Notes on some Binnenthal minerals (Ilmenite, Seligmannite, Marrite, &c.)

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Ilmenite.[1]

Some very brilliant and well-modified crystals of ilmenite, recently found in the neighbourhood of the Ofenhorn, are of interest in that they exhibit a well-marked parallel hemihedrism and show the presence of a number of new forms. Although constantly sought for, it is more than fifteen years since crystals of this mineral were last found in the Binnenthal. The crystals described by H. Bücking[2] in 1877 appear to differ in habit from those of the new find.

The crystals now described are attached to a matrix of mica-schist, and the associated minerals are quartz, adularia, magnetite, and mica. The plane (111) of the ilmenite is largely developed, and is finely striated parallel to its edges of intersection with the planes of the form $n = \{31\bar{1}\}$

[1] The crystal described above, and the specimen from which it was taken, have been acquired by the British Museum. The crystal was measured on the three-circle goniometer by Mr. G. F. Herbert Smith, and the following additional new forms were observed:—$q = \{\bar{3}31\} = \{\bar{6}241\}$, $k = \{\bar{4}52\} = \{\bar{3}121\}$, $\Gamma = \{3\bar{1}\bar{1}\} = \{40\bar{4}1\}$, and $d = \{411\} = \{10\bar{1}2\}$. The faces were in all cases small, but gave distinct reflections of the collimator-slit. The measurements were made from the large basal plane $c = \{111\} = \{0001\}$, and the azimuths were determined from the nearest zone containing a pole of the form $a = \{10\bar{1}\} = \{1120\}$. The calculated values were computed from Koksharov's fundamental angle adopted in Dana's 'System of Mineralogy,' 6th edit., 1892.

[2] Zeits. Kryst. Min., 1877, vol. i, p. 576.

Form.	Indices.		Calculated Values.		Observed Means.		Number.	Limits of Observations.	
	Rhombohedral.	Hexagonal.	Azimuth.	Distance.	Azimuth.	Distance.		Azimuth.	Distance.
Γ	$3\bar{1}\bar{1}$	$40\bar{4}1$	30° 0′	81° 6½′	30° 0′	81° 5′	1		
d	411	$10\bar{1}2$	,, ,,	38 38	,, ,,	38 30	1		
q	$\bar{3}31$	$\bar{6}241$	10 53½	83 16	10 40	83 9	3	10° 34′–10° 45′	83° 4′–83° 13′
k	$\bar{4}52$	3121	,, ,,	76 42	,, ,,	76 41	2	,, ,, ,,	76 40, 76 42

The forms present are the following, the six in the second column being new for ilmenite:—

$c = \{111\} = \{0001\}$	$a = \{992\} = \{0{\cdot}7{\cdot}7{\cdot}20\}$
$a = \{10\bar{1}\} = \{11\bar{2}0\}$	$X = \{51\bar{3}\} = \{44\bar{8}3\}$
$r = \{100\} = \{10\bar{1}1\}$	$\gamma = \{21\bar{1}\} = \{12\bar{3}2\}$
$s = \{11\bar{1}\} = \{02\bar{2}1\}$	$\delta = \{53\bar{1}\} = \{24\bar{6}7\}$
$n = \{31\bar{1}\} = \{22\bar{4}3\}$	$\beta = \{3{\cdot}8{\cdot}13\} = \{5{\cdot}5{\cdot}10{\cdot}24\}$
	$h = \{3\bar{1}2\} = \{41\bar{5}0\}$

The forms n, X, γ, δ, and β are hemihedral with parallel faces, being rhombohedra of the third order or hemi-scalenohedra. The faces X, n, and β lie in the zone $[ca]$, X and n being on one side of c and β on the other side. The face a lies between the faces c and s in the zone $[cr]$: γ lies between n and s, and δ is near to this in the zone $[c\delta\gamma]$. On the crystal (fig. 1) which was measured there are also some very small faces between c and n, and between c and s. The angles observed on this crystal are given below.

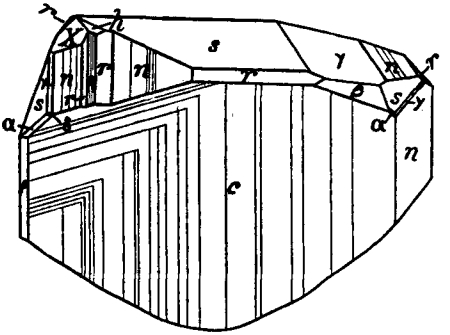

Fig. 1.—Ilmenite.

	Calculated.[1]	Measured.
$cr =$	$57°58\frac{1}{2}'$	57°58′, 57°59′, 57°58′.
$ca =$	29 14	29°12′, 29°10′, 29° (max. light).
$cs =$	72 38	72°38′, 72°38′, 72°38′.
$cc' =$	180 0	180°0′.
$cn =$	61 33	61°33′, 61°34′, 61°31′, 61°33′.
$cX =$	$74\ 50\frac{1}{2}$	74°50′, 74°51, 75° (max. light).
$ca =$	90 0	90° (max. light).
$c\beta =$	$29\ 58\frac{1}{2}$	30°0′, 29°59′, 29°57′, 30° (poor image).
$c\delta =$	$50\ 23\frac{1}{2}$	50°22′, 50°30′ (faint), 50° (max. light).
$c\gamma =$	$64\ 41\frac{1}{2}$	64°41′, 64°40′ (faint), 64°42′.

[1] Calculated from the element of N. I. Koksharov, 'Materialien zur Mineralogie Russlands,' 1870, vol. vi, p. 357.

$as =$	34 15	34°16′, 34°18′.
$a\gamma =$	53 43	53°43′, 53°43′.
$an =$	63 55	63°55′, 63°55′.
$ar =$	90 0	90°0′, 90°0′.

Seligmannite.

Hitherto [1] only twinned crystals of this rare mineral have been discovered. In August, 1905, however, a large untwinned crystal was found in the Lengenbach quarry. It was met with as a single crystal in the iron-stained dolomite, which seldom carries any of the numerous sulpharsenites. The crystal measures $10 \times 7 \times 5$ mm., and its actual shape is represented in fig. 2. Owing to the absence of twinning and of cleavage, it appeared at first sight to be a large and highly modified crystal of tennantite ('binnite'), but when measured the angles were seen to be those of seligmannite.

The planes of the form $\{110\}$ are largely developed. Those of the forms $\{131\}$, $\{121\}$, and $\{111\}$ are finely striated parallel to their mutual intersections; and those of $\{031\}$ are striated parallel to their intersection with $\{010\}$.

Forty-five forms are present on the crystal, of which twenty-two are new; the latter are distinguished by an asterisk in the following list of forms. Fifty-seven forms have now been observed on this mineral, but only twenty-five of these are met with on bournonite, which Professor Baumhauer has suggested to be isomorphous with seligmannite.

$a = \{100\}$	$*F = \{061\}$	$*V = \{12{\cdot}1{\cdot}2\}$	$s = \{212\}$
$b = \{010\}$	$\Sigma = \{031\}$	$*S = \{713\}$	$*N = \{323\}$
$c = \{001\}$	$n = \{011\}$	$*T = \{613\}$	$D = \{322\}$
	$\kappa = \{013\}$	$*P = \{611\}$	$\phi = \{113\}$
$i = \{130\}$		$*X = \{14{\cdot}3{\cdot}6\}$	$u = \{112\}$
$f = \{120\}$	$*G = \{601\}$	$*U = \{413\}$	$y = \{111\}$
$m = \{110\}$	$*H = \{703\}$	$*O = \{313\}$	$*M = \{233\}$
$*l = \{320\}$	$*I = \{201\}$	$*Y = \{312\}$	$\rho = \{121\}$
$e = \{210\}$	$o = \{101\}$	$C = \{311\}$	$*L = \{131\}$
$\eta = \{310\}$	$*h = \{203\}$	$*Q = \{733\}$	$*Z = \{261\}$
$A = \{410\}$	$x = \{102\}$	$v = \{211\}$	$*K = \{161\}$
$*E = \{610\}$	$\epsilon = \{103\}$	$*R = \{533\}$	

[1] H. Baumhauer, Sitz.-ber. Akad. Wiss. Berlin, 1901, p. 110; 1902, p. 611. R. H. Solly, Min. Mag., 1903, vol. xiii, p. 336; 1905, vol. xiv, p. 82.

The following angles were measured on this crystal:—

	Calculated.	Measured.
Zone [100,010].		
100 : 610	8°45′	9° ′
: 410	13 0	13 5
: 310	17 6½	17 10
: 210	24 47	24 48
: 320	31 37	31 37
: 110	42 43	42 43½
: 120	61 34	61 40
: 130	70 9	70 9½
: 010	90 0	90 0
Zone [100,001].		
100 : 601	9 59½	10
: 703	24 22½	24 30
: 201	27 51½	27 51
: 101	46 35½	46 35
: 203	57 46	57 50
: 102	64 41½	64 45
: 103	72 30	72 31
: 001	90 0	90 0
Zone [010,001].		
010 : 061	10 48	11
: 031	20 53½	20 52
: 011	48 52	48 52
: 013	73 46	73 46
: 001	90 0	90 0
Zone [100,013].		
100 : 713	25 16½	25
: 613	28 51	29
: 413	39 34	39 30
: 313	47 46	47 45
: 113	73 10	73 10
: 013	90 0	90 0

	Calculated.	Measured.
Zone [100,012].		
100 : 12.1.2	10°53′	11° ′
: 14.3.6	26 18½	27
: 312	37 34	38
: 212	49 5	49 2
: 112	66 34	66 35
: 012	90 0	—
Zone [100,011].		
100 : 611	13 10½	13
: 311	25 4½	25 4
: 733	31 2	31
: 211	35 3½	35 3
: 533	40 6	40
: 322	43 6	43 6
: 111	54 32	54 33
: 011	90 0	90 0
Zone [010,101].		
010 : 161	14 43	14
: 131	27 43	28 1
: 121	38 14½	38 14
: 111	57 36½	57 37
: 323	67 4½	67 8
: 212	72 24	72 21
: 313	78 3½	78 4
: 101	90 0	90 0

(233) lies in zones [121,112], [011,111]; (261) in zones [130,131], [010,211]; and (161) in zones [130,031], [010,131].

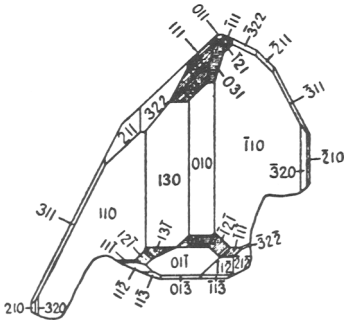

Fig. 2.—Seligmannite.

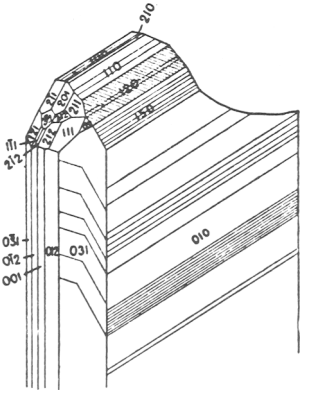

Fig. 3.—Marrite.

Marrite.

During the summer of 1905 I came across only two crystals of this very rare mineral, of which there is still insufficient material for a chemical analysis. The two new crystals differ in habit from those previously described (this vol. p. 76).

Crystal No. 1 (fig. 3) was deposited in a cavity of the white dolomite, and in appearance closely resembles a tabular crystal of dufrenoysite. The faces in the zone [100,010] are deeply striated parallel to their mutual intersections; the face (031) is largely developed and is marked with obliquely placed striations.

Crystal No. 2, with a sharply pointed oblique habit, was deposited in the centre of a large hollow crystal of rathite. On this crystal the forms {170}, {150}, {140}, {031}, and {083} are largely developed.

The following list of thirty-four forms observed on the two crystals includes seven which are new.

$a = \{100\}$	$7r = \{170\}$	$*4k = \{041\}$	$-p = \{111\}$	$+p = \{11\bar{1}\}$
$b = \{010\}$	$5r = \{150\}$	$\frac{7}{2}k = \{072\}$	$-2t = \{212\}$	$+2q = \{12\bar{1}\}$
$c = \{001\}$	$4r = \{140\}$	$3k = \{031\}$	$-2u = \{211\}$	
	$3r = \{130\}$	$*\frac{8}{3}k = \{083\}$	$-2q = \{121\}$	
$-2h = \{201\}$	$2r = \{120\}$	$\frac{7}{3}k = \{073\}$	$*-3q = \{131\}$	
$+2h = \{20\bar{1}\}$	$r = \{110\}$	$2k = \{021\}$	$*-5q = \{151\}$	
$+h = \{10\bar{1}\}$	$\frac{3}{2}s = \{320\}$	$k = \{011\}$	$*-w = \{271\}$	
	$2s = \{210\}$	$\frac{2}{3}k = \{023\}$	$*-v = \{312\}$	
	$*3s = \{310\}$	$\frac{1}{2}k = \{012\}$		

The plane 312 is well developed and lies in the zones [201,111] and [212,100].

In the following list of measured angles it will be noticed that the angles measured in the zone [010,201] differ somewhat from the calculated values. The same difference was observed in a crystal previously measured, and it would seem that the elements have not been quite correctly chosen.

	Calculated.	Measured. I.	II.		Calculated.	Measured. I.	II.
Zone [100,001].				Zone [010,100].			
(100) : (201)	30°58′	30°57′	—	(010) : (170)	13°55½′	—	13°59′
: (001)	88 45	88 46	—	: (150)	19 8½	19° 8′	19 13
(100) : (20$\bar{1}$)	31 38	31 37	—	: (140)	23 27	23 30	23 27
Zone [010,001].				: (130)	30 3	30 3	30 5
(010) : (041)	32 53	22 45	—	: (120)	40 57	41 0	40 53
: (072)	21 5½	31 3	31° 3′	: (110)	60 3	60 5	60 2
: (031)	35 8	35 6	35 8	: (320)	68 59	69 1	—
: (083)	38 22	—	38 21	: (210)	73 55½	73 50	—
: (073)	42 8	—	42 30	: (310)	79 8	79 2	—
: (021)	46 32½	46 22	46 28	: (100)	90 0	90	—
: (011)	64 39	—	64 30	Zone [010,10$\bar{1}$].			
: (023)	72 28½	73	—	(010) : (151)	28 55	28 53	—
: (012)	76 40½	76 48	—	: (131)	42 38½	42 38	—
: (001)	90 0	90	—	: (121)	54 5½	54 6	—
Zone [010,201].				: (111)	70 6	70 7	—
(010) : (271)	31 10½	30 13	—	: (212)	79 44½	79 46	—
: (211)	76 43	76 17	—	Zone [010,10$\bar{1}$].			
: (201)	90 0	90 0	—	(010) : (12$\bar{1}$)	53 30	—	53 25
				: (11$\bar{1}$)	69 42	—	69 45
				: (10$\bar{1}$)	90 0	—	90

PROUSTITE.

This mineral has not hitherto been recorded from the Binnenthal. A single, minute crystal was found attached to a crystal of rathite[1], which was taken in 1905 from the white crystalline dolomite of the Lengenbach quarry. The crystal is a hexagonal prism $a\ \{10\bar{1}\}$ terminated by the rhombohedron $r\ \{100\}$. The prism-angle was measured as 60° 0′, and the angles between the prism and rhombohedral faces as 53° 57′ and 53° 58′ (from the element given by Miers, $ar = 53° 54′$). The crystals of the two minerals are so arranged with respect to each other that the prism-edges are parallel.

TRECHMANNITE.

During the season 1905 very few crystals of the new red minerals described in the last number of this Magazine have been found in the Lengenbach quarry. One crystal, which was at first thought to be hutchinsonite, proved on measurement to be the very rare mineral trechmannite. It was found attached to a crystal of tennantite ('binnite'). The crystal is very irregularly developed; it shows the forms $a\ \{10\bar{1}\}$, $m\ \{2\bar{1}\bar{1}\}$, $r\ \{100\}$, and $x = a\ \{21\bar{2}\}$. The faces of $x = a\ \{21\bar{2}\}$ ar-

[1] The rathite crystal is similar to that represented in fig. 5, Min. Mag., 1901, vol. xiii, Plate III.

large and belong to a trigonal trapezohedron. This trapezohedral-hemihedral type of symmetry of trechmannite (like that of quartz and cinnabar) had already been noticed by Mr. G. F. Herbert Smith on the crystals previously described by me (this vol. p. 75).

Hyalophane and Barytes.

Some of the hyalophane crystals found during 1905 in the Lengenbach quarry are of a pale green colour, and had been mistaken for green tourmaline. Pale green crystals of barytes have also been found. At this locality the crystals of barytes are usually colourless, though sometimes bluish-grey in colour.

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