II. Mineral Substances of Extra-Terrestrial Origin.

Among the many substances contributing to the formation of deep-sea deposits, there are a few of small dimensions which it has not been possible to refer to a terrestrial origin. Both on account of their small size and their rarity, they make up only an insignificant part of any of the samples of the different types of deep-sea deposits, but on account of the extra-terrestrial origin attributed to them, and their peculiar distribution over the floor of the ocean, they are exceedingly interesting, have given rise to much discussion, and therefore merit a detailed description. Mr. Murray first called attention to certain of these particles from the deep-sea deposits in the year 1876,[1] and described them as cosmic dust, pointing out at the same time that these particles were much more abundant in all the deep-water deposits far from land, where accumulation must be relatively slow, than in other regions of the ocean's bed. The detailed characters of these magnetic spherules, with illustrations, were given by us in a special paper published in 1883, in which were also described the brown-coloured spherules or chondres.[2]

When the magnetic particles are extracted from a marine deposit, in the manner described on page 17, and placed under the microscope, it will be found that the great majority consist of magnetite derived from eruptive and other rocks. Many of these are still attached to silicates or vitreous volcanic matter, which clearly indicate their origin. But along with these fragments of magnetite or titanic iron, there are other grains equally magnetic which do not present crystalline contours, and do not occur in the form of irregular grains;—it is to these that the name of cosmic dust has been applied. They may be divided for the purposes of description into two groups:—first, black magnetic spherules, with or without a metallic nucleus; second, brown-coloured spherules resembling chondres, with a crystalline structure.

(*a.*) *Black Magnetic Spherules.*

These magnetic spherules rarely exceed 0·2 mm. in diameter. Their black and shining surface is formed by a coating which possesses the properties of magnetic iron. This coating is absolutely opaque and black in thin splinters, has a metallic lustre, is attracted by the magnet, and is soluble with difficulty in acids. There is often at the periphery of the spherule a more or less pronounced depression. Such are the general external characters, which may be verified by reference to the various figures on Pl. XXIII., chiefly devoted to a representation of particles believed to have a cosmic origin. Fig. 1 shows one of these spherules extracted from the powder of a manganese

[1] *Proc. Roy. Soc. Edin.*, vol. ix. p. 258.

[2] Murray and Renard, "On the Microscopic Characters of Volcanic Ashes and Cosmic Dust, and their Distribution in Deep-Sea Deposits," *Proc. Roy. Soc. Edin.*, vol. xii. pp. 474–495.