lines in this case are luminous on a fainter continuous background and are not particularly sharp, whilst the reflection spectrum consists of black lines sharply defined on a continuous spectrum.

The spectrum emitted by incandescent erbia is shown in fig. 4.

Fig. 5 shows the characteristic lines in the spark spectrum of erbium, taken from a concentrated acid solution of erbic chloride, with a Leyden jar in a shunt circuit.

I have thought it advisable to give these five spectra of erbium, as they show how entirely different the phosphorescent spectrum is to any other spectrum given by this element.

IV. "On the Clark Cell as a Standard of Electromotive Force." By the Lord RAYLEIGH, M.A., D.C.L., Sec. R.S. Received January 7, 1886.

(Abstract.)

This paper, supplementary to that "On the Electrochemical Equivalent of Silver, and on the Absolute Electromotive Force of Clark Cells,"* gives the further history of the cells there spoken of, and discusses the relative advantages of various modes of preparation. The greatest errors arise from the liquid failing to be saturated with zinc sulphate, in which case the electromotive force is too high. The opposite error of *super*-saturation is met with in certain cases, especially when the cells have been heated during or after charging. Experiments are detailed describing how cells originally supersaturated have been corrected, and how in others the electromotive force has been reduced by the occurrence of supersaturation consequent on heating. If these errors be avoided, as may easily be done; if the mercury be pure (preferably distilled *in vacuo*), and if either the paste be originally neutralised (with zinc carbonate), or a few weeks be allowed to elapse (during which the solution is supposed to neutralise itself), the electromotive force appears to be trustworthy to $\frac{1}{1000}$ part. This conclusion is founded upon the comparison of a large number of cells prepared by the author and by other physicists, including Dr. Alder Wright, Mr. M. Evans, Dr. Fleming, Professor Forbes, and Mr. Threlfall.

As regards temperature coefficient, no important variation has been discovered in saturated cells, whether prepared by the author or by others. In all cases we may take with abundant accuracy for ordinary applications—

$$E = 1{\cdot}435\{1 - 0{\cdot}00077(t - 15^\circ)\},$$

the temperature being reckoned in centigrade degrees. For purposes of great delicacy it is advisable to protect the standards from large

* "Phil. Trans.," vol. 175, 1884.

fluctuations of temperature. Under favourable circumstances two cells will retain their relative values to $\frac{1}{10000}$ for weeks or months together.

Unless carefully sealed up, the cells lose liquid by exudation and evaporation, and then the electromotive force gradually falls. Marine glue appears to afford a better protection than paraffine-wax, and there seems to be no reason why cells thus secured should not remain in good order for several years.

In cells of the H-construction (§ 29 of former paper) the leg containing the amalgam (but not the one containing pure mercury) is liable to burst, apparently in consequence of a tendency to alloy with the platinum. Protection with cement of the part of the platinum next the glass has been tried, but no decisive judgment as to the adequacy of this plan can as yet be given.

Recent cells, intended for solid zincs, have been made of a simplified pattern—nothing more, in fact, than a small tube with a platinum wire sealed through its closed end. The zincs are not recast, and the paste is prepared from (unwashed) mercurous sulphate rubbed up in a mortar with *saturated* solution of zinc sulphate and a little zinc carbonate. A stock of paste may be prepared and retained for use in a bottle.

Experiments are described tending to prove that the irregularities observed during the first few weeks of the life of a cell prepared with acid materials, have their origin principally at the mercury electrode.

Cells prepared with dilute solutions have a lower temperature coefficient (about 0·00038), but would be more difficult to use as standards whose value is to be inferred from the mode of preparation.

Details are given of H-cells charged with amalgams of zinc and mercury in both legs, without mercurous sulphate. A very small proportion of zinc is sufficient to produce the maximum effect. Pure mercury, neither alloyed with zinc nor in contact with mercurous sulphate, has an uncertain electromotive value.

Since the comparison of cells does not absolutely exclude a small general alteration of electromotive force with age, further determinations of the standard cell (No. 1) have been effected by means of the silver voltameter. The results—

Table XVIII.

Date.	E.M.F. of No. 1 at 15° C. in B.A. volts.
October, 1883, to April, 1884	1·4542
November, 1884	1·4540
August, 1885	1·4537

are very satisfactory, and indicate a constancy sufficient for almost all practical purposes.

Finally, some comparisons are given between Clark cells and Daniells, with equi-dense solutions, both of Raoult's pattern and of that described recently by Dr. Fleming.

V. "Account of a new Volcanic Island in the Pacific Ocean." By WILFRED ROWELL, H.B.M. Consul in Samoa. In a letter to the Hydrographer of the Admiralty. Received January 17, 1886.

Hydrographic Department, Admiralty, S.W.,
SIR, *16th January*, 1886.

I HAVE the honour to forward to you a photograph and a copy of a letter received from H.M. Consul at Samoa, relating to a volcanic island recently formed by a submarine volcano, in the vicinity of the Friendly Group in the Pacific Ocean, which I think may be of interest to the Royal Society.

I also forward a chart of the locality showing the position of the new island.

It is unfortunate that, as the hydrographical knowledge of the vicinity is very imperfect, no information exists as to the depths from which this island has pushed its way.

(Signed) W. J. L. WHARTON,
The Secretary, Royal Society. *Hydrographer.*

(Enclosure.)

H.B.M. Consulate, Samoa,
SIR, *November 21st*, 1885.

I HAVE the honour to report that whilst on a passage from the "Friendly" Islands to the "Navigators" Islands, on board the steam ship "Janet Nicoll," we observed a newly-risen volcanic island. I was informed in "Tongatabu" that the eruption was first remarked from that island (a distance of over 40 miles) on Tuesday, 13th of October. We passed it on Sunday, the 8th of November, at a distance of about $1\frac{1}{2}$ miles.

The following will be the approximate position by compass bearings:—

Peak of "Kao" Island over centre of "Tefoa" Island, north by east.

West end of "Honga Tonga" Island, south by east.

Centre of crater from ship west $1\frac{1}{2}$ miles.

The island appeared to be about two miles in length north by west and south by east, of about 200 feet in height, having a reef on the