snake Cave)

Location: Opening is in valley wall on the north side of State Highway 133 about 0.2 miles south of intersection of County Highway "O" and State Highway 133 in Potosi in the SW$\frac{1}{4}$, NW$\frac{1}{4}$, SW$\frac{1}{4}$, Sec. 34, T. 3 N., R. 2 E., Grant County (Potosi 7.5-minute topographic quadrangle, 1972).



Author: M. G. Mudrey, Jr., (Modified from St. John Mine brochure, L.C. Ihm, owner, and Whitlow and West, 1966).

Description: This mine is a natural cave that was extensively exploited for lead prior to 1870. By 1843, it had yielded 250,000 pounds of lead. The Potosi sub-district produced 21,300 tons of 80 percent lead from 1862 to 1876. Galena occurs in gash veins and openings along minor joints. The vein strikes N. 65° W., and is noted for its length and continuity.

Host rock is Ordovician Galena Dolomite, with Maquoketa Shale on the ridge to the west.

The floor of the cave is in the Dunleith Member (cherty lower unit) of the Galena Dolomite. In most outcrops, it is a pale-yellowish-brown to light-olive-gray and grayish-orange fine- to medium-grained vuggy fossiliferous dolomite containing abundant chert as nodules or as nearly continuous layers. Chert in the Dunleith Member is nodular and distributed parallel to the bedding. Near mineralized zones chert is selectively mineralized and contains microscopic grains of disseminated iron sulfide that color it bluish gray and locally very dark gray.

The top of the cherty unit is marked by two discontinuous layers of chert odulesn separated from the main cherty section by 6-9 feet of non-cherty dolomite.

The roof of the cave is in the Wise Lake Member (non-cherty upper unit) of the Galena Dolomite. The strata of the non-cherty unit are pale-yellowish-brown to yellowish- and grayish-orange fine-grained porous fossiliferous dolomite.

The minerals of the zinc and lead deposits in the Potosi quadrangle are mostly simple sulfides, carbonates, and sulfates. The primary sulfide minerals are sphalerite, galena, pyrite, marcasite, chalcopyrite, and digenite. Galena is fairly stable and persists above the water table.; the others are commonly altered. These include smithsonite, cerussite, limonite, melanterite, malachite, azurite, and erythrite.

History: St. John Mine, originally a natural cave, was first named LaSalle Cave, after Robert Cavelier Sieur de La Salle, an early French explorer in North America, who traveled with his company on an expedition through the upper Mississippi River Valley in 1679 and again in 1687 after King Louis XIV names him Viceroy of North America. LaSalle is the man who claimed and named Louisiana Province for the French king.

St. John Mine was worked by the Indians many years before white pioneers arrived in the 1827 "lead rush". Drifts of the old mine follow the natural crevices filled with stalactites.

The foxes who used it for dens are said to have uncovered the rich lead deposits near the entrance by digging and running in and out the natural cave crevice. The Indians mined galena for barter but it was left to the white men to extensively develop these diggings.

The first white man known to have worked St. John Mine and who gave it the name it still bears was Willis St. John, who made a small fortune from this mine between 1828 and 1870.

In the Upper Mississippi Valley, lead seems to have been discovered about 1692 by Nicholas Perrott. This metal was also noted in 1700 by LeSueur, who took lead out of a place which we believe from the description must have been Snake Hollow, now Potosi, Wisconsin. In 1766 John Carver brought to St. Louis a 500 pound hunk of lead he had received from barter with the Indians who mined a cave on the eastern Mississippi bank somewhere between the mouth of the Grant and Platte Rivers. This 500 pound piece of lead may have been taken from St. John Mine, which points to the importance St. John Mine played in bringing settlers to the lead region.

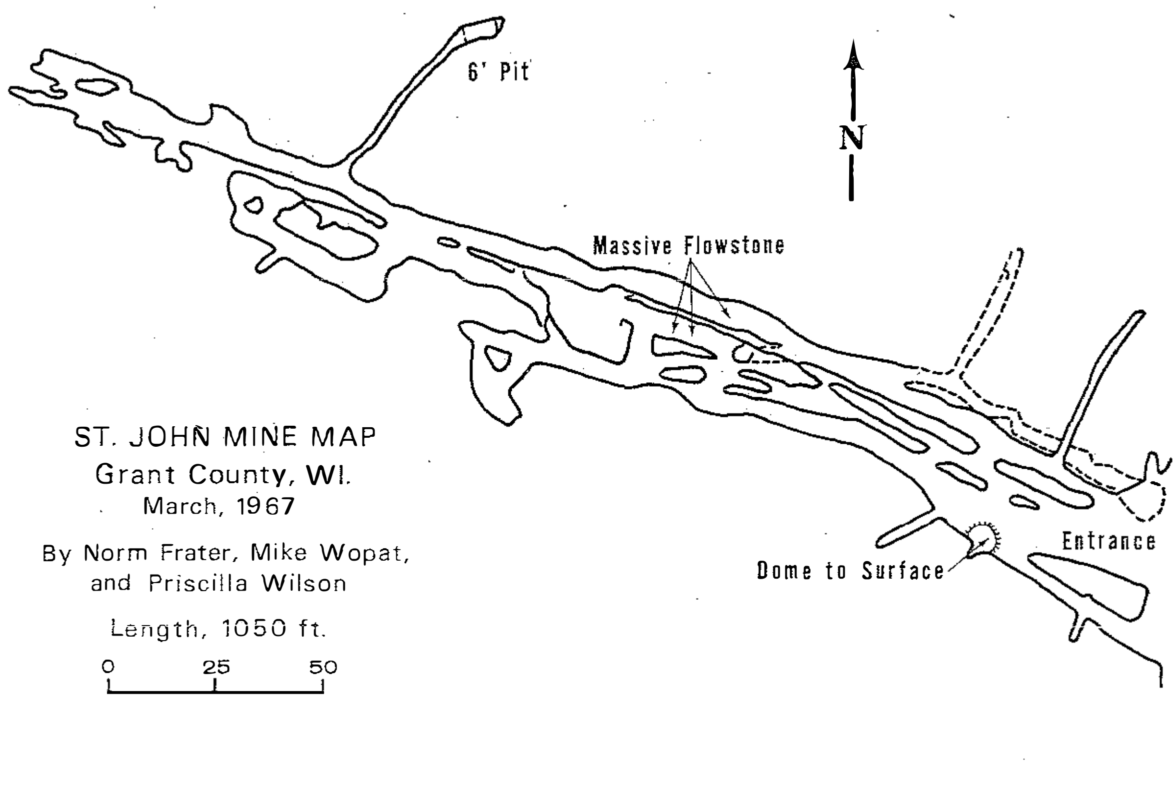
With the arrival of permanent settlers in 1825, the Winnebago Peace Treaty and "lead rush of 1827", the convening of the first Wisconsin Territorial Legislature in 1836, Potosi and its suburbs (La Fayette, Van Buren, Dutch Hollow, British Hollow, Buena Vista, and Rockville) flourished. Potosi in 1838 was hoping to become the capital of Wisconsin; first state capitol was Belmont, but Madison won out. The Mexican War of 1847; the Gold Rush of '49 and the cholera epidemic in 1854 depleted its citizens for a few years; but by 1859 when the Civil War broke out, production of lead, and with it the growth of the village of Potosi, was on an upswing.

Well over two-thirds of all lead for the North was supplied during the Civil War by the Galena, Benton, New Diggings, Shullsburg, Mineral Point and Potosi mines. The remainder was furnished by mining towns called Platteville, Hardscrabble, Yuba, and Meeker's Grove, all in the southwestern Wisconsin zinc-lead region.

References: Whitlow, J. W., and West, W. S., 1966, Geology of the Potosi quadrangle, Grant County, Wisconsin, and Dubuque County, Iowa: U.S. Geol. Survey Bull. 1123-I, p. 533-571.

Heyl, A. V., Jr., Agnew, A. F., Lyons, E. J., and Behre, C. H., Jr., 1959, The Geology of the Upper Mississippi Valley Zinc-Lead District: U.S. Geol. Survey Prof. Paper 309, 310 p.

Ihm, L. C., undated, St. John Mine Brochure, Potosi, Wisconsin.



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UPPER MISSISSIPPI VALLEY BASE—METAL DISTRICT

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