

NOTE ON THE SHAPE OF THE EARTH.

BY WM. O. BEAL.

The University of Minnesota, Minneapolis.

In the Question and Answer Department of Current Events, a condensed weekly newspaper widely distributed among public school children, of November 19, 1920, there is the following question and answer:

"If the earth's rate of rotation were increased, what effect would it have on the length of the day and shape of the earth?" Answer: "The day would be shorter. The shape of the earth would not be changed unless the increase in speed were very great. The tendency would be to increase the diameter at the equator and reduce the polar diameter. If the earth were still in a melted state, and revolving many times faster than it does now, it might finally solidify in a shape more like a wheel than a globe. The fact that the earth is somewhat flattened at the poles indicates that something of the kind occurred while the earth was hot and soft. . . ."

This answer is a curious mixture of truth and improbability. It has been demonstrated in various ways that the whole earth resists deformation when subjected to small forces, like a piece of steel does, and that it returns quickly to its former shape when the force is removed, showing its high degree of rigidity and elasticity. But this in no way demonstrates that the earth would retain its present shape if subjected to a constant large force tending to produce a permanent deformation.

For the sake of illustration consider a cake of ice; it is hard and brittle. But a large sheet of it will flow slowly down a mountain valley, forming a glacier, the central part flowing more rapidly than the margin; the constant large deforming force here being the component of gravity in the direction of the flow.

The volume and mass of the earth are so great, and the deforming forces would be continuous and so large, that if the length of the day were increased or decreased by so much as a minute of time, the shape of the earth would probably be modified to correspond to a new state of equilibrium.

We are not without direct evidence bearing on this conclusion, for Hayford has shown from a thorough discussion of the elaborate geodetic surveys that have been made, that the earth is in an isostatic condition. This means that the mean density of the rock underneath a mountain is less than underneath a trough in the ocean, so that the pressure at the centre of the earth is the same from every direction, and equal to the total weight of the material along any radius of the earth.