

March 13, 1884.

THE PRESIDENT in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read :—

- I. "Researches in Spectrum Photography in Relation to new Methods of Quantitative Chemical Analysis. Part II."\* By W. N. HARTLEY, F.R.S.E., &c., Professor of Chemistry, Royal College of Science, Dublin. Communicated by Professor G. G. STOKES, Sec. R.S. Received February 28, 1884.

(Abstract.)

This paper includes an introduction recording the methods which have been proposed by different authors for the quantitative estimation of various metallic elements. An account is then given of the length and strength of metallic lines in solutions of definite strength. Under given conditions each solution emits a characteristic spectrum. In the case of magnesium, a minute description is given of the spectra presented by various solutions containing from 1 per cent. to 0·00000001 per cent. of the metal, but in the case of other elements tabular descriptions of the spectra of solutions containing 1, 0·1, and 0·01, in some instances 0·001, of metal are given together with carefully drawn maps. The substances thus treated of are magnesium, zinc, cadmium, aluminium, indium, thallium, copper, silver, mercury, tin, lead, tellurium, arsenic, antimony, and bismuth.

The sensitiveness of the spectrum reaction is practically unlimited when applied to magnesium compounds dissolved in water, since it was shown that with a given length of spark,  $\frac{1}{100000000}$  of a milligram could easily be detected; when, however, the strength of spark was greatly increased, but the striking distance between the electrodes left unaltered, the sensitiveness was increased ten thousand-fold. In point

\* For Part I see "Phil. Trans.," Part I, 1884.

of fact, one part of magnesium was detected in 10,000,000,000 parts of water, the lines seen under these circumstances being those with wave-lengths 2801·6 and 2794·1. The spectrum reaction of arsenic is the weakest, those of antimony and tellurium are also weak, while that of bismuth is not strong. In fact it is noticeable that the more strongly basic elements are those with the most persistent lines.

Evidence is afforded in the case of the aluminium spectrum that it is not invariably the longest or strongest line which is the most persistent. The line with wave-length 3584·4 is both longer and stronger than a pair of lines adjacent thereto with wave-lengths 3612·4 and 3601·1, but whereas the first is not seen in solutions containing 0·1 per cent. of aluminium, the pair are still visible in solutions containing 0·01 per cent. Under certain conditions this single line appears the longest in the whole spectrum, whereas otherwise, and under most circumstances, the lines with wave-lengths 3960·9 and 3943·4 are longest.

As a rule, even the longest lines are shortened by great dilution of the solutions, but there is a pair of lines in the spectrum of copper with wave-lengths 3273·2 and 3246·9 which become greatly attenuated, yet nevertheless remain long lines till they finally disappear.

It is shown by one or two examples how the tables of spectra and accompanying maps may be employed in rendering quantitative results. The special applications of this method it is proposed to describe in a further communication.

II. "On the Mean Diurnal Variation of Magnetic Declination, from Hourly Observations at Fort Rae." Communicated by Professor G. G. STOKES, Sec. R.S. By Captain H. P. DAWSON, R.A. Received February 28, 1884.

The accompanying diagrams represent the mean diurnal variation of declination for each month from September, 1882, to August, 1883, at the Circumpolar station at Fort Rae, British North America.

These curves are plotted from the hourly means for each month, and include the effect of disturbances which have greatly influenced them during the winter months, especially in November.

One effect of an unusual amount of disturbance is an increase of the mean declination; the easterly disturbance, or that tending to increase the declination, being always in excess.