

heavenly motions: they could not advance in the study of the Mechanics of the heavens, till they had learned the Mechanics of terrestrial bodies. And thus they were, in such speculations, at a stand for nearly a century, from the time of Kepler to the time of Newton, while the science of Mechanics was formed by Galileo and his successors. Till that task was executed, all the attempts to assign the causes of cosmical phenomena were fanciful guesses and vague assertions; after that was done, they became demonstrations. The science of *Dynamics* enabled philosophers to pass securely and completely from *Phenomenal Astronomy* to *Physical Astronomy*.

In like manner, in order that we may advance from Phenomenal Geology to Physical Geology, we need a science of *Geological Dynamics*;—that is, a science which shall investigate and determine the laws and consequences of the known causes of changes such as those which Geology considers:—and which shall do this, not in an occasional, imperfect, and unconnected manner, but by systematic, complete, and conclusive methods;—shall, in short, be a Science, and not a promiscuous assemblage of desultory essays.

The necessity of such a study, as a distinct branch of geology, is perhaps hardly yet formally recognized, although the researches which belong to it have, of late years, assumed a much more methodical and scientific character than they before possessed. Mr. Lyell's work (*Principles of Geology*), in particular, has eminently contributed to place Geological Dynamics in its proper prominent position. Of the four books of his Treatise, the second and third are upon this division of the subject; the second book treating of aqueous and igneous causes of change, and the third, of changes in the organic world.

There is no difficulty in separating this auxiliary geological science from theoretical Geology itself, in which we apply our principles to the explanation of the actual facts of the earth's surface. The former, if perfected, would be a demonstrative science dealing with general cases; the latter is an ætiological view having reference to special facts; the one attempts to determine what always must be under given conditions; the other is satisfied with knowing what is and has been, and why it has been; the first study has a strong resemblance to Mechanics, the other to philosophical Archæology.

Since this portion of science is still so new, it is scarcely possible to give any historical account of its progress, or any complete survey of its shape and component parts. I can only attempt a few notices,