BATHYMETRY OF LAKE ERIE AND LAKE SAINT CLAIR

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LONG POINT ESCARPMENT

This north-facing escarpment is surrounded by irregular topography which has a relief of 1-5 meters and a dominant NE-SW lineation running at a diagonal to the escarpment. Possibly, the escarpment lies along the boundary separating gently southward dipping, more resistant upper Devonian deltaic sands and silts, or an upper Devonian limestone bed which is more resistant than the marine shales to the north. Alternately, the escarpment could have been formed along a preexisting fault, which had juxtaposed more resistant and less resistant strata. The escarpment is parallel to the inferred direction of flow of glacial ice advancing down the axis of the lake floor. Lack of large-scale irregularities along the edge of the escarpment probably reflects the likelihood that in the subglacial regime of erosion, any northward projections of the resistant eroding strata were sheared off due to the eroding power of the ice.

LONG POINT SPIT

This is one of the most prominent topographic features in Lake Erie, extending about 35 kilometers east-southeastward from the Ontario shore out into the Eastern Erie Basin. The spit is a late Holocene to recent depositional feature constructed of sand eroded from the Ontario shore cliffs to the west and brought eastward and deposited by long shore drift. Steep slopes and 55 meters of relief, the highest lake floor relief in Lake Erie, separate the Spit from the floor of the Eastern Erie Basin, direct physical evidence of its recent depositional origin.

NORTHERN SHORE OF EASTERN ERIE BASIN

An irregular shoreline underlain by relatively resistant bedrock, capped by only a thin mantle of glacial drift, characterizes the northern shore of the Eastern Erie Basin. Bedrock outcrops occur at several locations along the shore. The irregularities of the shoreline are continuous with NE-SW trending ridges and valleys which extend offshore. These ridges are formed in relatively resistant basal limestones of the Devonian (Bois Blanc and Dundee Limestones in Ontario; continuing eastward as Bois Blanc and Onondaga Limestones in New York State).

LAKE SAINT CLAIR

The floor of Lake Saint Clair is very shallow, with the deepest point lying just in excess of 6 meters. Deep water sea lanes are therefore dredged channels across the extent of the Lake. Microtopography formed by dumping of dredge spoils is present on either side of the dredged sea lane channel. Other small-scale topography, including a north-south ridge extending northward from the south shore, may be anthropogenic in origin. The delta of the Saint Clair River is the dominant feature of the Lake. This platform of deltaic deposits has been built out into the Lake, the outer edge of which is bounded by foreset slopes extending downward from platform depths of less than one meter to more than 3 meters depth.

SOUTHERN SHORE OF EASTERN BASIN

The southern shore bordering the Eastern Erie Basin is straighter than the northern shore and is relatively free of coves and inlets. Middle and upper Devonian marine shales and terrigenous siltstones of the Hamilton, Genesee, Sonyea, West Falls, Java, and Canadaway Groups, in ascending order, crop out along the shore. These Devonian strata intersect the shore at a low angle and extend westward beneath the Lake.

POINT PELEE RIDGE

Point Pelee Ridge includes Point Pelee and extends offshore south-southeastward for a distance of about 10 kilometers, where it ends abruptly. This ridge has 6-8 meters of total relief and extends up to depths of less than 5 meters. Previous interpretations have presented Point Pelee together with Point Pelee Ridge as moraine associated with the Pelee-Lorain Ridge on which 3500 years before present-to-recent sand deposits have been concentrated. Since 3500 years before present, the subaerial extent of Point Pelee has diminished as a consequence of continued rising water levels.

POINT PELEE FAN

Extending to the east of the Point Pelee Ridge is the Point Pelee Fan, a fan-shaped delta-like body of sediments which crests at 11-12 meters below present lake level. This fan is recognizable down slope to a depth of 18 m and it extends as far south as the Pelee-Lorain Ridge. Because of its crestal depth of 11-12 meters, we believe that this fan may have been principally formed at the time when the lake level was about 10-15 meters lower than at present, prior to deposition of the shallower 3500 years before present to present sands on the Point Pelee Ridge. If this fan is in fact a relict shoreline feature, it may have been formed by the Detroit River when the Port Huron outlet from Lake Huron was first opened up and the newly formed Detroit River was eroding its channel and bringing a heavy load of sediment into Lake Erie.

CLEAR CREEK RIDGE

A small, narrow arcuate ridge having a few meters relief occurs 8-15 kilometers west of, and approximately parallel to, the Long Point-Erie Ridge. This ridge, probably glacial in origin, is unusually linear for a topographic feature. It extends southward from the Ontario coast across more than half the width of the Lake. Although its exact origin remains a mystery, it has some of the morphological characteristics of an esker.

LONG POINT-ERIE RIDGE

The Long Point- Erie Ridge is a broad (14-22 kilometers) arcuate ridge of 5-10 meters overall relief, capped by complex topography, extending upward to minimum depths of 10-15 meters, and extending across the lake floor from near the inshore end of the Long Point Spit, almost to the Presque Isle Spit at Erie, PA. This feature has been interpreted as an end moraine formed during the last major re-advance of glacial ice into the Eastern Erie Basin. Overall shape of the Eastern Erie Basin, and the arcuate shape and topography of the Long Point-Erie Ridge, as seen in this new bathymetry, strengthens the interpretation that this feature is an end moraine.

PENNSYLVANIA CHANNEL

A ridge extending westward along the north wall of the Pennsylvania Channel suggests a "natural levee" in which sediments eroded from the southern end of the Long Point-Erie Ridge are carried westward and deposited as overbank deposits. This channel is the location of strong return flow from the Eastern Erie Basin to the Central Erie Basin, which is set up during and following periods of strong frontal winds blowing from west to east longitudinally down the length of the lake surface. Such winds transport surface water eastward, raising lake levels in eastern Lake Erie and requiring a compensating westward flow at depth once equilibrium is reached, or following relaxation of the strong winds. This pattern of water flow occurs at present, but it may have been stronger when lake levels were lower.

EXPOSED BEDROCK IN WESTERN LAKE ERIE

Areas of exposed bedrock, characterized by a fine-scale topography, have been identified off the southern shoreline west and east of Vermilion, and east of Lorain, Ohio. Several ledges are clearly delineated; as many as three separate ledges occur in parts of both areas. These ledges are presumably the erosional surface expression of stratification or jointing in the underlying upper Devonian shales. Other areas of exposed bedrock occur around the lake, especially along the shoreline of the Eastern Erie Basin.

THE ISLANDS AREA

The islands and reefs bordering and lying within the western basin have bedrock cores which are erosional remnants of the more resistant rock strata. The islands and reefs occur mainly in two north-south bands, the western band (Bass Islands, Catawba Island, Middle and East Sister Islands) formed on erosional remnants of resistant upper Silurian dolomites of the Put-in-Bay and Raisin River Formations; and the eastern band (Marblehead Peninsula, Kelleys Island, Pelee Island) formed on erosional remnants of resistant lower Devonian limestones of the Columbus Formation. The natural channels which occur in the straits between the Bass Islands and adjacent to these islands to the west are over deepened and have eroded/corroded through the limestone and dolomite bedrock. The deepest channel depth is the 19-meter Starve Island Deep located between the southern- most Bass Island and Marblehead Peninsula.

PELEE-LORAIN RIDGE

The Pelee-Lorain Ridge extends southeastward from Pelee Island almost to the Ohio shore. Previously it was assumed that this low ridge was continuous between Point Pelee and its southern terminus near the Ohio Shore. This new bathymetry shows clearly, however, that the Pelee-Lorain Ridge is not continuous with Point Pelee, but is instead continuous with Pelee Island, 20 kilometers to the southwest! This ridge has been interpreted as an end moraine probably associated with a re-advance of the retreating Wisconsin Ice Sheet, and probably correlating with the proglacial Lake Maumee II.

Lake Evolution

1) A succession of Paleozoic (250-500 million years before present) strata were deposited over the region, including the easily erodible Devonian (350-400 million years before present) shallow water marine shales and carbonates into which the Lake Basin was eroded.

2) An elaborate system of drainage channels was incised into the Paleozoic bedrock during post-Paleozoic, pre-glacial time when the region was elevated above sea level.

3) Repeated episodes of glacial erosion excavated the lake basin during Pleistocene time (0-2 million years before present).

4) Final retreat of glacial ice from the area about 13,000 years before present left in place a topographic surface formed by erosion of bedrock and by deposition of sediments underneath and near the margins of the ice sheet.

5) Lake floor topography was modified following deglaciation by deposition and current sculpting of sediments on the lake floor. Anthropogenic effects of dredging and mining also contributed to topographic modification.

Bathymetric Compilation

Continuing cooperative effort between NOAA and the Canadian Hydrographic Service has resulted in the completion of this bathymetry. The bathymetry was compiled mostly at scales ranging from 1:2,500 to 1:100,000, using the entire historic hydrographic sounding data base from the United States and Canada. The contours have been registered to the NOAA nominal scale 1:80,000 digital vector shoreline.

In some areas, such as along the Canadian shore, greater detail is seen in the contours than in other areas. This is a natural consequence of differences in the trackline spacing of the bathymetric surveys used in the compilation. The bathymetry has been raster scanned and vectorized, and will soon be available in the form of digital data and imagery.

For Further Reading:

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Depth in Meters

0 15 30 45 60 64

Scale 1:350,000 Transverse Mercator Projection Contour Interval: 1 meter

km

0 50

This map is intended to show lake floor topography and is not to be used for navigation.
Lake floor feature names have been approved by the U.S. Board on Geographic Names.

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Data Coverage