

# Minerals of Norway – the (almost) complete inventory

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## Preamble

A monographic survey of the minerals of Norway (*Norges Mineraler*) was published by Neumann (1985), covering all minerals recorded on its mainland up to about 1983. The index contains ca. 880 different mineral names, including varieties and synonyms. A large number of minerals new to Norway have been recorded since the book appeared. The inventory given below is an attempt to list all accepted mineral species from Norway, including those from Neumann (1985) and later discoveries. Minerals from Spitsbergen and Bjørnøya are also included here.

The minerals are arranged according to the *Strunz Mineralogical Tables* (Strunz & Nickel 2001). Names of minerals discovered in Norway after the edition of Neumann's monograph are in boldface and preceded by an asterisk (\*). A double asterisk (\*\*) means that the mineral is new and not listed in Strunz & Nickel (2001). In such cases, the mineral is placed where it most likely belongs in the system, according to structure and chemistry. Formulae are mainly taken from *Fleischer's Glossary of Mineral Species* (Mandarino & Back 2004) but modified where appropriate. The sign [] denotes vacancies.

It is realized that the present list by no means can be complete, although every effort was taken to search the literature thoroughly. The author shall be pleased to receive information about omissions and errors, to be included in a future update. Such reports, preferably to be sent by e-mail to [gunn-ra@online.no](mailto:gunn-ra@online.no), must contain locality data and information on who did the identification and by which method.

Information from *Interne Notater*, the in-house newsletter of the former Mineralogisk-Geologisk Museum, is not to be regarded as published material, and is referred to only in the text. The series of annotated bibliographies on the mineralogy of Norway (*Mineralogia Norvegica*), published by Larsen, Nordrum and Kristiansen in *Norsk Bergverksmuseums Skrifter*, has been an invaluable source during the preparation of the present inventory.

## 1. ELEMENTS

Copper Cu

Silver Ag

Gold Au

Lead Pb

Awaruite Ni<sub>2</sub>Fe to Ni<sub>3</sub>Fe

\* Osmium (Os,Ir,Ru) Osthammeren, Røros (Nilsson 1990)

\* Palladium Pd PGE occurrences in the Karasjok greenstone belt (Nilsson & Larsen 1998)

\* Iridium (Ir,Os,Ru) Osthammeren, Røros (Nilsson 1990)

Platinum Pt

\* Isoferroplatinum Pt<sub>3</sub>Fe Raudberget, Stølsheimen, Sogn (Nilsson & Larsen 1998)

\* Tulameenite Pt<sub>2</sub>FeCu Leka (Nilsson & Larsen 1998)

\* Tetraferroplatinum PtFe Raudberget, Stølsheimen, Sogn (Nilsson & Larsen 1998) [needs verification]

Arsenic As

Antimony Sb  
Bismuth Bi  
Graphite C  
Diamond C [Microdiamonds in high-grade metamorphic rocks of the Western Gneiss Region,  
see Dobrzhinetskaya et al. 1995, Smith 1995, Carswell & van Roermund 2005.  
Microdiamonds in the Gardnos impactites, see Gilmour et al. 2003]  
Sulphur S  
Tellurium Te

## 2. SULPHIDES, SULPHOSALTS

Allargentum  $\text{Ag}_{1-x}\text{Sb}_x$   
Dyscrasite  $\text{Ag}_3\text{Sb}$   
Maucherite  $\text{Ni}_{11}\text{As}_8$   
\* **Stillwaterite**  $\text{Pd}_8\text{As}_3$  PGE occurrences in the Karasjok greenstone belt (Nilsson & Larsen 1998)  
\* **Mertieite-I**  $\text{Pd}_{11}\text{As}_2\text{Sb}_2$  PGE occurrences in the Karasjok greenstone belt (Nilsson & Larsen 1998)  
\* **Mertieite-II**  $\text{Pd}_8(\text{Sb},\text{As})_3$  PGE occurrences in the Karasjok greenstone belt (Nilsson & Larsen 1998)  
\* **Arsenopalladinite**  $\text{Pd}_8(\text{As},\text{Sb})_3$  PGE occurrences in the Karasjok greenstone belt (Nilsson & Larsen 1998)  
\* **Stibiopalladinite**  $\text{Pd}_5\text{Sb}_2$  Osthammeren, Røros (Nilsson 1990) [needs verification]; Leka and Stormyрplutten, Grong (Nilsson & Larsen 1998)  
\* **Palladoarsenide**  $\text{Pd}_2\text{As}$  PGE occurrences in the Karasjok greenstone belt (Nilsson & Larsen 1998)  
Chalcocite  $\text{Cu}_2\text{S}$   
Djurleite  $\text{Cu}_{31}\text{S}_{16}$   
Digenite  $\text{Cu}_9\text{S}_5$   
Bornite  $\text{Cu}_5\text{FeS}_4$   
Acanthite  $\text{Ag}_2\text{S}$   
Stromeyerite  $\text{AgCuS}$   
McKinstryite  $(\text{Ag},\text{Cu})_2\text{S}$   
Jalpaite  $\text{Ag}_3\text{CuS}_2$   
Naumannite  $\text{Ag}_2\text{Se}$   
Hessite  $\text{Ag}_2\text{Te}$   
Heazlewoodite  $\text{Ni}_3\text{S}_2$   
Pentlandite  $(\text{Fe},\text{Ni})_9\text{S}_8$   
Cobalt pentlandite  $\text{Co}_9\text{S}_8$   
\* **Keithconnite**  $\text{Pd}_{20}\text{Te}_7$  Leka (Nilsson & Larsen 1998)  
Temagamite  $\text{Pd}_3\text{HgTe}_3$   
\* **Borovskite**  $\text{Pd}_3\text{SbTe}_4$  Stormyрplutten, Grong, Nord-Trøndelag (Nilsson & Larsen 1998)  
\* **Parkerite**  $\text{Ni}_3(\text{Bi},\text{Pb})_2\text{S}_2$  From the Norwegian coesite-eclogite province (Smith 1988)  
Covellite  $\text{CuS}$   
Idaite  $\text{Cu}_3\text{FeS}_4$  or  $\sim\text{Cu}_5\text{FeS}_6$  [inadequately defined]  
\* **Nukundamite**  $\sim\text{Cu}_{3.4}\text{Fe}_{0.6}\text{S}_4$  Konnerudkollen, Drammen (Segalstad & Telstø 2002), Huken pukkverk, Oslo (Kvamsdal 1999)  
Sphalerite  $\text{ZnS}$   
\* **Hawleyite**  $\text{CdS}$  Konnerudkollen, Drammen, Buskerud (Raade & Sæbø 1990, Interne Notater, 150)  
Chalcopyrite  $\text{CuFeS}_2$   
Roquésite  $\text{CuInS}_2$

Stannite  $\text{Cu}_2\text{FeSnS}_4$   
 \* Černýite  $\text{Cu}_2\text{CdSnS}_4$  Bleikvassli, Nordland (Cook et al. 1998)  
 \* Késterite  $\text{Cu}_2(\text{Zn},\text{Fe})\text{SnS}_4$  Bleikvassli, Nordland (Cook et al. 1998)  
 Colusite  $\text{Cu}_{26}\text{V}_2(\text{As},\text{Sn},\text{Sb})_6\text{S}_{32}$   
 Mawsonite  $\text{Cu}_6\text{Fe}_2\text{SnS}_8$   
 Greenockite CdS [First positive identification by Raade 1993, Interne Notater, 163-164.  
     Locality: Konnerudkollen, Drammen, Buskerud]  
 Enargite  $\text{Cu}_3\text{AsS}_4$   
 Cubanite  $\text{CuFe}_2\text{S}_3$   
 Sternbergite  $\text{AgFe}_2\text{S}_3$  [Sternbergite from Akersberg mine, Oslo, see Nilsen & Bjørlykke 1991]  
 Vulcanite CuTe  
 \* Empressite AgTe Sulitjelma (Cook 1996, Nordrum & Cook 2001)  
 Nickeline NiAs  
 Breithauptite NiSb  
 \* Sudburyite PdSb Stormyrplutten, Grong, Nord-Trøndelag (Nilsson & Larsen 1998)  
 \* Sobolevskite PdBi Ørnstolen, Selsøyvik, Rødøy (Nilsson & Larsen 1998)  
 Pyrrhotite  $\text{Fe}_{1-x}\text{S}$   
 Smythite  $\text{Fe}_9\text{S}_{11}$   
 Millerite NiS  
 Mackinawite  $(\text{Fe},\text{Ni})_{1+x}\text{S}$   
 Cooperite  $(\text{Pt},\text{Pd},\text{Ni})\text{S}$   
 \* Kotulskite Pd(Te,Bi) Fæøy, Haugesund (Boyd & Nixon 1985)  
 \* Herzenbergite SnS Bleikvassli, Nordland (Cook et al. 1998)  
 Alabandite MnS  
 Galena PbS  
 Clausthalite PbSe  
 Altaite PbTe  
 Matildite AgBiS<sub>2</sub>  
 \* Volynskite AgBiTe<sub>2</sub> Dragset, Sør-Trøndelag (McQueen 1990)  
 \* Cinnabar HgS Gottes Hülfe in der Noth, Kongsberg (Nordrum et al. 2003a)  
 Linnaeite CoCo<sub>2</sub>S<sub>4</sub>  
 Siegenite CoNi<sub>2</sub>S<sub>4</sub>  
 Violarite FeNi<sub>2</sub>S<sub>4</sub> [Brickwood 1986]  
 Carrollite Cu(Co,Ni)<sub>2</sub>S<sub>4</sub>  
 Stibnite Sb<sub>2</sub>S<sub>3</sub>  
 Bimuthinite Bi<sub>2</sub>S<sub>3</sub>  
 Hedleyite Bi<sub>2+x</sub>Te<sub>1-x</sub> ( $x \sim 0.13$ )  
 \* Tsumoite BiTe Sulitjelma (Cook 1996, Nordrum & Cook 2001)  
 Tetradymite Bi<sub>2</sub>Te<sub>2</sub>S  
 Tellurobismuthite Bi<sub>2</sub>Te<sub>3</sub>  
 Joséite-B Bi<sub>4</sub>Te<sub>2</sub>S  
 \* Rucklidgeite (Bi,Pb)<sub>3</sub>Te<sub>4</sub> Dragset, Sør-Trøndelag (McQueen 1990)  
 Calaverite AuTe<sub>2</sub>  
 Melonite NiTe<sub>2</sub>  
 Merenskyite (Pd,Pt)(Te,Bi)<sub>2</sub>  
 Moncheite (Pt,Pd)(Te,Bi)<sub>2</sub>  
 Molybdenite MoS<sub>2</sub>  
 Pyrite FeS<sub>2</sub>  
 Bravrite [= nickeloan pyrite]  
 Vaesite NiS<sub>2</sub>  
 \* Aurostibite AuSb<sub>2</sub> Sulitjelma, Nordland (Cook 1992, Cook 1996)  
 \* Laurite RuS<sub>2</sub> Osthammeren, Røros (Nilsson 1990)

\* **Erlichmanite** OsS<sub>2</sub> Osthammeren, Røros (Nilsson 1990)  
 Sperrylite PtAs<sub>2</sub>  
 \* **Geversite** PtSb<sub>2</sub> Raudberget, Stølsheimen, Sogn; Leka (Nilsson & Larsen 1998)  
 Gersdorffite NiAsS  
 \* **Hollingworthite** (Rh,Pt,Pd)AsS Osthammeren, Røros (Nilsson 1990)  
 \* **Irarsite** (Ir,Ru,Rh,Pt)AsS Osthammeren, Røros (Nilsson 1990)  
 \* **Platarsite** (Pt,Rh,Ru)AsS Osthammeren, Røros (Nilsson 1990)  
 Ullmannite NiSbS  
 \* **Tolovkite** IrSbS Osthammeren, Røros (Nilsson & Larsen 1998)  
 \* **Michenerite** PdBiTe Raudberget, Stølsheimen, Sogn (Nilsson & Larsen 1998)  
 Cobaltite CoAsS  
 Willyamite (Co,Ni)SbS  
 Marcasite FeS<sub>2</sub>  
 Frohbergite FeTe<sub>2</sub>  
 Arsenopyrite FeAsS  
 Glaucomorphite (Co,Fe)AsS  
 Gudmundite FeSbS  
 \* **Osarsite** (Os,Ru)AsS Osthammeren, Røros (Nilsson 1990)  
 Löllingite FeAs<sub>2</sub>  
 Safflorite (Co,Fe)As<sub>2</sub>  
 Rammelsbergite NiAs<sub>2</sub>  
 \* **Nisbite** NiSb<sub>2</sub> Sulitjelma (Cook 1996, Nordrum & Cook 2001)  
 \* **Costibite** CoSbS Sulitjelma (Cook 1996, Nordrum & Cook 2001)  
 Skutterudite CoAs<sub>3</sub>  
 Smaltite [= skutterudite]  
 Nickel-skutterudite (Ni,Co,Fe)As<sub>3-x</sub> [chloanthite in Neumann (1985)]  
 \* **Realgar** AsS Sulitjelma (Cook 1996)  
 \* **Rasvumite** KFe<sub>2</sub>S<sub>3</sub> Flekkeren, Skrim (Jamtveit et al. 1997)  
 \* **Djerfisherite** K<sub>6</sub>Na(Fe,Cu)<sub>24</sub>S<sub>26</sub>Cl Flekkeren, Skrim (Jamtveit et al. 1997)  
 Valleriite 4(Fe,Cu)S·3(Mg,Al)(OH)<sub>2</sub>  
  
 Proustite Ag<sub>3</sub>AsS<sub>3</sub>  
 Pyrargyrite Ag<sub>3</sub>SbS<sub>3</sub>  
 Wittichenite Cu<sub>3</sub>BiS<sub>3</sub>  
 Tennantite (Cu,Ag,Fe,Zn)<sub>12</sub>As<sub>4</sub>S<sub>13</sub>  
 Tetrahedrite (Cu,Fe,Ag,Zn)<sub>12</sub>Sb<sub>4</sub>S<sub>13</sub>  
 \* **Freibergite** (Ag,Cu)<sub>10</sub>(Fe,Zn)<sub>2</sub>(Sb,As)<sub>4</sub>S<sub>13</sub> Sulitjelma (Cook 1992), Bleikvassli, Nordland  
     (Cook et al. 1998)  
 Stephanite Ag<sub>5</sub>SbS<sub>4</sub>  
 Pearceite (Ag,Cu)<sub>16</sub>As<sub>2</sub>S<sub>11</sub>  
 Polybasite (Ag,Cu)<sub>16</sub>Sb<sub>2</sub>S<sub>11</sub>  
 \* **Jordanite** Pb<sub>14</sub>(As,Sb)<sub>6</sub>S<sub>23</sub> Bleikvassli, Nordland (Raade, Austrheim & Sæbø 1990, Interne  
     Notater, 151-152; Cook et al. 1998)  
 Geocrontite Pb<sub>14</sub>(Sb,As)<sub>6</sub>S<sub>23</sub>  
 Chalcostibite CuSbS<sub>2</sub>  
 Emplectite CuBiS<sub>2</sub>  
 Berthierite FeSb<sub>2</sub>S<sub>4</sub>  
 Meneghinite Pb<sub>13</sub>CuSb<sub>7</sub>S<sub>24</sub>  
 Aikinite PbCuBiS<sub>3</sub>  
 \* **Miharaite** Cu<sub>4</sub>FePbBiS<sub>6</sub> Konnerudkollen, Drammen (Segalstad & Telstø 2002)  
 Giessenite Cu<sub>2</sub>Pb<sub>26</sub>(Bi,Sb)<sub>20</sub>S<sub>57</sub> [New data on giessenite from Bjørkåsen in Makovicky &  
     Karup-Møller 1986]

Jamesonite  $Pb_4FeSb_6S_{14}$   
 \* **Dufrénoisite**  $Pb_2As_2S_5$  Bleikvassli, Nordland (Cook et al. 1998)  
 Boulangerite  $Pb_5Sb_4S_{11}$   
 \* **Nuffieldite**  $Pb_2Cu(Pb,Bi)Bi_2S_7$  Tennvatn, Sørfold, Nordland (Ellingsen et al. 2000)  
 Zinkenite  $Pb_9Sb_{22}S_{42}$   
 Schirmerite  $Ag_3Pb_3Bi_9S_{18}$  to  $Ag_3Pb_6Bi_7S_{18}$   
 Galenobismutite  $PbBi_2S_4$   
 Cosalite  $Pb_2Bi_2S_5$   
 \* **Seligmannite**  $PbCuAsS_3$  Sulitjelma (Cook 1996; Nordrum & Cook 2001, with wrong formula); Bleikvassli, Nordland (Cook et al. 1998)  
 Bournonite  $PbCuSbS_3$

### 3. HALIDES

Chlorargyrite  $AgCl$   
 Villiaumite  $NaF$   
 Halite  $NaCl$   
 Sylvite  $KCl$   
 \* **Sal ammoniac**  $NH_4Cl$  Mt. Pyramide, Spitsbergen (from a burning coal seam) (Oftedal 1922)  
 Neighborite  $NaMgF_3$   
 Sellaite  $MgF_2$   
 Fluorite  $CaF_2$   
 Ytirofluorite [species discredited 2006, = yttrian fluorite]  
 Cerfluorite [not a valid species, = cerian fluorite]  
 Tveitite-(Y)  $Ca_{14}Y_5F_{43}$   
 Gagarinite-(Y)  $NaCaYF_6$   
 Fluocerite-(Ce)  $(Ce,La)F_3$   
 Hydrohalite  $NaCl \cdot 2H_2O$   
 Cryolite  $Na_3AlF_6$   
 Thomsenolite  $NaCaAlF_6 \cdot H_2O$   
 Pachnolite  $NaCaAlF_6 \cdot H_2O$   
 Gearsutite  $CaAl(OH)F_4 \cdot H_2O$   
 Ralstonite  $Na_xMg_xAl_{2-x}(F,OH)_6 \cdot H_2O$   
 Atacamite  $Cu_2Cl(OH)_3$   
 \* **Abhurite**  $Sn_3O(OH)_2Cl_2$  Shipwreck off Hidra (Griffin et al. 1977; Raade 1988, Interne Notater, 139-140)  
 \* **Bismoclite**  $BiOCl$  Tennvatn, Sørfold, Nordland (Ellingsen et al. 2000)  
 \* **Cotunnite**  $PbCl_2$  Shipwreck off Hidra, with abhurite (Griffin et al. 1977)

### 4. OXIDES

Ice  $H_2O$   
 Cuprite  $Cu_2O$   
 Tenorite  $CuO$   
 \* **Bromellite**  $BeO$  Saga, Mørje, Porsgrunn, Telemark (Larsen et al. 1987)  
 Zincite  $ZnO$   
 Periclase  $MgO$   
 Bunsenite  $NiO$   
 Chrysoberyl  $BeAl_2O_4$   
 Spinel  $MgAl_2O_4$   
 Hercynite  $FeAl_2O_4$

Gahnite  $ZnAl_2O_4$   
 Magnesioferrite  $MgFe_2O_4$   
 Magnetite  $FeFe_2O_4$   
 Jacobsite  $MnFe_2O_4$   
 Chromite  $FeCr_2O_4$   
 Ulvöspinel  $TiFe_2O_4$   
 Hausmannite  $MnMn_2O_4$   
 Maghemite  $Fe_2O_3$   
 \* **Minium**  $Pb^{2+}_2Pb^{4+}O_4$  Meland blyglansskjerp på Hitra (Personal communication from Tor Witsø 1997. X-ray determination NGU; see Witsø 1998b) [looks like paint]  
 Corundum  $Al_2O_3$   
 Hematite  $Fe_2O_3$   
 Ilmenite  $FeTiO_3$   
 Pyrophanite  $MnTiO_3$   
 \* **Geikielite**  $MgTiO_3$  Liset, Selje (Smith & Pinet, 1985)  
 Pseudobrookite  $(Fe^{2+}, Fe^{3+})_2(Ti, Fe^{3+})O_5$   
 Högbomite  $(Mg, Fe)_2(Al, Ti)_5O_{10}$  [NB! New nomenclature for the group]  
 \* **(Be,□)(V,Ti)<sub>3</sub>O<sub>6</sub>** [Mineral crystallographically and chemically related to kyzylkumite, which has the alleged composition  $V_2Ti_3O_9$ ] Byrud, Eidsvoll, Akershus (Raade & Balić-Žunić 2006)  
 Arsenolite  $As_2O_3$   
 Bismite  $Bi_2O_3$   
 Perovskite  $CaTiO_3$   
 Loparite-(Ce)  $(Ce, Na, Ca)(Ti, Nb)O_3$   
 \* **Senaite**  $Pb(Ti, Fe, Mn)_{21}O_{38}$  Bjørndalen, Tvedalen (Larsen 1989)  
 \* **Davidite-(La)**  $(La, Ce)(Y, U)Fe_2(Ti, Fe)_{18}O_{38}$  Intergrown with loveringite from Biggejarvi, Finnmark (Olerud, 1988)  
 Davidite-(Ce)  $(Ce, La)(Y, U)Fe_2(Ti, Fe)_{18}O_{38}$   
 \* **Loveringite**  $(Ca, Ce)(Ti, Fe, Cr, Mg)_{21}O_{38}$  Intergrown with davidite-(La) from Biggejavri, Finnmark (Olerud 1988)  
 Quartz  $SiO_2$   
 \* **Moganite**  $SiO_2$  Huken pukkverk, Grorud, Oslo (X-ray powder-diffraction by G. Raade, see Kvamsdal 1999)  
 Opal  $SiO_2 \cdot nH_2O$   
 \* **Coesite**  $SiO_2$  Grytting, Selje (Smith 1984)  
 Rutile  $TiO_2$   
 Ilmenorutile  $(Ti, Nb, Fe)_3O_6$  [species discredited 2006, = niobian rutile]  
 Strüverite  $(Ti, Ta, Fe)_3O_6$  [species discredited 2006, = tantalian rutile]  
 Pyrolusite  $MnO_2$   
 Cassiterite  $SnO_2$   
 Ferrotapiolite  $(Fe, Mn)(Ta, Nb)_2O_6$   
 Ramsdellite  $MnO_2$  [The locality "Balksjø" in Neumann (1985) is an error for Bolkesjø near Notodden. Personal communication from A.O. Larsen 1997]  
 Nsutite  $Mn^{2+}_x Mn^{4+}_{1-x} O_{2-2x} (OH)_{2x}$  ( $x$  is small)  
 Samarskite-(Y)  $(Y, REE, Fe, U, Th, Ca)(Nb, Ta, Ti)O_4$   
 Yttrotantalite-(Y)  $(Y, U, Fe)(Ta, Nb)O_4$   
 \* **Ixiolite**  $(Ta, Nb, Sn, Fe, Mn)_4O_8$  Heftetjern, Tørdal, Telemark (Bergstøl & Juve 1988)  
 Ferberite  $FeWO_4$   
 Ferrocolumbite  $FeNb_2O_6$   
 \* **Manganocolumbite**  $MnNb_2O_6$  Ågskaret, Holandsfjord (Kristiansen 1994)  
 Ferrotantalite  $FeTa_2O_6$   
 Anatase  $TiO_2$

Brookite  $TiO_2$   
 \* **Stibiotantalite**  $SbTaO_4$  Tjeldøya (personal communication from Tomas Husdal 2006)  
 \* **Stibiocolumbite**  $SbNbO_4$  Tennvatn, Sørfold (personal communication from Tomas Husdal 2006)  
 Baddeleyite  $ZrO_2$   
 Aeschynite-(Y)  $(Y,Ca,Fe,Th)(Ti,Nb)_2(O,OH)_6$   
 \* **Rynersonite**  $Ca(Ta,Nb)_2O_6$  Herrebøkasa, Halden (Personal communication from Tor Witsø 1997. X-ray determination NGU. See Witsø 1999, Kristiansen 2000a and Sørli 2003)  
 Fersmite  $(Ca,Ce,Na)(Nb,Ta,Ti)_2(O,OH,F)_6$  [Larsen 2001a]  
 Euxenite-(Y)  $(Y,Ca,Ce,U,Th)(Nb,Ta,Ti)_2O_6$   
 Polycrase-(Y)  $(Y,Ca,Ce,U,Th)(Ti,Nb,Ta)_2O_6$   
 Kobeite-(Y)  $(Y,U)(Ti,Nb)_2(O,OH)_6$  (?)  
 [Yttrotantalite-(Y) moved, placed after samarskite-(Y)]  
 Brannerite  $(U,Ca,Y,Ce)(Ti,Fe)_2O_6$   
 Pyrochlore  $(Ca,Na)_2Nb_2O_6(OH,F)$   
 \* **Plumbopyrochlore**  $PbNb_2O_6$  Gjerding selva, Lunner, Oppland (electron-microprobe analysis by G. Raade)  
 \* **Yttropyrochlore-(Y)**  $YNb_2O_6(OH)$  Heftetjern, Tørdal, Telemark (Bergstøl & Juve 1988)  
 \* **Uranpyrochlore**  $(U,Ca)Nb_2O_6(OH)$  Gjerstad, Aust-Agder (Hawthorne et al. 1991, Table 5)  
 Microlite  $(Ca,Na)_2Ta_2O_6(O,OH,F)$   
 \* **Plumbomicrolite**  $PbTa_2O_6$  Heftetjern, Tørdal, Telemark (Raade & Kristiansen 2000)  
 Betafite  $(Ca,Na,U)_2(Ti,Nb,Ta)_2O_6(OH)$   
 \* **Yttrobetafite-(Y)**  $(Y,U)_2(Ti,Nb)_2O_6(OH))$  Heftetjern, Tørdal, Telemark (Bergstøl & Juve 1988)  
 \* **Roméite**  $(Ca,Fe)_2(Sb,Ti)_2(O,OH,F)_7$  Tennvatn, Sørfold (Raade et al. 2006)  
 Zirconolite  $CaZrTi_2O_7$  [In Neumann (1985) with the discredited name polymignite]  
 Zirkelite  $(Ti,Ca,Zr)O_{2-x}$  ( $x \sim 0.3$ )  
 Hollandite  $Ba(Mn^{4+},Mn^{2+})_8O_{16}$   
 \* **Coronadite**  $Pb(Mn^{4+},Mn^{2+})_8O_{16}$  Skjerpemyr, Grua, Oppland (Raade 1993, Interne Notater, 168-170)  
 \* **Todorokite**  $(Mn^{2+},Ca,Mg)Mn^{4+}_3O_7\beta H_2O$  Sandstones of the Brøttum formation (Morad 1985); Tuften and Vevja, Tvedalen (Andersen et al. 1996)  
 Romanèchite  $(Ba,H_2O)(Mn^{4+},Mn^{2+})_5O_{10}$   
 Uraninite  $UO_2$   
 Thorianite  $ThO_2$   
 Cerianite-(Ce)  $CeO_2$   
 \* **Petscheckite**  $U^{4+}Fe^{2+}(Nb,Ta)_2O_8$  Tiltvika, Nordland (Tomašić et al. 2004) [(Y+REE)-dominated analogues of petscheckite are known from the Tysfjord area: Raade & Williams (2005)]  
 \* **Liandratite**  $U^{6+}(Nb,Ta)_2O_8$  Herrebøkasa, Østfold (Kristiansen 2006)  
 Molybdite  $MoO_3$   
  
 Behoite  $Be(OH)_2$   
 Wickmanite  $MnSn(OH)_6$   
 Diaspore  $AlO(OH)$   
 Goethite  $FeO(OH)$   
 Groutite  $MnO(OH)$   
 Manganite  $MnO(OH)$   
 Brucite  $Mg(OH)_2$   
 Gibbsite  $Al(OH)_3$   
 \* **Doyleite**  $Al(OH)_3$  Gjerding selva, Lunner, Oppland (Raade & Sæbø 1990, Interne Notater, 149)

- \* **Nordstrandite**  $\text{Al}(\text{OH})_3$  Siktøya, Langesundsfjord (Engvoldsen et al. 1991, Larsen & Raade 1991, Andersen et al. 1996)
- Böhmite  $\text{AlO}(\text{OH})$
- Lepidocrocite  $\text{FeO}(\text{OH})$
- Lithiophorite  $(\text{Al},\text{Li})\text{Mn}^{4+}\text{O}_2(\text{OH})_2$
- Tungstate  $\text{WO}_3 \cdot 8\text{H}_2\text{O}$
- \* **Chalcophanite**  $(\text{Zn},\text{Fe},\text{Mn}^{2+})\text{Mn}^{4+}\text{O}_7 \cdot 3\text{H}_2\text{O}$  Skjerpe myr, Grua, Oppland (Raade 1993, Interne Notater, 168-170)
- \* **Ranciéite**  $(\text{Ca},\text{Mn}^{2+})\text{Mn}^{4+}\text{O}_9 \cdot 3\text{H}_2\text{O}$  Ålefjær, Kristiansand (Nordrum & Garmo 2006) [Identification by A.O. Larsen]
- Birnessite  $(\text{Na},\text{Ca})_{0.5}(\text{Mn}^{4+},\text{Mn}^{2+})_2\text{O}_4 \cdot 1.5\text{H}_2\text{O}$
- \* **Hochelagaite**  $(\text{Ca},\text{Na},\text{Sr})\text{Nb}_4\text{O}_{11} \cdot 8\text{H}_2\text{O}$  Vardeåsen, Skautvedt, Larvik (Berge 1993, Interne Notater, 196. Identified by A.O. Larsen. See also Andersen et al. 1996 and Nordrum 2004a)
- Schoepite  $(\text{UO}_2)_4\text{O}(\text{OH})_6 \cdot 6\text{H}_2\text{O}$
- Studtite  $\text{UO}_4 \cdot 4\text{H}_2\text{O}$  [See Kristiansen 1990]
- Becquerelite  $\text{Ca}(\text{UO}_2)_6\text{O}_4(\text{OH})_6 \cdot 8\text{H}_2\text{O}$
- Fourmarierite  $\text{PbU}_4\text{O}_{13} \cdot 4\text{H}_2\text{O}$
- Vandendriesscheite  $\text{Pb}_{1.5}(\text{UO}_2)_{10}\text{O}_6(\text{OH})_{11} \cdot 11\text{H}_2\text{O}$
- Curite  $\text{Pb}_2\text{U}_5\text{O}_{17} \cdot 4\text{H}_2\text{O}$
- Clarkeite  $\text{Na}(\text{UO}_2)\text{O}(\text{OH}) \cdot 0\text{-}1\text{H}_2\text{O}$
- Tyuyamunite  $\text{Ca}(\text{UO}_2)_2(\text{VO}_4)_2 \cdot 5\text{-}8\text{H}_2\text{O}$
- Metatyuyamunite  $\text{Ca}(\text{UO}_2)_2(\text{VO}_4)_2 \cdot 3\text{H}_2\text{O}$
- Carnotite  $\text{K}_2(\text{UO}_2)_2(\text{VO}_4)_2 \cdot 3\text{H}_2\text{O}$
- \* **Asbecasite**  $\text{Ca}_3\text{Be}_2(\text{Ti},\text{Sn})\text{As}_6\text{Si}_2\text{O}_{20}$  Tennvatn, Sørfold, Nordland (Larsen 1990, Interne Notater, 158-160; Ellingsen et al. 1995)
- \* **Teineite**  $\text{CuTeO}_3 \cdot 2\text{H}_2\text{O}$  Gråurdalen, Oppdal (Isbrekke 1991, Kristiansen 1992, Witsø 1998a)

## 5. CARBONATES, NITRATES

- \* **Nahcolite**  $\text{NaHCO}_3$  Daughter mineral in fluid inclusions from microdiamond-bearing granulites in the Western Gneiss Region (R.B. Larsen et al. 1998)
- Calcite  $\text{CaCO}_3$
- Magnesite  $\text{MgCO}_3$
- Siderite  $\text{FeCO}_3$
- Rhodochrosite  $\text{MnCO}_3$
- Smithsonite  $\text{ZnCO}_3$
- Dolomite  $\text{MgCa}(\text{CO}_3)_2$
- Ankerite  $(\text{Fe},\text{Mg},\text{Mn})\text{Ca}(\text{CO}_3)_2$
- Kutnohorite  $(\text{Mn},\text{Mg},\text{Fe})\text{Ca}(\text{CO}_3)_2$
- Aragonite  $\text{CaCO}_3$
- \* **Strontianite**  $\text{SrCO}_3$  Vinje, Åmot i Telemark (K.E. Larsen 2003)
- \* **Witherite**  $\text{BaCO}_3$  Sulitjelma (Nordrum 1999, Nordrum & Cook 2001, Nordrum 2004b), Blyhatten mine, Bjørnøya (Nordrum 2001)
- Cerussite  $\text{PbCO}_3$
- Azurite  $\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$
- Malachite  $\text{Cu}_2(\text{CO}_3)_2(\text{OH})_2$
- Rosasite  $(\text{Cu},\text{Zn})_2(\text{CO}_3)(\text{OH})_2$  [First authenticated find from Skjerpe myr, Grua, Oppland (Raade & Sæbø 1990, Interne Notater, 145; Raade 1995)]
- Hydrozincite  $\text{Zn}_5(\text{CO}_3)_2(\text{OH})_6$
- Aurichalcite  $(\text{Zn},\text{Cu})_5(\text{CO}_3)_2(\text{OH})_6$

- \* **Dawsonite**  $\text{NaAl}(\text{CO}_3)(\text{OH})_2$   
 Synchysite-(Ce)  $\text{Ca}(\text{Ce},\text{La})(\text{CO}_3)_2\text{F}$   
 Parisite-(Ce)  $\text{Ca}(\text{Ce},\text{La})_2(\text{CO}_3)_3\text{F}_2$   
 Bastnäsite-(Ce)  $(\text{Ce},\text{La})(\text{CO}_3)\text{F}$   
 Hydrocerussite  $\text{Pb}_3(\text{CO}_3)_2(\text{OH})_2$
- \* **Phosgenite**  $\text{Pb}_2(\text{CO}_3)\text{Cl}_2$  Blystadlia, Rælingen (Kamphaug 1986), Tennvatn, Sørfold, Nordland (Ellingsen et al. 2000)
- Bismutite  $\text{Bi}_2(\text{CO}_3)\text{O}_2$
- \* **Beyerite**  $(\text{Ca},\text{Pb})\text{Bi}_2(\text{CO}_3)_2\text{O}_2$  De Lampertiske Duers gruve, Moisesberg, Fyresdal (Nordrum & Larsen 1995)
- \* **Brianyoungite**  $\text{Zn}_{12}(\text{CO}_3)_3(\text{SO}_4)(\text{OH})_{16}$  Konnerudkollen, Drammen; Glomsrudkollen, Modum; Nyseter, Grua (Raade 1995)
- Leadhillite  $\text{Pb}_4(\text{SO}_4)(\text{CO}_3)_2(\text{OH})_2$
- Nesquehonite  $\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$
- Lansfordite  $\text{MgCO}_3 \cdot 5\text{H}_2\text{O}$
- Tengerite-(Y)  $\text{Y}_2(\text{CO}_3)_3 \cdot 2\text{-}3\text{H}_2\text{O}$
- \* **Kimuraite-(Y)**  $\text{CaY}_2(\text{CO}_3)_4 \cdot 6\text{H}_2\text{O}$  Pegmatite at Kragerø, Telemark (Personal communication from A.V. Voloshin 1987. Found on a kainosite specimen in the collection of the Mining Museum in St. Petersburg. The locality is probably the Tangen pegmatite quarry)
- Lokkaite-(Y)  $\text{CaY}_4(\text{CO}_3)_7 \cdot 9\text{H}_2\text{O}$
- \*\* **Adamsite-(Y)**  $\text{NaY}(\text{CO}_3)_2 \cdot 6\text{H}_2\text{O}$  Hundholmen, Tysfjord (personal communication from Tomas Husdal 2006)
- Lanthanite-(La)  $(\text{La},\text{Ce})_2(\text{CO}_3)_3 \cdot 8\text{H}_2\text{O}$
- Hydromagnesite  $\text{Mg}_5(\text{CO}_3)_4(\text{OH})_2 \cdot 4\text{H}_2\text{O}$
- \* **Giorgiosite**  $\text{Mg}_5(\text{CO}_3)_4(\text{OH})_2 \cdot 5\text{H}_2\text{O}$  (?) Sørdalen, Ytre Holmedal, Sunnfjord (Raade 1993, Interne Notater, 188-189)
- Dypingite  $\text{Mg}_5(\text{CO}_3)_4(\text{OH})_2 \cdot 5\text{H}_2\text{O}$
- \* **Artinite**  $\text{Mg}_2(\text{CO}_3)(\text{OH})_2 \cdot 3\text{H}_2\text{O}$  Svartholhaugen, Risberget, Vinstrandalen, Oppdal (Personal communication from Tor Witsø 1997. X-ray determination NGU. See Witsø 2005)
- Manasseite  $\text{Mg}_6\text{Al}_2(\text{CO}_3)(\text{OH})_{16} \cdot 4\text{H}_2\text{O}$
- Hydrotalcite  $\text{Mg}_6\text{Al}_2(\text{CO}_3)(\text{OH})_{16} \cdot 4\text{H}_2\text{O}$
- \* **Pyroaurite**  $\text{Mg}_6\text{Fe}_2(\text{CO}_3)(\text{OH})_{16} \cdot 4\text{H}_2\text{O}$  Ytre Arna, Hordaland (Raade 1983, Interne Notater, 115); Dypingdal, Snarum (Eldjarn 1988) [Needs chemical verification for both localities]
- \* **Strontiodresserite**  $\text{SrAl}_2(\text{CO}_3)_2(\text{OH})_4 \cdot \text{H}_2\text{O}$  Kjøpsvik, Tysfjord (personal communication from Tomas Husdal 2006)
- \* **Calcio-ancylite-(Ce)**  $(\text{Ca},\text{Sr})\text{Ce}_3(\text{CO}_3)_4(\text{OH})_3 \cdot \text{H}_2\text{O}$  Tvedalen, Larvik (Berge 1993, Interne Notater, 196-197; Larsen 1996; Larsen & Gault 2002)
- Ancylite-(Ce)  $\text{SrCe}(\text{CO}_3)_2(\text{OH}) \cdot \text{H}_2\text{O}$
- \* **Kamphaugite-(Y)**  $\text{Ca}_2(\text{Y},\text{REE})_2(\text{CO}_3)_4(\text{OH})_2 \cdot 2\text{-}3\text{H}_2\text{O}$  Hørtekollen, Lier, Buskerud (Raade & Brastad 1993, Rømming et al. 1993). See also Ljøstad (1994)
- Rutherfordine  $\text{UO}_2(\text{CO}_3)$
- \* **Joliotite**  $(\text{UO}_2)(\text{CO}_3) \cdot 2\text{H}_2\text{O}$  Bjertnes, Krødsherad, Buskerud (Kristiansen 1989, Interne Notater, 141-143; Kristiansen 1990)
- Liebigite  $\text{Ca}_2(\text{UO}_2)(\text{CO}_3)_3 \cdot 11\text{H}_2\text{O}$
- \* **Urancalcarite**  $\text{Ca}(\text{UO}_2)_3(\text{CO}_3)(\text{OH})_6 \cdot 3\text{H}_2\text{O}$  Bjertnes, Krødsherad, Buskerud (Kristiansen 1989, Interne Notater, 141-143; Kristiansen 1990)
- \* **Kamotoite-(Y)**  $\text{Y}_2(\text{UO}_2)_4\text{O}_4(\text{CO}_3)_3 \cdot 14.5\text{H}_2\text{O}$  Bjertnes, Krødsherad, Buskerud (Kristiansen 1989, Interne Notater, 141-143; Kristiansen 1990)
- Schröckingerite  $\text{NaCa}_3(\text{UO}_2)(\text{CO}_3)_3(\text{SO}_4)\text{F} \cdot 10\text{H}_2\text{O}$
- Nitrocalcite  $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$

## 6. BORATES

Nordenskiöldine  $\text{CaSn}(\text{BO}_3)_2$

Hambergite  $\text{Be}_2(\text{BO}_3)(\text{OH})$

Berborite  $\text{Be}_2(\text{BO}_3)(\text{OH}, \text{F}) \pm \text{H}_2\text{O}$  [Polytypes 1T, 2T and 2H were described from Saga, Mørje, Porsgrunn, by Giuseppetti et al. (1990)]

\* **Ludwigite**  $(\text{Mg}, \text{Fe}^{2+})_2\text{Fe}^{3+}\text{O}_2(\text{BO}_3)$  Mehus, Hinnøya (Bøe 1997)

Cahnite  $\text{Ca}_2\text{B}(\text{AsO}_4)(\text{OH})_4$

Szaibelyite  $\text{MgBO}_2(\text{OH})$

## 7. SULPHATES, MOLYBDATES, TUNGSTATES

Thenardite  $\text{Na}_2\text{SO}_4$

\* **Aphthitalite**  $(\text{K}, \text{Na})_3\text{Na}(\text{SO}_4)_2$  Daughter mineral in fluid inclusions in quartz from the Eikeren–Skrim granite complex, Oslo Region (Hansteen & Burke 1994)

Anhydrite  $\text{CaSO}_4$

Celestite  $\text{SrSO}_4$

Barite  $\text{BaSO}_4$

Anglesite  $\text{PbSO}_4$

Brochantite  $\text{Cu}_4(\text{SO}_4)(\text{OH})_6$

Natrojarosite  $\text{Na}_2\text{Fe}_6(\text{SO}_4)_4(\text{OH})_{12}$

Jarosite  $\text{K}_2\text{Fe}_6(\text{SO}_4)_4(\text{OH})_{12}$

Osarizawaite  $\text{Pb}(\text{Al}, \text{Cu})_3(\text{SO}_4)_2(\text{OH})_6$

\* **Caledonite**  $\text{Pb}_5\text{Cu}_2(\text{CO}_3)(\text{SO}_4)_3(\text{OH})_6$  Minge, Halden, Østfold (Raade 1993, Interne Notater, 164–165)

Linarite  $\text{PbCu}(\text{SO}_4)(\text{OH})_2$

Szomolnokite  $\text{FeSO}_4 \pm \text{H}_2\text{O}$

Gunningite  $\text{ZnSO}_4 \pm \text{H}_2\text{O}$

Rozenite  $\text{FeSO}_4 \pm 4\text{H}_2\text{O}$

\* **Boyleite**  $\text{ZnSO}_4 \pm 4\text{H}_2\text{O}$  Sauda, Rogaland (Bryhni 1993, Interne Notater, 199–205)

\* **Pentahydrite**  $\text{MgSO}_4 \pm 5\text{H}_2\text{O}$  Dragehullet, Porsgrunn, Telemark (Raade & Sæbø 1990, Interne Notater, 149)

\* **Siderotil**  $\text{FeSO}_4 \pm 5\text{H}_2\text{O}$  Hatlestrand, Hardanger (Raade 1988, Interne Notater, 134–138; R. Ellingsen 1989)

Chalcanthite  $\text{CuSO}_4 \pm 5\text{H}_2\text{O}$

Hexahydrite  $\text{MgSO}_4 \pm 6\text{H}_2\text{O}$

Nickelhexahydrite  $\text{NiSO}_4 \pm 6\text{H}_2\text{O}$

Bianchite  $\text{ZnSO}_4 \pm 6\text{H}_2\text{O}$

Melanterite  $\text{FeSO}_4 \pm 7\text{H}_2\text{O}$

Boothite  $\text{CuSO}_4 \pm 7\text{H}_2\text{O}$

Epsomite  $\text{MgSO}_4 \pm 7\text{H}_2\text{O}$  [First positive identification from Bruvassfeltet, Råna (Raade 1988, Interne Notater, 134–138)]

Goslarite  $\text{ZnSO}_4 \pm 7\text{H}_2\text{O}$  [Needs verification, see Raade 1995]

Alunogen  $\text{Al}_2(\text{SO}_4)_3 \pm 17\text{H}_2\text{O}$

Pickeringite  $\text{MgAl}_2(\text{SO}_4)_4 \pm 22\text{H}_2\text{O}$

Halotrichite  $\text{FeAl}_2(\text{SO}_4)_4 \pm 22\text{H}_2\text{O}$

Mendozite  $\text{NaAl}(\text{SO}_4)_2 \pm 11\text{H}_2\text{O}$

Leightonite  $\text{K}_2\text{Ca}_2\text{Cu}(\text{SO}_4)_4 \pm 2\text{H}_2\text{O}$

Mirabilite  $\text{Na}_2\text{SO}_4 \pm 10\text{H}_2\text{O}$

\* **Görgeyite**  $\text{K}_2\text{Ca}_5(\text{SO}_4)_6 \pm \text{H}_2\text{O}$  Daughter mineral in fluid inclusions in quartz from the Eikeren–Skrim granite complex, Oslo Region (Hansteen 1988)

- Gypsum  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$   
 Copiapite  $\text{Fe}^{2+}\text{Fe}^{3+}_4(\text{SO}_4)_6(\text{OH})_2 \cdot 20\text{H}_2\text{O}$   
 Aluminocopiapite  $\text{Al}_{2/3}\text{Fe}_4(\text{SO}_4)_6(\text{OH})_2 \cdot 20\text{H}_2\text{O}$   
 Fibroferrite  $\text{Fe}(\text{SO}_4)(\text{OH}) \cdot 5\text{H}_2\text{O}$   
 \* **Posnjakite**  $\text{Cu}_4(\text{SO}_4)(\text{OH})_6 \cdot 8\text{H}_2\text{O}$  Konnerudkollen, Drammen; Stabbeldalsgruva, Lisleherad, Notodden; Gullnes, Seljord; Glomsrudkollen, Modum (Raade & Sæbø 1990, Interne Notater, 145; Raade 1995); Herzog Ulrich mine and Knutehåvet prospect, Kongsberg (Nordrum 1995)  
 Langite  $\text{Cu}_4(\text{SO}_4)(\text{OH})_6 \cdot 8\text{H}_2\text{O}$   
 \* **Wroewolfeite**  $\text{Cu}_4(\text{SO}_4)(\text{OH})_6 \cdot 8\text{H}_2\text{O}$  Skyttemyr, Froland (Raade & Sæbø 1990, Interne Notater, 146; Raade 1995)  
 \* **Schulenbergite**  $(\text{Cu},\text{Zn})_7(\text{SO}_4,\text{CO}_3)_2(\text{OH})_{10} \cdot 3\text{H}_2\text{O}$  Konnerudkollen, Drammen and Glomsrudkollen, Modum (Raade 1993, Interne Notater, 170-171; Raade 1995)  
 Ktenasite  $(\text{Cu},\text{Zn})_5(\text{SO}_4)_2(\text{OH})_6 \cdot 6\text{H}_2\text{O}$   
 \* **Devilline**  $\text{CaCu}_4(\text{SO}_4)_2(\text{OH})_6 \cdot 3\text{H}_2\text{O}$  Glomsrudkollen, Modum; Konnerudkollen, Drammen; Skyttemyr, Froland (Raade & Sæbø 1990, Interne Notater 146; Raade 1995); Herzog Ulrich mine and Knutehåvet prospect, Kongsberg (Nordrum 1995)  
 Serpierite  $\text{Ca}(\text{Cu},\text{Zn})_4(\text{SO}_4)_2(\text{OH})_6 \cdot 3\text{H}_2\text{O}$   
 \* **Woodwardite**  $\text{Cu}_{1-x}\text{Al}_x(\text{SO}_4)_{x/2}(\text{OH})_2 \cdot n\text{H}_2\text{O}$  Eidshaug, Minnesund; Skyttemyr, Froland; Sauda, Rogaland (Raade & Sæbø 1990, Interne Notater, 146-147)  
 \* **Glaucocerinite**  $(\text{Zn},\text{Cu})_{10}\text{Al}_6(\text{SO}_4)_3(\text{OH})_{32} \cdot 18\text{H}_2\text{O}$  Sauda, Rogaland (Raade & Sæbø 1990, Interne Notater, 147)  
 \* **Namuwite**  $(\text{Zn},\text{Cu})_4(\text{SO}_4)(\text{OH})_6 \cdot 4\text{H}_2\text{O}$  Glomsrudkollen, Modum, Buskerud (Raade 1993, Interne Notater, 170-171) [Needs verification, see Raade 1995]  
 Slavikite  $\text{NaMg}_2\text{Fe}^{3+}_5(\text{SO}_4)_7(\text{OH})_6 \cdot 33\text{H}_2\text{O}$   
 Thaumasite  $\text{Ca}_6\text{Si}_2(\text{CO}_3)_2(\text{SO}_4)_2(\text{OH})_{12} \cdot 24\text{H}_2\text{O}$   
 \* **Rapidcreekite**  $\text{Ca}_2(\text{SO}_4)(\text{CO}_3) \cdot 4\text{H}_2\text{O}$  Mildigkeit Gottes, Kongsberg, Buskerud (Raade & Sæbø 1990, Interne Notater, 149-150; Raade 1989)  
 Powellite  $\text{CaMoO}_4$   
 Wulfenite  $\text{PbMoO}_4$   
 Scheelite  $\text{CaWO}_4$   
 Stolzite  $\text{PbWO}_4$   
 Fergusonite-(Y)  $\text{YNbO}_4$   
 Lindgrenite  $\text{Cu}_3(\text{MoO}_4)_2(\text{OH})_2$   
 Ferrimolybdite  $\text{Fe}^{3+}_2(\text{MoO}_4)_3 \cdot 7-8\text{H}_2\text{O}$

## 8. PHOSPHATES, ARSENATES, VANADATES

- Lithiophilite  $\text{LiMnPO}_4$   
 Sicklerite  $(\text{Li},\text{Mn})(\text{Mn}^{2+},\text{Fe}^{3+})\text{PO}_4$   
 \* **Beusite**  $(\text{Ca},\text{Mn})(\text{Mn},\text{Ca})_2(\text{PO}_4)_2$  Høydal, Tørdal (personal communication from S. Bergstøl 1989)  
 Whitlockite  $\text{Ca}_9(\text{Mg},\text{Fe})(\text{PO}_4)_6(\text{PO}_3\text{OH})$   
 Xenotime-(Y)  $\text{YPO}_4$   
 \* **Chernovite-(Y)**  $\text{YAsO}_4$  Gjerstad, Aust-Agder (Hawthorne et al. 1991, Table 5); Lindvikskollen, Kragerø (Kristiansen 1993); Tennvatn, Sørfold, Nordland (Ellingsen et al. 1995, Ellingsen et al. 2000)  
 Monazite-(Ce)  $\text{CePO}_4$   
 \* **Cheralite**  $(\text{Ca},\text{Th},\text{Ce})(\text{P},\text{Si})\text{O}_4$  Ytterøy, Nord-Trøndelag (Grønlie & Torsvik 1989)  
 \* **Gasparite-(Ce)**  $\text{CeAsO}_4$  Tennvatn, Sørfold (Raade et al. 2006)  
 \* **Bergslagite**  $\text{CaBe}(\text{AsO}_4)(\text{OH})$  Tennvatn, Sørfold, Nordland (Raade et al. 2006)  
 Triplite  $(\text{Mn},\text{Fe},\text{Mg})_2(\text{PO}_4)(\text{F},\text{OH})$

Wagnerite  $Mg_2(PO_4)F$   
 Holtedahlite  $Mg_{12}(PO_3OH,CO_3)(PO_4)_5(OH,O)_6$  [Structure description by Rømming & Raade (1989)]  
 Althausite  $Mg_4(PO_4)_2(OH,O)(F,[])$   
 Lazulite  $MgAl_2(PO_4)_2(OH)_2$   
 Scorzalite  $(Fe,Mg)Al_2(PO_4)_2(OH)_2$   
 \* **Phosphoellenbergerite**  $Mg_{12}(Mg,Fe,[])_2(PO_4,PO_3OH,AsO_4)_6(PO_3OH,CO_3)_2(OH)_6$   
     Tingelstadtjern, Modum, Buskerud (Raade et al. 1998)  
 Pseudomalachite  $Cu_5(PO_4)_2(OH)_4$   
 \*\* **Raadeite**  $Mg_7(PO_4)_2(OH)_8$  Tingelstadtjern, Modum, Buskerud (Chopin et al. 2001)  
 Isokite  $CaMg(PO_4)F$   
 \* **Pyrobelonite**  $PbMn(VO_4)(OH)$  Ålefjær, Kristiansand (Nordrum & Garmo 2006)  
     [Identification by A.O. Larsen]  
 Woodhouseite  $CaAl_3(PO_4)(SO_4)(OH)_6$   
 Svanbergite  $SrAl_3(PO_4)(SO_4)(OH)_6$   
 Beudantite  $PbFe_3(AsO_4)(SO_4)(OH)_6$  [Blystadlia, Rælingen, see Kamphaug 1986]  
 Fluorapatite  $Ca_5(PO_4)_3F$   
 Hydroxylapatite  $Ca_5(PO_4)_3(OH)$   
 Carbonate-hydroxylapatite  $Ca_5(PO_4,CO_3)_3(OH)$  [not a species, = carbonate-bearing hydroxylapatite]  
 Svabite  $Ca_5(AsO_4)_3F$   
 Chlorapatite  $Ca_5(PO_4)_3Cl$   
 Mimetite  $Pb_5(AsO_4)_3Cl$   
 Vanadinite  $Pb_5(VO_4)_3Cl$   
 \* **Heneuite**  $CaMg_5(PO_4)_3(CO_3)(OH)$  Tingelstadtjern, Modum, Buskerud (Raade et al. 1986, Rømming & Raade 1986)  
 Huréaulite  $Mn_5(PO_4)_2(PO_3OH)_2\cdot4H_2O$   
 Scorodite  $FeAsO_4\cdot2H_2O$   
 Bobierrite  $Mg_3(PO_4)_2\cdot8H_2O$   
 Vivianite  $Fe_3(PO_4)_2\cdot8H_2O$   
 Erythrite  $Co_3(AsO_4)_2\cdot8H_2O$   
 Annabergite  $Ni_3(AsO_4)_2\cdot8H_2O$   
 Symplesite  $Fe_3(AsO_4)_2\cdot8H_2O$  [Blystadlia, Rælingen, see Kamphaug 1986]  
 \* **Collinsite**  $Ca_2Mg(PO_4)_2\cdot2H_2O$  Overntjern, Modum, Buskerud (Chopin et al. 2001)  
 Rhabdophane-(Ce)  $(Ce,La)PO_4\cdot2H_2O$   
 Churchite-(Y)  $YPO_4\cdot2H_2O$   
 \* **Wavellite**  $Al_3(PO_4)_2(OH)_3\cdot5H_2O$  Knepphaughytta, Nannestad (Personal communication from Tor Witsø 1997. On a rock specimen found in a box at NGU, collected by P. Ihlen). See Witsø (1998a)  
 Turquoise  $CuAl_6(PO_4)_4(OH)_8\cdot4H_2O$   
 Pharmacosiderite  $KFe_4(AsO_4)_3(OH)_4\cdot6-7H_2O$   
 \* **Yukonite**  $Ca_2Fe_3(AsO_4)_4(OH)\cdot12H_2O$  (?) Kolsvika, Bindalen (Raade 1993, Interne Notater, 171-173)  
 Torbernite  $Cu(UO_2)_2(PO_4)_2\cdot10-12H_2O$   
 \* **Pittcrite** amorphous hydrous ferric arsenate-sulphate Kolsvika, Bindalen (Raade 1993, Interne Notater, 171-173) [doubtful species]

## 9. SILICATES

Phenakite  $Be_2SiO_4$   
 Willemite  $Zn_2SiO_4$   
 Forsterite  $Mg_2SiO_4$

Fayalite  $\text{Fe}_2\text{SiO}_4$   
 Tephroite  $\text{Mn}_2\text{SiO}_4$   
 \* **Monticellite**  $\text{CaMgSiO}_4$  Seiland (personal communication from Jens Hysingjord 1989);  
 Flekkeren, Skrim (Jamtveit et al. 1997)  
 Pyrope  $\text{Mg}_3\text{Al}_2(\text{SiO}_4)_3$   
 Almandine  $\text{Fe}_3\text{Al}_2(\text{SiO}_4)_3$   
 Spessartine  $\text{Mn}_3\text{Al}_2(\text{SiO}_4)_3$   
 Grossular  $\text{Ca}_3\text{Al}_2(\text{SiO}_4)_3$   
 Andradite  $\text{Ca}_3\text{Fe}_2(\text{SiO}_4)_3$   
 Uvarovite  $\text{Ca}_3\text{Cr}_2(\text{SiO}_4)_3$   
 \* **Schorlomite**  $\text{Ca}_3\text{Ti}_2\text{Fe}_2\text{SiO}_{12}$  Flekkeren, Skrim (Jamtveit et al. 1997)  
 \* **Kimzeyite**  $\text{Ca}_3\text{Zr}_2\text{Al}_2\text{SiO}_{12}$  Flekkeren, Skrim (Jamtveit et al. 1997)  
 \* **Hibschite**  $\text{Ca}_3\text{Al}_2(\text{SiO}_4)_{3-x}(\text{OH})_{4x}$  ( $x = 0.2-1.5$ ) Flekkeren, Skrim (Jamtveit et al. 1997)  
 \* **Katoite**  $\text{Ca}_3\text{Al}_2(\text{SiO}_4)_{3-x}(\text{OH})_{4x}$  ( $x = 1.5-3$ ) Flekkeren, Skrim (Jamtveit et al. 1997) [Fluorine-bearing hydrogarnets ("hydrograndites") were described from Blengsvatn, Bamble by Visser (1993)] ["Hydrogrossular" is registered by Neumann (1985)]  
 Zircon  $\text{ZrSiO}_4$   
 Thorite  $(\text{Th},\text{U})\text{SiO}_4$   
 Thorogummite  $\text{Th}(\text{SiO}_4)_{1-x}(\text{OH})_{4x}$   
 \* **Coffinite**  $\text{U}(\text{SiO}_4)_{1-x}(\text{OH})_{4x}$  Biggejavri, Finnmark (Olerud 1988); Eretveit, Iveland (Frigstad 1999, Appendix; Hansen 2001)  
 Tombarthite-(Y)  $\text{YH}(\text{SiO}_4)_{1-x}(\text{OH})_{4x}$   
 \*\* **Sphaerobertrandite**  $\text{Be}_3\text{SiO}_4(\text{OH})_2$  Tuften, Tvedalen (Pekov et al. 2003)  
 Euclase  $\text{BeAlSiO}_4(\text{OH})$   
 Sillimanite  $\text{Al}_2(\text{SiO}_4)\text{O}$   
 Andalusite  $\text{Al}_2(\text{SiO}_4)\text{O}$   
 Kyanite  $\text{Al}_2(\text{SiO}_4)\text{O}$   
 Staurolite  $(\text{Fe},\text{Mg},\text{Zn})_2\text{Al}_4(\text{SiO}_4)_4\text{O}_7(\text{OH})$   
 Topaz  $\text{Al}_2(\text{SiO}_4)(\text{F},\text{OH})_2$   
 Chondrodite  $(\text{Mg},\text{Fe})_5(\text{SiO}_4)_2(\text{F},\text{OH})_2$   
 Humite  $(\text{Mg},\text{Fe})_7(\text{SiO}_4)_3(\text{F},\text{OH})_2$   
 Clinohumite  $(\text{Mg},\text{Fe})_9(\text{SiO}_4)_4(\text{F},\text{OH})_2$   
 Chloritoid  $(\text{Fe},\text{Mg},\text{Mn})_2\text{Al}_4\text{Si}_2\text{O}_{10}(\text{OH})_4$   
 Otrélite  $(\text{Mn},\text{Fe},\text{Mg})_2\text{Al}_4\text{Si}_2\text{O}_{10}(\text{OH})_4$   
 Braunite  $\text{Mn}^{2+}\text{Mn}^{3+}_6(\text{SiO}_4)\text{O}_8$   
 Långbanite  $(\text{Mn}^{2+},\text{Ca})_4(\text{Mn}^{3+},\text{Fe}^{3+})_9\text{Sb}(\text{SiO}_4)_2\text{O}_{16}$   
 Titanite  $\text{CaTi}(\text{SiO}_4)\text{O}$   
 \* **Cerite-(Ce)**  $\text{Ce}_9\text{Fe}(\text{SiO}_4)_6(\text{SiO}_3\text{OH})(\text{OH})_3$  Lagmannsvik, Hamarøy, Nordland (Raade, Austrheim & Sæbø 1990, Interne Notater, 153-154) [Probably a separate species with  $\text{Al} > \text{Fe}$ ]  
 Törnebohmite-Ce)  $(\text{Ce},\text{La})_2\text{Al}(\text{SiO}_4)_2(\text{OH})$   
 \* **Kuliokite-(Y)**  $(\text{Y},\text{Yb})_4\text{Al}(\text{SiO}_4)_2(\text{OH})_2\text{F}_5$  Høydalen, Tørdal, Telemark (Raade et al. 1993)  
 \* **limoriite-(Y)**  $\text{Y}_2(\text{SiO}_4)(\text{CO}_3)$  Øvre Lapplægret, Drag i Tysfjord (personal communication from Stein Rørvik 2007)  
 Britholite-(Y)  $(\text{Ca},\text{Ce})_2\text{Y}_3(\text{SiO}_4,\text{PO}_4)_3(\text{O},\text{OH},\text{F})$   
 Britholite-(Ce)  $(\text{Ca},\text{Ce})_2\text{Ce}_3(\text{SiO}_4,\text{PO}_4)_3(\text{O},\text{OH},\text{F})$   
 Tritomite-(Ce)  $(\text{Ce},\text{La},\text{Y},\text{Th})_5(\text{Si},\text{B})_3(\text{O},\text{OH},\text{F})_{13}$   
 Melanocerite-(Ce)  $(\text{Ce},\text{Ca})_5(\text{Si},\text{B})_3\text{O}_{12}(\text{OH},\text{F})\text{H}_2\text{O}$  (?)  
 Grandidierite  $(\text{Mg},\text{Fe})\text{Al}_3(\text{BO}_3)(\text{SiO}_4)\text{O}_2$   
 \*\* **Ominelite**  $(\text{Fe},\text{Mg})\text{Al}_3(\text{BO}_3)(\text{SiO}_4)\text{O}_2$  Almgjotheii, Rogaland (Huijsmans et al. 1982, Grew et al. 1998, Hiroi et al. 2001)  
 Dumortierite  $\text{Al}_6(\text{Al},\text{Mg})(\text{BO}_3)(\text{SiO}_4)_3(\text{O},\text{OH})_3$

- \* **Magnesiodumortierite**  $\text{Al}_4(\text{Al},\text{Mg})_2(\text{Mg},\text{Ti})(\text{BO}_3)(\text{SiO}_4)_3(\text{O},\text{OH})_3$  Bøylefossbru, Aust-Agder  
 (Visser & Senior 1991, Chopin et al. 1995, Nijland et al. 1998)
- Datolite  $\text{CaB}(\text{SiO}_4)(\text{OH})$   
 Homilite  $\text{Ca}_2(\text{Fe},\text{Mg})\text{B}_2(\text{SiO}_4)_2\text{O}_2$   
 Gadolinite-(Y)  $\text{Y}_2\text{FeBe}_2(\text{SiO}_4)_2\text{O}_2$   
 Gadolinite-(Ce)  $(\text{Ce},\text{La},\text{Nd},\text{Y})_2\text{FeBe}_2(\text{SiO}_4)_2\text{O}_2$
- \* **Hingganite-(Y)**  $(\text{Y},\text{Yb})_2\text{Be}_2(\text{SiO}_4)_2(\text{OH})_2$  Tuften, Tvedalen (Haugen & Ellingsen 1991,  
 Larsen 1996)
- \* **Hingganite-(Yb)**  $(\text{Yb},\text{Y})_2\text{Be}_2(\text{SiO}_4)_2(\text{OH})_2$  Tangen, Kragerø (Kristiansen 1994, Kristiansen  
 1999)
- Stillwellite-(Ce)  $(\text{Ce},\text{La},\text{Ca})\text{B}(\text{SiO}_4)\text{O}$   
 Cappelenite-(Y)  $\text{Ba}(\text{Y},\text{Ce})_6\text{B}_6(\text{SiO}_4)_3\text{O}_{12}\text{F}_2$
- \*\* **Hundholmenite-(Y)**  $(\text{Y},\text{REE},\text{Ca},\text{Na})_{15}(\text{Al},\text{Fe}^{3+})\text{Ca}_x\text{As}_{1-x}^{3+}(\text{Si},\text{As}^{5+})\text{Si}_6\text{B}_3(\text{O},\text{F})_{48}$  ( $x = 0.78$ )  
 [See okanoganite-(Y) by Larsen 1990, Interne Notater, 161-162] [New mineral species,  
 IMA approved]
- Uranophane  $\text{Ca}(\text{UO}_2)_2(\text{SiO}_3\text{OH})_2 \pm 5\text{H}_2\text{O}$   
 Uranophane-beta  $\text{Ca}(\text{UO}_2)_2(\text{SiO}_3\text{OH})_2 \pm 5\text{H}_2\text{O}$
- \* **Boltwoodite**  $\text{K}(\text{UO}_2)(\text{SiO}_3\text{OH}) \pm 1.5\text{H}_2\text{O}$  Hundholmen, Tysfjord (Eldjarn 1988), Storehaug,  
 Rygge, Østfold (Raade & Sæbø 1990, Interne Notater, 149)
- Kasolite  $\text{Pb}(\text{UO}_2)\text{SiO}_4 \pm \text{H}_2\text{O}$   
 \* Werdingite  $(\text{Mg},\text{Fe}^{2+})_2\text{Al}_{12}(\text{Al},\text{Fe}^{3+})_2(\text{BO}_3)_4(\text{Si}_2\text{O}_7)_2\text{O}_{11}$  Almgjotheii, Rogaland (Grew et al.  
 1998b)
- \* **Åkermanite**  $\text{Ca}_2\text{MgSi}_2\text{O}_7$  Flekkeren, Skrim (Jamtveit et al. 1997)  
 Melilite  $(\text{Ca},\text{Na})_2(\text{Al},\text{Mg})(\text{Si},\text{Al})_2\text{O}_7$
- \* **Okayamalite**  $\text{Ca}_2\text{B}_2\text{SiO}_7$  Skarn from Arendal, Aust-Agder (Olmi et al. 2000, Giuli et al.  
 2000)
- Barylite  $\text{BaBe}_2\text{Si}_2\text{O}_7$   
 Thortveitite  $(\text{Sc},\text{Y})_2\text{Si}_2\text{O}_7$
- \* **Keiviite-(Y)**  $(\text{Y},\text{Yb})_2\text{Si}_2\text{O}_7$  Høgetveit, Evje (this is the  $\text{Y}_2\text{Si}_2\text{O}_7$ -beta phase in Neumann 1985;  
 see also Raade 1988, Interne Notater, 139)
- Yttrialite-(Y)  $(\text{Y},\text{Th})_2\text{Si}_2\text{O}_7$   
 Keldyshite  $\text{Na}_{2-x}\text{H}_x\text{ZrSi}_2\text{O}_7 \pm n\text{H}_2\text{O}$   
 Parakeldyshite  $\text{Na}_2\text{ZrSi}_2\text{O}_7$   
 Bertrandite  $\text{Be}_4\text{Si}_2\text{O}_7(\text{OH})_2$   
 Hemimorphite  $\text{Zn}_4\text{Si}_2\text{O}_7(\text{OH})_2 \pm \text{H}_2\text{O}$   
 Ferro-axinite  $\text{Ca}_2\text{FeAl}_2\text{BO}(\text{Si}_2\text{O}_7)_2(\text{OH})$   
 Manganaxinite  $\text{Ca}_2\text{MnAl}_2\text{BO}(\text{Si}_2\text{O}_7)_2(\text{OH})$  [Nordrum et al. 2005a, Nordrum et al. 2006]
- \*\* **Kristiansenite**  $\text{Ca}_2\text{ScSn}(\text{Si}_2\text{O}_7)(\text{Si}_2\text{O}_6\text{OH})$  Heftetjern, Tørdal, Telemark (Raade et al. 2002,  
 Ferraris et al. 2001, Ellingsen & Haugen 2002)
- Ilvaite  $\text{CaFe}^{2+}_2\text{Fe}^{3+}(\text{Si}_2\text{O}_7)\text{O}(\text{OH})$
- \*\* **Manganilvaite**  $\text{CaFe}^{2+}(\text{Mn},\text{Fe}^{2+})\text{Fe}^{3+}(\text{Si}_2\text{O}_7)\text{O}(\text{OH})$  Konnerudkollen, Drammen (Larsen &  
 Dahlgren 2002, Bonev et al. 2005)
- \* **Cuspidine**  $\text{Ca}_8(\text{Si}_2\text{O}_7)_2\text{F}_4$  Flekkeren, Skrim (Jamtveit et al. 1997)
- Låvenite  $(\text{Na},\text{Ca})_2(\text{Mn},\text{Fe})(\text{Zr},\text{Ti})(\text{Si}_2\text{O}_7)(\text{O},\text{OH},\text{F})_2$   
 Janhaugite  $(\text{Na},\text{Ca})_3(\text{Mn},\text{Fe})_3(\text{Ti},\text{Nb})_2(\text{Si}_2\text{O}_7)_2(\text{OH},\text{F},\text{O})_4$  [Gjerding selva, Lunner, Oppland  
 (Raade & Mladeck 1983, Annehed et al. 1985)]
- Hiortdahllite I  $(\text{Ca},\text{Na})_3(\text{Zr},\text{Ti})(\text{Si}_2\text{O}_7)(\text{O},\text{F})_2$   
 Wöhlerite  $\text{Na}_2\text{Ca}_4\text{Zr}(\text{Nb},\text{Ti})(\text{Si}_2\text{O}_7)_2\text{O}_3\text{F}$
- \* **Baghdadite**  $\text{Ca}_3\text{Zr}(\text{Si}_2\text{O}_7)\text{O}_2$  Flekkeren, Skrim (Jamtveit et al. 1997)
- Mosandrite  $([],\text{Ca},\text{Na},\text{REE})_3(\text{Ca},\text{REE})_4(\text{Ti},\text{Zr})(\text{Si}_2\text{O}_7)_2(\text{H}_2\text{O},\text{OH},\text{F},\text{O})_4 \sim 1.4\text{H}_2\text{O}$  [Formula:  
 personal communication from M. Bellezza 2005]
- \* **Rinkite** (johnstrupite)  $(\text{Ca},\text{Ce})_4\text{Na}(\text{Na},\text{Ca})_2\text{Ti}(\text{Si}_2\text{O}_7)_2\text{F}_2(\text{O},\text{F})_2$  [Identity of rinkite and

- johnstrupite: personal communication from M. Bellezza 2005]
- Rosenbuschite  $(\text{Ca},\text{Na})_3(\text{Zr},\text{Ti})(\text{Si}_2\text{O}_7)\text{OF}$
- Götzenite  $\text{Na}_2\text{Ca}_5\text{Ti}(\text{Si}_2\text{O}_7)_2(\text{F},\text{OH})_4$
- \*\* Grenmarite**  $(\text{Zr},\text{Mn})_2(\text{Zr},\text{Ti})(\text{Mn},\text{Na})(\text{Na},\text{Ca})_4(\text{Si}_2\text{O}_7)_2(\text{O},\text{F})_4$  Vesle Arøya, Langesundsfjord (Bellezza et al. 20004)
- Perrierite-(Ce)  $(\text{Ce},\text{Ca},\text{Th})_4(\text{Mg},\text{Fe})(\text{Ti},\text{Fe})_4(\text{Si}_2\text{O}_7)_2\text{O}_8$
- Chevkinite-(Ce)  $(\text{Ca},\text{Ce},\text{Th})_4(\text{Fe},\text{Mg})(\text{Ti},\text{Fe})_4(\text{Si}_2\text{O}_7)_2\text{O}_8$
- Kentrolite  $\text{Pb}_2\text{Mn}_2(\text{Si}_2\text{O}_7)\text{O}_2$
- \* Tilleyite**  $\text{Ca}_5(\text{CO}_3)_2\text{Si}_2\text{O}_7$  Flekkeren, Skrim (Jamtveit et al. 1997)
- Rowlandite-(Y)  $\text{FeY}_4(\text{Si}_2\text{O}_7)_2\text{F}_2$  [First positive identifications from Stetind and Øvre Lapplægret, Tysfjord; personal communication from Tomas Husdal 2006]
- \* Boralsilite**  $\text{Al}_{16}\text{B}_6(\text{Si}_2\text{O}_7)\text{O}_{30}$  Almgjøtheii, Rogaland (Grew et al. 1998a, Kristiansen 2000b)
- Clinzoisite  $\text{Ca}_2\text{Al}_3(\text{SiO}_4)(\text{Si}_2\text{O}_7)\text{O}(\text{OH})$
- Epidote  $\text{Ca}_2(\text{Fe},\text{Al})_3(\text{SiO}_4)(\text{Si}_2\text{O}_7)\text{O}(\text{OH})$
- Piemontite  $\text{Ca}_2(\text{Mn}^{3+},\text{Fe})(\text{Al},\text{Mn}^{3+})_2(\text{SiO}_4)(\text{Si}_2\text{O}_7)\text{O}(\text{OH})$
- \* Allanite-(Y)**  $(\text{Y},\text{Ce},\text{Ca})_2(\text{Al},\text{Fe}^{3+},\text{Fe}^{2+})_3(\text{SiO}_4)(\text{Si}_2\text{O}_7)\text{O}(\text{OH})$  Hundholmen, Tysfjord (personal communication from Tomas Husdal 2006; analyzed by Callum Hetherington) [Probably the same as "lombaardite" listed by Neumann (1985)]
- Allanite-(Ce)  $(\text{Ce},\text{Ca},\text{Y})_2(\text{Al},\text{Fe}^{3+},\text{Fe}^{2+})_3(\text{SiO}_4)(\text{Si}_2\text{O}_7)\text{O}(\text{OH})$
- Epidote-(Pb)  $(\text{Pb},\text{Ca},\text{Sr})_2(\text{Al},\text{Fe})_3(\text{SiO}_4)(\text{Si}_2\text{O}_7)\text{O}(\text{OH})$  [Previous name hancockite discredited 2006]
- Zoisite  $\text{Ca}_2\text{Al}_3(\text{SiO}_4)(\text{Si}_2\text{O}_7)\text{O}(\text{OH})$
- Pumpellyite-(Mg)  $\text{Ca}_2\text{MgAl}_2(\text{SiO}_4)(\text{Si}_2\text{O}_7)(\text{OH})_2 \pm \text{H}_2\text{O}$
- Julgoldite-(Fe<sup>2+</sup>)  $\text{Ca}_2\text{Fe}^{2+}(\text{Fe}^{3+},\text{Al})_2(\text{SiO}_4)(\text{Si}_2\text{O}_7)(\text{OH})_2 \pm \text{H}_2\text{O}$  [Brastad 1984]
- Ganomalite  $\text{Pb}_3(\text{Ca},\text{Mn})(\text{SiO}_4)(\text{Si}_2\text{O}_7)$
- Vesuvianite  $\text{Ca}_{19}\text{Al}_{10}(\text{Mg},\text{Fe})_3(\text{SiO}_4)_{10}(\text{Si}_2\text{O}_7)_4(\text{OH},\text{F})_{10}$  [Eldjarn et al. 2005]
- \* Vyuntspakhkite-(Y)**  $\text{Y}_4\text{Al}_2(\text{Si},\text{Al})(\text{SiO}_4)_3(\text{Si}_2\text{O}_7)(\text{O},\text{OH})_4$  Stetind, Tysfjord (personal communication from Tomas Husdal 2006)
- Thalénite-(Y)  $\text{Y}_3\text{Si}_3\text{O}_{10}(\text{OH},\text{F})$
- Kornerupine  $([],\text{Mg},\text{Fe})(\text{Al},\text{Mg},\text{Fe})_9(\text{Si},\text{Al},\text{B})_5(\text{O},\text{OH},\text{F})_{22}$
- Catapleiite  $\text{Na}_2\text{ZrSi}_3\text{O}_9 \pm 2\text{H}_2\text{O}$  [Larsen 2001]
- Nenadkevichite  $(\text{Na},\text{K},\text{Ca})(\text{Nb},\text{Ti})\text{Si}_2\text{O}_6(\text{O},\text{OH}) \pm 2\text{H}_2\text{O}$
- \* Labuntsovite**  $\text{Na}_4\text{K}_4(\text{Ba},\text{K})_2(\text{Fe},\text{Mg},\text{Mn})_{1+x}\text{Ti}_8(\text{Si}_4\text{O}_{12})_4(\text{O},\text{OH})_8 \cdot 10\text{H}_2\text{O}$  With dalyite from Dalsfjord, Sunnfjord (Robins et al. 1983) [Needs verification as to species; formula for labuntsovite-Fe is shown here]
- \* Gjerdingenite-Fe**  $(\text{K},\text{Na})_2(\text{Fe},\text{Mn})[(\text{Nb},\text{Ti})_4(\text{Si}_4\text{O}_{12})_2(\text{O},\text{OH})_4] \cdot 6\text{H}_2\text{O}$  Gjerding Selva, Lunner, Oppland (Raade et al. 2002b)
- \* Gerdingenite-Mn**  $(\text{K},\text{Na})_2(\text{Mn},\text{Fe})[(\text{Nb},\text{Ti})_4(\text{Si}_4\text{O}_{12})_2(\text{O},\text{OH})_4] \cdot 6\text{H}_2\text{O}$  Gjerding Selva, Lunner, Oppland (Raade et al. 2004)
- Kainosite-(Y)  $\text{Ca}_2(\text{Y},\text{Ce})_2(\text{CO}_3)(\text{Si}_4\text{O}_{12}) \pm \text{H}_2\text{O}$
- Beryl  $\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$
- \* Bazzite**  $\text{Be}_3\text{Sc}_2\text{Si}_6\text{O}_{18}$  Heftetjern, Tørdal, Telemark (Bergstøl & Juve 1988, Juve & Bergstøl 1990, Demartin et al. 2000)
- Cordierite  $\text{Mg}_2\text{Al}_4\text{Si}_5\text{O}_{18}$
- Elbaite  $\text{Na}(\text{Li}_{1.5}\text{Al}_{1.5})\text{Al}_6(\text{BO}_3)_3\text{Si}_6\text{O}_{18}(\text{OH})_4$
- \* Liddicoatite**  $\text{Ca}(\text{Li}_{1.5}\text{Al}_{1.5})\text{Al}_6(\text{BO}_3)_3\text{Si}_6\text{O}_{18}(\text{OH},\text{O})_4$  Sandnessjøen, Nordland (Larsen et al. 1999, Nordrum et al. 2003c)
- Dravite  $\text{NaMg}_3\text{Al}_6(\text{BO}_3)_3\text{Si}_6\text{O}_{18}(\text{OH})_4$
- Uvite  $(\text{Ca},\text{Na})(\text{Mg},\text{Fe})_3\text{Al}_5\text{Mg}(\text{BO}_3)_3\text{Si}_6\text{O}_{18}(\text{OH},\text{F})_4$
- Schorl  $\text{NaFe}_3\text{Al}_6(\text{BO}_3)_3\text{Si}_6\text{O}_{18}(\text{OH})_4$
- \* Scawtite**  $\text{Ca}_7(\text{CO}_3)\text{Si}_6\text{O}_{18} \cdot 2\text{H}_2\text{O}$  Flekkeren, Skrim (Jamtveit et al. 1997)
- Milarite  $\text{KCa}_2\text{AlBe}_2\text{Si}_{12}\text{O}_{30} \pm 0.5\text{H}_2\text{O}$

- \*\* **Oftedalite**  $K(Sc,Ca,Mn)_2(Be,Al)_3Si_{12}O_{30}$  Heftetjern, Tørdal, Telemark (Cooper et al. 2006, Kristiansen 2005)
- Osumilite  $(K,Na)(Fe,Mg)_2(Al,Fe)_3(Si,Al)_{12}O_{30}$
- Armenite  $BaCa_2Al_6Si_9O_{30}\cdot 2H_2O$
- Eudialyte  $Na_{15}Ca_6Fe_3Zr_3Si(Si_{25}O_{73})(O,OH,H_2O)_3(Cl,OH)_2$  [Nomenclature of eudialyte-group minerals, see Johnsen et al. (2004)]
- \*\* **Ferrokentbrooksite**  $Na_{15}Ca_6(Fe,Mn)_3Zr_3Nb(Si_{25}O_{73})(O,OH,H_2O)_3(Cl,F,OH)_2$  Sagåsen, Mørje, Porsgrunn (Larsen et al. 2005b), Skutesundskjær, Langesundsfjord (Larsen et al. 2005c)
- \*\* **Zirsilit-(Ce)**  $(Na,□)_{12}(Ce,Na)_3Ca_6Mn_3Zr_3Nb(Si_{25}O_{73})(OH)_3(CO_3)\cdot H_2O$  Sagåsen, Mørje, Porsgrunn (Larsen et al. 2005b)
- Enstatite  $Mg_2Si_2O_6$
- Ferrosilite  $(Fe,Mg)_2Si_2O_6$
- \* **Clinoenstatite**  $Mg_2Si_2O_6$  In enstatite crystals from Bamble, Telemark (Schrader et al. 1986)
- Pigeonite  $(Mg,Fe,Ca)(Mg,Fe)Si_2O_6$
- Diopside  $CaMgSi_2O_6$
- Hedenbergite  $CaFeSi_2O_6$
- Augite  $(Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)_2O_6$
- Johannsenite  $CaMnSi_2O_6$
- Omphacite  $(Ca,Na)(Mg,Fe,Al)Si_2O_6$
- Aegirine-augite  $(Ca,Na)(Mg,Fe^{3+},Fe^{2+})Si_2O_6$  [Oslofeltets syenittpegmatitter: Larsen & Raade 1997]
- Jadeite  $Na(Al,Fe)Si_2O_6$
- Aegirine  $NaFeSi_2O_6$
- Spodumene  $LiAlSi_2O_6$
- Lorenzenite  $Na_2Ti_2(Si_2O_6)O_3$  [Larsen et al. 1992]
- Astrophyllite  $(K,Na)_3(Fe,Mn)_7Ti_2Si_8O_{24}(O,OH)_7$
- Kupletskite  $(K,Na)_3(Mn,Fe)_7(Ti,Nb)_2Si_8O_{24}(O,OH)_7$
- \*\* **Hydroastrophyllite**  $(H_3O,K,Ca)_3Fe_7(Ti,Nb)_2Si_8O_{24}(O,OH,F)_7$  Buer, Vesterøya, Sandefjord (Berge & Andersen 2002)
- Anthophyllite  $(Mg,Fe)_7Si_8O_{22}(OH)_2$
- Gedrite  $(Mg,Fe)_5Al_2(Al_2Si_6)O_{22}(OH)_2$
- \* **Sodic gedrite** (sodium gedrite)  $Na(Mg,Fe)_6Al(Al_2Si_6O)_{22}(OH)_2$  From the Norwegian coesite-eclogite province (Smith 1988)
- Cummingtonite  $(Mg,Fe)_7Si_8O_{22}(OH)_2$
- Grunerite  $(Fe,Mg)_7Si_8O_{22}(OH)_2$
- Dannemorite  $Mn_2(Fe,Mg)_5Si_8O_{22}(OH)_2$  [the species name is manganogrunerite]
- Tremolite  $Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$
- Actinolite  $Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$
- Hornblende  $Ca_2Fe^{2+}_4(Al,Fe^{3+})(AlSi_7)O_{22}(OH)_2$  [the formula is that of ferrohornblende]
- \* **Tschermakite**  $Ca_2(Mg,Fe)_3Al_2(Al_2Si_6)O_{22}(OH)_2$  Central islands of Boknfjord, Rogaland (Müller & Strauss 1985) [the formula is that of aluminotschermakite]
- Pargasite  $NaCa_2(Mg,Fe)_4Al(Al_2Si_6)O_{22}(OH)_2$
- \* **Magnesiohastingsite**  $NaCa_2(Mg,Fe^{2+})_4Fe^{3+}(Al_2Si_6)O_{22}(OH)_2$  Syenite pegmatites in the Oslo Region (Larsen 1995, Larsen 1998b)
- Hastingsite  $NaCa_2(Fe^{2+},Mg)_4Fe^{3+}(Al_2Si_6)O_{22}(OH)_2$
- Edenite  $NaCa_2(Mg,Fe)_5(AlSi_7)O_{22}(OH)_2$
- \* **Ferro-edenite**  $NaCa_2(Fe,Mg)_5(AlSi_7)O_{22}(OH)_2$  Syenite pegmatites in the Oslo Region (Larsen 1995, Larsen 1998b)
- Kaersutite  $NaCa_2(Mg,Fe)_4Ti(Al_2Si_6)O_{22}(OH)_2$
- \* **Oxy-kaersutite**  $NaCa_2(Mg,Fe)_4(Si,Al)_8O_{22}O_2$  Larvik alkaline complex (Satoh et al. 2004)
- \* **Winchite**  $NaCa(Mg,Fe)_4AlSi_8O_{22}(OH)_2$  From the Norwegian coesite-eclogite province

(Smith 1988)

- \* **Barroisite**  $\text{NaCa}(\text{Mg},\text{Fe})_3\text{AlFe}^{3+}(\text{AlSi}_7)\text{O}_{22}(\text{OH})_2$  Naustdal, Sogn og Fjordane (Binns 1967); from the Norwegian coesite-eclogite province (Smith 1988)
- Katophorite  $\text{Na}(\text{Na,Ca})\text{Fe}^{2+}(\text{Al,Fe}^{3+})(\text{Si}_7\text{Al})\text{O}_{22}(\text{OH})_2$
- \* **Alumino-magnesiotaramite**  $\text{Na}_2\text{Ca}(\text{Mg},\text{Fe})_3\text{Al}_2(\text{Al}_2\text{Si}_6)\text{O}_{22}(\text{OH})_2$  Nybø, Nordfjord (Ungaretti et al. 1981), Liset, Selje (Ungaretti et al. 1985, Smith et al. 1986) [magnesio-aluminotaramite]
- \* **Aluminotaramite**  $\text{Na}_2\text{Ca}(\text{Fe,Mg})_3\text{Al}_2(\text{Al}_2\text{Si}_6)\text{O}_{22}(\text{OH})_2$  Liset, Selje (Ungaretti et al. 1985, Smith et al. 1986) [ferro-aluminotaramite]
- Glaucophane  $\text{Na}_2(\text{Mg},\text{Fe})_3\text{Al}_2\text{Si}_8\text{O}_{22}(\text{OH})_2$
- Riebeckite  $\text{Na}_2(\text{Fe}^{2+},\text{Mg})_3\text{Fe}^{3+}\text{Si}_8\text{O}_{22}(\text{OH})_2$
- \* **Eckermannite**  $\text{NaNa}_2(\text{Mg},\text{Fe})_4\text{AlSi}_8\text{O}_{22}(\text{OH})_2$  Dalsfjord, Sunnfjord (Robins et al. 1983)
- Arfvedsonite  $\text{NaNa}_2(\text{Fe}^{2+},\text{Mg})_4\text{Fe}^{3+}\text{Si}_8\text{O}_{22}(\text{OH})_2$
- Nybøite  $\text{NaNa}_2\text{Mg}_3\text{Al}_2(\text{AlSi}_7)\text{O}_{22}(\text{OH})_2$  [Ungaretti et al. 1981, Oberti et al. 2003]
- \* **Jimthompsonite**  $(\text{Mg},\text{Fe})_5\text{Si}_6\text{O}_{16}(\text{OH})_2$  Nordland (personal communication from Kurt Bucher 1988)
- \* **Chesterite**  $(\text{Mg},\text{Fe})_{17}\text{Si}_{20}\text{O}_{54}(\text{OH})_6$  Nordland (personal communication from Kurt Bucher 1988)
- \* **Tvedalite**  $(\text{Ca},\text{Mn})_4\text{Be}_3\text{Si}_6\text{O}_{17}(\text{OH})_4 \pm 3\text{H}_2\text{O}$  Vevja, Tvedalen, Vestfold (Larsen et al. 1992a)
- Bavenite  $\text{Ca}_4\text{Be}_2\text{Al}_2\text{Si}_9\text{O}_{26}(\text{OH})_2$
- Wollastonite  $\text{CaSiO}_3$
- Bustamite  $\text{Ca}_3(\text{Mn,Ca})_3(\text{Si}_3\text{O}_9)_2$
- Pectolite  $\text{NaCa}_2\text{Si}_3\text{O}_8(\text{OH})$
- \* **Serandite**  $\text{Na}(\text{Mn,Ca})_2\text{Si}_3\text{O}_8(\text{OH})$  Vesle Arøya, Langesundsfjord (Andersen et al. 1996)
- \* **Cascandite**  $\text{Ca}(\text{Sc,Fe}^{2+})\text{Si}_3\text{O}_8(\text{OH})$  Heftetjern, Tørdal, Telemark (Raade & Erambert 1999, Kristiansen 2003)
- Tobermorite  $\sim \text{Ca}_5(\text{Si}_3\text{O}_8\text{OH})_2 \cdot 2\text{H}_2\text{O}$
- Jennite  $\text{Ca}_9(\text{Si}_3\text{O}_8\text{OH})_2(\text{OH})_8 \cdot 6\text{H}_2\text{O}$  [This mineral, reported from Valleråsen near Porsgrunn (error for Sandefjord) by Neumann (1985) is actually tobermorite. Personal communication from A.O. Larsen 1997]
- \* **Hillebrandite**  $\text{Ca}_2\text{SiO}_3(\text{OH})_2$  Flekkeren, Skrim (Jamtveit et al. 1997)
- Epididymite  $\text{Na}_2\text{Be}_2(\text{Si}_6\text{O}_{15}) \cdot \text{H}_2\text{O}$
- Eudidymite  $\text{Na}_2\text{Be}_2(\text{Si}_6\text{O}_{15}) \cdot \text{H}_2\text{O}$
- Elpidite  $\text{Na}_2\text{ZrSi}_6\text{O}_{15} \pm 3\text{H}_2\text{O}$
- Leucophanite  $\text{NaCaBe}(\text{Si}_2\text{O}_6)\text{F}$
- Aenigmatite  $\text{Na}_2\text{Fe}_5\text{Ti}(\text{Si}_6\text{O}_{18})\text{O}_2$
- Sapphirine  $(\text{Mg},\text{Al})_8(\text{Al},\text{Si})_6\text{O}_{20}$
- \* **Høgtuvaite**  $(\text{Ca},\text{Na})_2(\text{Fe}^{2+},\text{Fe}^{3+},\text{Ti},\text{Mg},\text{Mn},\text{Sn})_6(\text{Si},\text{Be},\text{Al})_6\text{O}_{18}\text{O}_2$  Høgtuva, Mo i Rana, Nordland (Grauch et al. 1994)
- Narsarsukite  $\text{Na}_4\text{Ti}_2(\text{Si}_8\text{O}_{20})\text{O}_2$
- \* **Caysichite-(Y)**  $\text{Ca}_3\text{REEY}_4\text{Si}_8\text{O}_{20}(\text{CO}_3)_6(\text{OH}) \pm 7\text{H}_2\text{O}$  Lindvikskollen, Kragerø (Kristiansen 1993)
- Rhodonite  $\text{CaMn}_4\text{Si}_5\text{O}_{15}$
- Babingtonite  $\text{Ca}_2(\text{Fe}^{2+},\text{Mn})\text{Fe}^{3+}\text{Si}_5\text{O}_{14}(\text{OH})$
- \* **Scandiobabingtonite**  $\text{Ca}_2(\text{Fe}^{2+},\text{Mn})\text{ScSi}_5\text{O}_{14}(\text{OH})$  Heftetjern, Tørdal, Telemark (Raade & Erambert 1999, Kristiansen 2003)
- Hellandite-(Y)  $(\text{Ca,Y})_6(\text{Al,Fe})\text{Si}_4\text{B}_4\text{O}_{20}(\text{OH})_4$
- Tadzhikite-(Ce)  $\text{Ca}_2(\text{Ca,Y})_2(\text{Ti,Fe}^{3+},\text{Al})(\text{Ce,Y,})_2[\text{B}_4\text{Si}_4\text{O}_{16}(\text{O},\text{OH})_6](\text{OH})_2$  [See Engvoldsen et al. 1991]
- Inesite  $\text{Ca}_2\text{Mn}_7\text{Si}_{10}\text{O}_{28}(\text{OH})_2 \pm 5\text{H}_2\text{O}$
- Hilairite  $\text{Na}_4\text{Zr}_2\text{Si}_6\text{O}_{18} \pm 6\text{H}_2\text{O}$  [See Engvoldsen et al. 1991]
- \* **Gaidonnayite**  $\text{Na}_4\text{Zr}_2\text{Si}_6\text{O}_{18} \pm 4\text{H}_2\text{O}$  Siktesøya, Langesundsfjord (Larsen & Raade 1991)

Pyroxferroite  $(\text{Ca}, \text{Fe})(\text{Fe}, \text{Mn})_6(\text{Si}_7\text{O}_{21})$   
 Pyroxmangite  $(\text{Ca}, \text{Fe})(\text{Mn}, \text{Fe})_6(\text{Si}_7\text{O}_{21})$   
 Meliphanite  $\text{NaCaBe}(\text{Si}_2\text{O}_6)\text{F}$   
 Chiavennite  $\text{CaMnBe}_2\text{Si}_5\text{O}_{13}(\text{OH})_2 \pm 2\text{H}_2\text{O}$   
 Prehnite  $\text{Ca}_2\text{Al}_2\text{Si}_3\text{O}_{10}(\text{OH})_2$   
 Fluorapophyllite  $\text{KCa}_4\text{Si}_8\text{O}_{20}(\text{F}, \text{OH}) \pm 8\text{H}_2\text{O}$   
 Hydroxyapophyllite  $\text{KCa}_4\text{Si}_8\text{O}_{20}(\text{OH}, \text{F}) \pm 8\text{H}_2\text{O}$   
 Dalyite  $\text{K}_2\text{ZrSi}_6\text{O}_{15}$   
 Okenite  $\text{Ca}_{10}\text{Si}_{18}\text{O}_{46} \pm 18\text{H}_2\text{O}$   
 Pyrophyllite  $\text{Al}_2\text{Si}_4\text{O}_{10}(\text{OH})_2$   
 Talc  $\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$   
 Paragonite  $\text{NaAl}_2(\text{AlSi}_3)\text{O}_{10}(\text{OH})_2$   
 Muscovite  $\text{KAl}_2(\text{AlSi}_3)\text{O}_{10}(\text{OH}, \text{F})_2$   
 \* **Celadonite**  $\text{K}(\text{Mg}, \text{Fe}^{2+})(\text{Fe}^{3+}, \text{Al})\text{Si}_4\text{O}_{10}(\text{OH})_2$  Dalsfjord, Sunnfjord (Robins et al. 1983); Buer, Bjørkedalen (Andersen et al. 1996)  
 Glauconite  $(\text{K}, \text{Na})(\text{Fe}, \text{Al}, \text{Mg})_2(\text{Si}, \text{Al})_4\text{O}_{10}(\text{OH})_2$   
 Phlogopite  $\text{KMg}_3(\text{AlSi}_3)\text{O}_{10}(\text{F}, \text{OH})_2$   
 Biotite  $\text{K}(\text{Mg}, \text{Fe}^{2+})_3((\text{Al}, \text{Fe}^{3+})\text{Si}_3)\text{O}_{10}(\text{OH}, \text{F})_2$   
 \* **Annite**  $\text{KFe}^{2+}3\text{AlSi}_3\text{O}_{10}(\text{OH})_2$  Syenite pegmatites in the Langesundsfjord district (Larsen 1998a) ["lepidomelane"]  
 Lepidolite  $\text{K}(\text{Li}, \text{Al})_3(\text{Si}, \text{Al}_4)\text{O}_{10}(\text{F}, \text{OH})_2$   
 Polylithionite  $\text{KLi}_2\text{AlSi}_4\text{O}_{10}(\text{F}, \text{OH})_2$   
 Zinnwaldite  $\text{KLiFeAl}(\text{AlSi}_3)\text{O}_{10}(\text{F}, \text{OH})_2$   
 Illite  $\text{K}_{0.65}\text{Al}_{2.0}[\text{Al}_{0.65}\text{Si}_{3.35}\text{O}_{10}] \cdot \text{nH}_2\text{O}$  [a series name]  
 Margarite  $\text{CaAl}_2(\text{Al}_2\text{Si}_2)\text{O}_{10}(\text{OH})_2$   
 \* **Ephesite**  $\text{NaLiAl}_2(\text{Al}_2\text{Si}_2)\text{O}_{10}(\text{OH})_2$  Saga, Mørje, Porsgrunn, Telemark (Raade 1993, Interne Notater, 167. First identified by Uwe Kolitsch)  
 \* **Preiswerkite**  $\text{Na}(\text{AlMg}_2)(\text{Al}_2\text{Si}_2)\text{O}_{10}(\text{OH})_2$  Liset, Selje (Smith et al. 1986); Blengsvatn, Bamble, Telemark (Visser et al. 1999)  
 Montmorillonite  $(\text{Na}, \text{Ca})_{0.3}(\text{Al}, \text{Mg})_2\text{Si}_4\text{O}_{10}(\text{OH})_2 \pm \text{nH}_2\text{O}$   
 Beidellite  $(\text{Na}, \text{Ca}_{0.5})_{0.3}\text{Al}_2(\text{Si}, \text{Al})_4\text{O}_{10}(\text{OH})_2 \pm \text{nH}_2\text{O}$   
 Nontronite  $\text{Na}_{0.3}\text{Fe}^{3+}{}_2(\text{Si}, \text{Al})_4\text{O}_{10}(\text{OH})_2 \pm \text{nH}_2\text{O}$   
 Saponite  $(\text{Ca}_{0.5}, \text{Na})_{0.3}(\text{Mg}, \text{Fe})_3(\text{Si}, \text{Al})_4\text{O}_{10}(\text{OH})_2 \pm \text{nH}_2\text{O}$   
 Vermiculite  $(\text{Mg}, \text{Fe}, \text{Al})_3(\text{Si}, \text{Al})_4\text{O}_{10}(\text{OH})_2 \pm 4\text{H}_2\text{O}$   
 Cookeite  $\text{LiAl}_4(\text{AlSi}_3)\text{O}_{10}(\text{OH})_8$   
 Clinochlore  $(\text{Mg}, \text{Al})_6(\text{Si}, \text{Al})_4\text{O}_{10}(\text{OH})_8$   
 Chamosite  $(\text{Fe}, \text{Al}, \text{Mg})_6(\text{Si}, \text{Al})_4\text{O}_{10}(\text{OH})_8$   
 \* **Gonyerite**  $(\text{Mn}^{2+}, \text{Mg}, \text{Fe}^{3+})_6\text{S}_4\text{O}_{10}(\text{OH})_8$  Sagåsen, Mørje, Porsgrunn (Nordrum & Garmo 2006, p. 58)  
 \* **Kegelite**  $\text{Pb}_4\text{Al}_2\text{Si}_4(\text{SO}_4)(\text{CO}_3)_2(\text{OH})_4\text{O}_{10}$  Minge, Halden, Østfold (Raade 1993, Interne Notater, 164-165)  
 Kaolinite  $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$   
 Dickite  $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$   
 Halloysite  $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4 \pm 2\text{H}_2\text{O}$   
 Hisingerite  $\text{Fe}_2\text{Si}_2\text{O}_5(\text{OH})_4 \pm 2\text{H}_2\text{O}$   
 \* **Neotocite**  $(\text{Mn}^{3+}, \text{Fe}^{3+})_2\text{Si}_2\text{O}_5(\text{OH})_4 \cdot \text{nH}_2\text{O}$  (?) Sagåsen and Saga I, Mørje, Porsgrunn; Saga Pearl quarry, Tvedalen (Larsen & Erambert 2005)  
 Chrysocolla  $(\text{Cu}, \text{Al})_2\text{H}_2\text{Si}_2\text{O}_5(\text{OH})_4 \pm \text{nH}_2\text{O}$   
 Allophane amorphous hydrous aluminium silicate  
 Antigorite  $(\text{Mg}, \text{Fe})_3\text{Si}_2\text{O}_5(\text{OH})_4$   
 Chrysotile  $\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4$   
 Lizardite  $\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4$

- \* **Amesite**  $Mg_2Al(SiAl)O_5(OH)_4$  Liaæs, Modum, Buskerud (Raade 1986)
- \* **Cronstedtite**  $Fe^{2+}_2Fe^{3+}(Fe^{3+}Si)O_5(OH)_4$  Rønningen, Eidanger (Andersen et al. 1996)  
[Needs verification]
- \* **Caryopilite**  $(Mn,Mg)_3Si_2O_5(OH)_4$  Brandsnuten, Botnedal, Tokke, Telemark (Larsen 1988,  
Interne Notater, 130)
- \* **Bementite**  $Mn_7Si_6O_{15}(OH)_8$  Lom (personal communication from Torgeir T. Garmo 1986)  
Determination by Dr. G. Gebhard
- Ferropyrosmalite  $(Fe,Mn)_8Si_6O_{15}(OH,Cl)_{10}$
- Palygorskite  $(Mg,Al)_2Si_4O_{10}(OH)_8(4+4)H_2O$
- Sepiolite  $Mg_4Si_6O_{15}(OH)_2(4+8)H_2O$
- Gyrolite  $NaCa_{16}(AlSi_{23})O_{60}(OH)_8\cdot 15H_2O$
- Zeophyllite  $Ca_{13}(Si_5O_{14})_2(F,OH)_{10}\cdot 6H_2O$
- Stilpnomelane  $K(Fe^{2+},Mg,Fe^{3+})_8(Si,Al)_{12}O_{28}(OH)_8\cdot 2H_2O$
- \* **Bannisterite**  $KCa(Fe,Mn,Zn,Mg)_{20}(Si,Al)_{32}O_{76}(OH)_{16}\cdot 4-12H_2O$  Brandsnuten, Botnedal,  
Tokke, Telemark (Larsen 1988, Interne Notater, 130)
- \* **Leifite**  $Na_6Be_2Al_2Si_{16}O_{39}(OH,F)_2\cdot 1.5H_2O$  Vesle Arøya, Langesundsfjord (Larsen & Åsheim  
1995) [The mineral from Vesle Arøya is probably different from leifite *sensu stricto*  
(Sokolova et al. 2002)]
- Nepheline  $(Na,K)AlSiO_4$
- \* **Kalsilite**  $KAISiO_4$  Flekkeren, Skrim (Jamtveit et al. 1997)
- Leucite  $KAISi_2O_6$
- Orthoclase  $KAISi_3O_8$
- Sanidine  $(K,Na)AlSi_3O_8$
- Microcline  $KAISi_3O_8$
- Anorthoclase  $(Na,K)AlSi_3O_8$
- Hyalophane  $(K,Ba)(Al,Si)_2Si_2O_8$
- Celsian  $BaAl_2Si_2O_8$
- Albite  $NaAlSi_3O_8$  (= Ab)  $An_{0-10}Ab_{100-90}$
- Oligoclase  $An_{10-30}Ab_{90-70}$  [Not a species name]
- Andesine  $An_{30-50}Ab_{70-50}$  [Not a species name]
- Labradorite  $An_{50-70}Ab_{50-30}$  [Not a species name]
- Bytownite  $An_{70-90}Ab_{30-10}$  [Not a species name]
- Anorthite  $CaAl_2Si_2O_8$  (= An)  $An_{90-100}Ab_{10-0}$
- \* **Lisetite**  $Na_2CaAl_4Si_4O_{16}$  Liset, Selje (Smith et al. 1986, Rossi et al. 1986)
- Danburite  $CaB_2Si_2O_8$
- Cancrinite  $(Na,Ca)_8(CO_3,SO_4)_2(AlSiO_4)_6\cdot 2H_2O$
- \* **Giuseppettite**  $Na_{40}K_{16}Ca_8(Si_{48}Al_{48}O_{192})Cl_2(SO_4)_{11}\cdot 9H_2O$  Flekkeren, Skrim (Jamtveit et al.  
1997)
- Sodalite  $Na_8Al_6Si_6O_{24}Cl_2$
- Nosean  $Na_8Al_6Si_6O_{24}(SO_4)\cdot H_2O$
- Lazurite  $(Na,Ca)_8Al_6Si_6O_{24}S_2$
- \* **Danalite**  $Fe_4Be_3(SiO_4)_3S$  Høgtuva, Nordland (Grauch et al. 1994)
- Helvite  $Mn_4Be_3(SiO_4)_3S$
- Genthelvite  $Zn_4Be_3(SiO_4)_3S$
- Scapolite group [needs closer investigation as to species] [marialite is  $Na_4Al_3Si_9O_{24}Cl$ ]
- Natrolite  $Na_2Al_2Si_3O_{10}\cdot 2H_2O$
- Gonnardite  $(Na,Ca)_{6-8}(Si,Al)_{20}O_{40}\cdot 12H_2O$  [Crystal structure determination on gonnardite from  
Vevja, Tvedalen in Mazzi et al. (1986)] ["tetranatrolite" = gonnardite]
- Mesolite  $Na_2Ca_2Al_6Si_9O_{30}\cdot 8H_2O$
- Thomsonite  $NaCa_2Al_5Si_5O_{20}\cdot 6H_2O$
- Scolecite  $CaAl_2Si_3O_{10}\cdot 3H_2O$
- Analcime  $NaAlSi_2O_6\cdot H_2O$

- Laumontite  $\text{CaAl}_2\text{Si}_4\text{O}_{12}\cdot 4\text{H}_2\text{O}$
- \* **Phillipsite**  $(\text{Ca}, \text{Na}, \text{K})_4(\text{Si}, \text{Al})_{16}\text{O}_{32} \cdot 12\text{H}_2\text{O}$  Flekkeren, Skrim (Jamtveit et al. 1997) [formula is that of phillipsite-Ca]
- Harmotome  $\text{Ba}_2(\text{Ca}_{0.5}, \text{Na})\text{Al}_6\text{Si}_{10}\text{O}_{32} \cdot 12\text{H}_2\text{O}$
- Mordenite  $(\text{Ca}, \text{Na}_2, \text{K}_2)\text{Al}_2\text{Si}_{10}\text{O}_{24} \cdot 7\text{H}_2\text{O}$
- Epistilbite  $\text{Ca}_3\text{Al}_6\text{Si}_{18}\text{O}_{48} \cdot 16\text{H}_2\text{O}$
- Heulandite-Ca  $(\text{Ca}, \text{Na}, \text{K})_9[(\text{Si}, \text{Al})_{36}\text{O}_{72}] \cdot 26\text{H}_2\text{O}$  [Larsen 2002, Nordrum et al. 2003b, Nordrum et al. 2005b, Nordrum et al. 2006]
- Heulandite-Sr  $(\text{Sr}, \text{Ca}, \text{Na})_9[(\text{Si}, \text{Al})_{36}\text{O}_{72}] \cdot n\text{H}_2\text{O}$  [Nordrum et al. 2003b, Nordrum et al. 2005b]
- Heulandite-K  $(\text{K}, \text{Ca}, \text{Na}, \text{Sr})_9[(\text{Si}, \text{Al})_{36}\text{O}_{72}] \cdot 26\text{H}_2\text{O}$  [Larsen 2002, Nordrum et al. 2003b, Nordrum et al. 2005b, Nordrum et al. 2006]
- \*\* **Heulandite-Ba**  $(\text{Ba}, \text{Ca}, \text{Sr})_9[(\text{Si}, \text{Al})_{36}\text{O}_{72}] \cdot n\text{H}_2\text{O}$  Nordre Ravnås prospect, Vinoren near Kongsberg, Flesberg, Buskerud (Larsen et al. 2005a) [Flere forekomster i Nordrum 2005]
- \* **Clinoptilolite**  $(\text{Na}, \text{K}, \text{Ca})_6[(\text{Si}, \text{Al})_{36}\text{O}_{72}] \cdot \sim 20\text{H}_2\text{O}$  Arnøya, Troms (Nordrum 2000) [formula is that of clinoptilolite-Na]
- Stilbite-Ca  $(\text{Ca}, \text{Na})_9(\text{Si}, \text{Al})_{36}\text{O}_{72} \cdot 28\text{H}_2\text{O}$
- Stellerite  $\text{CaAl}_2\text{Si}_7\text{O}_{18} \cdot 7\text{H}_2\text{O}$
- \* **Brewsterite-Sr**  $(\text{Sr}, \text{Ba}, \text{Ca})\text{Al}_2\text{Si}_6\text{O}_{16} \cdot 5\text{H}_2\text{O}$  Heimsjø, Snåsa (Larsen et al. 2003, Nordrum & Garmo 2006)
- \* **Brewsterite-Ba**  $(\text{Ba}, \text{Sr}, \text{Ca})\text{Al}_2\text{Si}_6\text{O}_{16} \cdot 5\text{H}_2\text{O}$  Nordre Ravnås prospect, Vinoren near Kongsberg, Flesberg, Buskerud (Larsen et al. 2003, Nordrum et al. 2003a) [X-ray powder diffraction by G. Raade 1994]
- \* **Goosecreekite**  $\text{CaAl}_2\text{Si}_6\text{O}_{16} \cdot 5\text{H}_2\text{O}$  Juvvatn, Lom, Oppland (Raade & Berg 2002)
- Gmelinite  $\text{Na}_8\text{Al}_8\text{Si}_{16}\text{O}_{48} \cdot 21.5\text{H}_2\text{O}$  [formula is that of gmelinite-Na]
- Chabazite  $(\text{Ca}, \text{K})_4(\text{Si}, \text{Al})_{12}\text{O}_{24} \cdot 13\text{H}_2\text{O}$  [formula is that of chabazite-Ca]
- \* **Levyne**  $(\text{Ca}, \text{Na})_6(\text{Si}, \text{Al})_{18}\text{O}_{36} \cdot 17\text{H}_2\text{O}$  Snøhetta, Oppland (K.E. Larsen 2003) [formula is that of levyne-Ca]

## 10. ORGANIC COMPOUNDS

- \* **Moolooite**  $\text{Cu}(\text{C}_2\text{O}_4) \cdot n\text{H}_2\text{O}$  (copper(II)oxalate) Gjersvik, Nord-Trøndelag (in lichens) (Chisholm et al. 1987)
- \* **Hoelite**  $\text{C}_{14}\text{H}_8\text{O}_2$  (anthraquinone) Mt. Pyramide, Spitsbergen (from a burning coal seam) (Oftedal 1922)

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