

# List of all minerals identified in the Ilímaussaq alkaline complex, South Greenland

Ole V. Petersen

About 220 minerals have been described from the Ilímaussaq alkaline complex. A list of all minerals, for which proper documentation exists, is presented with formulae and references to original publications. The Ilímaussaq alkaline complex is the type locality for 27 minerals including important rock-forming minerals such as aenigmatite, arfvedsonite, eudialyte, poly-lithionite, rinkite and sodalite. Nine minerals, chalcocathallite, karupmøllerite-Ca, kvanefjeldite, nabesite, nacareniobsite-(Ce), naujakasite, rohaite, semenovite and sorensenite appear to be unique to the Ilímaussaq complex.

*Geological Museum, University of Copenhagen, Øster Voldgade 5–7, DK-1350 Copenhagen K, Denmark. E-mail: ovp@savik.geomus.ku.dk*

Keywords: agpaitite, Ilímaussaq, mineral inventory, minerals type locality

The agpaitic complexes Ilímaussaq (South Greenland), Khibina and Lovozero (Kola Peninsula, Russia), and Mont Saint-Hilaire (Quebec, Canada) are among the areas in the world which are richest in rare minerals. About 700 minerals have been found in these complexes which hold the type localities for about 200 minerals.

About 220 minerals have been found in the Ilímaussaq complex of which 27 have their type localities within the complex. In comparison Khibina and Lovozero hold the type localities for 127 minerals (Pekov 1998) and Mont Saint-Hilaire holds the type localities for 38 minerals (R.A. Gault, personal communication 1999).

The existence of a locality in South Greenland rich in rare minerals has been known since the beginning of the 19th century when K.L. Giesecke in 1806 and 1809 visited the Kangerluarsuk and Tunulliarfik fjords in the area now known as the Ilímaussaq alkaline complex (Giesecke 1910). Minerals collected by him were examined by European mineralogists resulting in the discovery of the then new minerals sodalite (1810), eudialyte (1819) and arfvedsonite (1823). Since then the complex has been visited by many mineralogists and mineral collectors. This has resulted in the discovery of additional new minerals and a number of minerals known from very few other localities in the

world. Most of the minerals for which Ilímaussaq is the type locality have later been found in other complexes of agpaitic rocks.

Two minerals were described simultaneously from Ilímaussaq and the Kola Peninsula, tugtupite and vitusite. Tugtupite was published from the Lovozero complex by Semenov & Bykova (1960) under the name beryllsodalite and from Ilímaussaq by Sørensen (1960) under the preliminary name beryllium sodalite which was changed to tugtupite in later publications (Sørensen 1962, 1963). Vitusite from the Ilímaussaq and Lovozero complexes was described in a joint Danish-Russian publication (Rønsbo *et al.* 1979). A tetragonal form of natrolite was described from Ilímaussaq (Andersen *et al.* 1969) and later found at Mont Saint-Hilaire and given the name tetranatrolite (Chen & Chao 1980). This name has since been discredited by I.M.A. The approved name is gonnardite (Grice 2001).

Nine minerals to our knowledge have not been identified at other localities: chalcocathallite, karupmøllerite-Ca, kvanefjeldite, nabesite, nacareniobsite-(Ce), naujakasite, rohaite, semenovite and sorensenite. There is, however, a specimen in the collections of the Geological Museum, University of Copenhagen, labelled chalcocathallite from Kazakhstan but the provenance of this specimen is dubious.

Bøggild (1905, 1953) described all the then known

Table 1. The major rock types of the Ilimaussaq alkaline complex

Rock type	Texture	Essential minerals*	Minor minerals
Augite syenite	hypidiomorphic to xenomorphic granular, massive or layered, medium to coarse	alkali feldspar, hedenbergite, titanomagnetite, ferropargasite, olivine, biotite	ternary feldspar, apatite, pyrrhotite, nepheline
Pulaskite and foyaite	massive, medium to coarse, platy feldspars	alkali feldspar, nepheline, hedenbergite, fayalite, aegirine-augite to aegirine, katophorite	titanomagnetite, apatite, aenigmatite, biotite, fluorite, eudialyte
Sodalite foyaite	foyaitic, coarse	alkali feldspar, nepheline, sodalite, aegirine-augite to aegirine, katophorite, arfvedsonite	fayalite, hedenbergite, apatite, aenigmatite, titanomagnetite, eudialyte, rinkite, fluorite, biotite
Naujaite	poikilitic, coarse to pegmatitic	sodalite, alkali feldspar, nepheline, aegirine, arfvedsonite, eudialyte	aenigmatite, hedenbergite, aegirine-augite, fayalite, apatite, katophorite, rinkite, polyolithionite, biotite, sphalerite, pectolite, villiaumite, fluorite, titanomagnetite
Kakortokite	laminated, layered, medium to coarse	alkali feldspar, nepheline, aegirine, arfvedsonite, eudialyte	sodalite, aenigmatite, magnetite, rinkite, fluorite, löllingite, sphalerite, galena
Lujavrite <sup>†</sup>	laminated, fine-grained; sometimes layered or massive, medium to coarse	microcline, albite, nepheline, sodalite, analcime, naujakasite, aegirine, arfvedsonite, eudialyte,	monazite, britholite, villiaumite, sphalerite, pectolite, steenstrupine, lovozerite, vitusite, polyolithionite, ussingite, lueshite, neptunite
Alkali granite, quartz syenite	hypidiomorphic granular, medium to coarse	alkali feldspar, quartz, aegirine, arfvedsonite	aenigmatite, elpidite, zircon, ilmenite, pyrochlore, neptunite, fluorite, sphalerite

\* Analcime and natrolite are secondary minerals in most rocks.

† There are several types of lujavrites. Three major groups may be distinguished: *aegirine or green lujavrite* with aegirine being the dominant mafic mineral; *arfvedsonite or black lujavrite*, fine grained, often laminated with arfvedsonite as the dominant mafic mineral; *medium- to coarse-grained lujavrite (M-C lujavrite)* with arfvedsonite as the dominant mafic mineral and generally showing foyaitic textures. *Naujakasite lujavrite* is a variety of arfvedsonite lujavrite containing naujakasite instead of nepheline and with steenstrupine instead of eudialyte.

Table 1 (continued)

Mineral	Formula	Reference
Cuprite	Cu <sub>2</sub> O	López-Soler <i>et al.</i> (1975)
<b>Cuprostibite</b>	Cu <sub>2</sub> (Sb,Tl)	Sørensen <i>et al.</i> (1969)
Dahlite, <i>see</i> carbonate-hydroxylapatite		
Diaspore	AlO(OH)	Ussing (1894)
Digenite	Cu <sub>1,8</sub> S	López-Soler <i>et al.</i> (1975)
Djerfisherite	K <sub>6</sub> (Na,Li)(Fe,Cu,Ni) <sub>24</sub> S <sub>26</sub> Cl	Karup-Møller (1978b)
Djurleite *	Cu <sub>1,96</sub> S	Karup-Møller <i>et al.</i> (1978)
Dorfmanite	Na <sub>2</sub> (PO <sub>3</sub> OH)·2H <sub>2</sub> O	Petersen <i>et al.</i> (1993)
Dyscrasite	Ag <sub>3</sub> Sb	López-Soler <i>et al.</i> (1975)
Elpidite	Na <sub>2</sub> ZrSi <sub>6</sub> O <sub>15</sub> ·3H <sub>2</sub> O	Ussing (1912)
Ephesite	NaLiAl <sub>2</sub> (Si <sub>2</sub> Al <sub>2</sub> )O <sub>10</sub> (OH) <sub>2</sub>	Semenov (2001)
Epididymite	NaBeSi <sub>3</sub> O <sub>7</sub> (OH)	Hamilton (1964)
Epidote	Ca <sub>2</sub> FeAl <sub>2</sub> (Si <sub>2</sub> O <sub>7</sub> )(SiO <sub>4</sub> )(O,OH) <sub>2</sub>	Flink (1898)
<b>Epistolite</b>	Na <sub>5</sub> TiNb <sub>2</sub> (Si <sub>2</sub> O <sub>7</sub> ) <sub>2</sub> (O,F) <sub>4</sub> ·5H <sub>2</sub> O	Bøggild (1899)
Erikite ‡		Bøggild (1903), Pekov <i>et al.</i> (1997a)
<b>Eudialyte</b>	Na <sub>15</sub> Ca <sub>6</sub> Fe <sub>3</sub> Zr <sub>3</sub> Si(Si <sub>25</sub> O <sub>73</sub> )(O,OH,H <sub>2</sub> O) <sub>3</sub> (Cl,OH) <sub>2</sub>	Stromeyer (1819)
Eudidymite	Na <sub>2</sub> Be <sub>2</sub> Si <sub>6</sub> O <sub>15</sub> ·H <sub>2</sub> O	Semenov & Sørensen (1966)
Evenkite * †	C <sub>24</sub> H <sub>5</sub>	
Famatinite	Cu <sub>3</sub> SbS <sub>4</sub>	Karup-Møller (1974)
Fayalite	Fe <sub>2</sub> SiO <sub>4</sub>	Ussing (1912)
Ferrosalite	Ca <sub>3</sub> Fe <sub>2</sub> Mg(Si <sub>2</sub> O <sub>6</sub> ) <sub>3</sub>	Larsen (1976)
Ferropargasite	NaCa <sub>2</sub> (Fe,Mg,Al) <sub>5</sub> (Si <sub>6</sub> Al <sub>2</sub> )O <sub>22</sub> (OH) <sub>2</sub>	Larsen (1976)
Fersmite	(Ca,Ce,Na)(Nb,Ta,Ti) <sub>2</sub> (O,OH,F) <sub>6</sub>	Petersen <i>et al.</i> (1998)
Fluorite	CaF <sub>2</sub>	1809 (Giesecke)‡‡
Galena	PbS	1809 (Giesecke)‡‡
Garnet (group)		Flink (1898)
Gelbertrandite * ‡		Semenov (1969)
Genthelvitite	Be <sub>3</sub> Zn <sub>4</sub> (SiO <sub>4</sub> ) <sub>3</sub> S	Bollingberg & Petersen (1967)
Gerasimovskite	(Mn,Ca)(Nb,Ti) <sub>5</sub> O <sub>12</sub> ·9H <sub>2</sub> O(?)	Semenov <i>et al.</i> (1967a)
Gmelinitite	Na <sub>4</sub> (Al <sub>4</sub> Si <sub>8</sub> )O <sub>24</sub> ·11H <sub>2</sub> O	Karup-Møller (1976)
Goethite (limonite)	FeO(OH)	1806 (Giesecke)‡‡
Gold	Au	Davison (1989), Bohse & Frederiksen (2001)
Gonnardite ( <i>formerly</i> tetranatrolite)	(Na,K) <sub>2</sub> (Si,Al) <sub>5</sub> O <sub>10</sub> ·2H <sub>2</sub> O	Grice (2001)
Gudmundite	FeSbS	Oen & Sørensen (1964)
Halite	NaCl	Sobolev <i>et al.</i> (1970)
Halloysite	Al <sub>2</sub> Si <sub>2</sub> O <sub>5</sub> (OH) <sub>4</sub>	Semenov (1969)
Hastingsite	NaCa <sub>2</sub> (Fe,Mg) <sub>5</sub> (Si <sub>6</sub> Al <sub>2</sub> )O <sub>22</sub> (OH,Cl) <sub>2</sub>	Larsen (1976)
Hedenbergite	Ca(Fe,Mg)Si <sub>2</sub> O <sub>6</sub>	Semenov (1969)
Helvite	Be <sub>3</sub> Mn <sub>4</sub> (SiO <sub>4</sub> ) <sub>3</sub> S	Johnsen & Bohse (1981)
Hematite	Fe <sub>2</sub> O <sub>3</sub>	Ussing (1894)
Hemimorphite	Zn <sub>4</sub> Si <sub>2</sub> O <sub>7</sub> (OH) <sub>2</sub> ·H <sub>2</sub> O	Sørensen (1962)
Herschelite	(Na,Ca,K)(AlSi <sub>2</sub> )O <sub>6</sub> ·3H <sub>2</sub> O	Karup-Møller (1976)
Hisingerite	Fe <sub>2</sub> Si <sub>2</sub> O <sub>5</sub> (OH) <sub>4</sub> ·2H <sub>2</sub> O	Semenov (1969)
Hiortdahlite	Na <sub>4</sub> Ca <sub>2</sub> Zr <sub>2</sub> (Nb,Mn,Ti,Fe,Mg,Al) <sub>2</sub> (Si <sub>2</sub> O <sub>7</sub> ) <sub>4</sub> O <sub>3</sub> F <sub>5</sub>	Larsen & Steenfelt (1974), Robles <i>et al.</i> (2001)
Hydrargillite (gibbsite)	Al(OH) <sub>3</sub>	Semenov (1969)
Hydrocerussite	Pb <sub>3</sub> (CO <sub>3</sub> ) <sub>2</sub> (OH) <sub>2</sub>	Karup-Møller (1975)
Hydronephelite ‡		Ussing (1894)
<b>Ilmaussite</b>	Na <sub>4</sub> Ba <sub>2</sub> CeFeNb <sub>2</sub> Si <sub>8</sub> O <sub>28</sub> ·5H <sub>2</sub> O	Semenov <i>et al.</i> (1968)
Ilmenite	FeTiO <sub>3</sub>	Ussing (1912)
Ilvaite	CaFe <sup>3+</sup> (Fe <sup>2+</sup> ) <sub>2</sub> O(Si <sub>2</sub> O <sub>7</sub> )(OH)	Lorenzen (1881)
Joaquinite-(Ce)	NaBa <sub>2</sub> FeTi <sub>2</sub> Ce <sub>2</sub> (SiO <sub>3</sub> ) <sub>8</sub> O <sub>2</sub> (OH)·H <sub>2</sub> O	Semenov (1969)
Katophorite	(Na,Ca) <sub>3</sub> (Mg,Fe,Al) <sub>5</sub> (Si <sub>7</sub> Al)O <sub>22</sub> (F,OH) <sub>2</sub>	Ussing (1912)
<b>Karupmøllerite-Ca †</b>		Name accepted by IMA 2001
<b>Kvanefjeldite</b>	Na <sub>4</sub> (Ca,Mn)Si <sub>6</sub> O <sub>14</sub> (OH) <sub>2</sub>	Johnsen <i>et al.</i> (1983), Petersen <i>et al.</i> (1984)

Table 3. Analyses of rocks representing Ilimaussaq liquids

	1	2	3	4	5	6	7	8
	augite syenite, chilled margin	evolved augite syenite, av. of 3	Cl-poor sodalite foyaite, av. of 3	Fe-rich phonolite dyke	Fe-rich phonolite dyke	aegirine lujavrite av. of 3	arfvedsonite lujavrite av. of 2	medium- to coarse-grained lujavrite weighted av.
SiO <sub>2</sub> (wt%)	53.24	62.33	51.01	51.83	52.27	52.38	52.25	52.71
TiO <sub>2</sub>	2.44	0.50	0.34	0.55	0.46	0.22	0.23	0.35
CrO <sub>2</sub>	0.04	0.11	0.36	0.55	0.78	0.95	0.25	0.13
Al <sub>2</sub> O <sub>3</sub>	14.79	15.65	17.38	14.57	14.09	13.20	12.23	13.29
Fe <sub>2</sub> O <sub>3</sub>	2.64	2.12	4.73	7.56	11.03	10.90	6.06	4.04
FeO	8.66	3.54	4.62	4.61	1.15	1.96	8.72	8.21
MnO	0.24	0.16	0.25	0.48	0.30	0.37	0.64	0.60
MgO	1.60	0.31	0.13	0.14	0.07	0.10	0.12	0.12
CaO	4.94	1.69	1.97	2.54	2.06	1.20	0.27	0.30
Na <sub>2</sub> O	4.68	6.74	10.08	8.81	9.27	10.72	9.25	9.20
K <sub>2</sub> O	4.26	5.53	3.93	4.87	4.12	2.82	3.23	4.69
P <sub>2</sub> O <sub>5</sub>	0.74	0.08	0.05	0.08	0.09	0.18	0.54	0.41
H <sub>2</sub> O <sup>+</sup>	0.29 <sup>†</sup>	0.68	4.19	1.56 <sup>†</sup>	1.18 <sup>†</sup>	3.44	3.65	3.70
H <sub>2</sub> O <sup>-</sup>	0.19	0.20	0.16	0.47	0.36	0.28	0.24	0.13
CO <sub>2</sub>		0.23	0.07			0.09	0.19	0.07
S	0.15	0.00	0.02	0.12	0.03	0.06	0.06	0.14
Cl	0.03	0.01	0.09	0.33	0.08	0.05	0.03	0.05
F	0.10	0.15	0.41	0.84	1.80	0.08	0.14	0.16
Others	0.46	0.08	0.31	0.42	0.71	0.89	1.64	1.47
	98.99	100.11	100.10	100.33	99.85	99.89	99.74	99.77
- O	0.12	0.07	0.20	0.49	0.79	0.07	0.10	0.15
	98.87	100.04	99.90	99.84	99.06	99.82	99.64	99.62
A.I.	0.83	1.09	1.20	1.36	1.40	1.57	1.53	1.52
FeO*	11.04	5.45	8.88	11.41	11.08	11.77	14.17	11.85
Zr (ppm)	284	836	2690	4040	5740	7010	1860	939

Analysts: J. Kystol, J.C. Bailey and R. Fuge.

<sup>†</sup> Loss on ignition corrected for other volatiles where known.

A.I.: Agpaite index, (Na<sub>2</sub>O+K<sub>2</sub>O)/Al<sub>2</sub>O<sub>3</sub> mol.

FeO\*: Total Fe as FeO.

1: GGU 153394 (new analysis of sample U-106 from Ussing's collection in the Geological Museum, Copenhagen).

2: Average of GGU 152122, 152130, 154378.

3: Average of GGU 57070, 154303, 154347.

4: Sample GGU 42475 (Larsen & Steenfelt 1974), new analysis.

5: Sample ARM 62/8010 (Martin 1985). New analysis.

6: Average of GGU 152128, 154302, 66143.

7: Average of GGU 152127, 154363.

8: 1:1 average of (a) 3 large surface samples (GGU 154397, 154399, 154724) and (b) 21 smaller samples from drill cores.

GGU prefixed to sample numbers: samples in the collections of the Geological Survey of Denmark and Greenland.

Table 1 (continued)

Mineral	Formula	Reference
Riebeckite	$\text{Na}_2(\text{Fe}^{2+}, \text{Mg})_3(\text{Fe}^{3+})_2\text{Si}_8\text{O}_{22}(\text{OH}, \text{F})_2$	Ussing (1894)
Riebeckite <i>var.</i> crocidolite (crocidolite)	$\text{Na}_2(\text{Fe}^{2+}, \text{Mg})_3(\text{Fe}^{3+})_2\text{Si}_8\text{O}_{22}(\text{OH}, \text{F})_2$	1809 (Giesecke)‡‡
<b>Rinkite</b>	$(\text{Na}, \text{Ca})_3(\text{Ca}, \text{Ce})_4(\text{Ti}, \text{Nb})(\text{Si}_2\text{O}_7)_2(\text{O}, \text{F})_4$	Lorenzen (1884a)
Rinkolite ‡		Semenov (1969)
<b>Rohaite</b>	$(\text{Ti}, \text{Pb}, \text{K})_2\text{Cu}_{8,7}\text{Sb}_2\text{S}_4$	Karup-Møller (1978a)
Rosenbuschite	$(\text{Ca}, \text{Na})_5(\text{Zr}, \text{Ca})_2(\text{Ti}, \text{Mn})(\text{Si}_2\text{O}_7)_2(\text{F}, \text{OH})_4$	Ussing (1912)
Rutile	$\text{TiO}_2$	Semenov (1969)
Sauconite	$\text{Na}_{0,3}\text{Zn}_3(\text{Si}, \text{Al})_4\text{O}_{10}(\text{OH})_2 \cdot 4\text{H}_2\text{O}$	Semenov (1969)
Schizolite <i>see</i> pectolite (manganoan)		
Seinäjokite	$(\text{Fe}, \text{Ni})(\text{Sb}, \text{As})_2$	Karup-Møller (1978b)
<b>Semenovite</b>	$(\text{Na}, \text{Ca})_9\text{Fe}(\text{Ce}, \text{La})_2(\text{Si}, \text{Be})_2(\text{O}, \text{OH})_{48}$	Petersen & Rønso (1972)
Senarmontite	$\text{Sb}_2\text{O}_3$	Karup-Møller (1974)
Sepiolite	$\text{Mg}_4\text{Si}_6\text{O}_{15}(\text{OH})_2 \cdot 6\text{H}_2\text{O}$	Semenov (1969)
Siderite	$\text{FeCO}_3$	1806 (Giesecke)‡‡
Silver	Ag	Semenov <i>et al.</i> (1967b)
<b>Skinnerite</b>	$\text{Cu}_3\text{SbS}_3$	Karup-Møller & Makovicky (1974)
Skutterudite	$(\text{Co}, \text{Fe}, \text{Ni})\text{As}_{3-x}$	Oen & Sørensen (1964)
<b>Sodalite</b>	$\text{Na}_4(\text{Si}_3\text{Al}_3)\text{O}_{12}\text{Cl}$	Thomson (1811)
Sodium-acetate-tri-hydrate	$\text{CH}_3\text{COONa} \cdot 3\text{H}_2\text{O}$	Sørensen <i>et al.</i> (1970)
<b>Sorensenite</b>	$\text{Na}_4\text{Be}_2\text{Sn}(\text{Si}_3\text{O}_9)_2 \cdot 2\text{H}_2\text{O}$	Semenov <i>et al.</i> (1965)
Sphaerobrandite ‡		Semenov & Sørensen (1966)
Sphalerite	ZnS	Flink (1898)
Staffelite, <i>see</i> carbonate-fluorapatite		
Stannite *	$\text{Cu}_2\text{FeSnS}_4$	Oen & Sørensen (1964)
<b>Steenstrupine</b>	$\text{Na}_{14}\text{Ce}_6\text{Mn}_2\text{Fe}_2\text{Zr}(\text{PO}_4)_7\text{Si}_{12}\text{O}_{36}(\text{OH})_2 \cdot 3\text{H}_2\text{O}$	Lorenzen (1881)
Stilbite	$\text{NaCa}_4(\text{Al}_9\text{Si}_{27})\text{O}_{72} \cdot 30\text{H}_2\text{O}$	Ferguson (1964)
Stillwellite	$(\text{Ce}, \text{La}, \text{Ca})\text{BSiO}_5$	Karup-Møller (1975)
Strontianite †	$\text{SrCO}_3$	
Synchysite †	$\text{Ca}(\text{Ce}, \text{La})(\text{CO}_3)_2\text{F}$	
Talc †	$\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$	
Tenorite	CuO	Karup-Møller & Makovicky (2001)
Terskite	$\text{Na}_4\text{Zr}(\text{H}_4\text{Si}_6\text{O}_{18})$	Khomyakov <i>et al.</i> (1983)
Tetrahedrite	$(\text{Cu}, \text{Fe})_{12}\text{Sb}_4\text{S}_{13}$	Karup-Møller (1974)
Tetranatrolite ¶ <i>see</i> Gonnardite		Chen & Chao (1980), Grice (2001)
		Andersen <i>et al.</i> (1969)
Thalcosite	$\text{Cu}_3\text{FeTi}_2\text{S}_4$	Makovicky <i>et al.</i> (1980)
Thermonatrite	$\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$	Sørensen <i>et al.</i> (1970)
Thorianite	$\text{ThO}_2$	Bondam & Sørensen (1958)
Thorite	$\text{ThSiO}_4$	Buchwald & Sørensen (1961)
Tin *	Sn	Karup-Møller (1978b)
Titanite	$(\text{Ca}, \text{Na})(\text{Ti}, \text{Ta}, \text{Al}, \text{Nb}, \text{Sb})\text{SiO}_4(\text{O}, \text{F})$	Hamilton (1964)
Titanomagnetite		Larsen (1976)
Todorokite	$(\text{Na}, \text{Ca}, \text{K}, \text{Ba}, \text{Sr})_{1-x}(\text{Mn}, \text{Mg}, \text{Al})_6\text{O}_{12} \cdot 3-4\text{H}_2\text{O}$	Semenov (1969)
Troilite	FeS	Karup-Møller (1978b)
Trona	$\text{Na}_3(\text{HCO}_3)(\text{CO}_3) \cdot 2\text{H}_2\text{O}$	Sørensen <i>et al.</i> (1970)
<b>Tugtupite</b>	$\text{Na}_4\text{BeAlSi}_4\text{O}_{12}\text{Cl}$	Sørensen (1962)
Tundrite	$\text{Na}_2\text{Ce}_2\text{TiO}_2\text{SiO}_4(\text{CO}_3)_2$	Semenov <i>et al.</i> (1967a)
<b>Tundrite (Nd) **</b>	$\text{Na}_2\text{NdTiO}_2\text{SiO}_4(\text{CO}_3)$	Semenov <i>et al.</i> (1967a)
<b>Tuperssuatsiaite</b>	$\text{NaFe}_3\text{Si}_8\text{O}_{22}(\text{OH})_2 \cdot 5\text{H}_2\text{O}$	Karup-Møller & Petersen (1984)
Turkestanite	$\text{Th}(\text{Ca}, \text{Na})_2(\text{K}_{1-x}\text{Ca}_x)\text{Si}_8\text{O}_{20} \cdot n\text{H}_2\text{O}$	Petersen <i>et al.</i> (1999)
Ulövöspinel	$\text{Fe}_2\text{TiO}_4$	Karup-Møller (1978b)
Uranothorite	$(\text{Th}, \text{U})\text{SiO}_4$	Makovicky <i>et al.</i> (1980)
<b>Ussingite</b>	$\text{Na}_2\text{AlSi}_3\text{O}_8(\text{OH})$	Bøggild (1913)
Valentinite	$\text{Sb}_2\text{O}_3$	Karup-Møller (1974)
Vesuvianite †	$(\text{Ca}, \text{Na})_{19}(\text{Al}, \text{Mg}, \text{Fe})_{13}(\text{SiO}_4)_{10}(\text{Si}_2\text{O}_7)_4(\text{OH}, \text{F}, \text{O})_{10}$	
Villiaumite	NaF	Bondam & Ferguson (1962)
Vinogradovite	$(\text{Na}, \text{Ca})_4\text{Ti}_4\text{Si}_8\text{O}_{26} \cdot (\text{H}_2\text{O}, \text{K}_3)$	Rønso <i>et al.</i> (1990)

Table 1. All minerals identified in the Ilímaussaq alkaline complex

Mineral	Formula	Reference
<b>Aegirine</b>	<b>NaFe<sup>3+</sup>Si<sub>2</sub>O<sub>6</sub></b>	1806 (Giesecke)‡‡; Allan (1813)
<b>Aegirine-augite</b>	<b>(Na, Ca, Mg, Fe<sup>2+</sup>, Fe<sup>3+</sup>)<sub>2</sub>(Si, Al)<sub>2</sub>O<sub>6</sub></b>	Ussing (1894)
<b>Aenigmatite</b>	<b>Na<sub>2</sub>(Fe<sup>2+</sup>)<sub>3</sub>TiSi<sub>2</sub>O<sub>20</sub></b>	Breithaupt (1865), Lorenzen (1881)
<b>Albite</b>	<b>NaAlSi<sub>3</sub>O<sub>8</sub></b>	Ussing (1894)
<b>Alkali feldspar</b>	<b>(K, Na)AlSi<sub>3</sub>O<sub>8</sub></b>	Ussing (1894)
<b>Allanite</b>	<b>Ca(Ce, La)(Al, Fe, Cr, V)<sub>3</sub>(Si<sub>2</sub>O<sub>7</sub>)(SiO<sub>4</sub>)(O, OH)<sub>2</sub></b>	Semenov & Sørensen (1966)
<b>Allargentum</b>	<b>Ag<sub>2</sub>Sb</b>	López-Soler <i>et al.</i> (1975)
<b>Alumino-ferro-hornblende (barkevikite)</b>	<b>Ca<sub>2</sub>Fe<sub>2</sub>Al(Si<sub>7</sub>Al)O<sub>22</sub>(OH)<sub>2</sub></b>	Ussing (1894)
<b>Analcime</b>	<b>NaAlSi<sub>3</sub>O<sub>8</sub>·H<sub>2</sub>O</b>	Lorenzen (1881)
<b>Ancylite-(La)</b>	<b>Sr(La, Ce)(CO<sub>3</sub>)<sub>2</sub>(OH)·H<sub>2</sub>O</b>	Petersen <i>et al.</i> (in press a)
<b>Antimony</b>	<b>Sb</b>	Karup-Møller (1974)
<b>Apatite</b>	<b>Ca<sub>5</sub>(PO<sub>4</sub>)<sub>3</sub>(F, OH, Cl)</b>	Ussing (1894)
<b>Apophyllite</b>	<b>KCa<sub>2</sub>Si<sub>6</sub>O<sub>20</sub>(F, OH)·8H<sub>2</sub>O</b>	Bøggild (1953)
<b>Artvedsonite</b>	<b>Na<sub>3</sub>(Fe<sup>2+</sup>, Mg)<sub>3</sub>Fe<sup>3+</sup>Si<sub>6</sub>O<sub>22</sub>(OH)<sub>2</sub></b>	Brooke (1823)
<b>Argentite</b>	<b>Ag<sub>2</sub>S</b>	Semenov (1969)
<b>Arsenopyrite</b>	<b>FeAsS</b>	Bøggild (1953)
<b>Astrophyllite</b>	<b>(K, Na)<sub>3</sub>(Fe, Mn)<sub>7</sub>Ti<sub>2</sub>Si<sub>6</sub>(O, OH)<sub>21</sub></b>	Lorenzen (1884b)
<b>Augite</b>	<b>(Ca, Mg, Fe)<sub>2</sub>(Si, Al)<sub>2</sub>O<sub>6</sub></b>	Ussing (1912)
<b>Avicennite *</b>	<b>Tl<sub>2</sub>O<sub>3</sub></b>	Semenov <i>et al.</i> (1967b)
<b>Azurite *</b>	<b>Cu<sub>3</sub>(CO<sub>3</sub>)<sub>2</sub>(OH)<sub>2</sub></b>	Karup-Møller <i>et al.</i> (1978)
<b>Baddeleyite</b>	<b>ZrO<sub>2</sub></b>	Markl & Marks (1999)
<b>Barkevikite, see alumino-ferro-hornblende</b>		
<b>Barylite</b>	<b>BaBe<sub>2</sub>Si<sub>2</sub>O<sub>7</sub></b>	Petersen <i>et al.</i> (1991)
<b>Bastnäsite</b>	<b>(Ce, La)CO<sub>3</sub>F</b>	Hansen (1968)
<b>Bavenite</b>	<b>Ca<sub>4</sub>(Al, Be)<sub>2</sub>Si<sub>6</sub>O<sub>20</sub>(OH)<sub>2</sub></b>	Petersen <i>et al.</i> (1995)
<b>Bertrandite</b>	<b>Be<sub>2</sub>Si<sub>2</sub>O<sub>7</sub>(OH)<sub>2</sub></b>	Andersen (1967)
<b>Beryllite</b>	<b>Be<sub>3</sub>Si<sub>2</sub>O<sub>7</sub>(OH)<sub>2</sub>·H<sub>2</sub>O</b>	Andersen (1967)
<b>Boudantite</b>	<b>PbFe<sub>2</sub>(AsO<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>·2(OH)<sub>2</sub></b>	Karup-Møller & Makovicky (1977)
<b>Biotite</b>	<b>K(Mg, Fe)<sub>2</sub>(Si<sub>2</sub>Al)O<sub>10</sub>(OH, F)<sub>2</sub></b>	Ussing (1894)
<b>Birnessite</b>	<b>(Na, Ca, K)<sub>0.6</sub>(Mn<sup>4+</sup>, Mn<sup>3+</sup>)<sub>2</sub>O<sub>4</sub>·1.5H<sub>2</sub>O</b>	Semenov (1969)
<b>Bornite</b>	<b>Cu<sub>5</sub>FeS<sub>4</sub></b>	Bøggild (1905)
<b>Breithauptite</b>	<b>(Ni, Pd)Sb</b>	Oen & Sørensen (1964)
<b>Britholite</b>	<b>(Ce, Ca, Sr)<sub>2</sub>(Ce, Ca)<sub>3</sub>(SiO<sub>4</sub>, PO<sub>4</sub>)<sub>3</sub>(O, OH, F)</b>	Winther (1899)
<b>Brochantite</b>	<b>Cu<sub>2</sub>SO<sub>4</sub>(OH)<sub>6</sub></b>	Karup-Møller <i>et al.</i> (1978)
<b>Burpalite †</b>	<b>Na<sub>2</sub>CaZrSi<sub>2</sub>O<sub>7</sub>F<sub>2</sub></b>	F. Fontan, personal commun. 2000
<b>Calcioancylite-(Ce)</b>	<b>(Ce, Ca, Sr)CO<sub>3</sub>(OH, H<sub>2</sub>O)</b>	Pekov <i>et al.</i> (1997b)
<b>Calcite</b>	<b>CaCO<sub>3</sub></b>	1806 (Giesecke)‡‡
<b>Canclrinite</b>	<b>(Na, Ca)<sub>6</sub>(Si<sub>6</sub>Al<sub>6</sub>)O<sub>24</sub>(CO<sub>3</sub>)<sub>2</sub>·2H<sub>2</sub>O</b>	Ussing (1894)
<b>Carbonate-fluorapatite (staffelite)</b>	<b>Ca<sub>5</sub>(PO<sub>4</sub>, CO<sub>3</sub>)<sub>3</sub>F</b>	Semenov (1969)
<b>Carbonate-hydroxylapatite (dahllite)</b>	<b>Ca<sub>10</sub>(PO<sub>4</sub>)<sub>6</sub>(CO<sub>3</sub>)<sub>2</sub>(OH)<sub>2</sub></b>	Bøggild (1915)
<b>Catapleite</b>	<b>Na<sub>2</sub>ZrSi<sub>2</sub>O<sub>7</sub>·2H<sub>2</sub>O</b>	Ussing (1894)
<b>Ceropyrochlore-(Ce)</b>	<b>(Ce, Ca, Y, Cl)<sub>2</sub>(Nb, Ta)<sub>2</sub>(O, OH, F)<sub>7</sub></b>	Semenov (1969)
<b>Cerussite</b>	<b>PbCO<sub>3</sub></b>	Semenov (1969)
<b>Chabazite</b>	<b>Ca(Al<sub>2</sub>Si<sub>4</sub>)O<sub>12</sub>·6H<sub>2</sub>O</b>	Bøggild (1953)
<b>Chalcoite</b>	<b>Cu<sub>2</sub>S</b>	Bøggild (1905)
<b>Chalcopyrite</b>	<b>CuFeS<sub>2</sub></b>	Semenov (1969)
<b>Chalcostibite</b>	<b>CuSbS<sub>2</sub></b>	Karup-Møller (1974)
<b>Chalcothallite</b>	<b>(Cu, Fe, Ag)<sub>0.5</sub>(Ti, K)<sub>2</sub>SbS<sub>4</sub></b>	Semenov <i>et al.</i> (1967b)
<b>Chkalovite</b>	<b>Na<sub>2</sub>BeSi<sub>2</sub>O<sub>6</sub></b>	Sørensen (1960)
<b>Chlorite</b>	<b>(Mg, Al)<sub>3</sub>(Si, Al)<sub>4</sub>O<sub>10</sub>(OH)<sub>2</sub></b>	Flink (1898)
<b>Chrysocolla</b>	<b>(Cu, Al)<sub>2</sub>H<sub>2</sub>Si<sub>2</sub>O<sub>7</sub>(OH)<sub>2</sub>·nH<sub>2</sub>O</b>	Karup-Møller <i>et al.</i> (1978)
<b>Connellite</b>	<b>Cu<sub>15</sub>Cl<sub>2</sub>SO<sub>4</sub>(OH)<sub>22</sub>·3H<sub>2</sub>O</b>	Karup-Møller <i>et al.</i> (1978)
<b>Copper</b>	<b>Cu</b>	Semenov (1969)
<b>Corundum</b>	<b>Al<sub>2</sub>O<sub>3</sub></b>	Ussing (1912)
<b>Covellite</b>	<b>CuS</b>	Karup-Møller (1974)
<b>Crocidolite, see riebeckite var. crocidolite</b>		
<b>Cryptomelane</b>	<b>KMn<sub>8</sub>O<sub>16</sub></b>	Semenov (1969)

minerals from the complex. Lists of the minerals found in the complex have been compiled by Sørensen (1967), Semenov (1969), Sørensen *et al.* (1981) and Petersen & Secher (1993).

Table 1, compiled for this anniversary volume, contains all the Ilímaussaq minerals for which sufficient documentation exists. Those first described from the Ilímaussaq complex are indicated in bold type.

## References

- Allan, T. 1813: Memorandums respecting some minerals from Greenland. Thomson's Annals of Philosophy **1**, 99–110.
- Andersen, E.K., Danø, M. & Petersen, O.V. 1969: A tetragonal natrolite [from the Ilímaussaq alkaline intrusion, South Greenland]. Bulletin Grønlands Geologiske Undersøgelse **79**, 19 pp. (also Meddelelser om Grønland **181**(10)).
- Andersen, S. 1967: On beryllite and bertrandite from the Ilímaussaq alkaline intrusion, South Greenland. Bulletin Grønlands Geologiske Undersøgelse **68**<sup>2</sup>, 11–27 (also Meddelelser om Grønland **181**(4)).
- Bøggild, O.B. 1899: In: Bøggild, O.B. & Winther, C.: On some minerals from the nephelite-syenite at Julianehaab, Greenland, (epistolite, britholite, schizolite and steenstrupite), collected by G. Flink. Meddelelser om Grønland **24**, 181–213.
- Bøggild, O.B. 1903: On some minerals from the nephelite-syenite at Julianehaab, Greenland (erikite and schizolite). Meddelelser om Grønland **26**, 91–139.
- Bøggild, O.B. 1905: Mineralogia Groenlandica. Meddelelser om Grønland **32**, 625 pp.
- Bøggild, O.B. 1913: Ussingit, et nyt Mineral fra Kangerdluarsuk. Meddelelser om Grønland **51**, 103–110.
- Bøggild, O.B. 1915: Dahllit fra Kangerdluarsuk. Meddelelser om Grønland **51**, 435–443.
- Bøggild, O.B. 1933: Igalikite and naujakasite, two new minerals from South Greenland. Meddelelser om Grønland **92**(9), 12 pp.
- Bøggild, O.B. 1953: The mineralogy of Greenland. Meddelelser om Grønland **149**(3), 442 pp.
- Bohse, H. & Frederiksen, J. 2001: A note on the occurrence of gold in the Ilímaussaq alkaline complex, South Greenland. In: Sørensen, H. (ed.): The Ilímaussaq alkaline complex, South Greenland: status of mineralogical research with new results. Geology of Greenland Survey Bulletin **190**, 167 only (this volume).
- Bollingberg, H. & Petersen, O.V. 1967: Genthelvitte from the Ilímaussaq alkaline intrusion, South Greenland. Bulletin Grønlands Geologiske Undersøgelse **68**<sup>2</sup>, 1–9 (also Meddelelser om Grønland **181**(4)).
- Bondam, J. & Ferguson, J. 1962: An occurrence of villiaumite in the Ilímaussaq intrusion, South Greenland. Meddelelser om Grønland **172**(2), 12 pp.
- Bondam, J. & Sørensen, H. 1958: Uraniferous nepheline syen-

- ites and related rocks in the Ilímaussaq area, Julianehaab District, southwest Greenland. Proceedings 2nd UN International Conference on the Peaceful Uses of Atomic Energy **2**, 555–559.
- Breithaupt, A. 1858: Neue Beobachtungen an Felsiten. Berg- und Hüttenmännische Zeitung **17** (Neue Folge, 12. Jahrgang), 11–12.
- Breithaupt, A. 1865: Mineralogische Studien. Berg- und Huettenmännische Zeitung **24**(47), 397–398.
- Brooke, H.J. 1823: A description of the crystalline form of some new minerals. Thomson's Annals of Philosophy (New Series) **5**, 381–384.
- Buchwald, V. & Sørensen, H. 1961: An autoradiographic examination of rocks and minerals from the Ilímaussaq batholith, South-West Greenland. Bulletin Grønlands Geologiske Undersøgelse **28**, 35 pp. (also Meddelelser om Grønland **162**(11)).
- Chen, T.T. & Chao, G.Y. 1980: Tetranatrolite from Mont St-Hilaire, Quebec. Canadian Mineralogist **18**, 77–84.
- Danø, M. & Sørensen, H. 1959: An examination of some rare minerals from the nepheline syenites of South West Greenland. Bulletin Grønlands Geologiske Undersøgelse **20**, 35 pp. (also Meddelelser om Grønland **162**(5)).
- Davison, J.G. 1989: Mineralogical examination of Greenland ore samples submitted by Highwood Resources. Unpublished Progress Report 11, Lakefield Research. A division of Falconbridge Limited, 20 pp + appendices. Toronto, Canada (in archives of Geological Survey of Denmark and Greenland GEUS Report File 20577).
- Ferguson, J. 1964: Geology of the Ilímaussaq alkaline intrusion, South Greenland. Description of map and structure. Bulletin Grønlands Geologiske Undersøgelse **39**, 82 pp. (also Meddelelser om Grønland **172**(4)).
- Flink, G. 1898: Berättelse om en mineralogisk Resa i Syd-Grønland Sommaren 1897. Meddelelser om Grønland **14**, 221–262.
- Giesecke, K.L. 1910: Mineralogisches Reisejournal über Grønland, 1806–13. 2te vollständige Ausgabe. Meddelelser om Grønland **35**, 478 pp.
- Grice, J.D. 2001: [Errata]. The crystal structure of tetranatrolite from Mont Saint Hilaire, Quebec, and its chemical and structural relationship to paranatrolite and gonnardite by H.T. Evans Jr., J.A. Kohn, and M. Ross (v. 85, 1808–1815, 2000) and Gonnardite: Re-examination of holotype material and the discreditation of tetranatrolite by G. Artioli and E. Galli (v. 84, 1445–1450, 1999). American Mineralogist **86**, 588 only.
- Hamilton, E.I. 1964: The geochemistry of the northern part of the Ilímaussaq intrusion, S.W. Greenland. Bulletin Grønlands Geologiske Undersøgelse **42**, 104 pp. (also Meddelelser om Grønland **162**(10)).
- Hansen, J. 1968: Niobium mineralization in the Ilímaussaq alkaline complex, South-West Greenland. Report 23rd International Geological Congress, Czechoslovakia 1968 **7**, 263–273.
- Johnsen, O. & Bohse, H. 1981: Helvine from the Ilímaussaq intrusion. In: Bailey, J.C., Larsen, L.M. & Sørensen, J. (eds): The Ilímaussaq intrusion, South Greenland. A progress report on geology, mineralogy, geochemistry and economic geology. Rapport Grønlands Geologiske Undersøgelse **103**, 25–29.
- Johnsen, O., Leonardsen, E.S., Fälth, L. & Annehed, H. 1983: Crystal structure of kvanefjeldite: The introduction of  $[Si_3O_7OH]$  layers with eight-membered rings. Neues Jahrbuch für Mineralogie Monatshefte **1983**, 505–512.
- Karup-Møller, S. 1974: Mineralogy of two copper-antimony-sulfide-oxide occurrences from the Ilímaussaq alkaline intrusion in South Greenland. Neues Jahrbuch für Mineralogie Abhandlungen **122**, 291–313.
- Karup-Møller, S. 1975: On the occurrence of the native lead, litharge, hydrocerussite and plattnerite within the Ilímaussaq alkaline intrusion in South Greenland. Neues Jahrbuch für Mineralogie Monatshefte **1975**, 229–241.
- Karup-Møller, S. 1976: Gmelinite and herschelite from the Ilímaussaq intrusion in South Greenland. Mineralogical Magazine **40**, 867–873.
- Karup-Møller, S. 1978a: Primary and secondary ore minerals associated with cuprostibite. In: Karup-Møller, S., Løkkegaard, L., Semenov, E.I. & Sørensen, H.: Cuprostibite and associated minerals from the Ilímaussaq intrusion, South Greenland. Bulletin Grønlands Geologiske Undersøgelse **126**, 23–47.
- Karup-Møller, S. 1978b: The ore minerals of the Ilímaussaq intrusion: their mode of occurrence and their conditions of formation. Bulletin Grønlands Geologiske Undersøgelse **127**, 51 pp.
- Karup-Møller, S. 1983: Lomonosovite from the Ilímaussaq intrusion, South Greenland. Neues Jahrbuch für Mineralogie Abhandlungen **148**, 83–96.
- Karup-Møller, S. 1986: Murmanite from the Ilímaussaq alkaline complex, South Greenland. Neues Jahrbuch für Mineralogie Abhandlungen **155**, 67–88.
- Karup-Møller, S. & Makovicky, E. 1974: Skinnerite,  $Cu_3SbS_3$ , a new sulfosalt from the Ilímaussaq alkaline intrusion, South Greenland. American Mineralogist **59**, 889–895.
- Karup-Møller, S. & Makovicky, E. 1977: Westerveldite from the Ilímaussaq alkaline intrusion in South Greenland. Mineralogy, crystallography, mineral associations and alteration products. Neues Jahrbuch für Mineralogie Abhandlungen **130**, 208–242.
- Karup-Møller, S. & Makovicky, E. 2001: Thalcusite from Nakkalaq, the Ilímaussaq alkaline complex, South Greenland. In: Sørensen, H. (ed.): The Ilímaussaq alkaline complex, South Greenland: status of mineralogical research with new results. Geology of Greenland Survey Bulletin **190**, 127–130 (this volume).
- Karup-Møller, S. & Petersen, O.V. 1984: Tapersuatsiaite, a new mineral species from the Ilímaussaq intrusion in South Greenland. Neues Jahrbuch für Mineralogie Monatshefte **1984**, 501–512.
- Karup-Møller, S., Løkkegaard, L., Semenov, E.I. & Sørensen, H. 1978: The occurrence of cuprostibite. In: Karup-Møller, S., Løkkegaard, L., Semenov, E.I. & Sørensen, H.: Cuprostibite and associated minerals from the Ilímaussaq intrusion, South Greenland. Bulletin Grønlands Geologiske Undersøgelse **126**, 6–22.

- Khomyakov, A.P., Semenov, E.I., Voronkov, A.A. & Nechelyustov, G.N. 1983: Terskite,  $\text{Na}_4\text{ZrSi}_6\text{O}_{16}\cdot 2\text{H}_2\text{O}$ , a new mineral. *Zapiski Vsesoyuznogo Mineralogicheskogo Obschestva* **112**, 226–232 (in Russian).
- Kobell, F.v. 1838: Ueber den Arfvedsonit. *Journal für praktische Chemie* **13**, 3–8.
- Krivokoneva, G.K., Portnov, A.M., Semenov, Ye.I. & Dubakina, L.S. 1979: Komarovite – silicified pyrochlore. *Doklady Akademii Nauk SSSR* **248**, 443–447 (in Russian). (Translation: *Doklady Earth Science Sections* **248**, 127–130.)
- Larsen, L.M. 1976: Clinopyroxenes and coexisting mafic minerals from the alkaline Ilímaussaq intrusion, South Greenland. *Journal of Petrology* **17**, 258–290.
- Larsen, L.M. & Steenfelt, A. 1974: Alkali loss and retention in an iron-rich peralkaline phonolite dyke from the Gardar province, south Greenland. *Lithos* **7**, 81–90.
- López-Soler, A., Bosch-Figueroa, J.M., Karup-Møller, S., Besteiro, J. & Font-Altaba, M. 1975: Optical study of cuprostitibite ( $\text{Cu}_2\text{Sb}$ ). *Fortschritte der Mineralogie* **52**, 557–565.
- Lorenzen, J. 1881: Undersøgelse af nogle Mineralier i Sodalith-Syeniten fra Julianehaabs Distrikt. *Meddelelser om Grønland* **2**, 43–79. (English version: On some minerals from the sodalite-syenite in Julianehaab district, South Greenland. *Mineralogical Magazine* **5**, 49–70 (1882).)
- Lorenzen, J. 1884a: Undersøgelse af Mineralier fra Grønland. *Meddelelser om Grønland* **7**, 1–31 (German version: Untersuchungen einiger Mineralien aus Kangerdluarsuk in Grönland. *Zeitschrift für Krystallographie und Mineralogie* **9**, 243–254).
- Lorenzen, J. 1884b: Fortsatte Undersøgelser af Mineralier fra Kangerdluarsuk. *Meddelelser om Grønland* **7**, 33–46 (also printed in *Öfersigt af K. Svenska Vetenskaps Akademiens Förhandlingar* **41**(2), 105–117).
- Makovicky, E., Johan, Z. & Karup-Møller, S. 1980: New data on bukovite, thalculusite, chalcocallite and rohaite. *Neues Jahrbuch für Mineralogie Abhandlungen* **138**, 122–146.
- Markl, G. & Marks, M. 1999: Clinopyroxene exsolutions from fayalitic olivine in augite syenites of the Ilímaussaq intrusion, South Greenland. *Berichte der Deutschen Mineralogischen Gesellschaft. Beihefte zum European Journal of Mineralogy* **11**, 152 only.
- Metcalf-Johansen, J. 1977: Willemite from the Ilímaussaq alkaline intrusion. *Mineralogical Magazine* **41**, 71–75.
- Metcalf-Johansen, J. 1983: Prehnite from the Ilímaussaq alkaline intrusion. *Mineralogical Magazine* **47**, 403–404.
- Oen, I.S. & Sørensen, H. 1964: The occurrence of nickel-arsenides and nickel-antimonide at Igdlúnguaq, in the Ilímaussaq alkaline massif, South Greenland. *Bulletin Grønlands Geologiske Undersøgelse* **43**, 50 pp. (also *Meddelelser om Grønland* **172**(1)).
- Pekov, I.V. 1998: Minerals first discovered on the territory of the former Soviet Union, 369 pp. Moscow: Ocean Pictures.
- Pekov, I.V., Chukanov, N.V., Rønsbo, J.G. & Sørensen, H. 1997a: Erikite – a pseudomorph after vitusite. *Neues Jahrbuch für Mineralogie Monatshefte* **1997**, 97–112.
- Pekov, I.V., Petersen, O.V. & Voloshin, A.V. 1997b: Calcio-ancylite-(Ce) from Ilímaussaq and Narssárssuk, Greenland, Kola Peninsula and Polar Urals, Russia; ancylite-(Ce) – calcio-ancylite-(Ce) an isomorphous series. *Neues Jahrbuch für Mineralogie Abhandlungen* **171**, 309–322.
- Petersen, O.V. & Rønsbo, J.G. 1972: Semenovite – a new mineral from the Ilímaussaq alkaline intrusion, south Greenland. *Lithos* **5**, 163–173.
- Petersen, O.V. & Secher, K. 1993: The minerals of Greenland. *Mineralogical Record* **24**(2), 1–65.
- Petersen, O.V., Johnsen, O., Leonardsen, E.S. & Rønsbo, J.G. 1984: Kvanefjeldite, a new mineral species from the Ilímaussaq alkaline complex, Southwest Greenland. *Canadian Mineralogist* **22**, 465–467.
- Petersen, O.V., Rønsbo, J. & Leonardsen, E. 1989: Nacareniobsite-(Ce), a new mineral species from the Ilímaussaq alkaline complex, South Greenland, and its relation to mosandrite and the rinkite series. *Neues Jahrbuch für Mineralogie Monatshefte* **1989**, 84–96.
- Petersen, O.V., Randløv, J., Leonardsen, E.S. & Rønsbo, J.G. 1991: Barylite from the Ilímaussaq alkaline complex and associated fenites, South Greenland. *Neues Jahrbuch für Mineralogie Monatshefte* **1991**, 212–216.
- Petersen, O.V., Johnsen, O., Bernhardt, H.-J. & Medenbach, O. 1993: Dorfmanite,  $\text{Na}_3\text{HPO}_4\cdot 2\text{H}_2\text{O}$ , from the Ilímaussaq alkaline complex, South Greenland. *Neues Jahrbuch für Mineralogie Monatshefte* **1993**, 254–258.
- Petersen, O.V., Rønsbo, J.G., Leonardsen, E.S., Johnsen, O., Bollingberg, H. & Rose-Hansen, J. 1994: Leifite from the Ilímaussaq alkaline complex, South Greenland. *Neues Jahrbuch für Mineralogie Monatshefte* **1994**, 83–90.
- Petersen, O.V., Micheelsen, H.I. & Leonardsen, E.S. 1995: Bavenite,  $\text{Ca}_4\text{Be}_3\text{Al}[\text{Si}_9\text{O}_{25}(\text{OH})_3]$ , from the Ilímaussaq alkaline complex, South Greenland. *Neues Jahrbuch für Mineralogie Monatshefte* **1995**, 321–335.
- Petersen, O.V., Micheelsen, H.I., Toft, P.C., Johnsen, O. & Medenbach, O. 1998: Fersmite from the Ilímaussaq alkaline complex, South Greenland. *Neues Jahrbuch für Mineralogie Monatshefte* **1998**, 328–336.
- Petersen, O.V., Johnsen, O. & Micheelsen, H. 1999: Turkestanite from the Ilímaussaq alkaline complex, South Greenland. *Neues Jahrbuch für Mineralogie Monatshefte* **1999**, 424–432.
- Petersen, O.V., Gault, R.A. & Balić-Žunić, T. 2001a: Odintsovite from the Ilímaussaq alkaline complex, South Greenland. *Neues Jahrbuch für Mineralogie Monatshefte* **2001**, 235–240.
- Petersen, O.V., Khomyakov, A.P. & Sørensen, H. 2001b: Natrophosphate from the Ilímaussaq alkaline complex, South Greenland. In: Sørensen, H. (ed.): The Ilímaussaq alkaline complex, South Greenland: status of mineralogical research with new results. *Geology of Greenland Survey Bulletin* **190**, 139–141 (this volume).
- Petersen, O.V., Niedermayr, G., Gault, R.A., Brandstätter, F., Micheelsen, H. & Giester, G. in press a: Ancylite-(La) from the Ilímaussaq alkaline complex, South Greenland. *Neues Jahrbuch für Mineralogie Monatshefte* **2001**.
- Petersen, O.V., Niedermayr, G., Johnsen, O., Gault, R.A. & Brandstätter, F. in press b: Lovdarite from the Ilímaussaq alkaline complex, South Greenland. *Neues Jahrbuch für Mineralogie Monatshefte* **2001**.



- Robles, E.R., Fontan, F., Monchoux, P., Sørensen, H. & de Parseval, P. 2001: Hiertdahlite II from the Ilímaussaq alkaline complex, South Greenland, the Tamazeght complex, Morocco, and the Iles de Los, Guinea. In: Sørensen, H. (ed.): The Ilímaussaq alkaline complex, South Greenland: status of mineralogical research with new results. *Geology of Greenland Survey Bulletin* **190**, 131–137 (this volume).
- Rønsbo, J.G., Khomyakov, A.P., Semenov, E.I., Voronkov, A.A. & Garanin, V.K. 1979: Vitusite – a new phosphate of sodium and rare earths from the Lovozero alkaline massif, Kola, and the Ilímaussaq alkaline intrusion, south Greenland. *Neues Jahrbuch für Mineralogie Abhandlungen* **137**, 42–53.
- Rønsbo, J.G., Leonardsen, E.S., Petersen, O.V. & Johnsen, O. 1983: Second occurrence of vuonnemite: the Ilímaussaq alkaline complex, South West Greenland. *Neues Jahrbuch für Mineralogie Monatshefte* **1983**, 451–460.
- Rønsbo, J.G., Petersen, O.V. & Leonardsen, E.S. 1990: Vinogradovite from the Ilímaussaq alkaline complex, South Greenland, a beryllium bearing mineral. *Neues Jahrbuch für Mineralogie Monatshefte* **1990**, 481–492.
- Semenov, E.I. 1969: Mineralogy of the Ilímaussaq alkaline massif (South Greenland), 165 pp. Moscow: Nauka (in Russian).
- Semenov, E.I. 2001: Notes on ephesite, terskite, Na-komarovite, ceriopyrochlore-(Ce), joaquinite-(Ce) and other minerals from the Ilímaussaq alkaline complex, South Greenland. In: Sørensen, H. (ed.): The Ilímaussaq alkaline complex, South Greenland: status of mineralogical research with new results. *Geology of Greenland Survey Bulletin* **190**, 123–125 (this volume).
- Semenov, E.I. & Bykova, A.V. 1960: Beryllsodalite. *Doklady Akademii Nauk SSSR* **133**(5), 1191–1193 (in Russian).
- Semenov, E.I. & Sørensen, H. 1966: Eudidymite and epididymite from the Ilímaussaq alkaline intrusion, South Greenland. *Bulletin Grønlands Geologiske Undersøgelse* **63**, 21 pp. (also *Meddelelser om Grønland* **181**(2)).
- Semenov, E.I., Gerassimovskiy, V.I., Maksimova, N.V., Andersen, S. & Petersen, O.V. 1965: Sorensenite, a new sodium-beryllium-tin-silicate from the Ilímaussaq intrusion, South Greenland. *Bulletin Grønlands Geologiske Undersøgelse* **61**, 19 pp. (also *Meddelelser om Grønland* **181**(1)).
- Semenov, E.I., Kazakova, M.E. & Aleksandrova, R.A. 1967a: The Lovozero minerals – nenadkevichite, gerassimovskite and tundrite – from Ilímaussaq, South Greenland. *Bulletin Grønlands Geologiske Undersøgelse* **68**<sup>3</sup>, 1–11 (also *Meddelelser om Grønland* **181**(5<sup>1</sup>)).
- Semenov, E.I., Sørensen, H., Bessmertnaja, M.S & Novorossova, L.E. 1967b: Chalcothallite – a new sulphide of copper and thallium from the Ilímaussaq alkaline intrusion, South Greenland. *Bulletin Grønlands Geologiske Undersøgelse* **68**<sup>3</sup>, 13–26 (also *Meddelelser om Grønland* **181**(5<sup>11</sup>)).
- Semenov, E.I., Kazakova, M.E. & Bukin, V.J. 1968: Ilimaussite, a new rare earth-niobium-barium silicate from Ilímaussaq, South Greenland. *Bulletin Grønlands Geologiske Undersøgelse* **75**<sup>2</sup>, 3–7 (also *Meddelelser om Grønland* **181**(7<sup>1</sup>)).
- Sobolev, V.S., Bazarova, T.Y., Shugurova, N.A., Bazarov, L.Sh., Dolgov, Yu.A. & Sørensen, H. 1970: A preliminary examination of fluid inclusions in nepheline, sorensenite, tugtupite and chkalovite from the Ilímaussaq alkaline intrusion, South Greenland. *Bulletin Grønlands Geologiske Undersøgelse* **81**, 32 pp. (also *Meddelelser om Grønland* **181**(11)).
- Sørensen, H. 1960: Beryllium minerals in a pegmatite in the nepheline syenites of Ilímaussaq, South West Greenland. Report 21st International Geological Congress Norden 1960 **17**, 31–35.
- Sørensen, H. 1962: On the occurrence of steenstrupine in the Ilímaussaq massif, southwest Greenland. *Bulletin Grønlands Geologiske Undersøgelse* **32**, 251 pp. (also *Meddelelser om Grønland* **167**(1)).
- Sørensen, H. 1963: Beryllium minerals in a pegmatite in the nepheline syenites of Ilímaussaq, South West Greenland. Report 21st International Geological Congress Norden 1960 **27**, 157 and 159 only.
- Sørensen, H. 1967: On the history of exploration of the Ilímaussaq alkaline intrusion, South Greenland. *Bulletin Grønlands Geologiske Undersøgelse* **68**<sup>1</sup>, 33 pp. (also *Meddelelser om Grønland* **181**(3)).
- Sørensen, H., Semenov, E.I., Bezsmertnaya, M.S. & Khalezova, E.B. 1969: Cuprostibite – a new natural compound of copper and antimony. *Zapiski Vsesoyuznogo Mineralogicheskogo Obshchestva* **98**, 716–724 (in Russian).
- Sørensen, H., Leonardsen, E.S. & Petersen, O.V. 1970: Trona and thermonatrite from the Ilímaussaq alkaline intrusion, South Greenland. *Bulletin of the Geological Society of Denmark* **20**, 1–19.
- Sørensen, H., Rose-Hansen, J. & Petersen, O.V. 1981: The mineralogy of the Ilímaussaq intrusion. In: Bailey, J.C., Larsen, L.M. & Sørensen, H. (eds): The Ilímaussaq intrusion, South Greenland. A progress report on geology, mineralogy, geochemistry and economic geology. *Rapport Grønlands Geologiske Undersøgelse* **103**, 19–24.
- Steenstrup, K.J.V. 1881: Bemærkninger til et geognostisk Oversigtskaart over en del af Julianehaabs Distrikt. *Meddelelser om Grønland* **2**, 27–42.
- Stromeyer, F. 1819: Summary of meeting 16 December 1819 [Analyse einiger grönlandischen, von Prof. Giesecke erhaltenen Fossilien]. *Göttingische gelehrte Anzeigen* **3**, 1993–2000.
- Thomson, T. 1811: A chemical analysis of sodalite, a new mineral from Greenland. *Journal of Natural Philosophy, Chemistry and the Arts* **29**, 285–292 (French version: *Journal des Mines* **30**, 135–146).
- Ussing, N.V. 1894: Mineralogiske-petrografiske Undersøgelse af grönlandske Nefelinsyeniter og beslægtede Bjærgarter. *Meddelelser om Grønland* **14**, 1–220.
- Ussing, N.V. 1912: Geology of the country around Julianehaab, Greenland. *Meddelelser om Grønland* **38**, 1–376.
- Winther, C. 1899: In: Bøggild, O.B. & Winther, C. On some minerals from the nephelinite-syenite at Julianehaab, Greenland, (epistolite, britholite, schizolite and steenstrupite), collected by G. Flink. *Meddelelser om Grønland* **24**, 181–213.