APPENDIX II.

REPORT on an ANALYTICAL EXAMINATION OF MANGANESE NODULES, with special reference to the PRESENCE or ABSENCE of the RARER ELEMENTS. By JOHN GIBSON, Ph.D., F.R.S.E.

The material subjected to analysis consisted of small and characteristically-shaped nodules, varying in size from about ¼ to ¾ inch in diameter. They were received from Mr Murray, labelled as follows:—

MANGANESE NODULES (medium size).

Station 285. 14th October 1875.
Lat. 32° 36′ S.; long. 137° 43′ W.
2375 fathoms.

A preliminary examination showed that these nodules consisted chiefly of hydrated oxides of manganese, iron, and aluminium, soluble in hydrochloric acid, together with a highly siliceous insoluble residue. No rare element was found in large quantity, so that it was obviously necessary for the purposes of this examination to operate upon a large quantity of the material. In carrying out the analyses special care was taken that the necessarily large quantities of the reagents employed should be minimised as far as possible, and every positive result was supplemented by cross tests, so as to ensure that the traces of the different elements found were really originally present in the nodules, and not derived from the reagents themselves, or from the vessels in which the various operations were carried out. In every case the possibility of such sources of error was made the subject of careful investigation, and from the outset the analytical methods adopted were chosen with special reference to this difficulty. The reagents used were rigorously tested, and in many cases specially prepared.

Spectroscopic Examination.

At first sight it might be supposed that a direct spectroscopic examination of the original material, or of its concentrated hydrochloric acid extract, would have gone far towards deciding as to the presence or absence of those elements at least which give characteristic spectra. The extreme delicacy of spectroscopic tests, when applied to relatively simple substances, is not unfrequently referred to in a manner which would lead one to suppose that qualitative analysis might, in the hands of a good spectroscopist, be reduced to the simple measurement of the lines present in the spectra of the substance to be analysed. Unfortunately it is not so. Repeated measurements of the lines in the very complex spectra produced by the original substance and its concentrated