

MEDDELELSER OM GRØNLAND

UDGIVNE AF

KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND

Bd. 181 · Nr. 1

GRØNLANDS GEOLOGISKE UNDERSØGELSE

SORENSENITE,
A NEW SODIUM-BERYLLIUM-TIN-SILICATE
FROM THE ILÍMAUSSAQ INTRUSION,
SOUTH GREENLAND

CONTRIBUTION TO
THE MINERALOGY OF ILÍMAUSSAQ, No. 1

BY

E. I. SEMENOV, V. I. GERASSIMOVSKY, N. V. MAKSIMOVA,
S. ANDERSEN AND O. V. PETERSEN

WITH CHEMICAL ANALYSES

by M. E. Kazakova and M. Mouritzen

WITH 6 FIGURES AND 3 TABLES IN THE TEXT
AND 2 PLATES

С РУССКИМ РЕЗЮМЕ

KØBENHAVN

C. A. REITZELS FORLAG

BIANCO LUNOS BOGTRYKKERI A/S

1965

Abstract

The new mineral sorensenite ($\text{Na}_4\text{SnBe}_2\text{Si}_6\text{O}_{16}(\text{OH})_4$) occurs in groups of prisms attaining diameters of several centimetres. The mineral is transparent or semi-transparent, colourless, brown or pink.

The crystals are monoclinic, $a_0 = 18.58$, $b_0 = 7.45$ and $c_0 = 12.05$, $\beta = 98^\circ 09'$. Space group $C_{2h}^2 - I2/a$, $C_s^4 - Ia$.

There are two distinct cleavages. The specific gravity is 2.9, the hardness 5–5.5.

The mineral sometimes forms flat pseudohexagonal triplets with the normal to $\langle 011 \rangle$ in (100) as twin axes.

The mineral is biaxial negative, $2V_\alpha = \text{small to } 75^\circ$, $n_\alpha = 1.576 - 1.579$, $n_\beta = 1.581 - 1.585$ and $n_\gamma = 1.584 - 1.586$.

The chemical analysis (by M. E. KAZAKOVA): SiO_2 49.73, SnO_2 20.07, Nb_2O_5 0.75, Fe_2O_3 0.04, BeO 8.02, Na_2O 15.95, K_2O 0.34, H_2O 5.24; total 100.14 corresponds to the formula: $\text{Na}_4\text{SnBe}_2\text{Si}_6\text{O}_{16}(\text{OH})_4$.

The mineral occurs in analcime-rich bodies in nepheline-sodalite-syenites of the Илмаусак massif, South Greenland. It is abundant in a few localities.

Sorensenite is named after professor HENNING SØRENSEN, Copenhagen, who directs the investigations in the Илмаусак region.

Реферат

Соренсенит образует призматические и игольчатые выделения размером до нескольких сантиметров. Прозрачный, бесцветный или розоватый. Спайность по (100) и (101). Удельный вес 2,9. Твердость 5,5.

Моноклинный $I2/a$ или Ia , $a_0 = 18,58$; $b_0 = 7,45$; $c_0 = 12,05 \text{ \AA}$ $v_0 = 1651 \text{ \AA}^3$. $\beta = 98^\circ 09'$.

Наиболее сильные линии дебаегранмы: 6,31; 3,41; 3,06; 2,960; 2,918; 2,837; 2,676; 2,122 \AA .

Оптически двуосный отрицательный. $2V$ малый до 75° . $N_g = 1,584 - 1,586$; $N_m = 1,581 - 1,585$; $N_p = 1,576 - 1,579$.

Эндотермические эффекты на кривой нагревания при 580° и 910° .

Химический анализ (М. Е. Казакова): $\text{SnO}_2 - 20,07$; $\text{SiO}_2 - 49,73$; $\text{Nb}_2\text{O}_5 - 0,75$; $\text{Fe}_2\text{O}_3 - 0,04$; $\text{BeO} - 8,02$; $\text{Na}_2\text{O} - 15,95$; $\text{K}_2\text{O} - 0,34$; $\text{H}_2\text{O} - 5,24$; Сумма 100,14.

Формула $\text{Na}_4\text{SnBe}_2\text{Si}_6\text{O}_{16}(\text{OH})_4$. $Z = 4$.

Встречается в пегматитах и гидротермалитах содалитовых нефелиновых сиенитов массива Илмаусак (Южная Гренландия). Ассоциирует с анальцимом, эгирином и др.

Назван в честь датского геолога, профессора Копенгагенского университета Хеннинга Соренсена, руководителя работ в Илмаусак и открывателя там бериллиевой минерализации.

CONTENTS

	Page
Abstract.....	2
Preface.....	5
Introduction.....	7
Mode of occurrence.....	8
Mineralogy.....	11
General description.....	11
Crystallography.....	11
Optical properties.....	15
Differential thermal analysis.....	15
Chemical composition.....	17
References.....	19
Plates.....	20

PREFACE

The mineral described in this paper was found during the field work in the Ilímaussaq Intrusion, South Greenland, in the summers of 1962 and 1964. This work, which is directed by professor HENNING SØRENSEN, is part of the activities of Grønlands geologiske Undersøgelse (the Geological Survey of Greenland) in South Greenland.

The authors wish to express their warmest thanks to "Rask-Ørsted Fondet", the Danish international scientific foundation, for a grant which made it possible for V. I. GERASSIMOVSKY and E. I. SEMENOV to visit the Ilímaussaq intrusion, and to the board of "Grønlands geologiske Undersøgelse" for the opportunity to work in Ilímaussaq and for the facilities placed at our disposal during the field work.

Moscow, March 1965
GEOCHI and IMGRE.

Copenhagen, March 1965.
Universitetets
mineralogisk-geologiske
Institut.

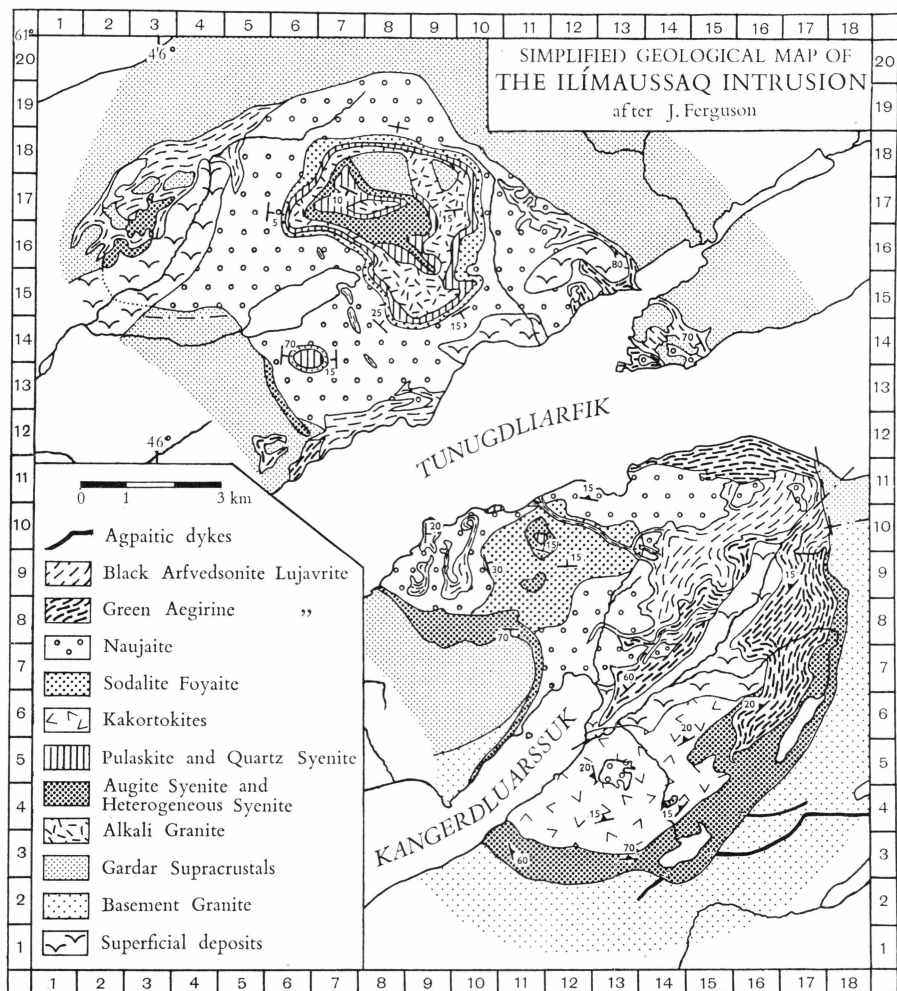


Fig. 1. Simplified geological map of the Ilímaussaq alkaline complex
after JOHN FERGUSON (Medd. om Grønland, 172, 4, 1964).

INTRODUCTION

During field work in the nepheline-sodalite syenites of the Ilimaussaq complex, South Greenland, the authors discovered and studied a new silicate of beryllium, tin and sodium. This mineral is named sorensenite after professor HENNING SØRENSEN, Danish mineralogist and petrographer and leader of the field work in the Ilimaussaq complex. He was the first to discover beryllium mineralisation in the complex.

The new mineral was first observed in 1962 in the Kvanefjeld area in the north-westernmost part of the Ilimaussaq complex (fig. 1, at the co-ordinate 3,17). No closer examination was, however, carried out until E. I. SEMENOV in 1964 found the mineral on the north slope of Nákâlâq (at the co-ordinate 6,18 of fig. 1). The samples collected by SEMENOV were examined immediately after his return to Moscow. When it turned out that they contained a new mineral, the samples from Kvanefjeld kept in Copenhagen were also examined and it was demonstrated that they contain the new mineral discovered by SEMENOV.

The samples from Nákâlâq have been examined at IMGRE, Moscow by E. I. SEMENOV, M. E. KAZAKOVA (chemical analysis) and N. V. MAK-SIMOVA (X-ray investigation). The Kvanefjeld samples have been examined at Mineralogisk-geologisk institut, Copenhagen by ME MOURITZEN (chemical analysis), S. ANDERSEN (description of field occurrence, crystallography) and O. V. PETERSEN (X-ray investigation, crystallography).

The name sorensenite has been approved by the I.M.A. Commission on New Minerals and Mineral Names.

Material is available for exchange at Mineralogisk Museum, Copenhagen.

MODE OF OCCURRENCE

On the north-east slope of Nákâlâq sorensenite occurs in hydrothermal veins in naujaite. The main associates are analcime, microcline, sodalite, neptunite and ægirine.

The Kvanefjeld specimens were found in small bodies of a coarse-grained melanocratic rock which intrude into the naujaite, lujavrite and the contact metamorphosed roof rocks of the Kvanefjeld area. This rock might from its main constituents—microcline, nepheline, analcime and arfvedsonite—be regarded as a coarse-grained variety of lujavrite. It is most likely a late, pegmatoid differentiate of the lujavrite (cf. SØRENSEN and ØSTERGAARD, in preparation).

White patches very rich in analcime are scattered through the coarse-grained rock (fig. 2). They may form vein-like bodies with a maximum length of 1.5 m but more often they are irregular and up to 0.5 m in size. Often several short thin veins are closely spaced and show parallel orientation. The bodies are often zoned with narrow contact zones composed of microcline, arfvedsonite and steenstrupine. The central zones are composed of analcime, sodalite and natrolite with minor amounts of pyrochlore, neptunite, blue apatite, igdloite, monazite, chkalovite and beryllite.

The analcime matrix forms an aggregate of millimetre-sized crystals which often show well-developed crystal faces. There are many cavities. In places the analcime has a dense chalcedony-like appearance.

Neptunite and the closely associated pyrochlore and igdloite occur in fine-grained streaks in the analcime. Neptunite furthermore occurs as small brown crystals in cavities in the analcime rock.

Blue apatite and sphalerite are found in grains up to about a millimetre in size.

In several analcime veins sorensenite is the next most abundant mineral and may make up one fifth of a vein. Sorensenite occurs in well-developed crystals varying in size from 0.05 mm to about 10 cm (plate 1, fig. 2). The smallest grains often occur in clusters enclosed in the analcime matrix. The mineral encloses analcime, neptunite, blue apatite and possibly sphalerite. Neptunite and apatite have the same size and form

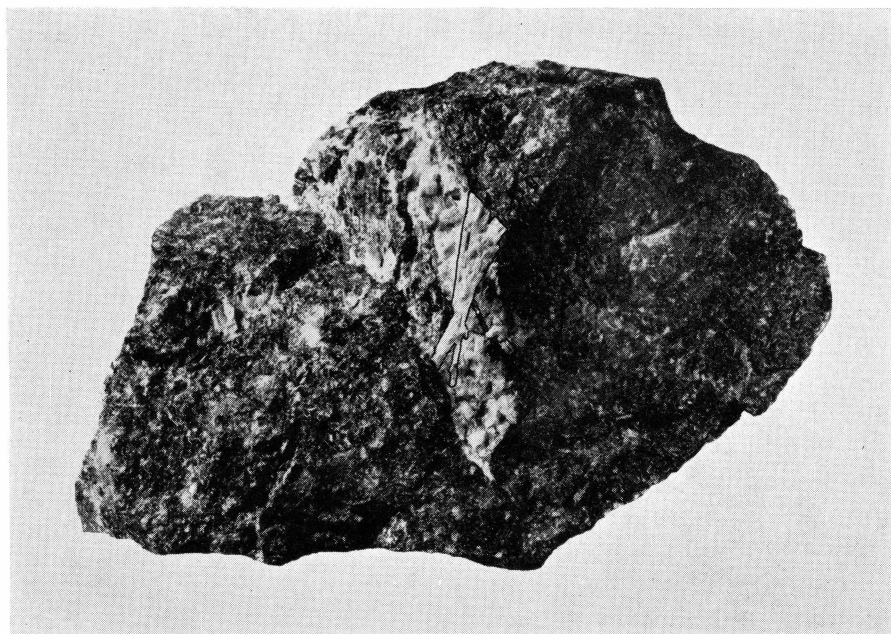


Fig. 2. Analcime vein with laths of sorensenite (outlined by black lines) in coarse-grained nepheline syenite, Kvanefjeld. $\times 1/2$. (CHR. HALKIER phot.)

as in other parts of the vein; analcime, however, when enclosed in sorensenite, is found as well-formed crystals of a much larger size than in the surrounding rock, attaining a diameter of up to 1 cm (plate 1, fig. 1).

Patches of earthy white beryllite are scattered through the vein. The patches are very irregular but often about 1 cm in size. The beryllite may enclose or fill the spaces in between sorensenite crystals and may also be associated with large grains of chkalovite.

In thin section the analcime-rich rocks of Kvanefjeld are seen to be composed mainly of equidimensional grains of analcime. Sodalite is occasionally present in fairly high amounts. Small laths of microcline are scattered in the analcime. In addition there are elongated aggregates and streaks of arfvedsonite, acmite, neptunite, pyrochlore, igdloite and possibly epistolite. The last mineral is found in aggregates of igdloite, neptunite and pyrochlore and may be subject to replacement by these minerals. Along the borders of the streaks, which may be pseudomorphs after epistolite, pyrochlore often occurs.

Sorensenite is colourless in thin section with a moderate relief (plate 2, fig. 1). It is most easily recognized under crossed nicols by means of the extinction pattern and the anomalous interference colours in shades of blue and yellowish brown (plate 2, fig. 2).

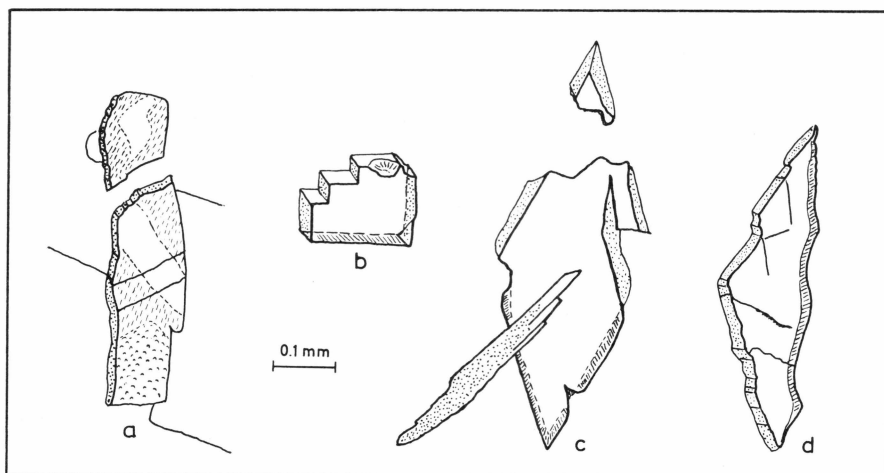


Fig. 3. Drawings of sorensenite crystals as seen in thin section: a) crystal with irregular extinction; b) fragment parted from a bigger crystal; c) crystal corroded by analcime, the needle of acmite is most altered outside the sorensenite; d) rhombic cross section showing corrugations.

Examples of the development of sorensenite grains are shown in fig. 3. The commonest prismatic grains show parallel extinction and negative or positive elongation. Sections perpendicular to the elongation show oblique extinction. The cleavage is distinct. In addition to the faces having the b-axis as zone axis small pyramidal faces oblique to the extension may be observed. Pigmentation is common.

In hand specimens crystals of analcime appear to be enclosed in sorensenite; however in thin section analcime appears to corrode the sorensenite (plate 2, fig. 3). The latter occurs in bent prisms which may be divided into cleavage fragments enclosed in analcime.

In a few specimens sorensenite is seen to be associated with large grains of chkalovite, and large grains of an unidentified mineral which is colourless in thin section with refractive indices around 1.54 and birefringence about 0.010. There is a kind of penetration twinning recalling that of the agpaitic type of microcline. $(-)$ 2V is about $35-50^\circ$.

Sorensenite, chkalovite and the unknown mineral are partially replaced by a white powdery mineral which is seen in thin section to occur in irregular veins and patches consisting of small spherulite-like aggregates of tiny needles. The refractive indices are lower than that of balsam. The X-ray powder diagram of the mineral is identical with that of beryllite from the Lovozero alkaline massif.

MINERALOGY

General description: Sorensenite occurs in elongated tabular or acicular crystals up to $10 \times 1 \times 1$ cm in size. The single crystals are straight or bent; groups composed of several needles can cross each other in an irregular way. Sheaf-like or radiating growth has been observed but is rather rare. In a few cases the crystals are intergrown in a regular way: small lath-shaped crystals cross one another at angles of 60° and 120° forming flat aggregates with pseudo-hexagonal outlines.

The single crystals have a rhombic cross section and the crystal faces often display a characteristic corrugated surface. There is a distinct cleavage in two directions at $63^\circ \pm 2^\circ$.

The mineral is transparent or semitransparent, colourless to pinkish or (when altered) milky white. It shows a fine, silky lustre with opalescence for the less coloured varieties. Some varieties have a greasy lustre. The mineral alters easily when exposed, becoming non-transparent white.

Sorensenite is brittle. The micro-hardness (measured by S. I. LEBEDEVA with the instrument PMT-3) varies between 572 and 658 kg/mm², the average being 616 kg/mm², which corresponds to a hardness of 5–5.5 on the Mohs hardness scale. The specific gravity is 2.9.

Crystallography: The results of the X-ray examination are presented in table 1.

The crystals are monoclinic (class Laue 2/m).

The parameters of the lattice are: $a_0 = 18.58 \pm 0.07$, $b_0 = 7.45 \pm 0.03$, and $c_0 = 12.05 \pm 0.05$; $\beta = 98^\circ 09'$; $a_0:b_0:c_0 = 2.49:1:1.62$; $V_0 = 1651 \text{ \AA}^3$, density calculated 2.90 g/cm³.

A pseudoaxis $a_0/2 = 9.3 \text{ \AA}$ was distinguished. The analysis of the systematic extinctions on the layer lines $h0l$, $h1l$ and $h2l$ have resulted in the space group C_{2h}^6 (I 2/a), C_s^4 (Ia). The parameters of the lattice are in the C-aspect: $a_0 = 20.78 \pm 0.08$, $b_0 = 7.45 \pm 0.03$, $c_0 = 12.05 \pm 0.05$; $\beta = 117^\circ 06'$; the space group C_{2h}^6 (C 2/c), C_s^4 (Cc). The X-ray powder diagram of the mineral is different from that of any known mineral.

A single crystal found in a loose mass of beryllite allowed goniometric measurements of faces parallel to $[010]$. The crystal was lath-shaped,

Table 1. *X-Ray Powder Data for Sorensenite.*

Sample from Nákâlâq Radiation Cr _{Kα} , V filter Camera 2 R = 114 mm. Internal standard: NaCl.			Sample from Kvanefjeld Radiation Fe _{Kα} , Mn filter Camera 2 R = 90 mm.		
No.	Int	d _{hkl}	No.	Int (est)	d _{hkl}
1	6	6.31	1	8	6.25
2	2.5	5.34	2	4	5.28
3	3.5	5.06	3	4	4.91
4	3.5	3.90	4	5	3.83
5	1	3.59	5	2	3.56
6	8.5	3.41	6	9	3.36
7	2	3.14	—	—	—
8	7.5	3.06	7	5	3.01
9	8.5	2.960	8	10	2.92
10	10	2.918	9	10	2.87
11	2.5	2.888	—	—	—
12	5	2.837	10	4	2.79
13	2	2.693	—	—	—
14	5	2.676	11	5	2.64
15	2.5	2.638	12	2	2.60
16	1	2.353	—	—	—
17	1	2.324	—	—	—
18	1	2.296	—	—	—
19	2	2.268	13	4	2.24
20	2	2.209	14	2	2.19
21	2	2.148	15	3	2.12
22	4.5	2.122	16	4	2.10
—	—	—	17	1	2.01
23	1	2.017	18	1	1.99
24	2	1.950	19	3	1.93
25	2	1.923	20	2	1.90
26	2.5	1.856	21	2	1.84
27	1	1.823	22	1	1.81
28	2.5	1.793	23	2	1.77
29	2.5	1.778	24	1	1.76
30	4.5	1.760	25	4	1.74
31	1	1.749	—	—	—
32	3	1.726	—	—	—
33	2	1.715	26	5 B	1.70
34	2	1.690	27	1	1.68
35	2	1.666	28	1.5	1.66
36	2	1.656	—	—	—
37	2	1.644	29	1.5	1.63
38	1	1.629	—	—	—
39	1	1.612	—	—	—
40	1	1.589	30	2	1.58

(continued)

Table 1 (cont.).

Sample from Nákâlâq Radiation $\text{Cr}_{K\alpha}$, V filter Camera $2R = 114$ mm. Internal standard: NaCl.			Sample from Kvanefjeld Radiation $\text{Fe}_{K\alpha}$, Mn filter Camera $2R = 90$ mm		
No.	Int	d_{hkl}	No.	Int (est)	d_{hkl}
41	2	1.573	31	1	1.56
42	2	1.550	32	1.5	1.54
43	1	1.535	—	—	—
44	1	1.523	33	1.5	1.51
45	1	1.493	34	1	1.48
46	2	1.480	35	3	1.47
47	1	1.457	36	1	1.45
48	2.5	1.445	—	—	—
49	3	1.437	37	4	1.43(0)
50	3.5	1.417	—	—	—
51	2	1.408	—	—	—
52	2	1.385	—	—	—
53	2	1.371	—	—	—
54	3	1.362	—	—	—
55	2	1.349	—	—	—
56	1	1.342	—	—	—
57	2.5	1.334	—	—	—
58	2	1.323	—	—	—
59	3	1.319	—	—	—
60	3.5	1.311	—	—	—
61	2	1.301	—	—	—
62	2	1.290	—	—	—
63	2	1.279	—	—	—
64	1	1.266	—	—	—
65	1	1.256	—	—	—
66	1	1.250	—	—	—
67	2	1.243	—	—	—
68	2	1.238	—	—	—
69	2	1.219	—	—	—
70	1	1.211	—	—	—
71	1	1.203	—	—	—
72	2	1.197	—	—	—
73	1	1.177	—	—	—
74	1	1.167	—	—	—
75	1	1.164	—	—	—
76	1	1.156	—	—	—

elongated parallel to the b-axis, with dimensions about $10 \times 1.3 \times 0.6$ mm. It was perfectly fresh and colourless but because of the corrugations most of the reflections were dull.

Table 2. *Goniometric Measurement of a Sorensenite Crystal.*

	Measured angle	Calculated angle
(100):(101).....	117.85 (± 0.18)	117.19
(101):(201).....	22.12 (± 0.28)	22.24
(100):(201).....	40.03 (± 0.10)	40.57

By means of the unit cell parameters the forms developed were determined as $\{100\}$, $\{101\}$ and $\{201\}$, where $\{201\}$ dominates (see table 2).

When examined by means of the universal stage the mineral is seen to be elongated in the direction of the b-axis. The angle between the two directions of perfect cleavage was determined to be $63^\circ \pm 2^\circ$. The best cleavage is $\{101\}$; the second one $\{100\}$. $\alpha:c = 35^\circ \pm 1^\circ$.

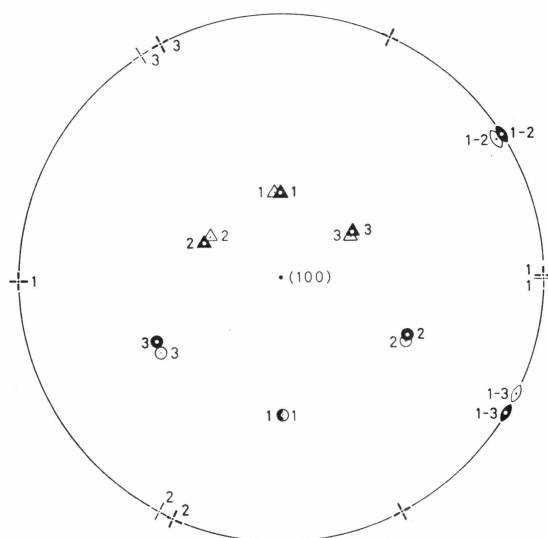


Fig. 4. Stereographic projection of soresenite triplet. Black symbols refer to a constructed triplet based on the crystallographical data. Open symbols refer to measurements of a soresenite triplet.

The pseudo-hexagonal flat aggregates of the mineral were examined on the universal stage by O. V. PETERSEN. They could be demonstrated to be pseudo-hexagonal triplets with the normal to $\langle 011 \rangle$ in (100) as twin axes (plate 2, fig. 4).

On examining the stereographic projection it is seen that one crystallographical direction is common to the individuals of one triplet; that is, one point on the projection represents the same direction in all individuals of a triplet. The point is situated at the intersection of the axial

planes of the individuals and makes an angle of 55° with the optical α directions. Thus it represents the normal to (100) of the individuals. According to the ratio $b_0/c_0 = 7.45/12.05$ which is close to $2/3$ the normal to (100) may be considered as a pseudo-hexagonal axis. The twin axis, which is situated in the b - c plane at an angle of about 31° with [010], corresponds to the normal to $\langle 011 \rangle$.

The stereographic projection of the measured triplet was compared with a projection of a pseudo-hexagonal triplet constructed such that monoclinic individuals having α : normal to (100) = 55° and b : normal to $\langle 011 \rangle$ in (100) = $31^\circ 44'$ formed a triplet with the normal to $\langle 011 \rangle$ as the twin axis. The coincidence between the measured and constructed projections was found to be satisfactory.

Optical properties: The mineral is biaxial negative with the axial angle varying from small to 75° . The axial plane is parallel to (010). The principal indices of refraction were determined on specimens from Kvanefjeld by means of the universal stage, using the λ -T variation method with optical glass as internal standard (MICHEELSEN, 1953). The principal indices of refraction for $\lambda = 5893 \text{ \AA}$ are:

$$\begin{aligned}n_\alpha &= 1.576 \pm 0.001 \\n_\beta &= 1.581 \pm 0.001 \\n_\gamma &= 1.584 \pm 0.001 \\n_\gamma - n_\alpha &= 0.008 \pm 0.002 \\2V_\alpha \text{ calculated} &= 76^\circ \pm 5^\circ.\end{aligned}$$

The refractive indices of the specimens from Nákâlâq are:

$$\begin{aligned}n_\alpha &= 1.579 \pm 0.001 \\n_\beta &= 1.585 \pm 0.001 \\n_\gamma &= 1.586 \pm 0.001 \\2V_\alpha \text{ calculated} &= 43^\circ.\end{aligned}$$

Sorensenite shows a strong inclined dispersion, the interference colours being grey to anomalous yellowish-brown and blue.

Differential thermal analysis: The DTA curve of the mineral (fig.5) has an endothermal reaction in the interval 500 – 600°C . This reaction is accompanied by a loss of weight of 4.3% which approximates the weight of water according to the chemical analysis. The high temperature of the water release (600°C) and distinct maximums at 3350 and 1440 cm^{-1} on

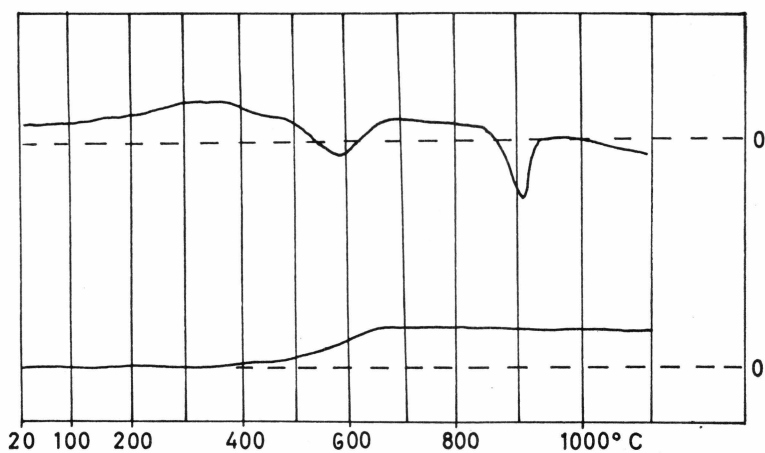


Fig. 5. Differential thermal analysis of sorensonite (upper curve) and thermogravimetric analysis (lower curve).

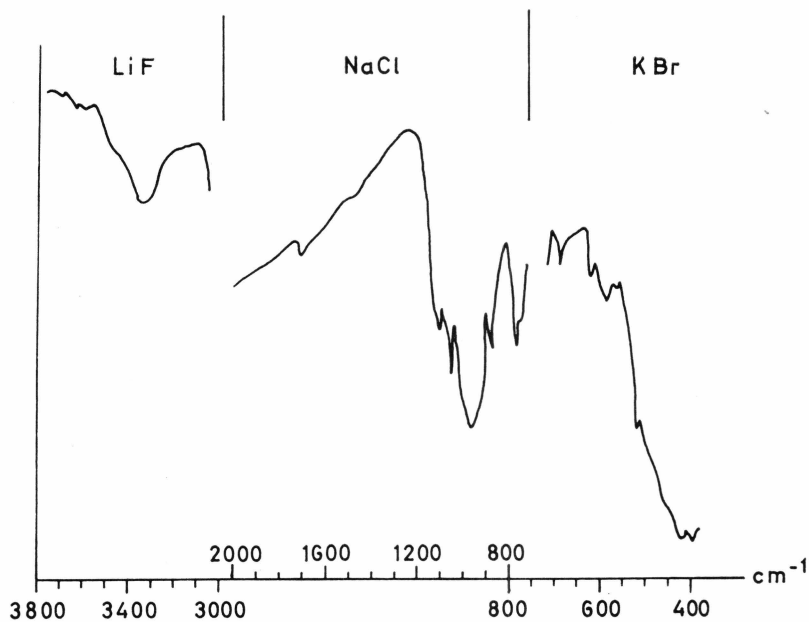


Fig. 6. Infra-red curve of absorption.

the infra-red curve of absorption of sorensonite (fig. 6) is evidence of the presence of hydroxyl in the mineral.

The endothermal reaction at 920°C corresponds to the melting of sorensonite.

CHEMICAL COMPOSITION

The chemical analyses of the mineral are presented in table 3. Traces of Ti, Mn, Mg, Ca and Al were determined in addition to Zr, La, Pb and Cu by spectrophotical methods (N. V. LIZUNOV). The formula obtained is $\text{Na}_4\text{SnBe}_2\text{Si}_6\text{O}_{16}(\text{OH})_4$. The corresponding molecular weight of 721 and the specific gravity of 2.9 indicates that there are four formula units in each unit cell, that is $Z = 4$.

Table 3. *Chemical Analyses of Sorensenite.*

	Nákâlâq		Kvanefjeld
	Weight percent	Relative number of atoms	Weight percent
SnO_2	20.07	0.133	18.40
SiO_2	49.73	0.828	50.41
Nb_2O_5	0.75	0.006	1.36
Fe_2O_3	0.04	—	tr.
BeO	8.02	0.321	7.43
Na_2O	15.95	0.515	17.21
K_2O	0.34	0.007	0.08
H_2O	5.24	0.582	5.01
Total	100.14	—	99.90
Analyst M. E. KAZAKOVA			Analyst M. MOURITZEN

As it is seen in tables 1 and 3 and on p. 15 there are small differences in the chemical compositions, the X-ray data and the optical data between sorensenite from Nákâlâq and Kvanefjeld.

As long as no detailed structural analysis of the mineral has been carried out the relations of sorensenite to other minerals cannot be determined. However, there is a certain similarity to the trigonal minerals leifite and karpinskyite. The substitution of Be for Al and Si is more

advanced in sorensenite than in these two minerals and the mineral is monoclinic, pseudo-hexagonal. A structural analysis of sorensenite is being prepared.

In addition to sorensenite other beryllium minerals from Ilímaussaq are: chkalovite, tugtupite (beryllosodalite), leucophane, epididymite and eudidymite (BØGGILD, 1953, p. 310, SØRENSEN, 1960 and 1962, HAMILTON, 1964 and SEMENOV and SØRENSEN, in preparation).

Only one tin mineral has previously been observed in the complex, namely stannite (OEN and SØRENSEN, 1964).

REFERENCES

- BØGGILD, O. B., 1953: The mineralogy of Greenland. *Medd. om Grønland*, 149, 3, (1-442).
- HAMILTON, E. I., 1964: The geochemistry of the northern part of the Ilímaussaq Intrusion, S.W. Greenland. *Medd. om Grønland*, 162, 10, (1-104).
- MICHEElsen, H., 1957: An immersion method for exact determinations of refractive indices. The glass method. *Medd. Dansk Geol. Foren.*, Bd. 13, (177-191).
- OEN, I. S. and H. SØRENSEN, 1964: The occurrence of nickel-arsenides and nickel-antimonide at Igdlúnguaq, in the Ilímaussaq alkaline massif, South Greenland. *Medd. om Grønland*, 172, 1, (1-50).
- SEMENTOV, E. I. and H. SØRENSEN (in preparation): Eudidymite and epididymite from the Ilímaussaq alkaline complex, South Greenland. *Medd. om Grønland*, 181.
- SØRENSEN, H., 1960: Beryllium minerals in a pegmatite in the nepheline syenites of Ilímaussaq, South West Greenland. *Rep. XXI Int. Geol. Congr. 1960, Part XVII*, (31-35).
- 1962: On the occurrence of steenstrupine in the Ilímaussaq massif, Southwest Greenland. *Medd. om Grønland*, 167, 1, (1-251).
- SØRENSEN, H. and T. V. ØSTERGAARD (in preparation): A late intrusive phase at Kvanefjeld in the Ilímaussaq Intrusion, South Greenland.

Plate 1

- Fig. 1. Group of sorensenite laths intergrown with crystals of analcime. $\times 2$.
(CHR. HALKIER phot.).
- Fig. 2. Group of sorensenite crystals in coarse-grained analcime rock. $\times 2$.
(CHR. HALKIER phot.).

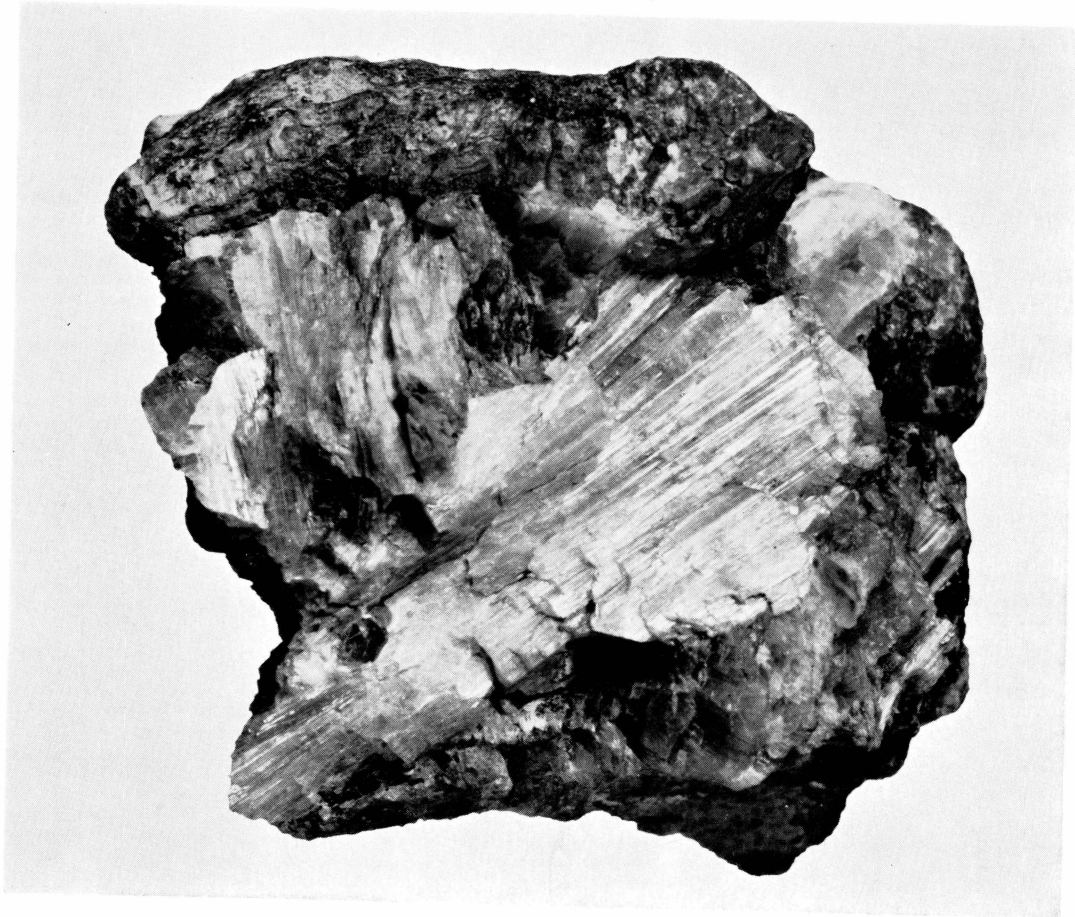


Fig. 2

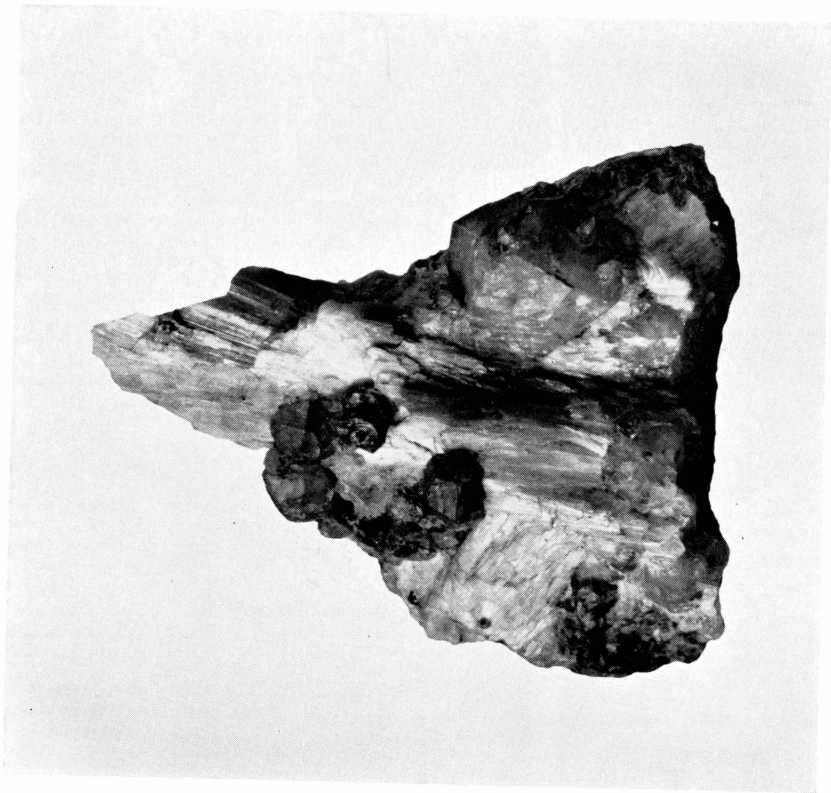


Fig. 1

Plate 2

- Fig. 1. Small laths of sorensenite enclosed in analcime with distinct cubic cleavage. 1 nicol, $\times 35$.
- Fig. 2. Crystal of sorensenite with irregular extinction pattern. + nicols, $\times 25$.
- Fig. 3. Big crystal of sorensenite in the lower righthand part of the photo. Small crystals of analcime and black needles of arfvedsonite. 1 nicol, $\times 35$.
- Fig. 4. Pseudo-hexagonal penetration triplet. + nicols, $\times 35$.

Microphotographs by S. ANDERSEN and O. V. PETERSEN.

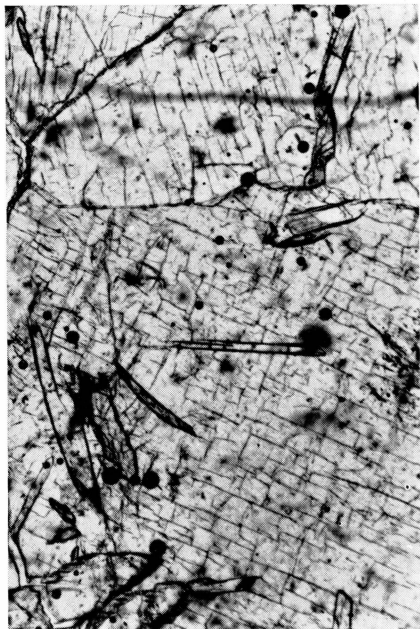


Fig. 1

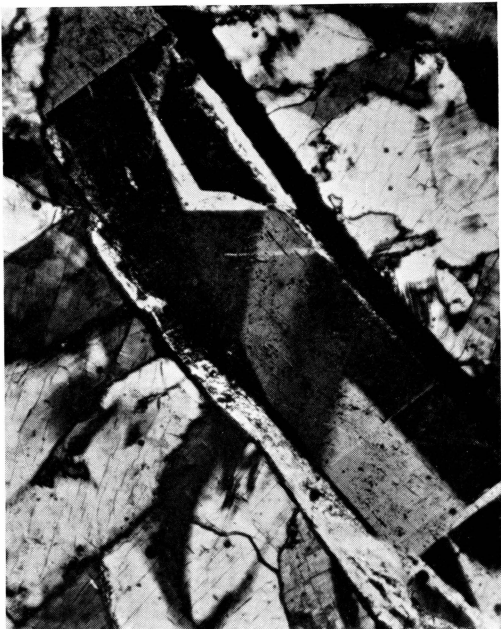


Fig. 2

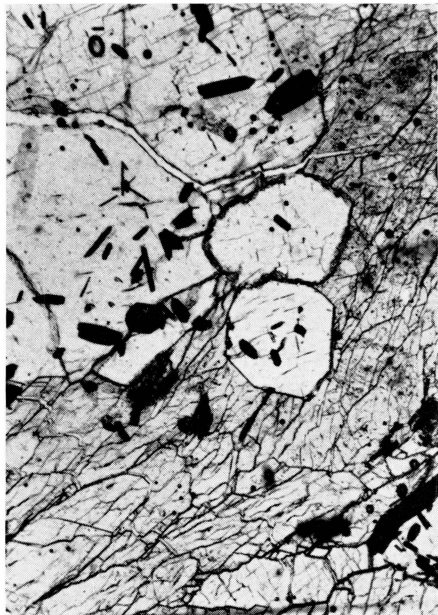


Fig. 3



Fig. 4