SPECIAL ARTICLES

TILTED SHORELINES OF ANCIENT CRAIGTON LAKE, OHIO [1]

Description.—A lake bed mentioned by Read,[2] by the present author[3] and by Dachnowski[4] lies in a mature, branched, preglacial, north and south, valley west of Wooster and east of Ashland, Ohio. The lake which occupied this bed shortly after the ice withdrew is called Craigton Lake. It may be said to center near Funk, Ashland county, and to extend in three arms, southward seven miles, northward about eleven miles and northwestward twelve miles. The main north-south axis is a little more than eighteen miles long.

That such a lake[5] really existed is abundantly attested by beaches, cliffs, deltas, water-modified moraines and extensive flats of lake clays.

A cursory examination of the features in 1912 suggested that the beaches were not now horizontal and during the past summer careful instrumental leveling starting from U. S. Geological Survey bench marks has been done at several points along the lake plain. By this means it was found that the beach lines are far from horizontal.

The delta surfaces at the northern end are 1,040 feet above sea level. Some little wave work can be seen higher. Three miles and a half southward the beaches are at about 1,020. The altitude of 1,000–998 was found about a mile north of Funk. At Craigton the beach is 973 feet high and at the southern end we found it to be 960 feet with no wave work higher. Allowing 5 feet for possible fans or outwash deposits on the delta at the upper end, where the proper level on which to read is extremely difficult to determine, we still have 1,035 here and a difference of 75 feet in 18 miles, the southern end being lower by this amount. This means a tilting upward relatively at the north with reference to the south end of about 4 feet in a mile.

Interpretations and Correlations.—The postglacial tilting of the shorelines of the precursors of our Great Lakes has long been recognized. Very little evidence has been found of tilting south of the borders of our present lakes. The long east-and-west abandoned beaches across Ohio show almost no tilting, but lines running more nearly north and south are appreciably displaced. The evidence presented above carries actual tilting 50 miles south of the most southern part of Lake Erie, itself the most southern lake. Furthermore the rate of tilting is greater in this case than that observed on many of the abandoned beaches further north.

Goldthwait[6] who has worked extensively on abandoned beaches to establish the amount and kind of warping that may have taken place, shows that the Algonquin beach is not tilted south of a line through the middle of Lake Michigan and Niagara Falls. In the same paper he shows that the older Iroquois beaches are tilted more than the Algonquin in the same latitudes and that the tilting extends farther southward for the Iroquois beach. He shows that the tilting is greatest further north and decreases southward, but he is unable to locate any southern limit for the tilting.

That the existence of Craigton Lake began earlier than that of any of those preceding even Lake Erie is easy to believe because of its location with reference to the retreating ice. Its site would be uncovered even before that of Lake Maumee. That tilting in the lake region began early is also shown by the fact that Craigton Lake shorelines are tilted more than such beaches as those of the Algonquin and Iroquois water planes. The warping in Craigton Lake lines amounts to four feet in a mile and is quite uniform for the 18 miles of length. It may be a little steeper in the last two or three miles at the north end

[1] Summary of a paper presented before the Ohio Academy of Science, at Oberlin, O., November 29, 1913, and published by permission of the state geologist.

[2] M. C. Read, Geol. Surv. Ohio, 1878, Vol. III., pp. 519–529.

[3] Geo. D. Hubbard, *Am. Jour. Sci.*, 1908, Ser. 4, Vol. XXV., pp. 239–43.

[4] A. Dachnowski, Geol. Surv. Ohio, 1912, Ser. 4, Bull. 16, p. 134.

[5] Full description of this evidence with maps and section will appear in *Amer. Jour. Sci.* soon.

[6] J. W. Goldthwait, G. S. A. Bull., Vol. 21 (1910), pp. 227–248.

but probably is not. The apparent increase in rate is more likely due to aggradation with glacial outwash or to the building of a fan on the delta at the northern end.

Craigton not only began, but probably completed its history as a lake before the tilting occurred; a considerable part of its tilting must have occurred before the Iroquois beaches were tilted and all of it before the Algonquin was tilted, because in the first place its tilting is greater than that of the Iroquois; and in the second, Algonquin tilting did not proceed so far south. Had water remained in Craigton during the tilting, it must have spilled over southward. There can be found no evidence of static water work on the hills above the recorded beach levels at the southern end. If water stood higher here, then many tracts, low between moraine hills but higher than 960 feet, should have been under water and should attest that fact by sorted drift, lake clays, and possibly by black earth deposits of palustrial origin. Nothing of the sort can be found.

Because the outlet was in the middle portion of the lake the southern part would not be drained by the tilting. Drainage possibly fairly well established would be interfered with; swampy conditions would develop and will persist until more perfect drainage is attained. Black, peaty earth, very abundant in the southern part, confirms the belief that this end of the lake was long swampy. In fact artificial ditching has but recently put it into agricultural condition. Hundreds of acres of onions are now grown on the black flats that are sufficiently drained. Water does not stand anywhere on the plain but swampy conditions are not entirely removed.

GEORGE D. HUBBARD

OBERLIN COLLEGE,
OBERLIN, OHIO

THE AMERICAN SOCIETY OF ZOOLOGISTS

II

COMPARATIVE PHYSIOLOGY

The Reactions of Normal and Eyeless Amphibian Larvæ to Light: HENRY LAURENS.

Although the photic reactions of Amphibians have been extensively investigated very little has been done on the larval forms. The purpose of the present investigation was to test the reactions to white light of normal and eyeless frog (*R. pipiens* and *R. sylvatica*) and *Amblystoma* (*A. punctatum*) larvæ. The optic vesicles were removed from the blinded individuals at a stage of development soon after the closure of the neural folds, when the tail bud is just beginning to be perceptible. Frog larvæ, both normal and blinded, show no reaction to the stimulus of light. Both normal and eyeless *Amblystoma* larvæ, however, show a very decided positive phototaxis. The reactions of the blinded individuals are apparently not due to the direct stimulation of the central nervous system by the light as is shown by a series of experiments in which three small areas of the larvæ were illuminated, these areas being roughly the head-region, the ventro-lateral mid-body region, and the tail-region. Positive responses were obtained when each of these regions were illuminated by a narrow beam of light, the percentage of positive responses being practically the same in each case. The skin chromatophores of *Amblystoma* larvæ show different conditions of expansion and contraction of their pigment under different conditions of light and darkness; the conditions in the normal and blinded larvæ being exactly opposite. Normal larvæ placed in diffuse light are pale (light brown), blinded larvæ so placed are very dark. Normal larvæ placed in darkness are darkly pigmented (dark brown), while blinded larvæ so placed are very pale. But normal larvæ placed in diffuse light on a black background are darkly pigmented, thereby showing the effect of the background. These different conditions of the pigment in the skin chromatophores do not affect the sensitiveness of the larvæ to light, but previous exposure to light or adaptation to darkness do, in that dark-adapted larvæ are more sensitive to light than are those which have been kept in the light.

An Analysis of the Egg Extractives of Arbacia and Asterias: OTTO C. GLASER.

Analyses (1) by means of sperm-suspensions; (2) by means of qualitative chemical tests; (3) by means of the rate of development, were made. The results briefly summarized, are:

1. A general corroboration of F. R. Lillie's observations with respect to *Arbacia punctulata;* their extension in certain directions, and their application to *Asterias forbesii.* Hetero-agglutination and hetero-activation between *Asterias* and *Arbacia* were found. Agglutination is very likely the result of a surface effect.