Communications from the Oxford Mineralogical Labovatory.

Note on the Hitchcockite, Plumbogummite and Beudantite analysed by Mr. Hartley.

By Professor H. A. Miers, M.A., F.R.S.

[Read January 23rd, 1900.]

Hitchcockite and Plumbogummite.

In a description of some British pseudomorphs, published in 1896 (*Mineralogical Magazine*, XI, p. 272), I mentioned that the sky-blue and lavender-blue mineral sometimes found encrusting the pyromorphite from Roughten Gill is not a zinc carbonate or silicate, as commonly supposed, but is a phosphate of lead and aluminium. Pseudomorphs of this substance after pyromorphite are not rare among Roughten Gill specimens, and these were described in the above-mentioned paper as examples of plumboresinite after pyromorphite.

Mr. E. G. J. Hartley, having at my suggestion undertaken the analysis of this mineral, made also analyses of the original plumboresinite (or plumbogummite) from Huelgoat, and of the hitchcockite from Georgia, which has generally been regarded as a variety of plumbogummite, with the view of comparing them with the Cumberland mineral. He has shown that the latter is identical with the mineral from Georgia. The pseudomorphs should, therefore, be described as of *hitchcockite after pyromorphite.*

The Cumberland Hitchcockite.—This beautiful blue substance occurs as a crust which generally lies directly upon the vein quartz, and usually has crystals of pyromorphite dispersed upon it. The pyromorphite crystals are sometimes quite fresh, but are often surrounded by a zone of hitchcockite, and on some specimens are only represented by hollow pseudomorphs consisting entirely of hitchcockite; these last are of a pale blue, or in some instances of a greenish yellow colour; but the ordinary colour of the crust is a rich smalt- or lavender-blue.

The surface of the crust is rough, and under the microscope it is seen to consist of minute crystals with pyramidal terminations. These are too small to be measured.

Between crossed nicols the crust gives aggregate polarisation, and is seen to consist of radiating needles. The underlying portions exhibit a

botryoidal structure, and when thin the crust shows the black crosses characteristic of spherulites. The effect produced by a thin piece of this crust viewed transversely in parallel light between crossed nicols is very beautiful, owing to the perfection of these crosses and the bright polarisation tints of the radii.

When crushed and examined in oil, the fibres of which the crust consists are seen to have straight extinction and to be elongated in the positive direction. In convergent light they appear to be either positive uniaxial crystals or biaxial with a very small axial angle and elongated along the positive acute bisectrix; but these observations are very difficult. The refractive power and the bi-refringence are distinctly less than those of pyromorphite.

A thin portion of the crust viewed in convergent light sometimes gives an effect closely resembling a positive uniaxial interference figure, but really due to the radial fibrous structure.

The pyromorphite and mimetite from Cumberland, with which hitchcockite is associated, seem to have been found at several of the lead workings in the neighbourhood of Roughten Gill, a small stream nearly three miles south of the village of Caldbeck. The workings have been practically abandoned for many years; the specimens which now adorn most collections seem to have been obtained shortly before the year 1834.

At a distance of a few hundred yards from each other are the workings, which were known from the streams upon which they are situated as Roughten Gill and Red Gill. Among the minerals found at the former have been recorded campylite, aurichalcite, pyromorphite, brochantite, anglesite, melaconite and various copper ores, calamine (smithsonite), psilomelane, chalcedony, barytes, and linarite. Among the minerals recorded from Red Gill are malachite and other copper ores, cerussite, leadhillite, caledonite, and linarite.

The chief sources of information on this subject are:—

Greg and Lettsom, *Mineralogy of Great Britain and Ireland*, 1858.

Bryce M. Wright, in Jenkinson's *Practical Guide to the English Lake District*, 1885, pp. lxxi-xcvii, where a very full list of localities is given.

J. G. Goodchild, "Contributions towards a List of the Minerals occurring in Cumberland and Westmoreland" (*Transactions of the Cumberland Association for the Advancement of Literature and Science*, Part VII, 1883, pp. 101-126; Part VIII, 1884, pp. 189-204; Part IX, 1885, pp. 175-199).

The reference in Dana's *System of Mineralogy*, 1850, to Roughten Gill

as a locality for plumboresinite probably relates to the brown resinous pyromorphite (perhaps one of the aluminous varieties), for the brilliant blue colour of the mineral is not alluded to.

Hitchcockite from Canton Mine, Georgia.—In the specimen analysed by Mr. Hartley this mineral occurs in nearly colourless crusts upon a matrix consisting mainly of quartz, galena, pyrites and chalcopyrite. Although so different from the Cumberland mineral in colour, it resembles it in every respect so far as its essential properties are concerned, and is absolutely indistinguishable from it under the microscope; the surface, the structure, and the optical characters are exactly as described above. Hitchcockite has been described as uniaxial and positive by E. Bertrand (*Bull. Soc. Min*, 1881, IV, 37).

Plumbogummite from Huelgoat, Brittany.—The specimen analysed by Mr. Hartley consisted of deep brown resinous botryoidal plumbogummite, which in parts showed a roughly facetted surface like that of some botryoidal hæmatite, but it was for the most part devoid of any definite radial structure. The plumbogummite was in contact with a pale brownish-yellow mineral of resinous lustre and fibrous structure, whose surface when botryoidal closely resembles that of the plumbogummite. The matrix consisted of galena and massive pyrites.

Viewed under the microscope no portion of the specimen shows the typical black crosses of hitchcockite. Where at all fibrous, the brown plumbogummite is seen to have a *positive* elongation and straight extinction; a positive uniaxial interference figure was obtained from some fragments. Both the refraction and the double refraction of this mineral are higher than those of the Cumberland and American hitchcockite, and are greater than those of pyromorphite. The mineral is also harder than hitchcockite.

The pale-coloured mineral upon this specimen is probably a variety of pyromorphite, for in one part it contains a small cavity lined with microscopic crystals. I was able to isolate one of these, and to measure it on the 2-circle goniometer. It proved to be a hexagonal prism terminated by the basal plane and six faces of a pyramid on the corners of the latter; the angle between pyramid and base is 39°38′ (38°55′ – 41°11′); the corresponding angle for pyromorphite is 40°22′. This crystal, like the pale material in general, was elongated in the *negative* direction; the mineral is also softer than the brown plumbogummite, and possesses weaker birefringence.

The optical examination of the above minerals, therefore, confirms Mr. Hartley's analysis in an interesting manner, for it shows that, although the three specimens resemble each other in some respects, the Cumberland and American minerals (hitchcockite) are absolutely indistinguishable, whereas they differ in most particulars from plumbogummite, and can easily be distinguished from it; also that the plumbogummite is quite distinct from the pale mineral (pyromorphite) with which it is associated. The microscope however fails to reveal any mechanical mixture of the two; the fragments of plumbogummite appear remarkably homogeneous and free from impurity.

Beudantite.

The specimen of beudantite analysed by Mr. Hartley professes to be from the Glandore mines in County Cork, and was bought as such from Dr. Krantz only two years after his discovery of the mineral at that locality. The appearance of the specimen resembles more closely specimens from Dernbach than the other specimens from Glandore which I have been able to see, but, since the matrix only contains limonite and quartz, the superficial appearance of the beudantite alone is not sufficient to disprove its Irish origin; neither does Mr. Hartley's analysis clear the doubt, for the percentage of phosphoric acid which he finds is about midway between that found by Müller in Dernbach beudantite and that found by Rammelsberg in the Cork mineral.

Under the microscope fragments of the beudantite from this specimen are indistinguishable from either the Dernbach or the Cork beudantite. Of the former there is a specimen in the Oxford Museum, and through the kindness of Mr. H. J. Seymour I have had the opportunity of examining a specimen of the latter belonging to University College, Dublin, which came from the collection made by the late Dr. Sullivan.

Fragments of all these are pale yellow or yellowish-brown, when sufficiently thick. They are easily distinguished from pharmacosiderite, which is green, and invariably exhibits a banding parallel to the cube faces. The beudantite possesses a stronger birefringence than pharmacosiderite, and does not show the same cubic banding; it does, however, sometimes exhibit a lamellar structure, and it shows frequent evidences of twinning, many fragments consisting of differently orientated birefringent material. For this reason, though brushes may be seen, it is very difficult to say whether the mineral is uniaxial or biaxial. One fragment presented what appeared to be the negative bisectrix of a biaxial crystal with large optic axial angle. E. Bertrand (*Bull. Soc. Min. Franc.* 1881,

IV, 255) also found the beudantite from Dernbach, Cork and Horhausen to be indistinguishable under the microscope; but found them to be uniaxial and negative. I have not been able to find a definite uniaxial figure in any of the fragments which I have examined.

One minute crystal from Dernbach with very brilliant rhombohedron faces gave the angle 88°22′ for the rhombohedron angle. Dauber found 88°42′ as the mean of all his measurements.