

VI.—A FORAMINIFEROUS DEPOSIT FROM BOTTOM OF THE  
NORTH ATLANTIC. BY A. H. MACKAY, LL. D.

(Read 10th December, 1894.)

The exact location of this deposit cannot be more tersely described than it is in the following note from Captain Trott, of the steamship *Minia*, dated Halifax, 31st April, 1894, which accompanied the material sent to Dr. Murphy, Provincial Engineer, who duly passed it on to me.

“Herewith the stones I spoke to you about. They came “from a depth of 2450 fathoms, in latitude  $49^{\circ} 50'$  N., longitude “ $40^{\circ} 15'$  W. The current in this vicinity runs strong to N. E., “varying sometimes two or three points either way, doubtless “influenced by the moon. The surface temperature ranges from “ $54^{\circ}$  to  $59^{\circ}$  Fahrenheit. This is as it is found nearly all the “months of June and July. A little further west we found cold “water and very little current. I am also sending some “*Globigerina* ooze which came up in the same mushroom anchor “with the stones—the anchor being full except on one side “where it had been washed out while heaving up, thereby “exposing the stones.”

The spot, roughly estimating, is therefore not far from 700 miles south-easterly from Cape Farewell, Greenland, and some 300 or 400 miles east from Labrador, or 300 miles east by north of Newfoundland. This is beyond the Great Banks and well down into the profounder depths of the Atlantic. It would appear then to lie near the circle which, like the circumference of a vast oceanic eddy, lies tangential to the Gulf Stream on the south-east, the westerly Arctic current from Iceland to Greenland on the north, and the southerly Arctic current along the Labrador Coast. The character of the deposit suggests the existence of such an eddy, no matter how circumscribed and swaying its position may be.

The mushroom anchor took up not only a nearly pure stratum of foraminiferous ooze, but also a very clayey foraminiferous stratum, in which were fine and coarse grains of quartz, mica, and other minerals, with pebbles, water-worn, of gneiss, hornblende, black and white limestones. But lavas compact and vesicular were abundant, one specimen weighing over a pound or two. One pebble of dark hard texture is apparently polished on one side, as if abraded by glacial action.

The ooze contracted into a comparatively small volume, say one-fourth, after being kept in a dry room for a few months. Of the more highly foraminiferous stratum, about 50% was sand and clay insoluble in Hydrochloric acid. The equivalent of over 25% of carbonate of lime was precipitated as calcium sulphate from the filtrate. From the more argillaceous stratum 66% of sand, &c., was insoluble in HCl, while  $H_2SO_4$  precipitated but a few grains from the filtrate. This rough analysis was verified approximately by specimens of the two strata analyzed more carefully in the laboratory of Dalhousie College by Mr. J. M. Nissen. The difference between the two strata was sufficiently discernible to the naked eye, and clearly so by a close examination with a simple lens.

The species of foraminifera are fairly numerous. The following list of them has the authority of Mr. F. S. Morton, F. R. M. S., of Portland, Maine, who compared them with the foraminifera described in the *Challenger's* papers and more particularly with those described in a "Synopsis of the Arctic and Scandinavian Recent Marine Foraminifera," by Dr. Alex. Goë's of Stockholm. which they more especially resemble. I have also to acknowledge the service of G. F. Matthew, M. A., F. R. S. C., of St. John, New Brunswick, in testing some of my observations.

- Globigerina, inflata ..... Abundant.
- G. dubia ..... Not abundant.
- G. conglobata ..... Not abundant.
- Orbulina universa ..... Not uncommon.

<i>Sphæroidina dehiscens</i> .....	Rare.
<i>Pulvinulina menardii</i> .....	Frequent.
<i>P. micheliniana</i> .....	Frequent.
<i>P. elegans</i> .....	Not rare.
<i>Gaudryina pupoides</i> .....	Not rare.
<i>Verneuilina propinqua</i> .....	Rather rare.
<i>Truncatulina lobatula</i> .....	A few.
<i>Uvigerina asperula</i> .....	Rare.
<i>Haplophragmium canariense</i> .....	Rather rare.
<i>H. globigeriniforme</i> .....	Rather rare.
<i>Nodosaria mucronata</i> .....	Rare.
<i>Biloculina depressa</i> .....	Rare.

Some other species and genera appear to be present, as well as occasional diatoms and sponge spicules. The stones appeared to be generally colored with a blackish hue which suggested manganese; but the only reaction observable was that of iron.

The presence of the stones, some of them quite large, some of them water-worn, and one at least polished on one side, intermingled with the ooze, seems to suggest that they must have been dropped into the deposit in recent time. The only manner in which this could occur is by their dropping from masses of floating ice in the process of dissolution. Have we here *debris* imprisoned in the glaciers of Iceland, Greenland, or Labrador, swept around the coast into the margin of the Gulf Stream which helps to whirl a great North Atlantic eddy, and at the same time rapidly dissolves the floating ice from distant coasts, and strews the oozy bottom of the ocean with rock and gravel and clays from many lands?

Both the changing temperature and changing current noted by Captain Trott would seem to suggest that the steamer was at the time near the contact of the Gulf Stream with this North-West Atlantic eddy. If there is such an eddy, we can easily see that it is building up a vast area of soil on the ocean bottom, which is being transported from the glaciated highlands and coasts of the Arctic regions already referred to. The process

may be an illustration of the manner in which some of the fertile fields of our present continents have to some extent been built up.

It is hoped that a large series of such dredgings from exactly noted points in the Atlantic may be obtained for examination. An extensive series of such dredgings might throw much light on the ocean currents and some geological problems, as well as extend our knowledge of the distribution of zoölogical forms on the floor of the ocean.