RIGIDITY AND VISCOSITY OF THE EARTH, AND THE BEHAVIOR OF SUBSTANCES UNDER STRESS

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The experiments recently conducted at the Yerkes Observatory for the purpose of ascertaining the action of the mass of the earth in yielding to the gravitation forces of the sun and the moon, gave the result that the earth acts like a solid body with an elastic coefficient of the order of that of steel—and with a coefficient of viscosity which is very high—probably also of the same order as that of steel.

For detailed account of these experiments, see Journal of Geology, Vol. XXII, No. 2, 1914.

From the known increase of temperature as we go below the surface of the earth, it follows that the temperature of the interior must be very high—high enough to melt almost if not quite all known substances under normal conditions.

It follows that the enormous gravitational pressure which the mass of the earth experiences is sufficient to prevent this fluid condition—in other words, that pressure increases elastic rigidity as well as viscosity.

An attempt was made to detect such an effect, using the relatively small pressures obtainable in the laboratory (of the order of 50,000 pounds per square inch) and the results obtained clearly confirmed this conclusion. However, certain rather curious and baffling anomalies presented themselves which made the results less conclusive than was anticipated.

The study of these anomalies has been in progress for several months and an account of the results will probably be published as soon as the information obtained is available.

At present it may be stated provisionally that the laws governing the behavior of substances under stress are the following:

First—There is a rapid elastic yield, which, if inertia be negligible, is practically instantaneous.

Second—This is followed by a slower yielding which diminishes with the time and ultimately attains a constant value which may be zero.

Third—If the stress is released the specimen returns almost instantly to a point short of its original position.

Fifth—The behavior depends, in many cases, on the previous stresses to which the specimen has been subjected—these usually tending to strengthen the specimen.

These experimental results are to be accounted for on theoretical grounds and considerable progress has been made in this direction.