

they should be originally separate. And if any other causes have been suggested, as electricity or magnetism, this has been done so vaguely as to elude all possibility of rigorous deduction from the hypothesis. The doctrine of a Central Heat, however, has occupied so considerable a place in theoretical geology, that it ought undoubtedly to form an article in geological dynamics.

*Sect. 4.—The Doctrine of Central Heat.*

THE early geological theorists who, like Leibnitz and Buffon, assumed that the earth was originally a mass in a state of igneous fusion, naturally went on to deduce from this hypothesis, that the crust consolidated and cooled before the interior, and that there might still remain a central heat, capable of producing many important effects. But it is in more recent times that we have measures of such effects, and calculations which we can compare with measures. It was found, as we have said, that in descending below the surface of the earth, the temperature of its materials increased. Now it followed from Fourier's mathematical investigations of the distribution of heat in the earth, that if there be no primitive heat (*chaleur d'origine*), the temperature, when we descend below the crust, will be constant in each vertical line. Hence an observed increase of temperature in descending, appeared to point out a central heat resulting from some cause now no longer in action.

The doctrine of a central heat has usually been combined with the supposition of a central igneous fluidity; for the heat in the neighborhood of the centre must be very intense, according to any law of its increase in descending which is consistent with known principles. But to this central fluidity it has been objected that such a fluid must be in constant circulation by the cooling of its exterior. Mr. Daniell found this to be the case in all fused metals. It has also been objected that there must be, in such a central fluid, *tides* produced by the moon and sun; but this inference would require several additional suppositions and calculations to give it a precise form.

Again, the supposition of a central heat of the earth, considered as the effect of a more ancient state of its mass, appeared to indicate that its cooling must still be going on. But if this were so, the earth might contract, as most bodies do when they cool; and this contraction might lead to mechanical results, as the shortening of the day. Laplace satisfied himself, by reference to ancient astronomical records, that no such