TOPOGRAPHY OF ABANDONED BEACH RIDGES
AT ELLISON BAY, DOOR COUNTY, WISCONSIN

O. L. KOWALKE AND E. F. KOWALKE

The abandoned shore lines and beach ridges near the village of Ellison Bay, Wisconsin indicate that the waters of Green Bay and of Lake Michigan were once joined by the route of Rogers Lake, locally called the Mink River. The Mink River (Rogers Lake) shown on the map in Fig. I, is a very sluggish stream with little fall. In fact its head waters near the junctions of sections 11, 12, 13 and 14 are only three feet above the level of Green Bay. At its mouth the solid rock sloping gently eastward is found at the water level. In Ellison Bay in contrast the ground slopes quite abruptly into the water; the slope is precipitous off the bluff in sections 15 and 16; it is likewise precipitous about 150 feet off shore in sections 10 and 2.

It is easy to see how ice on Ellison Bay driven by wind might push rock and sand from the beach inland and how waves would do likewise and thus fill this water way. As the water level fell the solids so transported became exposed to the air and thus formed the land on which the village of Ellison Bay now stands. The storms that raged threw up some interesting beach ridges now to be described.

A topographic survey to show the relationship of these ridges had long been under consideration, but it was not until the summer of 1935 that both of us were free to collaborate and do the job. The measurements in this report were made with an engineer’s transit equipped with stadia wires and level attachment, a steel tape, and a level rod. The starting point of the survey was the joint corner of sections 10, 11, 14 and 15 and the county surveyor’s location of the line east and west between sections 10 and 15. All elevations were based on the U. S. Coast and Geodetic Survey Bench Mark No. U 21, elevation 589.06 feet above sea level. The maximum deviation in levels closure was 0.15 feet and that of distances was 2.0 feet. The data gathered on the survey were combined in the map shown in Fig. II. It is re-
grettable that the necessary reduction in size for the lantern
slide and the Transactions makes some details obscure.

There are three distinct groups of beach ridges whose eleva-
tions above sea level are respectively 640 feet, 603 feet and 588
feet. They are all composed of well rounded limestone frag-
ments ranging in size from one inch to eight inches diameter
and are devoid of sand and soil material except for small
amounts of humus originating from decayed leaves and shrubs.
The vegetation growing on them, consists of balsam firs, white
cedar, white and Norway pine, hard maple, white birch, poplars,
and shrubs.

The beach ridge at the 640 feet level shown in Fig. II at J-J
is somewhat oval in shape, about 220 feet by 500 feet, and is
located at the end of a solid rock projection. The waves caused
by storms coming out of the northwest rolled the beach pebbles
southward along a small shelf in the cliff in sections 2 and 10
and then deposited them at J-J. At the 640 feet above sea level
stage of water the cliff in sections 10 and 2 rose only a short
distance out of the water. Indeed at this stage most of the land
north and east of the line from Ellison Bay through the Mink
River (Rogers Lake) to Rowleys Bay was submerged. There
are no other evidences in the immediate vicinity of beach ridges
at the 640 feet stage of the water.

The ridges of the 603 feet level marked K-K and L-L in Fig.
II are on opposite sides of Ellison Bay waters, and their crests
are not hachured but are left in white for the sake of clearness.
A noteworthy feature of them is that they were apparently
formed by one great storm. Note that the landward slopes are
not indented or lobed. The ridge K-K is about 2400 feet long;
its crest is not flat but slightly rounded, and a profile at the
section B-B shows that a succession of storms added deposits of
pebbles, but that the first crest was never topped. At the eastern
end of the ridge the crest is in the form of a flat shelf against the
hill at the back and it is also deflected toward the south because
of the solid rock humps in sections 10 and 14 respectively. The
forest covers consists of balsam fir, white cedar, some pine,
poplar, and dogwood.

The ridge L-L is more certainly the work of one big storm;
both seaward and the landward slopes are regular and not lobed.
The crest at the section G-G is only 6 feet above the surface at
the landward side and is continuous with the shore line at the 603 feet level of water where it begins on the west at the State Highway 42 and ends 2100 feet to the eastward near the Rowleys Bay Road. It has no forest cover. Another notable feature of this ridge is that it closes the north end of the gulley M-M; and this dyke has never been broken. The water that runs off the high hill to the south and to the west is received by this gulley and is then drained rapidly to the shore of Ellison Bay underground through the voids of the very coarse gravel. At the point (N) about 500 feet north from the gulley the drill record of a well showed that solid rock lay over 90 feet beneath the surface and that the intervening material was coarse gravel.

In contrast with the ridges just discussed, the ridge R-R at the 588 feet level is the work of a succession of storms. From a little north of the section line between sections 10 and 15 it runs in a southeasterly direction to State Highway 42. Notice the lobed form of the contour at the foot of the ridge on the landward side; notice particularly the long finger lobes at the north end near the section line; and finally how at the head of the bay the pebble ridge has been extended farther toward the south and the west leaving a circular area (S) which is a marsh. The ridge R-R east and north of the dock is grown over thickly with white cedar together with a few white pine; south and west of the dock there is no vegetation at present.

The saddle or col between Ellison Bay and the Mink River is on or near the profile section F-F about 400 feet east of the boundary line between sections 14 and 15 and its elevation is 596 feet. The slopes of the ground from the col to the east and to the west to water are gentle as shown in the profile F-F in Fig. III. The top soil is fine beach sand and is now mostly under cultivation.

For contrast and for comparison of the ridges it seemed desirable to construct a series of profiles across the area surveyed. The sectioning planes are shown on Fig. II by the lines A-A, B-B, G-G, and the respective profiles are shown in Fig. III. If the ridges were eliminated the pitch from land to water is nearly the same in profiles B-B, C-C, D-D, and E-E. The pitch in profiles F-F and G-G at the head of Ellison Bay is gentle due to the breaking of the waves. Note the ridge at the 604 feet level in profile G-G how steep the landward slope is which would
seem to predicate that the frontal thrusts of the waves piled up the ridge. Note in profile D-D the succession of ridges formed when the water was at the 588 feet stage.

The origin of the pebbles forming the ridges J-J, K-K, and R-R was the cliff that extends along almost the entire eastern shore of Ellison Bay. The weathering and disintegration of this cliff is fairly rapid owing to the large fluctuations in temperature, to freezing and thawing, and to its favorable exposure to the sun. Note on profile A-A in Fig. III, that there is an escarpment about 12 feet under water nearly 120 feet from the shore line, and this extends almost the entire length of the cliff toward the north. So as the cliff disintegrated and fell the fragments were rounded by wave actions and on the occasion of big storms were rolled into the ridges.

The contrast between the cliff in sections 15 and 16 on the south shore and that in sections 10, 2, and 35 on the east shore is striking. Because of the north exposure, the cliff in sections 15 and 16 has disintegrated but slowly. White cedars are now growing luxuriantly on every little shelf so that the face of the cliff is partially hidden; no such growth occurs on the east shore in sections 10 and 2 except on the benches in section 35. Furthermore along the shore in sections 15 and 16 and on some of the higher benches of old shore lines one may find glacial boulders in abundance; they are not in evidence on the east shore.

Some interesting correlations were made possible by combining our data with those on elevations and grade for the Wisconsin State Highway 42 from Sister Bay through Ellison Bay to Gills Rock. For example, the pebble ridge (SB) in Fig. I north of Sister Bay village has the same elevation, 633 feet above sea level, as the old shore line marked (OS) in Section 15 south of Ellison Bay village. The highest elevation above sea level on Highway 42 between Sister Bay and Ellison Bay is 767 ft. and is shown at (HE) in Fig. I. Between Ellison Bay and Gills Rock the highest elevation is 672 feet; so that at the 640 feet stage of the water much of that land was submerged. Further interest in the 640 feet stage centers about a cave in the cliff near the place where the north and south quarter line of Section 16 intersects the shore. The height above water of this cave was measured by Mr. Hilder Erickson of Ellison Bay to be about 65 feet which corresponds to 643 feet above sea level.
Grateful acknowledgments are here made to Mr. Frank Cnare of the Wisconsin Highway Commission for the data on State Highway 42 and to Mr. H. Erickson for his assistance.

University of Wisconsin
Madison
and
Milwaukee, Wisconsin