

ECOLOGICAL PROCESSES AT A SECTION OF SHORELINE OF SOUTH BASS ISLAND, LAKE ERIE¹

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ABSTRACT

The tombolo at the northeastern end of South Bass Island, and a contiguous till bank on the southeastern shore were studied between 1936 and 1963. The bar of the tombolo represents the line of convergence of waves from the east which had passed on both sides of the dolomitic outcrop at the outer end of the bar. Waves from the west, approaching the bar at right angles, brought to it materials from both sides. Changing levels of Lake Erie alternately submerged and exposed the bar for prolonged periods. During periods of exposure, many plants appeared, which were subjected to overriding sheet-ice and then were eliminated by subsequent prolonged submergence. The adjacent till bank receded by a combination of the effects of shoving ice, frost, rain, waves, and winds (dehydration and sand-blasting). Boulders which washed out of the till bank were moved by waves and ice and accumulated near the landward end of the bar. These changes are illustrated by a set of dated photographs.

East Point of South Bass Island (fig. 1) ends in an outcrop of dolomite (fig. 2). This is called Buckeye Island by local people (though labelled Buckeye Point on

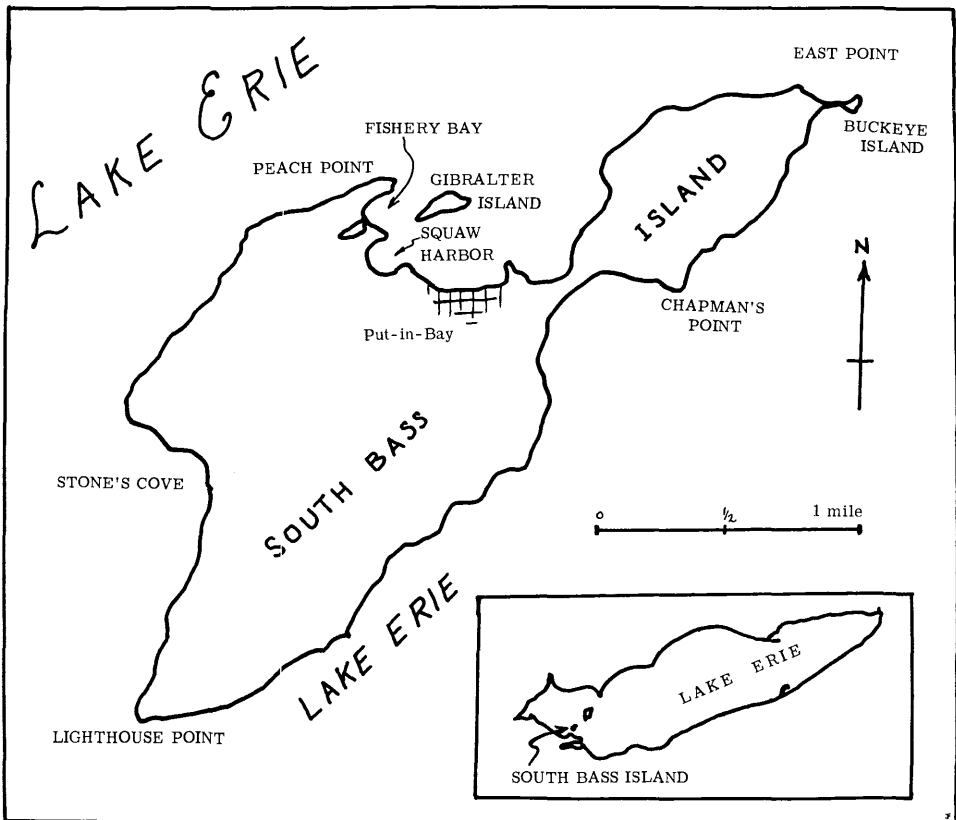


FIGURE 1. Map of South Bass Island, showing location of Buckeye Island.

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Verber's map of 1952) because its soil supports many Buckeye trees and because it is separated from the main island during periods of low lake levels. A gravel bar ties this rocky tip to East Point whenever the lake lowers appreciably, so the structure constitutes a "tombolo." The shore of Buckeye Island is the eastern

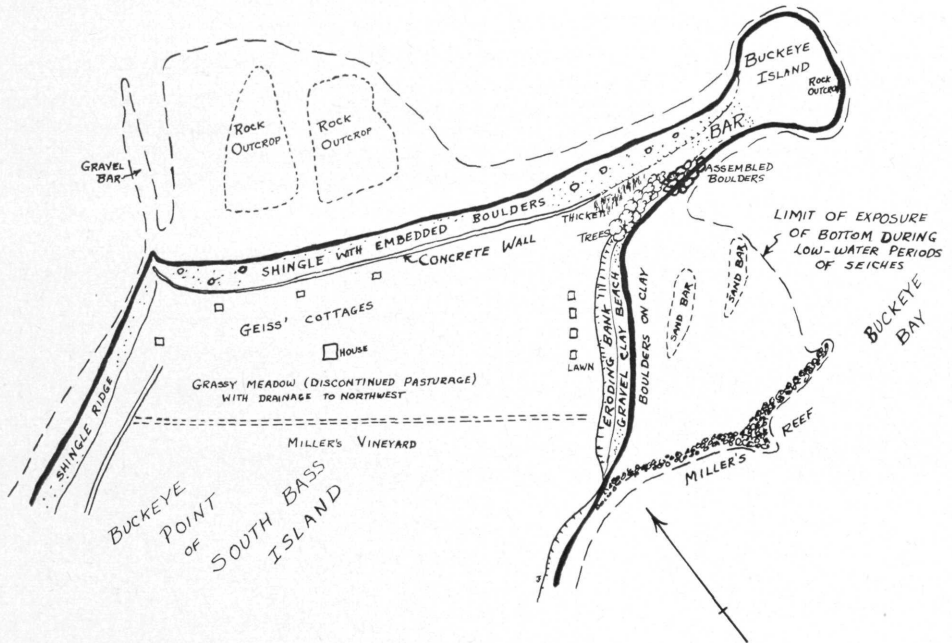


FIGURE 2. Detailed sketch map of the northeastern part of South Bass Island, showing Buckeye Island, Buckeye Bay and the Till Bank, and other shore features.



FIGURE 3. Buckeye Bay, S. Shore of East Point, South Bass Island. Note turbid water from eroding clay till bank. (Aerial view, eastwards.) August 13, 1950,



FIGURE 4. Waves converging over the bar from Buckeye Island. April 24, 1950.

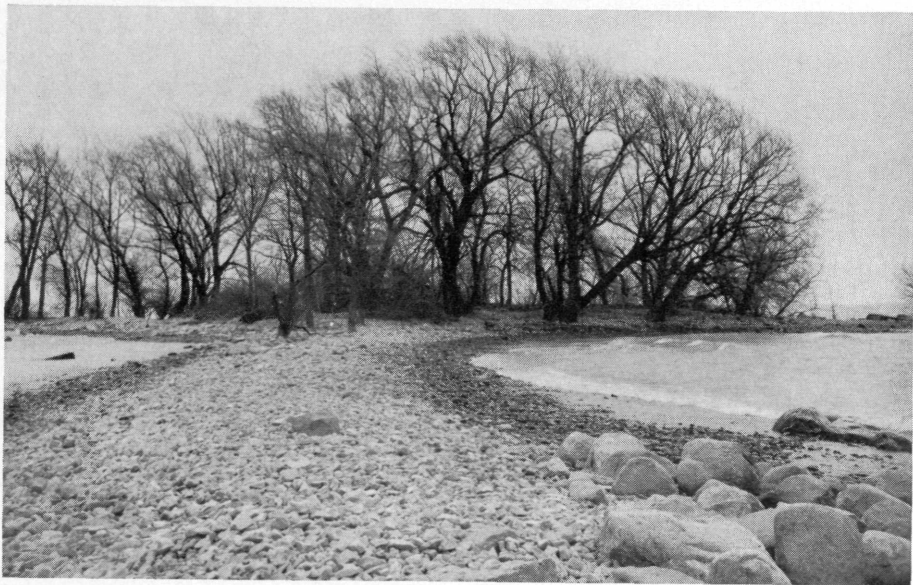


FIGURE 5. Bar to Buckeye Island, exposed during low water period. April 10, 1953.

end of an embayment on the south side of East Point, and Miller's Reef (so-called locally because it abuts land owned by the L. Miller family for about a century) is the partially submerged southern end of this part of the lake, here called "Buckeye Bay" (fig. 3).

The following observations of processes which affect this stretch of lake shoreline were made between 1936 and 1963, a span of years in which the mean level of Lake Erie varied over 6 ft (U.S. Lake Survey Records). Unfortunately, these observations, documented with dated photographs, do not include lake level data, nor measurements of the bar. A map made in 1951 and records of changing levels at Put-in-Bay, made when the O.S.U. Stone Laboratory was operating on the year-around basis, have not been available since 1956 when the change to summer-only operations took place, and are presumed to be lost.



FIGURE 6. Sheet-ice over-riding shrubs on bar to Buckeye Island. March 11, 1945.

The bar is formed by material eroded and moved by waves. Waves from the east pass around Buckeye Island on both sides, then converge on the west side of the outcrop, with waves from each side dampened when met by waves from the other side (fig. 4). Waves from the west or northwest pass around South Bass Island, then are deflected towards this tombolo from north and south. Storms from west and northwest, however, lower the level of the western end of Lake Erie and, except during years of very high water levels, expose the bar. Exposures of lake bottom shoals during such storms show that the bottom of Buckeye Bay consists of boulder-studded clay, with offshore bars of sand. On the north side of Buckeye Point, low water exposes a gravel bar at the edge of deep water to the west, and extensive areas of outcropping bedrock between the gravel bar and the base of the tombolo. It is probable that more soil has been removed here than

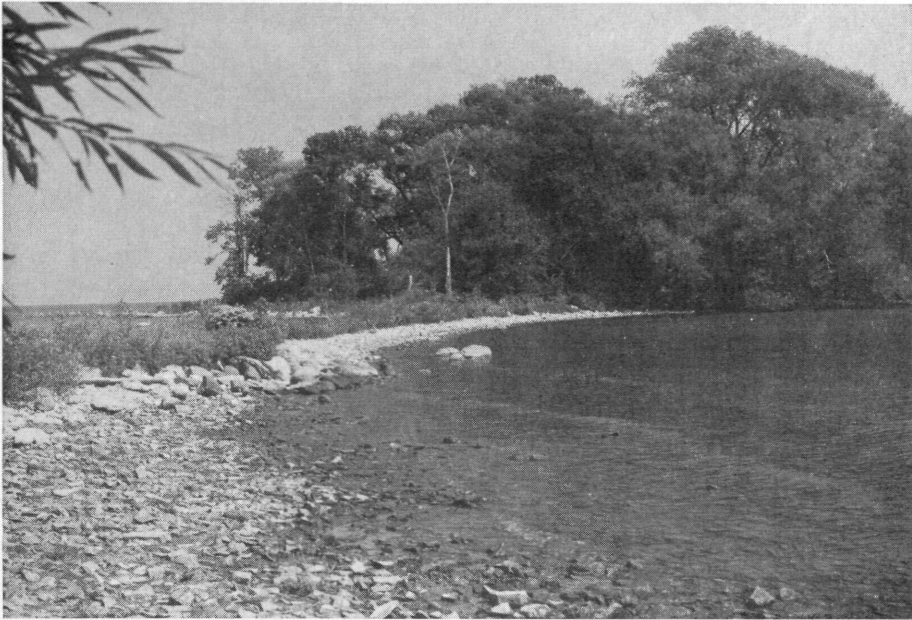


FIGURE 7. Bar overgrown after period of low water. August 24, 1959.



FIGURE 8. Bar exposed during low water, but not yet revegetated. October 24, 1961.

from the area of Buckeye Bay, and that here was the source of much of the material which now forms the bar to Buckeye Island.

There is an accumulation of moderately large boulders near the west end of the bar, on its south side (fig. 5). Similar boulders were watched as they were washed out of the till bank facing Buckeye Bay, and certain identifiable ones were followed from one location on the beach to others, after they had been moved by specific storms. The assembly of these stones into a group was done partly by storm waves, and, probably, partly by sheet ice. Sheet ice has been seen shoving boulders in this bay, and it may have relocated boulders which were frozen in elsewhere, but were dropped out when the ice melted here, a process that has been observed elsewhere by the author.



FIGURE 9. Bar again overgrown. December 13, 1963.

Whenever the bar was exposed by low water, as during the few years preceding 1943, it became occupied by herbs, shrubs, and low trees. This vegetation was eliminated after 1943, when the lake level became high, partly by submergence, and partly by strong waves and shoving sheet ice (fig. 6). The lake level again dropped in 1958 and remained low in 1959, allowing the establishment of thistle, burdock, sumac, dogwood, smartweed, goldenrod, jewelweed, milkweed, vervain, aster, nightshade, box-elder, poplar, and cherry (fig. 7). The bar was submerged again in 1960 and, denuded of plants, was still under water on May 30, 1961. The progressive lowering of the lake thereafter left the bar exposed in October, 1961 (fig. 8), and in 1962 and 1963 the species of plants listed above re-established themselves (fig. 9).

The till bank along the center of the shoreline of Buckeye Bay is subjected to various kinds of erosive actions. Specifically, (a) sheet-ice shoves up the sloping clay shoals against it (fig. 10); (b) frost extrudes particles of clay from the bank, then sunlight melts the frost, and the clay particles drop to the base of the bank (fig. 11) where they form a crumb-mulch talus; (c) rain drives against the



FIGURE 10. Sheet-ice shoving against eroding till bank. January 3, 1948.

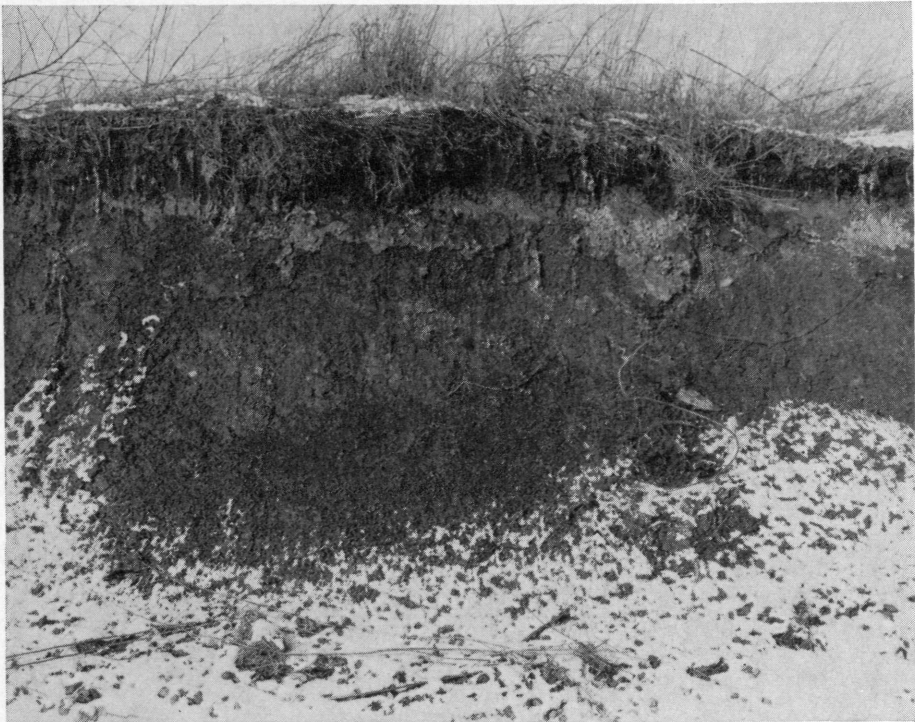


FIGURE 11. Sunlight has melted ribbons of frost, dropping clay particles, extruded, to the base of the bank. January 20, 1949.

bank, undermining the turf at the top and compacting the talus (fig. 12); (d) waves wash away the talus, then attack the bank itself, exposing, undermining, and moving rocks to a point a little way from the base of the bank, where they accumulate (fig. 13); (e) sunlight, during clear, dry periods, dehydrates the bank,



FIGURE 12. Crumb-mulch talus slumped by rainfall. February 16, 1949.



FIGURE 13. Talus washed from base of bank by waves. April 8, 1949.

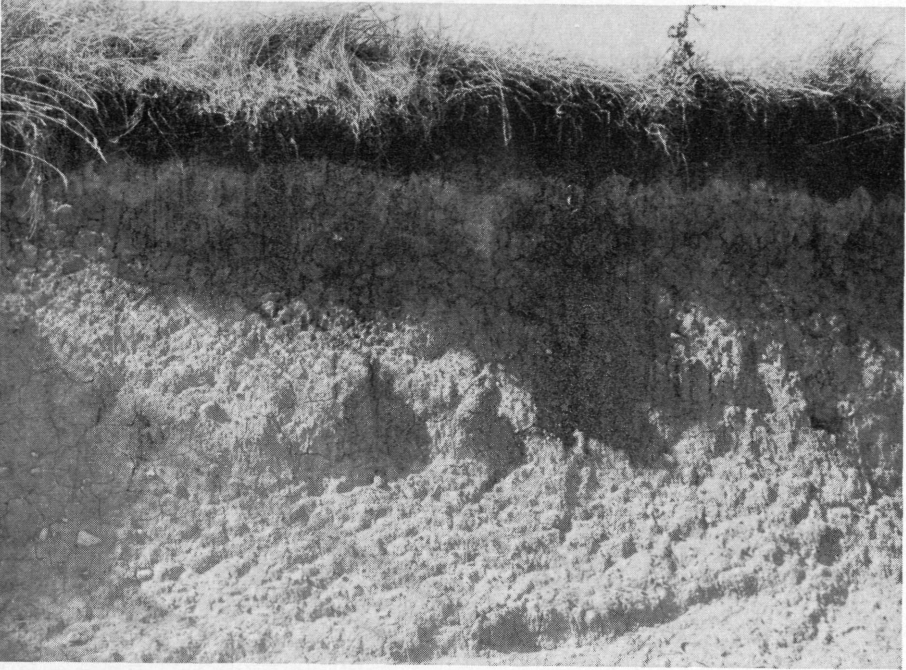


FIGURE 14. Bank, dehydrated by sunlight and heat, cracked open. September 30, 1949.



FIGURE 15. Waves, funnelled by ice cusps, splash and erode bank. February 13, 1950.

which then cracks open along the paths of grass roots and along structural cracks in the soil, the cracks sometimes extending down to a depth of 5 ft (fig. 14); (f) winds from the southwest bombard the face of the bank with sand particles; (g) cusps of winter splash-ice funnel waves so that they splash high, thereby washing the upper zone of the bank (fig. 15).

The shoreline of Buckeye Bay has receded over 25 ft in this till-bank region during the 27 years of observation, and many tons of land have been moved from this part of South Bass Island into Lake Erie. State or federal engineering projects to reduce the rate of loss would be desirable.
