OTHER SUPPOSED CAUSES OF ELEVATION.

1. *Earthquakes.*—Examples have been given in another place of small and limited elevations of land, produced by earthquakes. And it has been maintained that an indefinite repetition of such events might elevate the highest mountains, if they took place on no larger scale than at present. But it seems to be satisfactorily proved, that some elevations at least, such as those producing the enormous dislocations in the north of England, have occurred to an extent of several thousand feet, by a single paroxysmal effort; whereas the mightiest effects of a modern earthquake have produced elevations only a few feet, and in most cases the uplifted surface has again subsided. Again, there is little probability that a succession of earthquakes should take place along the same extended line through so many ages, as would be necessary to raise some existing mountain chains. Earthquakes may explain some slight vertical movements of limited districts; but the cause seems altogether inadequate to the effect, when applied to the elevation of continents.

2. *Expansion of Rocks by Heat.*—A block of granite, five feet long, if its temperature be raised 96°, will expand 0.027792 inch; a block of crystalline marble, 0.03264 inch; sandstone 0.054914 inch. By these data it appears, that were the temperature of a portion of the earth's crust ten miles thick to be raised 600°, it would cause the surface to rise 200 feet. A greater heat would produce greater results, such as have taken place in the earth's history.

This cause, therefore, though it may perhaps explain such vertical movements of particular regions as are taking place in Scandinavia, Greenland, Italy, England, etc., seems inadequate to account for the permanent elevation of large continents. If they had been raised in this manner, and the same remark applies to some extent to earthquakes, we should hardly expect to find several distinct systems of elevation on the same continent, nor so many examples of vertical strata.

3. *Unequal contraction and expansion of land and water by cold and heat.*—Assuming the mean depth of the ocean to be ten miles, and that it had cooled from boiling heat to 40° F., its volume would contract about 0.042; while the contraction of the land would be only 0.00417. This would produce a sinking of the ocean of 697 feet. An increase of temperature would produce an opposite effect; viz., the partial submersion of the land; though it would be less than the desiccation, because of the greater area over which the water would flow. Admitting these changes of temperature to have taken place, and the theory of central heat supposes the former, that is, the refrigeration, they could not account for the desiccation of the globe, because the tilted condition of the strata shows that the land has been raised up; whereas this theory implies a mere draining of the waters.

4. *A change in the position of the poles of the globe.*—This hypothesis—not long since so much in vogue—would explain how continents once beneath the ocean are now above it, if we admit the form of the earth before the change, to have been the same as at present: viz., an oblate spheroid. But it would not explain the tilted condition of the strata, nor is it sustained by any analogous phenomena which astronomy describes.

EFFECTS OF THE EARTH'S REFRIGERATION.

The consequences of the earth's cooling are these: 1. Solidification of the surface, so as to form a crust. 2. Contraction, involving both subsidence and elevation of parts of the crust. 3.