

tribes and vascular plants. While, therefore, the discovery of now and then a species of higher organization shows that their existence was possible at the earlier periods, yet it will require a vast number of such discoveries to prove the proportion between the more and the less perfect to have been then as now. And until that be proved, the evidence of progression remains unaffected.

*Inference 8. The causes of geological change have varied in intensity. There are two theories upon this subject.*

In his address before the London Geological Society in 1851, Sir Charles Lyell states what is called the uniformitarian hypothesis, as follows:—"That the ancient changes of the animate and inanimate world, of which we find memorials in the earth's crust, may be similar, both in kind and degree, to those which are now in progress."

*Proof 1.* It is agreed on all hands that the nature of geological causes has been the same in all ages; although even as late as the time of Cuvier, he says that "none of the agents nature now employs were sufficient for the production of her ancient works."

2. An indefinite repetition of an agency on a limited scale, can produce the same effects as a paroxysmal effort of the same agency, however powerful; provided the former is able to produce any effect, as, for instance, in the accumulation of detritus, the elevation of continents, the dislocation of strata, etc. Now it is unphilosophical to call in the aid of extraordinary agency, when its ordinary operation is sufficient to explain the phenomena.

3. Nearly every variety of rock found in the crust of the globe has been shown to be in the course of formation by existing aqueous and igneous agencies; and if a few have not yet been detected in the process of formation, it is probably because they are produced in places inaccessible to observation.

*The opposite hypothesis* admits that no causes of geological change different in their nature from those now in action, have ever operated on the globe; in other words, that the geological processes now going on, are in all cases the antitypes of those which were formerly in operation; but it maintains that the existing causes operate now, in many cases, with less intensity than formerly.

*Proof 1.* The spheroidal figure of the earth, and other facts already detailed, seem to render almost certain the former fluidity of the globe. Now, whether that fluidity was aqueous or igneous, or both in part, it is certain that the agencies which produced it must have operated in early times with vastly greater intensity than at this day, and that their energy has been constantly decreasing from that time to the present.

2. Still more direct is the evidence from the character of organic remains in high latitudes, of the prevalence of a temperature in early times hotter than tropical; too warm, indeed, to be explained by any supposed change of levels in the dry land. And if this be admitted, heat must have been more powerful in its operation than at present; and this would increase the aqueous, atmospheric, and organic agencies of those times.

3. No agency at present in operation, without a vast increase of energy, is adequate to the elevation, several thousand feet, of vast chains of mountains and continents, such as we know to have taken place in early times. A succession of elevations by earthquakes, repeated through an indefinite number of ages, the vertical movements being only a few feet at each recurrence, is a cause inadequate to the effect, if we admit that earthquakes have exhibited their maximum energy within historic times.