Art. LIII.—*On Allanite Crystals from Franklin Furnace, N. J.;** by A. S. Eakle.

Allanite, as a rock constituent, has been shown to be very widespread in its occurrence and the crystallographic properties of the mineral from many localities, have been determined. The present article is the result of an examination of a large number of crystals coming from the Trotter Mine, Franklin Furnace, N. J.

The presence of allanite at Franklin Furnace was first reported in 1850, by C. T. Jackson,† who published a short description of its occurrence and an analysis. His crystals came from a different locality, being in the feldspar of the old magnetite mines, while those described here occur with the zinc ores, in a great granite dyke.‡

The crystals are coal-black in color, very brittle, and occur in the common, flat, tubular forms, elongated parallel to the ortho-axis. The faces of the crystals are, in general, dull, and when magnified appear to be much pitted, so that reflections with the Fuess goniometer are poor. Imperfect cleavage occurs parallel to the basal- and ortho-pinacoid faces and more perfect in the direction of the prism face, but varying about 6° 30′ from parallelism. An average of several readings gives an angle of 47° 56′ between this cleavage face and the ortho-pinacoid.

Fourteen forms, in all, occur on the crystals, none of them, however, being new. The forms are the following:

$a = \infty P\bar{\infty}$	(100)	$n = P$	($\bar{1}11$)
$c = 0P$	(001)	$o = P\dot{\infty}$	(011)
$d = -P$	(111)	$r = P\bar{\infty}$	($\bar{1}01$)
$e = -P\bar{\infty}$	(101)	$u = \infty P\bar{2}$	(210)
$i = \frac{1}{2}P\bar{\infty}$	($\bar{1}02$)	$w = -2P\bar{2}$	(211)
$l = 2P\bar{\infty}$	($\bar{2}01$)	$s = \frac{1}{3}P\bar{\infty}$	($\bar{1}03$)
$m = \infty P$	(110)	$x = -\frac{1}{2}P\bar{\infty}$	(102)

The forms x, i and o are less common, and w and s are rare. The remaining faces are quite common to the species, not alone in this locality, but in general. On the "bucklandite" (allanite) of the Laacher See,§ and later on the allanite from Vesuvius,‖ Dr. G. vom Rath has described a large series of forms, most

* Published in the Trans. N. Y. Acad. Sci., Nov. 27. 1893.

† Allanite from Franklin Furnace, N. J., C. T. Jackson. Proc. A. A. A. S., 1850, p. 323.

‡ Kemp, J. F., Trans. N. Y. Acad. Sci., Oct. 30, 1893.

§ G. vom Rath, Ueber die Krystallform des Bucklandits vom Laacher See, Pogg. Ann. Phys. und Ch., vol. cxiii, p. 281.

‖ G. vom. Rath, ibid., vol. cxxxviii, p. 492.

of them being common on the Franklin crystals. Later, W. C. Brogger* has determined about the same faces on the allanite crystals of southern Norway.

In the drawings accompanying this paper are shown the various combinations. They are all drawn from the individual crystals, with the faces possessing the same relative dimensions.

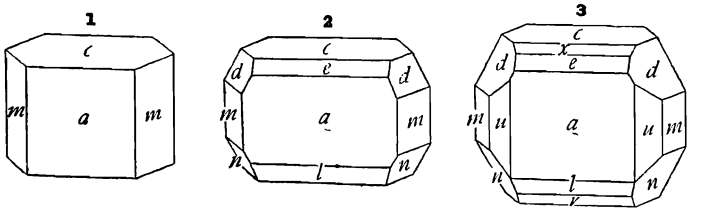

Fig. 1 shows the simplest form, consisting merely of the basal pinacoid (*c*)OP(001), the ortho-pinacoid (*a*)$\infty \breve{P}\bar{\infty}$(100) and the prism (*m*) ∞P(110). This simple combination rarely occurs.

Fig. 2 is a combination showing forms (*e*)$-\breve{P}\bar{\infty}$(101), (*d*)$-$P(111), (*n*)$+$P($\bar{1}$11) and (*l*)2$\breve{P}\bar{\infty}$(201) in addition to those in fig. 1. This crystal is the largest terminated one in the lot examined and the angles were measured with a contact goniometer.

Fig. 3 shows a much more general combination. The forms occurring are (*c*)OP(001), (*x*)$-\frac{1}{2}\breve{P}\bar{\infty}$(102), (*e*)$-\breve{P}\bar{\infty}$(101), (*a*) $\infty\breve{P}\bar{\infty}$(100), (*d*)$-$P(111), (*n*)$+$P($\bar{1}$11), (*u*) ∞P$\bar{2}$(210), (*m*) ∞P (110), (*l*)2$\breve{P}\bar{\infty}$(2$\bar{0}$1) and (*r*)$\breve{P}\bar{\infty}$($\bar{1}$01). This combination is similar to the one on the large allanite crystal from Moriah, N. Y., described by E. S. Dana,† lacking only the clino-dome $\breve{P}\infty$(011).

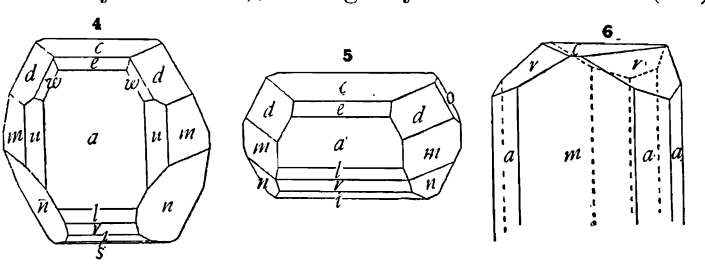

Fig. 4 shows the largest number of forms in combination. All of the forms shown in fig. 3, with the exception of $-\frac{1}{2}\breve{P}\bar{\infty}$ (102) occur, and in addition (*i*)$\frac{1}{2}\breve{P}\bar{\infty}$($\bar{1}$02), and the rarer forms (*s*)$\frac{1}{3}\breve{P}\bar{\infty}$($\bar{1}$03) and (*w*)$-$2P$\bar{2}$(211).

* W. C. Brögger, Mineralién der sudnorweg augitsyenits, Zeit. für Krys., xvi. 95, 1890.

† E. S. Dana, Allanite, Min. Notes. This Journal, III, vol. xxvii. p. 479.

Fig. 5 is a combination having part of the forms shown in fig. 4, with the addition of the clino-dome $(o)P\,\breve{\infty}(011)$.

The following is a list of the angles measured and calculated:

Faces.	Angles meas.	Angles calc.*
001 : 100	65° 2′	64° 59′
001 : 101	34 50	34 53
001 : 102	22 36	22 36½
001 : $\bar{2}01$	89 2	89 1
001 : $\bar{1}01$	63 26	63 24
001 : $\bar{1}02$	34 15	34 15½
001 : $\bar{1}03$	21 22	22 10
001 : 011	58 5	58 2⅔
001 : 111	52 8½	52 9
001 : $\bar{1}11$	74 50	74 49
100 : 101	29 56	30 6
100 : 210	35 42	35 5¾
100 : 111	49 35	49 40
100 : 211	34 9	34 15
100 : 110	54 26	54 34
100 : $\bar{2}01$	25 59	26
210 : 110	19 23	19 28¼
111 : $\bar{1}11$	61 41	61 38
102 : 101	12 18	12 16½
$\bar{2}01$: $\bar{1}01$	25 27½	25 37
$\bar{1}01$: $\bar{1}02$	28 13	28 8½
$\bar{1}02$: $\bar{1}03$	12 27	11 56½
211 : 111	15 8	15 25

Reflections were so poor in some cases that only approximate readings could be made but a sufficient number of these readings were taken to establish with certainty the identity of all the forms.

The mineral is so opaque and brittle that very thin sections are difficult to obtain. The sections are brown in transmitted light and show strong pleochroism from deep brown to yellowish brown: $\mathfrak{a}$ = yellowish brown; $\mathfrak{b}$ = dark red brown; $\mathfrak{c}$ = dark grayish brown. Absorption $\mathfrak{c} > \mathfrak{b} > \mathfrak{a} >$. The index of refraction is high while the double refraction appears to be weak. Sections parallel to the orthopinacoid show complete parallel extinction. In the clino-pinacoidal section, the extinction is about 36° from c in the acute angle β. One section, cut parallel to the basal pinacoid, shows a patchwork of reddish-brown and yellowish-green colors resembling an intergrowth. The crystals are abundantly seamed with cleavage cracks and contain many inclusions of the associated feldspar. The optical character of the mineral was not determined.

* E. S. Dana, New System of Mineralogy, 1892, Allanite, p. 522.

On Tourmaline.

An examination was also made of some large tourmaline crystals which came from Rudeville, N. J. This place is about three and one-half miles northeast of Franklin Furnace, and on the same belt of white limestone that contains the zinc ores. The limestone here is pierced by a large dike of so-called mica-diabase, as described by F. L. Nason* and which has lately been shown to contain more or less altered leucites.† The tourmalines occur near the dike and their formation is apparently due to its action. Other green and brown ones of great perfection have been obtained in the white limestone quarry near the furnace at Franklin. They are there associated with a granite dike.

Most of the crystals are dark brown in color and have well defined faces. The largest one in the lot has the common triangular form of prism, bounded by three broad ∞P faces, measuring four inches in width, and narrower ∞P2 faces. The prism is capped by the negative rhombohedron $-$R, and a large basal plane which completely cuts off the polar edges of the rhombohedron. This crystal is shown in fig. 6—$m = \infty P(10\bar{1}0)$; $a = \infty P2(11\bar{2}0)$; $r = -R(01\bar{1}1)$; $c = OP$ (0001).

All of the forms identified on the crystals are as follows:

$\infty P(10\bar{1}0)$	$R(10\bar{1}1)$
$OP(0001)$	$-R(01\bar{1}1)$
$\infty P2(11\bar{2}0)$	$-2R(02\bar{2}1)$
$\infty P\frac{5}{4}(41\bar{5}0)$	$R^5(32\bar{5}1)$

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