IV. "On the Effect of Polish on the Reflexion of Light from the Surface of Iceland Spar." By C. SPURGE, B.A., St. Catherine's College, Cambridge. Communicated by R. T. GLAZEBROOK, M.A., F.R.S. Received November 18, 1886.

(Abstract.)

The most complete experiments which have been hitherto instituted to determine the optical effect of polishing the surface of a transparent body are those of Seebeck, described in 'Poggendorff, Annalen,' vol. 20, 1830, p. 27; vol. 21, 1831, p. 290. Seebeck's method was to quench, as far as possible, the reflected light with a Nicol, and to measure the angle of incidence. It was from a change in the angle of incidence, *i.e.*, the angle of polarisation, that an alteration of the state of the surface was inferred.

This method is open to the objection that the light is not completely quenched, and, therefore, since the effect of polishing as observed by Seebeck was not very large, our conclusions as regards the surface state may be modified. Besides, the investigation is incomplete, for the precise change produced in the reflected light by polishing is not determined.

The present paper, of which this is an abstract, is an account of experiments made to determine with greater accuracy the effect of polishing the surface of a crystal of Iceland spar, and also the exact alteration produced in the reflected light, *i.e.*, the change in the ratio of the axes of the ellipse, and in the azimuth of the major axis of the elliptically polarised light.

To effect this, an elliptic analyser, consisting of a Nicol and a quarter undulation plate, was employed. If r, r' be the mean readings of moveable verniers attached to the Nicol in the two distinct positions in which the light is extinguished, and R, R' similar readings of fixed verniers which determine the azimuth of the quarter plate, then $\tan \varpi$, the ratio of the axes, and I, the azimuth of the major axis of the elliptically polarised light, were calculated from the formulæ—

$$\cos 2\varpi = \sin (r'-r) / \sin (R'-R) \text{ and } I = (R+R')/2.$$

Especial care was taken to secure fixity of position in all permanent parts of the instrument, and in the setting of the face of the crystal, since a small change was to be detected.

A first series of experiments was made with light reflected from a natural face, and with light reflected from the same face when polished. The polishing was performed by *myself*, and precautions

were taken that the polishing was effected under exactly the same conditions. To ensure that the face was polished parallel to itself, the inclinations of the face to fixed faces were measured before and after polishing. The mean of about 400 readings was taken with each state of the face of the crystal, to obtain as accurate a result as possible.

A second series of experiments was instituted with a view to determine the accuracy with which the means of each of the previous sets of observations could be determined. At the same time, a simple analyser, consisting of a Nicol and a graduated circle, was set up in addition to the elliptic analyser, with the object of testing the conclusions of Sir John Conroy as regards polished surfaces, which are given in the 'Proceedings of the Royal Society' for February, 1886. The effect of rotation of the face of the crystal through a small angle in its own plane is also discussed. The observations are divided into sets, the means of which are compared with each other.

Lastly, a set of experiments was made with a cleavage face split off near the former, and the results of these experiments were compared with those of the first series made some fifteen months previously.

The results of the experiments are embodied in tables, from which the following numerical results are extracted. I′ in the case of the simple analyser corresponds to I for the elliptic analyser.

The general conclusions of the paper are as follows:—

The process of polishing the surface of a crystal of Iceland spar with emery and rouge does most certainly alter the state of the surface. This alteration is evinced by a change both in the ratio of the axes and in the azimuth of the major axis of the elliptically polarised light. Such an alteration was observed in the case of two different crystals which were made the subject of experiment.

The light reflected is shown to be exceedingly nearly plane polarised, so that the absolute amount of change in the ratio of the axes is small; but the relative change is considerable, for tan ϖ is changed from 0·0334 to 0·0252. The change in the azimuth of the major axis is not very large. As regards disturbing causes, it is proved that moderate changes of temperature do not cause any very perceptible alteration in the surface state. The experiments prove a result unnoticed by Seebeck, that an emery-rouge polished surface gives perfectly concordant results on repolishing, and in this respect is quite as satisfactory as the chalk-polished surface that Seebeck recommends. And in general the results of the paper tend to confirm the views of Seebeck rather than those of Sir J. Conroy, for Seebeck in his paper prefers polished surfaces because of the liability of the natural surface to tarnish.

		Elliptic analyser.			Simple analyser.	
		tan ϖ.	I.	Readings.	I′.	Readings.
Ist Series......	Natural face.	0·03345	108° 5·3′	416	—	—
	Same face polished ..	0·02517	107 49·1	384	—	—
IInd Series. (Elliptic analyser reset)........	Same face polished ..	0·02655	107 49·1	448	266° 5·3′	100
	Same face *re*-polished ..	0·02723	107 52·6	1280	265 57·3	500
	The first polished face rotated thro' 4° 27′	0·03305	107 39·2	960	—	—
IIIrd Series. (Base of crystal broken up by cleavage).....	Natural face.	0·03368	108 31·4	384	—	—
Effect of time..	Polished face Dec. 8....	—	—	—	111 15·7	40
	Polished face Jan. 20 ...	—	—	—	111 16·7	60
	......	—	—	—	111 16·4	60

V. "Contributions to the Chemistry of Chlorophyll. No. II." By EDWARD SCHUNCK, F.R.S. Received November 25, 1886.

(Abstract.)

In this paper the author continues his account of the properties of phyllocyanin, one of the products of the action of acids on chlorophyll. He shows that by passing a current of CO_2 through an alcoholic solution of phyllocyanin holding oxide of zinc in suspension, a compound is obtained containing zinc and carbonic acid, a phyllocyanin zinc carbonate resembling phyllocyanin zinc acetate, but that no analogous compounds containing iron or copper are formed in this way. Attention is directed to the points of resemblance between the double compounds of phyllocyanin containing zinc and chlorophyll itself, particularly as regards their susceptibility to change when exposed to the action of air and light, and it is shown that while