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Fire og tyvende Hefte.

Med 20 Tavler,
et særskilt heftet, farvetrykt Bilag
og en
Résumé des Communications sur le Grönland.

Kjøbenhavn.
I Commission hos C. A. Reitzel.
Bianco Lunos Bogtrykkeri.
1901.

the crystals are often terminated in a number of points; occasionally these end portions have an asbestos-like appearance. Also here and there on the longitudinal faces of the crystals considerable depressions have been formed by corrosion; these depressions are lined with needles and splinters like those occurring at the ends of the crystals. Between these fibres of aegirine and often oriented parallel to them occur lorenzenite crystals of type II. Elpidite crystals also occur in a like manner, and it is evident that the two minerals have formed simultaneously and during the decomposition process of the aegirine. On the new-formed minerals there occur small curved scales and basin-shaped crystal tables of polylithionite as the latest formation. Also on small fresh aegirine crystals one finds lorenzenite crystals in such a position that the two minerals have their vertical axes parallel, while the first pinacoid of the former mineral coincides with the second pinacoid of the latter.

The later generation of aegirine consists of small green translucent brilliant needles, the terminations of which are also brilliant. Associated with this aegirine occur most of the lorenzenite crystals of type I. The very brilliant needle-shaped crystals of this type generally occur implanted in irregular orientation on feldspar, where that mineral borders on primary aegirine. Small secondary crystals of microcline, albite, and epididymite are the usual companions of this type of lorenzenite. These minerals are generally surrounded by a dark, earthy substance, which is intensely soiling and probably owes its origin to the decomposition of rhodochrosite, of which remains are sometimes visible.

28. Leucosphenite.

The name of this new mineral is derived from the Greek words *λευκός*, white, and *σφήν*, a wedge, and chosen in allusion to the white colour of the mineral and the wedge-like form of the crystals.

The mineral has been found in but small quantity and only in the crystalline state. The crystals seldom attain more than 5^{mm} in length and $1—2^{mm}$ in breadth and thickness; the majority are considerably smaller in size. They belong to the monoclinic system and are fairly regularly developed, so that fairly accurate measurements could be obtained. The crystallographical constants are derived from the following angular values:

$$(130):(1\bar{3}0) = 120°\,15',\ (130):(001) = 88°\,19',\ \text{and}$$
$$(101):(001) = 53°\,21'.$$

The axial ratios calculated from them are

$$a:b:c = 0{,}5813:1:0{,}8501.$$
$$\beta = 93°\,23'.$$

According to these constants the forms present have the following symbols:

$$a = \{100\},\ b = \{010\},\ c = \{001\},\ x = \{011\},\ d = \{101\},$$
$$m = \{110\},\ n = \{130\},\ s = \{112\},\ p = \{\bar{1}11\},$$
$$g = \{133\},\ r = \{263\}.$$

Nearly all the crystals of this mineral that I have observed are very like one another with regard to their habit. Only as regards the presence or absence of certain subordinate forms do they present any variation. The forms that are always present and give the crystals their constant habit, are *c*, *b* and *n*. The crystals are always elongated in the direction of the *a*-axis into rectangular prisms, bounded in the longitudinal zone by the second and third pinacoids. The crystals are always terminated by the form *n*, the faces of which form the wedge-like ends that characterize the leucosphenite crystals (Fig. 4, Plate VII). The faces of the third pinacoid are generally predominant, so that the crystals are more or less tabular parallel to them. However there occur individuals on which the said pinacoids are almost equally developed (Fig. 9, Plate VII) or

which are tabular parallel to the second pinacoid. The combination-edges between the pinacoids in the longitudinal zone are sometimes truncated by the prism of the first order x, whose faces are always narrow (Figs. 5, 9, Plate VII). The prism (pinacoid) of the second order d occurs distinctly developed only on a small number of crystals (Figs. 5, 7, 8, 9, Plate VII). Its faces are almost always smooth and brilliant. Occasionally they are tolerably large. The prism of the third order m occurs, or is at least present as traces on every crystal of leucosphenite; its faces are, however, in most cases very small and indistinct (Figs. 4—6). Often they occur only as step-like formations on the edge between n and d. The prism of the fourth order p is a form of tolerably common occurrence, and its faces are occasionally rather large. In the majority of cases, however, they are small (Fig. 6) and uneven with no high lustre. The two forms g and r occur as extremely narrow truncations on the obtuse combination-edge between n and c (Figs. 6, 7). Often the two forms occur together. The faces are brilliant, but their edges are frequently irregularly rounded off.

The forms a and s have been observed only on a single crystal. This crystal, which measures a little more than 1^{mm} in length and $^1/_3{}^{mm}$ in thickness, is represented by Fig. 9. It was found associated with minerals quite different to those which generally accompany leucosphenite, and it also differs in habit from other crystals of this mineral. Like them it is prismatically elongated in the direction of the a-axis and bounded in the zone of this axis by the second and the third pinacoids, which are almost equally well developed. Their combination-edges are truncated by narrow faces belonging to the form x. The crystal is developed only at one end and is there colourless and perfectly clear. The other end, by which the crystal has been attached, is opaque. As on this crystal the prismatic form n is very subordinate, the wedge-like termination

that otherwise characterizes the mineral is not found on this individual. On the other hand, the form *m* has on this crystal attained a development to which nothing corresponding is found on the common leucosphenite crystals. The faces of the form *p* are large, smooth and of a magnificent lustre. The pinacoid of the second order *d* is represented by a very small, but brilliant and quite determinable face. The face *a* of the first pinacoid is large, smooth and brilliant. The largest of the terminal planes of this crystal, however, are those of the form *s*. They belong to the zones [001, 110] and [011, 101], which is sufficient for a certain determination of the form.

The leucosphenite crystals of the common type are generally developed on both ends. The faces of the third pinacoid are, as a rule, striated longitudinally, which striation is due to the alternation of faces belonging to the forms *c* and *x*. Sometimes the striation disappears, at least in places, and then the face is dull. Some crystals are striated on one side and dull on the other. When dull and striated spots occur on the same faces, they border irregularly on one another. The faces of the second pinacoid are also striated, but on them the striation runs in the vertical direction, consequently across their longitudinal direction. Here it is the form *n* which causes the striation by alternation. In most cases the striation is most marked at the ends of the faces; the middle portions of the faces generally have no striation. These faces are, besides, seldom quite plane, but either show a continuous rounding or an abrupt bending, owing to which their ends make a smaller angle with *n* than the unbroken plane would make. The difference I have found almost unvariably to be about 1° towards each end. Also on the faces of the form *n* occurs a vertical striation, which, however, does not essentially interfere with the measurement of the angles. The crystals are not in general very sharply developed, their edges and corners usually being somewhat rounded off. Only the crystal represented by Fig. 9,

Plate VII, forms an exception from this rule, being perfectly developed in every respect.

In the annexed table are given the measurements obtained for eight crystals, together with the corresponding calculated values.

Table of angles.

	1	2	3	4	5	6	7	8	Calculated
(001) : (010)	89° 47′	90° 28′	90° 16′	89° 50	89° 58′	89° 57′	89° 58′	90° 6′	90°
(011) : (001)	.....	.....	40° 23′	.....	.....	.....	39° 56′	40° 21′	40° 19′
(100) : (001)	.....	.....	.....	.....	.....	.....	.....	86° 38½′	86° 37′
(101) : (001)	53° 44′	.....	.....	53° 22′	*53° 21′	.....	53° 20′	53° 27′	*53° 21′
(130) : (1$\bar{3}$0)	*120° 15′	.....	.....	120° 22′	120° 11′	120° 18′	.....	.....	*120° 15′
(110) : (1$\bar{1}$0)	60° 37′	.....	.....	.....	.....	60° 51′	.....	59° 55′	60° 16′
(110) : (130)	29° 54′	29° 58′	.....	30° 11′	30° 20	29° 51′	29° 57′	.....	29° 23′
(130) : (001)	*88° 19′	88° 14′	88° 16′	88° 25′	88° 21′	88° 15′	88° 18	.....	*88° 19′
(133) : (001)	.....	.....	.....	43° 25′	.....	42° 21′	.....	.....	43° 33′
(263) : (001)	61° 17′	.....	.....	.....	.....	62° 6′	.....	.....	61° 36′
($\bar{1}$11) : (001)	.....	.....	.....	.....	61° 36′	.....	.....	61° 38′	61° 35′
(221) : (001)	.....	.....	.....	.....	38° 47	.....	.....	38° 56′	38° 59′

Twinning is tolerably common in leucosphenite. The law according to which the twins are formed is as follows: the twinning plane is the third pinacoid c {001}; the twinning axis is a normal to this; one of the individuals is revolved 180° about the twinning axis. As the salient and re-entering angles between the faces of the form n on the sub-individuals deviate very little from 180°, these twins are not easily distinguished from simple crystals (Fig. 8, Plate VII). The vertical axes of the two subindividuals make with each other an angle $= 2(\beta - 90°) = 7° 16'$. On one of the twins (cryst. No. 4) the following determinations of angles have been made.

	Measured	Calculated
$d : \underline{d}$ =	73° 20′	73° 22′
$n : \underline{n}$ =	3° 24′	3° 30′

In colour leucosphenite is white inclining to greyish blue. This shade does not, however, occur on crystal No. 8. Pure crystals that have no cracks are often quite clear. Often, however, the leucosphenite crystals are traversed by cracks, or they contain inclusions of extraneous matter; in such cases they are somewhat opaque. The crystalline planes as well as the fracture show a marked vitreous lustre. Certain faces, as those of the forms b and n, often exhibit a pearly lustre.

In accordance with the monoclinic nature of the mineral sections oriented parallel to the first and the third pinacoids show extinction parallel to the second pinacoid. But also a section cut parallel to the last-mentioned pinacoid shows extinction parallel to the direction of the a-axis. At all events the deviation, if such there be, is so small that it has not been possible to ascertain it. On the other hand, one of the extinction-directions makes, of course, with the vertical axis an angle $= \beta - 90° = 3° 21'$ in the plane of symmetry. This direction lies in the obtuse angle β.

The vibration-direction falling in the obtuse angle β is the optic normal, for the optic axial plane lies almost parallel to the third pinacoid. The first mean line (the acute bisectrix) coincides with the crystallographic a-axis; and as this is at the same time the direction of the greatest velocity of light, the mineral is optically negative.

For the determination of the optic constants a natural and a prepared prism were used. The former was bounded by the two faces (130) and ($1\bar{3}0$) and bisected by the plane of the greatest and mean velocity of light. The refracting edge of this prism coincides with the crystallographic c-axis, but not exactly with the direction of the mean velocity of light of the substance. The deviation, which is $3°\,23'$, as above stated, gives rise to an error in the determination. It cannot, however, exercise any influence of importance on the result. The unavoidable errors in using prepared prisms will probably in most cases be no less. In the above-mentioned natural prism the indices of refraction α and β were determined by determining the minimum deviation. The other prism is bounded on one side by the third pinacoid and on the other by a cut and polished face which makes an angle of $31°\,42'$ with the said pinacoid. The refracting edge is parallel to the b-axis. In this prism the index γ, and again α, were determined by light falling perpendicularly to the first-mentioned face. The following values were obtained.

	α	β	γ	$\alpha-\gamma$
Red	1,6401	1,6572	1,6829	0,0428
Yellow . . .	1,6445	1,6609	1,6878	0,0433
Green	1,6475	1,6638	1,6923	0,0448

From these values the following axial angles are calculated

	Red	Yellow	Green
$2Va$ =	$79°\,26'$	$77°\,4'$	$75°\,18'$

The dispersion is thus rather considerable and takes place according to the formula

$$\rho > v.$$

The specific gravity of leucosphenite has been determined by weighing in benzole and found to be 3,05 (Mauzelius). Its hardness is 6,5. The mineral has a distinct cleavage parallel to the second pinacoid b {010}. The mineral is often easily cleaved in this direction; but in sections cut perpendicular to the cleavage, this is seldom quite distinct. A cleavage parallel to the form n could not be detected, though the mineral often shows a pearly lustre on the faces of this form.

As the material available was very scanty, no more than 0,5238 gr. of pure substance could be procured for the analysis. The analysis has been made by R. Mauzelius; and the values obtained are as follows.

		Molecular ratios	
SiO_2	56,94	0,943	10
TiO_2	13,20	0,165	2,06
ZrO_2	3,50	0,025	
BaO	13,75	0,090	0,95
Na_2O	11,14	0,180	1,97
K_2O	0,56	0,006	
H_2O	0,31		
	99,40		

To obtain an acceptable proportion between the acid and the basic constituents, TiO_2 and ZrO_2 must be made basic. The formula then becomes

$$BaO \cdot 2\,Na_2O \cdot 2\,Ti(Zr)O_2 \cdot 10\,SiO_2 \text{ or}$$
$$Ba\,Na_4(TiO)_2(Si_2O_5)_5.$$

Leucosphenite would thus be a dimetasilicate, and the only known substance of analogous composition would be petalite. The leucosphenite crystals do, indeed, remind one in some

measure of the crystallized petalite from Elba. I have not, however, succeeded in finding any analogy between the crystallographical constants of the two minerals. On the other hand there exists a partial agreement between the axial relations of leucosphenite and eudidymite. This appears distinctly if the a-axis of the former mineral be multiplied by three; one then obtains

for leucosphenite: $a:b:c = 1{,}7439 : 1 : 0{,}8501$; $\beta = 93°\,23'$
- eudidymite: $a:b:c = 1{,}71075 : 1 : 1{,}10712$; $\beta = 93°\,45\frac{1}{2}'$.

The angle β of the two minerals agrees very closely, and so is also the case with the a-axes. The angles in the vertical zone are for both very near 60°, *i. e.* they are both in a sense pseudo-hexagonal. With both minerals twinning occurs with the third pinacoid as composition-face. If the chemical formula of eudidymite is written

$$BeSiO_3 \cdot HNaSiO_2O_5,$$

then this mineral may be regarded as partially derived from the same silicic acid,

$$H_2Si_2O_5,$$

which must be assumed to enter into the composition of leucosphenite. The two minerals cannot, it is true, be said to be isomorphous in the proper sense of the word, but it is an indisputable fact that there exists a remarkable analogy between them crystallographically as well as chemically.

Before the blowpipe leucosphenite decrepitates and in the forceps fuses with some difficulty to a dark globule. In the salt of phosphorus bead a skeleton of silica is obtained; on cooling the bead becomes opalescent. The mineral is decomposed by hydrofluoric acid, but not acted upon by other acids.

The common leucosphenite has been met with only at the locality No. 2. On digging in this place a rather considerable

quantity of elpidite needles loosely agglomerated were found at some depth below the surface. They had been protected from the atmosphere and were snow-white and tolerably fresh. The mass was so loose that it could often be broken into pieces with the hands. On pressure it yielded and fell asunder into gravel with a crackling sound. The whole was traversed by larger aegirine crystals, which thus formed a sort of skeleton in the fragile aggregate. In the numerous spaces between the elpidite needles several other minerals occurred in crystals. There were small well-developed crystals of epididymite, albite, polylithionite, leucosphenite, etc. The last mineral was found only in small quantity. Like the other minerals mentioned here, it is of later formation than the elpidite. Elpidite needles sometimes traverse the leucosphenite crystals, which, however, have been formed earlier than the albite. The crystal No. 8, which is of a type differing from the others, was found on a specimen from the locality No. 1.

29. Elpidite.

By the name elpidite G. Lindström[1]) designated a previously unknown mineral which he had observed in the Lütze collection. In his article he chiefly gives an account of the way in which he analyzed the mineral and the result of his analysis. To the latter we shall return later on. Lindström further gives a statement of the physical properties of the mineral as observed by him. He describes it as finely columnar, forming long sheaves. Occasionally the columns are short and confusedly intergrown. Sometimes they are matted together into a half-compact, felt-like, brick-red mass. The mineral occurs on aegirine crystals and sometimes fills up the drusy cavities in which the latter occur. It is, further, accompanied

[1]) Geol. Fören. Förhandl. Vol. 16, 1894, p. 330.