

the first place, that vulgar opinion of recent writers concerning magnetic mountains, or a certain magnetic rock, or an imaginary pole at a certain distance from the pole of the earth." For, he adds, "we learn by experience, that there is no such fixed pole or term in the earth for the variation." Gilbert describes the whole earth as a magnetic globe, and attributes the variation to the irregular form of its protuberances, the solid parts only being magnetic. It was not easy to confirm or refute this opinion, but other hypotheses were tried by various writers; for instance, Halley had imagined, from the forms of the lines of equal variation, that there must be four magnetic poles; but Euler<sup>14</sup> showed that the "Halleian lines" would, for the most part, result from the supposition of two magnetic poles, and assigned their position so as to represent pretty well the known state of the variation all over the world in 1744. But the variation was not the only phenomenon which required to be taken into account; the dip at different places, and also the intensity of the force, were to be considered. We have already mentioned M. de Humboldt's collection of observations of the dip. These were examined by M. Biot, with the view of reducing them to the action of two poles in the supposed terrestrial magnetic axis. Having, at first, made the distance of these poles from the centre of the earth indefinite, he found that his formulæ agreed more and more nearly with the observations, as the poles were brought nearer; and that fact and theory coincided tolerably well when both poles were at the centre. In 1809,<sup>15</sup> Krafft simplified this result, by showing that, on this supposition, the tangent of the dip was twice the tangent of the latitude of the place as measured from the magnetic equator. But M. Hansteen, who has devoted to the subject of terrestrial magnetism a great amount of labor and skill, has shown that, taking together all the observations which we possess, we are compelled to suppose four magnetic poles; two near the north pole, and two near the south pole, of the terrestrial globe; and that these poles, no two of which are exactly opposite each other, are all in motion, with different velocities, some moving to the east and some to the west. This curious collection of facts awaits the hand of future theorists, when the ripeness of time shall invite them to the task.

[2nd Ed.] [I had thus written in the first edition. The theorist who was needed to reduce this accumulation of facts to their laws,

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<sup>14</sup> *Ac. Berlin*, 1757.

<sup>15</sup> *Enc. Met.* p. 742.