

we must renounce all idea of a magnetic nucleus of the Earth. All magnetism is certainly not lost until we arrive at a white heat,* and it is manifested when iron is at a dark red heat, however different, therefore, the modifications may be which are excited in substances in their molecular state, and in the coercive force depending upon that condition in experiments of this nature, there will still remain a considerable thickness of the terrestrial stratum, which might be assumed to be the seat of magnetic currents. The old explanation of the horary variations of declination by the progressive warming of the Earth in the apparent revolution of the Sun from east to west must be limited to the uppermost surface, since thermometers sunk into the Earth, which are now being accurately observed at so many different places, show how slowly the solar heat penetrates even to the inconsiderable depth of a few feet. Moreover, the thermic condition of the surface of water, by which two thirds of our planet is covered, is not favorable to such modes of explanation, when we have reference to an immediate action and not to an effect of induction in the aerial and aqueous investment of our terrestrial globe.

In the present condition of our knowledge, it is impossible to afford a satisfactory reply to all questions regarding the ultimate physical causes of these phenomena. It is only with reference to that which presents itself in the triple manifestations of the terrestrial force, as a measurable relation of space and time, and as a stable element in the midst of change, that science has recently made such brilliant advances by the aid of the determination of mean numerical values. From Toronto in Upper Canada to the Cape of Good Hope and Van Diemen's Land, from Paris to Peking, the Earth has been covered, since 1828, with magnetic observatories,† in which every regu-

* Barlow, in the *Philos. Trans.* for 1822, Pt. i., p. 117; Sir David Brewster, *Treatise on Magnetism*, p. 129. Long before the times of Gilbert and Hooke, it was taught in the Chinese work *Ow-thsa-tsou* that heat diminished the directive force of the magnetic needle. (Klaproth, *Lettre à M. A. de Humboldt, sur l'Invention de la Boussole*, p. 95.)

† As the first demand for the establishment of these observatories (a network of stations, provided with similar instruments) proceeded from me, I did not dare to cherish the hope that I should live long enough to see the time when both hemispheres should be uniformly covered with magnetic houses under the associated activity of able physicists and astronomers. This has, however, been accomplished, and chiefly through the liberal and continued support of the Russian and British governments.

In the years 1806 and 1807, I and my friend and fellow-laborer, Herr Oltmanns, while at Berlin, observed the movements of the needle, espe-