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Banalsite crystals from Wales.

By W. CAMPBELL SMITH, M.C., T.D., M.A., Sc.D.

Keeper of Minerals, British Museum.

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BANALSITE, the new orthorhombic barium-felspar, was described from coarsely crystalline but massive material found as thin bands traversing manganese ore at the Benallt mine, Rhiw, Carnarvonshire.¹ Up to the time of the reading of the paper which announced the discovery of the mineral no crystals had been found except two showing indications of faces seen in a thin section of one of the veins. The only other indications of crystal form were lines of black inclusions seen in thin section within the irregular boundaries of crystals forming the vein-material. Now I have been fortunate to find, in a specimen recently collected by Dr. A. W. Groves from no. 5 ore-body in the Benallt mine, a small cavity containing minute crystals of banalsite.

The specimen shows a thin platy band of massive banalsite with a crust of pale-brown mica (colourless in thin flakes) carrying on its surface numerous minute, brilliant crystals of harmotome. Separated from this thin band of banalsite by a narrow slip of ore is a second mineralized band consisting of small groups of flakes of a blackish-brown chlorite partly coated with a film of baryte. It was in a shallow cavity in this band free from the baryte coating that the crystals of banalsite were found. The crystals are colourless with a pearly lustre on some faces, but the prismatic cleavage (110) shows a rather high vitreous lustre. One rather rough crystal is 2 mm. long, but the others are smaller and mostly between 0.5 and 1 mm. in length. Three of these crystals were detached from the specimen and mounted for measurement on a single-circle goniometer. The identity of the crystals as banalsite was first confirmed by means of an X-ray

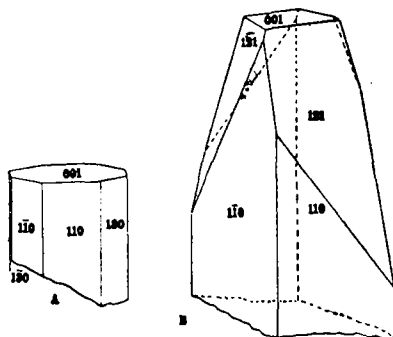


FIG. 1. Crystals of banalsite from Wales.

A. Prismatic habit. Forms (110), (130), (001).
B. Pyramidal habit. Forms (110), (121), (001).

¹ W. Campbell Smith, F. A. Bannister, and M. H. Hey, *Min. Mag.*, 1944, vol. 27, pp. 33-46.

rotation photograph of one of the crystals about the *c*-axis by Mr. F. A. Bannister and compared with his previous photographs obtained from cleavage fragments.

The crystal faces are dull and give no good images. By using a pin-hole signal it was found possible to obtain measurements which enabled the forms to be identified by reference to angles calculated from the axial ratios deduced for the mineral from the cell dimensions.

Two habits of crystals have been observed (fig. 1): (A) prisms terminated by basal plane; and (B) prisms combined with a steep pyramid and very small basal plane. Two crystals of the prismatic habit were measured. The forms present are *c*(001), *m*(110), and a second prism *t*(130). The identification of the new form is based on the following measurements:

	Average.	Limits.	Calculated.
<i>m</i> (110): <i>t</i> (130)	28° 24'	27° 44'–29° 5'	28° 11½'
<i>t</i> (130): <i>t'</i> (1̄30)	42 0	41 55–42 8	42 41
<i>t</i> (130): <i>c</i> (001)	90 39	—	90 0

A single crystal of the second habit measured showed the forms *m*(110) and *f*(121), both somewhat irregularly developed, terminated by small *c*(001), which is perhaps a cleavage face. The identification of the prism faces (110) and (1̄10) was checked from the optical orientation, and the following measurements and calculated angles establish the pyramid as *f*(121).

	Average.	Limits.	Calculated.
<i>m</i> (110): <i>f</i> (121)	24° 36'	24° 34'–24° 39'	23° 49'
<i>m'''</i> (1̄10): <i>f'''</i> (1̄21)	23 23	22 29–24 5	23 49
<i>c</i> (001): <i>f</i> (121)	75 18	75 0–75 32	75 35
<i>f</i> (121): <i>f''</i> (1̄21)	149 50	149 45–149 54	151 10
<i>m'''</i> (1̄10): <i>f</i> (121)	100 37	—	99 46
<i>m'''</i> (1̄10): <i>f''</i> (1̄21)	79 11	79 1–79 21	80 14
<i>f''</i> (1̄21): <i>f'''</i> (1̄21)	56 57	—	58 39

The forms exhibited by the crystals of banalsite so far discovered are, therefore, *c*(001), *m*(110), *t*(130), and *f*(121) referred to axial ratios *a*:*b*:*c* = 0.853:1:1.678. It is satisfactory to note that the form (121) is one of those identified by measurements on the universal stage of crystal edges and of planes of inclusions seen in thin sections of massive banalsite (loc. cit., pp. 34, 35).

Attempts to obtain direct measurements of refractive indices or of optic axial angle on the minute crystals were not successful, but an accurate determination of the birefringence was made. A (110) cleavage fragment of uniform thickness was mounted on a stage-goniometer and the thickness at right angles to the *m* cleavages was measured with a screw micrometer eyepiece. The fragment was then transferred to the universal stage and orientated so that in turn β and γ were brought into coincidence with the axis of the microscope and the retardation due to, first $\gamma - \alpha$, and then $\beta - \alpha$ could be measured with the Berek compensator. The values obtained in sodium-light (at 16–17° C.) are:

$\gamma - \alpha$ 0.0082 ± 0.0002, $\beta - \alpha$ 0.0010 ± 0.0001. Hence using the formula $\sin^2 V = \frac{\beta - \alpha}{\gamma - \alpha}$, the mean value of $2V = 40^\circ 52' \pm 2\frac{1}{2}^\circ$.

The values obtained from refractive indices determined by Becke line methods (loc. cit., p. 36) agree well with these measurements.