

COMMUNICATIONS FROM THE OXFORD MINERALOGICAL  
LABORATORY. NO. XIX.

*On the occurrence of Bertrandite at the Cheesewring  
Quarry, near Liskeard, Cornwall.*

By H. L. BOWMAN, M.A., D.Sc.

Professor of Mineralogy in the University of Oxford.

[Read November 15, 1904.]

IN the year 1904, two specimens were sent to me by Mr. F. H. Butler for determination, which showed small, colourless, rhombic or oblong tabular crystals on granite. The crystals proved on examination to be the beryllium silicate bertrandite, which forms a new addition to the list of British mineral species.

This mineral was first described by E. Bertrand in 1880 from the quarry of Petit Port, near Nantes, and it has since been found at other places in the same neighbourhood as well as in the old tin-workings at La Villeder in Morbihan, and near Alençon and Limoges, though always in very small quantity. Outside France it has been found only in the neighbourhood of Pisek in Bohemia; and, in the United States, at Stoneham and elsewhere in Maine, Amelia Court House in Virginia, and on Mt. Antero in Colorado. At all these localities it occurs in a pegmatite or granite, and at many of them it is associated with beryl, through the decomposition of which it appears to have been commonly formed.

The specimens sent to me by Mr. Butler had been found by him in 1904 in the Cheesewring Quarry, situated in the parish of Linkinhorne; and since that time a number of other specimens have been obtained from this place by him and by Mr. Arthur Russell. The latter has also discovered the mineral at some other localities in Cornwall, while minute crystals of another beryllium mineral, phenacite, have been found by him at the Cheesewring Quarry and elsewhere.<sup>1</sup>

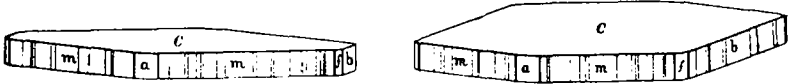
The following notes are the result of an examination of the original specimens, which Mr. Butler has kindly presented to the University

<sup>1</sup> See a paper by Mr. Russell, in this vol., p. 55.

Museum, and of a fine series collected by Mr. Russell, which he has kindly put at my disposal for the purpose. For the facts concerning the mode of occurrence I am further indebted to Mr. Russell.

The crystals of bertrandite are all tabular parallel to the face<sup>1</sup>  $c$  (001), and are usually rhombic in outline, though six-sided or oblong plates are occasionally observed. They are commonly 2 to 3 mm. in length by about 0.3 mm. thick; but crystals have been found as large as 11 mm. in length by 0.8 mm. thick.

The large faces have a pearly lustre, due to the perfect cleavage parallel to them, and show three sets of cleavage cracks corresponding, respectively, to a perfect cleavage along the short diagonal of the rhombs,  $b$  {010}, and to two good cleavages along the prism faces,  $m$  {110}.



Bertrandite from Cheesewring Quarry, Cornwall.

The crystals of rhombic and six-sided outline are bounded principally by faces of  $m$  {110} and  $b$  {010}, of varying relative size, and they frequently show small faces of  $f$  {130}, and sometimes also of  $a$  {100}. On one crystal a small uneven face of  $\eta$  {021} was observed. The faces around the edges of the plates ( $m$  and  $b$ ) are vertically striated, and the large basal planes often show a division into two parts along the longer diagonal, with transverse striation or channelling on either side. Several crystals are often found growing together in nearly parallel position to form sheafy aggregates, in which the shorter diagonals of the plates lie parallel to one another. The oblong crystals, which are seldom met with, are bounded chiefly by  $a$  and  $b$ , with smaller faces of  $m$  and  $f$ .

Viewed under the microscope through the tabular face, the crystals show strong birefringence, with extinction along their diagonals; and in convergent light thin plates show the central portion of a wide-angled axial figure of positive sign, of which the axial plane is parallel to  $b$  (010) and the bisectrix in the centre of the field. The optic axial angle in olive-oil ( $\mu = 1.47$ ), measured in a thin cleavage-plate, was found to be  $2H_o = 122^\circ 30'$  for sodium-light. The refractive indices as determined by Dr. Herbert Smith's refractometer with a cleavage flake parallel to  $c$  (001),

<sup>1</sup> Letters and indices of faces as in Dana's 'System of Mineralogy', 6th edit., 1892.

are for sodium-light,  $\alpha$  1.584,  $\beta$  1.603,  $\gamma$  1.611; while the true optic axial angle, calculated from the formula  $\sin V_o = \frac{\mu}{\beta} \sin H_o$  is  $2V = 73^\circ$ .

A cleavage-fragment bounded by faces of  $c$  and  $b$  was examined with a view to detecting any deviation from orthorhombic symmetry, such as was suspected by Scharizer in the bertrandite from Pisek;<sup>1</sup> but the obliquity of extinction, if any, did not exceed  $20'$ , on either face, an amount too small (considering the imperfection of the material) to lend any support to Scharizer's view. Moreover, no change in the directions of extinction was observable on heating.

The crystals are strongly pyroelectric, as shown by Kundt's method; and, when hot, they adhere to the fingers.

The density of two crystals was determined by flotation in methylene iodide and toluene, and a Westphal's balance, and found to be 2.604.

The bertrandite occurs mostly on the sides of nearly vertical joints which traverse the granite in an east-and-west direction, and is usually associated with small crystals of quartz, and with white, blue, or violet fluor, and it is frequently penetrated by small needles of greenish tourmaline. The crystals are often stained brown by iron oxide, but become colourless on boiling with hydrochloric acid. The joints are sometimes three to four inches wide, and filled with clay, and their walls are lined with crystals of orthoclase, resembling adularia in habit, fluor, and quartz. Lower down they also carry wolframite and a small amount of iron-pyrites, and some specimens show traces of torbernite, and rarely small crystals of anatase and of reddish blende. One or two large polysynthetic crystals (up to three and a half inches across) of violet fluor, of octahedral habit and showing faces of cube, octahedron, and  $v$  {731}, and bearing clusters of bertrandite crystals on their surface, have been found in the joints. There is a second series of joints, running north and south, but these have not yielded any bertrandite.

A somewhat different mode of occurrence has been once noted in another part of the Cheesewring Quarry, where bertrandite has been found in a vugh with orthoclase (of the adularia-habit and sometimes showing Baveno-twinning) and purple fluor.

Of the minerals mentioned above as associated with the bertrandite in the joints, the anatase occurs in small black or tarnished bipyramidal crystals ( $p$  {111}, with small  $c$  {001}): the torbernite sometimes forms

<sup>1</sup> R. Scharizer, Zeits. Kryst. Min., 1888, vol. xiv, pp. 35, 40.

small dark-green crystals of two habits, viz. square tables with bevelled edges, and bipyramidal crystals without basal plane (closely resembling the two well-known habits of anatase).

Crystallized autunite has also been found, with fluor, in a joint in another part of the quarry, but it is not associated with bertrandite. Near this spot, in the centre of a patch of coarse-grained granite, transparent tabular crystals of pale blue apatite with pyramid-planes have been found, associated with quartz, Carlsbad-twins of orthoclase, and gilbertite—the specimens closely resembling those from the well-known apatite occurrence at Colcerrow Quarry, Luxulyan.

Bertrandite has also been found by Mr. Russell at the neighbouring Gold-Diggings Quarry, as well as at East Kit Hill Mine, near Callington. All the other granite quarries in the district have, however, been searched by him for bertrandite without result.

It is worthy of note that in these localities the bertrandite does not appear to be associated with beryl, from which mineral it has usually been considered to be derived. Beryl is of extremely rare occurrence in Cornwall, and it has been recorded only from four localities in the west of the county.

---