

investigator. I know nothing more chilling to research or unfavorable to progress than the promulgation of a dogmatic decision that there is nothing to be learned but a merely fortuitous and uncaused succession, amenable to no law, and only to be covered in order to hide its shapeless and uncertain proportions, by the mantle of bold and gratuitous hypothesis.

So soon as we find evidence of continents and oceans we raise the question, Have these continents existed from the first in their present position and form, or have the land and water changed places in the course of geological time? In reality both statements are true in a certain limited sense. On the one hand, any geological map whatever suffices to show that the general outline of the existing land began to be formed in the first and oldest crumpings of the crust. On the other hand, the greater part of the surface of the land consists of marine sediments which must have been derived from land that has perished in the process, while all the continental surfaces, except perhaps, some high peaks and ridges, have been many times submerged. Both of these apparently contradictory statements are true; and without assuming both it is impossible to explain the existing contours and reliefs of the surface.

In the case of North America, the form of the old nucleus of Laurentian rock in the north already marks out that of the finished continent, and the successive later formations have been laid upon the edges of this, like the successive loads of earth dumped over an embankment. But in order to give the great thickness of the Paleozoic sediments, the land must have been again and again submerged and for long periods of time. Thus, in one sense, the continents have been fixed; in another, they have been constantly fluctuating. Hall and Dana have well illustrated these points in so far as eastern North America is concerned. Prof. Hull of the Geological Survey of Ireland has recently had the boldness to reduce the fluctuations of land and water as evidenced in the British Islands to the form of a series of maps intended to show the physical geography of each successive period. The attempt is probably premature, and has been met with much adverse criticism; but there can be no doubt that it has an element of truth. When we attempt to calculate what could have been supplied from the old Eozoic nucleus by decay and aqueous erosion, and when we take into account the greater local thickness of sediments towards

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