

In 1834 Henry de la Beche published his admirable work entitled *Researches in Theoretical Geology*. He described the earth's matter as originally in a gaseous condition, condensation having taken place in consequence of the constant radiation of heat from the earth's surface. Gradually there formed round the inner glowing nucleus a zone composed of heavy metallic substances, beyond which was a region of lighter, molten oxides, and externally a mantle of vapours and gases. The zone, rich in oxygen combinations, afterwards consolidated as a firm crust of crystalline rocks, which protected the inner nucleus and prevented its complete cooling, while the outer vapours condensed in the form of oceans upon the solid crust.

The Cambridge physicist, W. Hopkins, in a series of papers (1839-42) investigated the internal constitution of the earth by means of mathematical calculation. Assuming that the earth was originally molten, then three possibilities are set forth by Hopkins as a result of cooling:—

1. An outer solid crust surrounds a nucleus that is still molten, or
2. The earth's sphere is surrounded by a firm crust, and contains a solid nucleus, both separated by a zone of molten material, or
3. The earth may be completely solid.

Hopkins calculated that the solid crust of the earth had a thickness of about $\frac{1}{4}$ or $\frac{1}{5}$ of the earth's diameter—that is, at least one hundred and seventy-two to two hundred and fifteen geographical miles. A direct communication of the internal molten material with the surface of the earth was therefore impossible in Hopkins's opinion, and he concluded that the volcanoes must draw their molten material from reservoirs of moderate size *within* the solid crust of the earth.

At the same time as Hopkins was following out his mathematical and physical calculations, Bischof in Bonn was making experiments similar to those which had previously been attempted by Buffon. Bischof caused large balls of basalt to be melted, and observed the time required for the cooling of the melted basalt. By the application of the results to the rate of cooling of the earth, Bischof calculated that the complete solidification of the earth would occupy a period of three hundred and fifty million years. Naturally, the application of results obtained upon such a small experimental scale cannot be relied upon in any accurate scientific sense. It was shown