

to Gilbert's dictum would be that the earth *acts* like a great magnet, if it is not in itself a magnet. We do not as yet know definitely *whether the earth is a magnet or an electro-magnet, i. e.*, whether the earth acts upon a freely suspended magnetic needle as a permanently magnetized body, with definite magnetic poles or centers of attraction, or whether it acts like a soft piece of iron rendered temporarily magnetic by a current of electricity circulating around it. To put the matter tersely, no satisfactory answer has as yet been given to the question: "*Is the earth's magnetism permanent or induced?*" We know that the earth possesses magnetism in some form, but the *how* and the *whence*, in spite of innumerable attempts of some of the most brilliant minds to solve the riddles, are still mysteries.

*Helmholtz* characterized the earth's magnetism as *one of the most puzzling of natural forces*.

Since it can be mathematically demonstrated that it is always possible to distribute electric currents within the earth's crust in such a way that the *external* magnetic effect of these currents will be precisely the same as that due to a system of permanent magnets embedded in the earth, it follows that we can equally as well satisfy the magnetic phenomena observed on the earth's surface, on either hypothesis.

The electric current theory has many points in its favor, but thus far no adequate cause has been found, that is, one that would explain not only qualitatively but also *quantitatively* the currents and the *direction* in which they would have to proceed, *i. e.*, roughly from east to west around the earth. And Professor Schuster's question as to whether every large rotating mass is a magnet has not yet been experimentally attacked. There is a strong suspicion that the earth's rotatory motion has an important share in the production of the earth's magnetism.

Furthermore, we as yet have no knowledge *whatever* with regard to the actual distribution of magnetism within the earth's crust; nor shall we ever have so long as we confine our observations entirely to the *surface* of the earth. For an infinite number of distributions of magnetism can be found which will satisfy *surface* phenomena. What is needed is observations in the region above us—in balloons—