

frozen or covered for most of the year with thick snow. In explanation of the difficulty, it has been suggested that the north pole did not occupy its present position, and that the locality where the plants occur lay in more southerly latitudes. Without at present entering on the discussion of the question whether the geological evidence necessarily requires so important a geographical change, let us consider how far a shifting of the axis of rotation has been a possible cause of change during that section of geological time for which there are records among the stratified rocks.

From the time of Laplace,¹⁸ astronomers have strenuously denied the possibility of any sensible change in the position of the axis of rotation. It has been urged that, since the planet acquired its present oblate spheroidal form, nothing but an utterly incredible amount of deformation could overcome the greater centrifugal force of the equatorial protuberance. It is certain, however, that the axis of rotation does not strictly coincide with the principal axis of inertia. Though the angular difference between them must always have been small, we can, without having recourse to any extramundane influence, recognize two causes which, whether or not they may suffice to produce any change in the position of the main axis of inertia, undoubtedly tend to do so. In the first place, a widespread upheaval or depression of certain unsymmetrically arranged portions of the surface to a considerable amount would tend to shift that axis. In the second place, an analogous result might arise from the denudation of continental masses of land, and the consequent filling up of sea-basins. Lord Kelvin (Sir William Thomson) freely concedes the physical

¹⁸ *Mécanique Céleste*, tome v. p. 14.