

have, under especial conditions of meridian or equatorial direction, and of solid, fluid, or gaseous inactive conditions of the bodies, confirmed this important result. Gilbert had so clear an idea of the force imparted by telluric magnetism, that he ascribed the magnetic condition of iron rods on crosses of old church towers to this action of the Earth.*

The increased enterprise and activity of navigation to the higher latitudes, and the improvement of magnetic instruments, to which had been added, since 1576, the dipping needle (inclinorium), constructed by Robert Norman, of Ratcliff, were the means, during the course of the seventeenth century, of extending the general knowledge of the periodical advance of a portion of the magnetic curves or lines of no variation. The position of the magnetic equator, which was believed to be identical with the geographical equator, remained uninvestigated. Observations of inclination were only carried on in a few of the capital cities of Western and Southern Europe. Graham, it is true, attempted in London, in 1723, to measure, by the oscillations of a magnetic needle, the intensity of the magnetic terrestrial force, which varies both with space and time; but, since Borda's fruitless attempt on his last voyage to the Canaries in 1776, Lemanon was the first who succeeded, in La Perouse's expedition in 1785, in comparing the intensity in different regions of the earth.

In the year 1683, Edmund Halley sketched his theory of four magnetic poles or points of convergence, and of the periodical movement of the magnetic line without declination, basing his theory on a large number of existing observations of declination of very unequal value, by Baffin, Hudson, James Hall, and Schouten. In order to test this theory, and render it more perfect by the aid of new and more exact observations, the English government permitted him to make three voyages (1698-1702) in the Atlantic Ocean, in a vessel under his own command. In one of these he reached 52° S. lat. This expedition constituted an epoch in the history of telluric magnetism. Its result was the construction of a general variation chart, on which the points at which navigators had found an equal amount of variation were connected together by curved

* The first observation of the kind was made (1590) on the tower of the church of the Augustines at Mantua. Grimaldi and Gassendi were acquainted with similar instances, all occurring in geographical latitudes where the inclination of the magnetic needle is very considerable. On the first measurements of magnetic intensity by the oscillation of a needle, compare my *Relation Hist.*, t. i., p. 260-264, and *Cosmos*, vol. i., p. 186, 187.