

first-mentioned of these great physicists, water, ice, glass, and carbon affect the vibrations of the needle entirely in the same manner as mercury in the rotation experiments.* Almost all substances show themselves to be, in a certain degree, magnetic when they are conductors, that is to say, when a current of electricity is passing through them.

Although the knowledge of the attracting power of native iron magnets or loadstones appears to be of very ancient date among the nations of the West, there is strong historical evidence in proof of the striking fact that the knowledge of the directive power of a magnetic needle and of its relation to terrestrial magnetism was peculiar to the Chinese, a people living in the extremest eastern portions of Asia. More than a thousand years before our era, in the obscure age of Codrus, and about the time of the return of the Heraclidæ to the Peloponnesus, the Chinese had already magnetic carriages, on which the movable arm of the figure of a man continually pointed to the south, as a guide by which to find the way across the boundless grass plains of Tartary; nay, even in the third century of our era, therefore at least 700 years before the use of the mariner's compass in European seas, Chinese vessels navigated the Indian Ocean† under the direction of magnetic needles pointing to the south. I have shown, in another work, what advantages this means of topographical direction, and the early knowledge and application of the magnetic needle gave the Chinese geographers over the Greeks and Romans, to whom, for instance, even the true direction of the Apennines and Pyrenees always remained unknown.‡

The magnetic power of our globe is manifested on the terrestrial surface in three classes of phenomena, one of which exhibits itself in the varying intensity of the force, and the two others in the varying direction of the inclination, and in

* Arago, in the *Annales de Chimie*, t. xxxii., p. 214; Brewster, *Treatise on Magnetism*, 1837, p. 111; Baumgartner, in the *Zeitschrift für Phys. und Mathem.*, bd. ii., s. 419.

† Humboldt, *Examen Critique de l'Hist. de la Géographie*, t. iii., p. 36.

‡ *Asie Centrale*, t. i., Introduction, p. xxxviii.-xlii. The Western nations, the Greeks and the Romans, knew that magnetism could be communicated to iron, and that that metal would retain it for a length of time. ("Sola hæc materia ferri vires, a magnete lapide accipit, retinetque longo tempore." Plin., xxxiv., 14.) The great discovery of the terrestrial directive force depended, therefore, alone on this, that no one in the West had happened to observe an elongated fragment of magnetic iron stone, or a magnetic iron rod, floating, by the aid of a piece of wood, in water, or suspended in the air by a thread, in such a position as to admit of free motion.