

tions with certainty; and these it is the more necessary to state distinctly, since they are often treated as mere subjects of speculation and fruitless discussion.

(1) Since the dawn of geological science, it has been evident that the crust on which we live must be supported on a plastic or partially liquid mass of heated rock, approximately uniform in quality under the whole of its area. This is a legitimate conclusion from the wide distribution of volcanic phenomena, and from the fact that the ejections of volcanoes, while locally of various kinds, are similar in every part of the world. It led to the old idea of a fluid interior of the earth, but this is now generally abandoned, and this interior heated and plastic layer is regarded as merely an under-crust.

(2) We have reason to believe, as the result of astronomical investigations,<sup>1</sup> that, notwithstanding the plasticity or liquidity of the under-crust, the mass of the earth—its nucleus as we may call it—is practically solid and of great density and hardness. Thus we have the apparent paradox of a solid yet fluid earth; solid in its astronomical relations, liquid or plastic for the purposes of volcanic action and superficial movements.<sup>2</sup>

(3) The plastic sub-crust is not in a state of dry igneous fusion, but in that condition of aqueo-igneous or hydrothermic fusion which arises from the action of heat on moist substances, and which may either be regarded as a fusion or as a species of solution at a very high temperature. This we learn from the phenomena of volcanic action, and from

<sup>1</sup> Hopkins, Mallet, Sir William Thomson, and Prof. G. H. Darwin maintain the solidity and rigidity of the earth on astronomical grounds; but different conclusions have been reached by Hennessey, Delaunay, and Airy. In America, it was taught from 1858 by Sterry Hunt, and later by Shaler and Le Conte.

<sup>2</sup> An objection has been taken to the effect that the supposed ellipsoidal form of the equator is inconsistent with a plastic sub-crust. But this ellipsoidal form is not absolutely certain, or, if it exists, is very minute. Bonney has, in a recent lecture, suggested the important consideration that a mass may be slowly mobile under long-continued pressure, while yet rigid with reference to more sudden movements.