

themselves according to their chemical affinities, and distinct mineral materials were developed in layers from elements that were in the original rock.

I have stated that to produce this kind of metamorphism, heat aided by water is necessary, so as to allow of internal movements in the rocks by the softening of their materials, without which I do not see how complete re-arrangement of matter accompanied by crystallisation could take place; and though it has always been easy to form theories on the subject, yet so little is known with precision about the interior of the earth beyond a few thousand feet in depth, that how to obtain the required heat is a difficulty.

From astronomical considerations it is believed by many persons that the earth has been condensed from a nebulous fluid, and passing into an intensely heated melted condition, by radiation into space at length cooled so far, that consolidation commenced at the surface, and by degrees that surface has gradually been thickening and overlies a melted nucleus within.

As the earth cooled and consequently gradually shrunk in size, the hardened crust, in its efforts to accommodate itself to the diminishing bulk of the cooling mass within, became in places crumpled again and again. Hence the upheaval of mountain chains and disturbances of different dates, which have affected strata of almost all geological ages.<sup>1</sup>

Reasoning on these disturbances, we know that strata which were originally deposited horizontally have often

<sup>1</sup> This theory is not universally received, and has been variously developed by different authors, but it would be quite beyond my present purpose to discuss the subject in detail, and, as far as I know, the hypothesis proposed by Elie de Beaumont seems best to explain the phenomena exhibited by the outside of the earth.