

alteration in the length of the day had taken place, even to the amount of one two-hundredth of a second; and thus, there was here no confirmation of the hypothesis of a primitive heat of the earth.

Though we find no evidence of the secular contraction of the earth in the observations with which astronomy deals, there are some geological facts which at first appear to point to the reality of a refrigeration within geological periods; as the existence of the remains of plants and shells of tropical climates, in the strata of countries which are now near to or within the frigid zones. These facts, however, have given rise to theories of the changes of climate, which we must consider separately.

But we may notice, as connected with the doctrine of central heat, the manner in which this hypothesis has been applied to explain volcanic and geological phenomena. It does not enter into my plan, to consider explanations in which this central heat is supposed to give rise to an expansive force,⁶ without any distinct reference to known physical laws. But we may notice, as more likely to become useful materials of the science now before us, such speculations as those of Mr. Babbage; in which he combines the doctrine of central heat with other physical laws;⁷ as, that solid rocks *expand* by being heated, but that clay contracts; that different rocks and strata *conduct* heat differently; that the earth *radiates* heat differently, or at different parts of its surface, according as it is covered with forests, with mountains, with deserts, or with water. These principles, applied to large masses, such as those which constitute the crust of the earth, might give rise to changes as great as any which geology discloses. For example: when the bed of a sea is covered by a thick deposit of new matter worn from the shores, the strata below the bed, being protected by a bad conductor of heat, will be heated, and, being heated, may be expanded; or, as Sir J. Herschel has observed, may produce explosion by the conversion of their moisture into steam. Such speculations, when founded on real data and sound calculations, may hereafter be of material use in geology.

The doctrine of central heat and fluidity has been rejected by some eminent philosophers. Mr. Lyell's reasons for this rejection belong

⁶ Scrope *On Volcanoes*, p. 192.

⁷ *On the Temple of Serapis*, 1834. See also *Journal of the Royal Inst.* vol. ii., quoted in *Conyb. and Ph.* p. xv. Lyell, *B.* ii. c. xix. p. 383, (4th ed.) on Expansion of Stone.