OHIO ACADEMY OF SCIENCE

AND

NATIONAL ASSOCIATION OF GEOLOGY TEACHERS

GEOLOGY FIELD TRIP

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PHYSICAL SETTING AND PROCESSES ALONG THE CENTRAL OHIO SHORE OF LAKE ERIE (MARBLEHEAD PENINSULA TO LORAIN)

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INTRODUCTION

The purpose of this field trip is to have a look at the shore deposits between Marblehead Peninsula and Lorain in the light of modern lake and shore processes (fig. 1). The shore of this 70-km[1] reach is made up of Devonian sedimentary rocks, Pleistocene till, and/or post-Pleistocene deposits (figs. 2, 3). These materials singly or in combination make up geomorphic forms such as banks, slopes, bluffs, spits, and marshes. The beaches which front the shore are narrow (less than 20 m wide) for the most part and, except for much of Cedar Point spit and the east side of the Huron jetties, are commonly discontinuous because of manmade structures and/or the limited sand supply (the shore is the source of most of the sand). Just offshore, the bottom slopes are gentle with water depths 100 m from the shoreline generally no more than 2 m; the nearshore bottom surface is generally made up of rock, till, and/or sand.

Wind storms are the most significant lakeshore process. Prevailing winds come from the west; however, the winds that generate the waves that do the bulk of the geomorphic work ("damage" to those with houses along the shore) are the infrequent northeasters. Northeast winds blowing the 350-km length (fetch length) of Lake Erie can generate waves with periods of

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[1]Metric-English conversions:

1 meter (m) = 3.28 feet (ft)

1 kilometer (km) = 0.62 mile (mi)

1 cubic meter (m^3) = 1.31 cubic yards (yd^3)

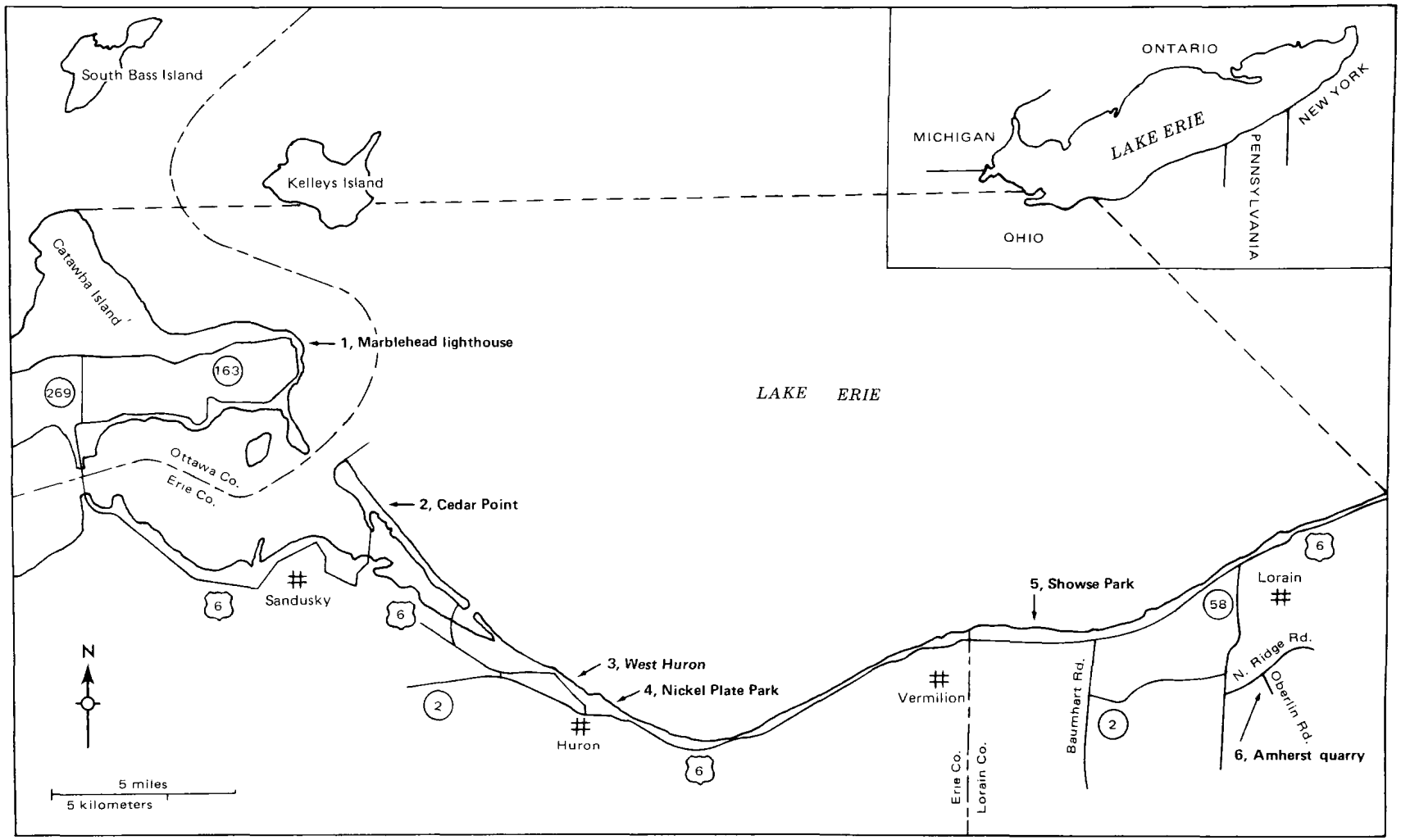

FIGURE 1.--Location map showing field trip stops.

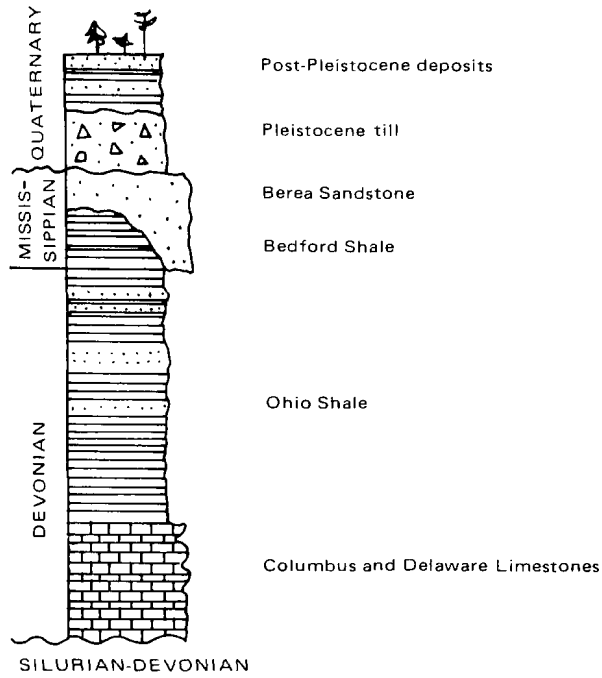

FIGURE 2.--Generalized stratigraphic column for the field trip area.

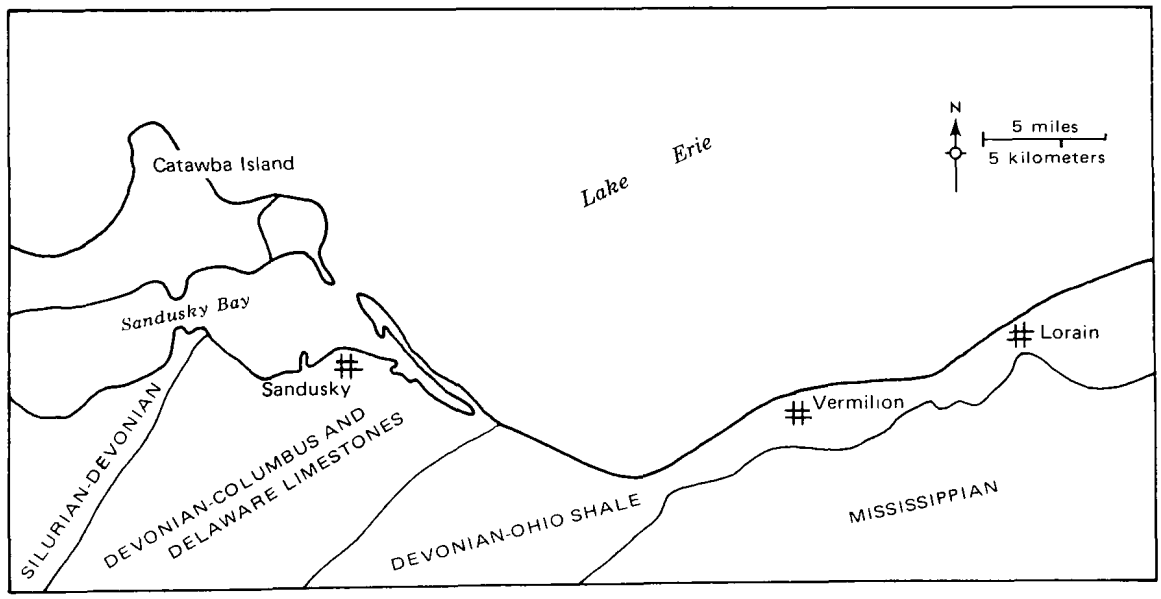

FIGURE 3.--Bedrock geology of the field trip area.

7-8 seconds and breaking wave heights of 1-2 m. In addition, northeast wind storms can set up the lake along this reach by as much as 1 m, thus contributing to greater flooding and erosion. Aside from wind setup (the rise in stillwater level caused by wind stress), the severity of flooding and erosion is greatly influenced by periods of high lake level caused by above-normal precipitation (fig. 4). Erosion rates during 2- to 3-year periods of high lake level are generally three to four times greater than the rates determined by long-term periods of 30-40 years.

An introduction to the lakeshore is incomplete without a brief summary of the early evolution of Lake Erie. About 14,000 years B.P. a glacial lake covered this area to an elevation of about 244 m above sea level. Within the next 1,500 years or so, relatively minor lake-level fluctuations - a few tens of meters—took place as the receding glacier, in a series of retreats and readvances, alternately exposed and buried different outlets. These fluctuations ended about 12,600 years B.P., when retreat of the Erie glacier finally allowed discharge northeastward across the Niagara Escarpment, which at that time was depressed owing to the weight of the glacier. Because this outlet was about 40 m below present lake level, the level of the lake was lowered by this amount, forming early Lake Erie. Isostatic rebound of the escarpment then led to the filling of the lake to its present elevation of 174 m above sea level.

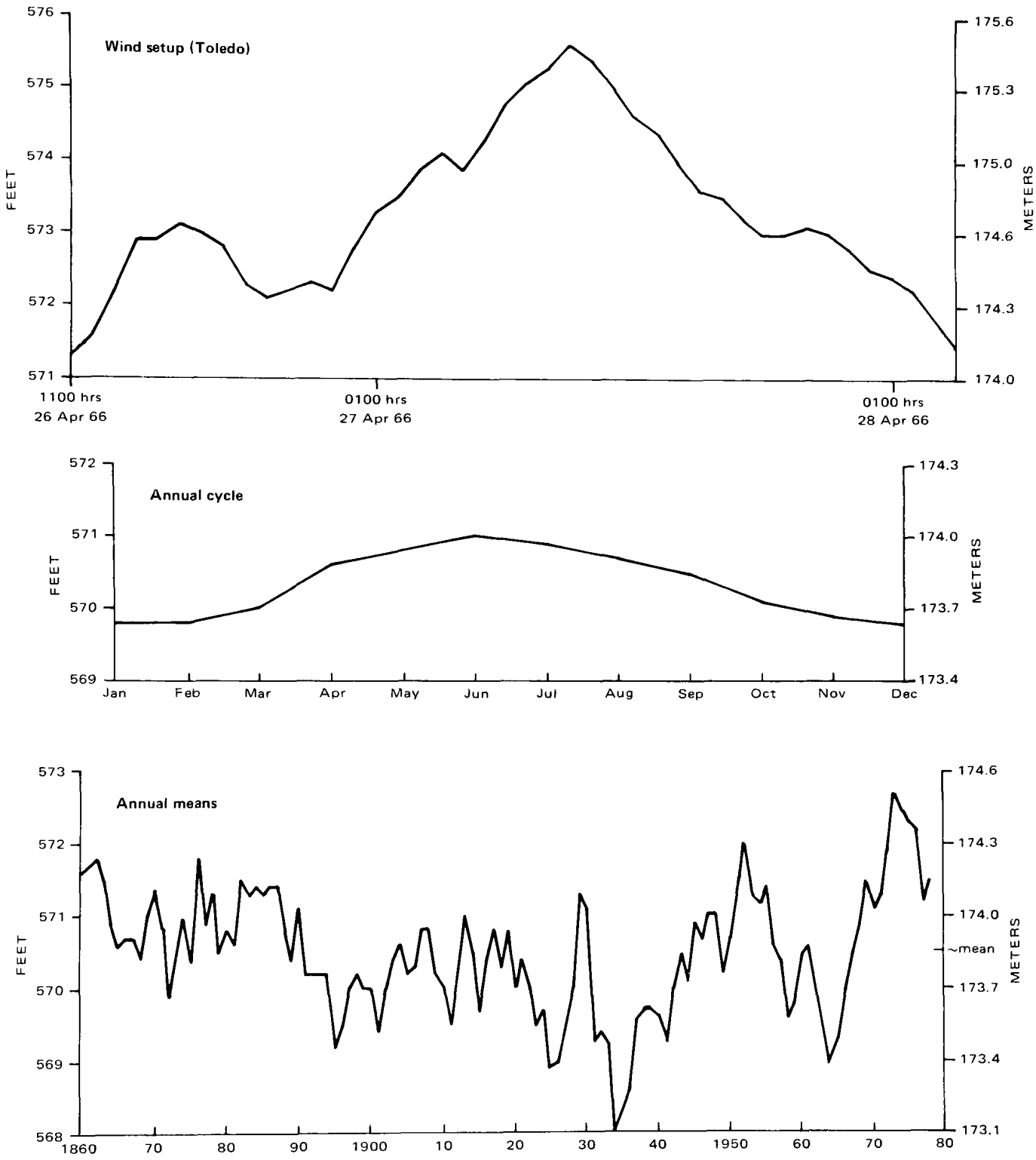

FIGURE 4.--Lake-level fluctuations: wind setup, annual cycle, and annual means (historic record).

ACKNOWLEDGMENTS

D. E. Guy, Jr. helped collect data, drafted figure 1, and was on the initial field trip run; M. S. Longer helped with the typing and drafted figure 3; J. A. Fuller and C. H. Hopfinger made the second field trip run. M. Hackathorn, P. J. Celnar, L. M. Guckenheimer, and B. A. Leffler did the editing, final drafting, and typing. The permission from H. R. Collins, State Geologist, to publish this guidebook is appreciated.

FIELD TRIP STOPS AND ROAD LOG

The field trip route may be followed on the following U. S. Geological Survey 7.5-minute topographic quadrangles maps: Castalia, Gypsum, Huron, Kelleys Island, Lorain, Sandusky, Vermilion East, Vermilion West.

The field trip begins at Marblehead lighthouse.

Stop 1. Marblehead lighthouse (end of Lighthouse Lane) (Kelleys Island 7.5-minute quadrangle).

Thin fossiliferous beds of Columbus Limestone make up the lighthouse point. Scattered piles of large (up to 1 m x 1 m x 15 cm) imbricated limestone slabs attest to the high wave energy impinging on this point during northeast storms, whereas low recession rates (<0.3 m/yr) attest to the overall erosional resistance of the rock in spite of its thin-bedded nature. The lack of sand beaches is related largely to the

location, shape, and orientation of the point. Devonian corals contrast strikingly with Quaternary glacial grooves. The lighthouse was established in 1821, 3 years after the Erie, Pennsylvania, and Buffalo, New York, lighthouses, and is now the oldest operating lighthouse on the Great Lakes.

	Cumulative mileage
Intersection of Lighthouse Lane and Main Street-Ohio Route 163-Bay Shore Road (Kelleys Island 7.5-minute quadrangle). *Turn left (south).*	0.0
Lime kiln stack and quarry. Columbus Limestone is used in breakwater and dike construction in the lake.	0.7
Bay Point (a baymouth bar) entrance; Johnson's Island (Columbus Limestone) to the south-southwest in Sandusky Bay was a prison for Confederate officers.	1.5
(Gypsum 7.5-minute quadrangle)	
Columbus Limestone exposure.	4.0
Intersection with Ohio Route 269; *continue straight (west)* on Ohio Route 269.	7.8
Intersection; *turn left (south)* and continue on Ohio Route 269 to cross Sandusky Bay on old bay bridge.	8.1
(Castalia 7.5-minute quadrangle)	
Ottawa County-Erie County line.	9.5
Continue straight (east) on Barrett Road, which becomes Venice Road; do not turn south on Ohio Route 269.	10.5
Much of this marshland occupies space strip mined for marl by Medusa Cement Company in late 1800's.	
Join U. S. Route 6 and cross Cold Creek.	13.7
(Sandusky 7.5-minute quadrangle)	

	Cumulative mileage
Intersection with Ohio Routes 101-412; *turn left (northeast)* onto Ohio Routes 101-412—U.S. Route 6 into Sandusky. Gas stations at this intersection.	15.7
Intersection with Shelby Street (Cronin's Bar on northeast corner); *turn left (northwest)* onto Shelby Street.	16.8
Intersection with West Water Street; *turn right (northeast)* onto Water Street.	17.0
The Norfolk and Western coal dock and breakwaters lie to the northwest. North of this intersection is the Erie Sand and Gravel dock; gypsum from Michigan, salt from beneath Lake Erie near Cleveland, and sand from Lake Erie are commonly stored here. The sand dredge *John R. Emery* is moored here.	
Cedar Point dock and Island ferries. Most of the land bayward of Water Street is fill.	17.5
Intersection with Meigs Street; *turn right (south)* onto Meigs Street.	18.1
Intersection (stoplight) with East Monroe Street-First Street; *turn left (east)* onto First Street.	18.6
Intersection with Causeway Drive; *turn left (north)* onto Causeway Drive.	19.9
Cedar Point tollgate; Sandusky waterworks (Lake Erie water!) to east.	20.0
Bear right (north) across Cedar Point spit to lake.	21.4
"Block 2200" street sign; park vehicles.	21.7

Stop 2. Cedar Point (intersection of Cedar Point Causeway and Cedar Point Chaussee) (Sandusky 7.5-minute quadrangle).

This spit is composed of well-sorted fine-grained quartz sand eroded from till along the shore as far east as Lorain, transported

by the net east-to-west longshore current, and deposited along the spit at the mouth of Sandusky Bay. Transportation and deposition by surface waves, wave-induced currents, and wind have formed the nearshore, beach, and dune environments. Construction of the Sandusky channel jetty in 1891 has contributed to the buildup of sand at the west end of the spit. Long-term recession rates (1937-1973) are <0.3 m/yr along much of the spit. However, northeast storms during the record-high lake levels of late 1972 and 1973 eroded large quantities of sand from the beach-dune zone, and, as a result, seawalls and other structures were constructed in front of what were formerly unprotected dunes.

The Cedar Point amusement park opened in 1870 and is visited by about 3 million people each year between late May and early September.

	Cumulative mileage
Continue southeast along Cedar Point Chaussee; note manmade structures, dunes, etc.	21.7
(Huron 7.5-minute quadrangle)	
"Block 10" street sign; *bear south* on Chaussee.	25.6
Breach in spit to east; breach developed in late 1972-early 1973 with simultaneous landward migration of the unprotected portion of the spit. Plum Brook (NASA) pumping station-old Cedar Point entrance about 1.3 miles to southeast. Contact between carbonates and siliciclastics near here.	25.7
Intersection with U.S. Route 6; *turn left (east)* onto U.S. Route 6.	26.8
Ohio (?) Shale in railroad cut on right (south).	27.2
Sheldon's Folly (old Cedar Point entrance) on left (north).	28.1

	Cumulative mileage
Intersection of U.S. Route 6-Cleveland Road and Rye Beach Road; gas stations. *Continue straight (east)* on Cleveland Road.	28.7
Huron Plaza, park at west end of lot.	30.5

Stop 3. West Huron (Huron Plaza, 1.8 miles east of Rye Beach Road-Cleveland Road intersection) (Huron 7.5-minute quadrangle).

Intercalated clay and silt laminations (varves?) make up the 3-m-high bank west of the apartment complex. Present-day recession rates are about 1 m/yr along this unprotected stretch, whereas farther to the west recession rates have been considerably reduced (generally <0.3 m/yr) because of the construction of seawalls. The dike adjacent to the Huron west jetty was constructed in 1975-76 for the containment of polluted material dredged from Huron Harbor. The structure has a capacity of 2×10^6 m^3 and is expected to be filled by 1985, at which time it will be used as a park.

	Cumulative mileage
Continue southeast on Cleveland Road.	30.5
Intersection with Center Street; *turn left (northeast)* onto Center Street.	30.9
Intersection with Wall Street; *turn right (southeast)* onto Wall Street. Note narrow beach to north and dike and jetties to northeast.	31.1
Intersection with Main Street; *turn right (southwest)* onto Main Street. Huron lime plant, Norfolk and Western dock, and Pillsbury dock to south.	31.2
Intersection with South Street; *turn right (northwest)* onto South Street.	31.3
Intersection with Williams Street; *turn left (southwest)* onto Williams Street.	31.4

	Cumulative mileage
Intersection with U.S. Route 6 (Ohio Route 2-Cleveland Road); carefully cross westbound lanes and *turn left (southeast)* onto U.S. Route 6.	31.8
Huron River.	32.2
Intersection with Tiffin Avenue; *turn left (north)* onto Tiffin Avenue.	32.6
Intersection with Berlin Road; *continue north* and follow signs to Norfolk and Western (Nickel Plate) Park.	32.8 33.1

Stop 4. Nickel Plate Park (just east of Huron Lime Company) (Huron 7.5-minute quadrangle).

The moderately well-sorted medium-grained quartz sand trapped by the east Huron jetty has protected about 1.5 km of shore east of the jetty by acting as a barrier between storm waves and the shore. Erosion of Quaternary deposits provides about 15,000 m^3/yr of sand to the beach and nearshore zones between Lorain and Huron. The dunes are characteristic of areas with low relief and a large sand supply such as areas along the updrift side of major stickout structures. LUNCH STOP.

	Cumulative mileage
Nickel Plate Park.	33.1
Retrace route to Tiffin Avenue-Berlin Road intersection.	33.5
Take Berlin Road southeast to intersection with U.S. Route 6; *turn left (east)* onto U.S. Route 6.	33.8
Old Woman Creek estuarine sanctuary.	35.3
Ceylon Junction, southernmost shore of Great Lakes.	36.0

	Cumulative mileage
(Vermilion West 7.5-minute quadrangle)	
Eastern entrance to old Lake Road that has been lost to the lake.	37.5
(Vermilion East 7.5-minute quadrangle)	
Vermilion River. Ohio Shale exposed to south on west bank of river.	44.2
Intersection with Berkley Road; *turn left (north)* onto Berkley Road and *travel east*.	45.4
Intersection with Overlook Avenue; *turn left (north)* onto Overlook Avenue (fire station on northeast corner).	46.2
Intersection with Edgewater Drive; *turn right (east)* onto Edgewater Drive and *continue east* on Edgewater Drive to Showse Park.	46.4 46.7

Stop 5. Showse Park (just east of Vermilion-on-the-Lake)

(Vermilion East 7.5-minute quadrangle).

Long-term recession rates in the shale are <0.3 m/yr and in the till are <1 m/yr. Rotational slumps east of the park represent one phase of slope retreat in the cohesive Quaternary deposits along the shore. Generally, there is steepening and undercutting of the slopes by waves in the summer and fall, a static period in the winter caused by freezing temperatures and lake ice, and then mass wasting in the spring caused largely by a decrease in the internal shear strength of the deposits. The poorly sorted sediment making up the beach is indicative of a nearby poorly sorted source, the till.

	Cumulative mileage
Showse Park.	46.7
Continue east on Edgewater Drive to Woodside Avenue; *turn right (south)* onto Woodside Avenue.	46.9
Intersection with U.S. Route 6; carefully cross westbound lanes and *turn left (east)* onto U.S. Route 6.	47.2
Intersection with Baumhart Road; *turn right (south)* onto Baumhart Road.	48.7
Intersection with Ohio Route 2; *take Ohio Route 2 east* (toward Cleveland).	50.4
Berea Sandstone at hilltop on left (north).	52.1
(Lorain 7.5-minute quadrangle)	
Ohio Shale in stream valley (Beaver Creek) on right (south).	53.4
Intersection with Ohio Route 58; *take Ohio Route 58 south*.	54.5
Intersection with Cleveland Avenue-North Ridge Road; *turn left (northeast)* onto North Ridge Road.	55.0
Intersection with Oberlin Road; *turn right (southeast)* onto Oberlin Road.	56.2
Intersection with private road (G.E. Brugger, Thompsons); *turn right (west)* just before "Slippery when wet" sign and follow road, *taking left (south) fork* up to quarry.	56.6 57.0
Turn right and park vehicles.	57.1

Stop 6. Amherst quarry (Lorain 7.5-minute quadrangle).

Face of deeply weathered and eroded Berea Sandstone exposed along northwest perimeter of quarry. The face has been interpreted as a glacial lake cliff. Depressions and holes are suggestive of chemical and mechanical weathering, as well as erosion by wind and water.

Berea Sandstone is quarried southwest of Amherst for dimension stone. Because it is more resistant than the laterally adjacent shale, it is commonly a ridge former.

END OF FIELD TRIP.

We suggest returning to Ohio Route 2 for points east or west and to Ohio Route 58 for points to the southeast (U.S. Route 250 to I-77) and southwest (I-71). Have a safe trip home.