

measure of those forces and conditions. The exterior influence of the sun, and the ethereal spaces ; the mass and quality of the atmosphere ; the size, figure, density, and motions of the earth ; the distribution of land and sea, — are all circumstances of great importance, to which the vegetable and animal productions of the globe, as well as the chemical and mechanical operations upon it, are adjusted.

It is soon apparent to the inquiring mind, that many of these conditions and forces vary, and with them, from time to time, suddenly or gradually, the characteristic phenomena of life and inorganic matter. If we knew the *measure of these variations*, the real state and momentary condition of the earth at the present, in former, and in future periods, would become a practicable problem.

Now it must be evident that we have not such knowledge ; for the variations in question, though quite sensible, are too complicated to be understood, except through an immensity of recorded observations ; and of these we have few that are trustworthy, except in astronomy. In astronomy, *with the help of the general theory*, it has been found possible to determine the “limits of variation” due to the disturbing forces of the planetary system ; but it is impossible to effect this in geology, from a survey of existing nature, *for want of such a theory*. Incapable, therefore, of learning from the most perfect survey of nature as it is, whether terrestrial phenomena are subject to progressive and permanent changes, or to a limited circle of compensating variations, the leaders of geological speculation have assumed one or other of these views — the only really general ones which the subject permits ; and thus we have, on the one hand, Leibnitz deducing the principal geological phenomena from the gradual refrigeration of an ignited globe ; and, on the other hand, Lyell, and the followers of Hutton, maintaining the sufficiency of “modern causes,” acting with their present intensity, to account for all, even the earliest traceable changes of