

# **New minerals recently approved by the Commission on New Minerals and Mineral Names : International Mineralogical Association**

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**New minerals recently approved  
by the  
Commission on New Minerals and Mineral Names  
International Mineralogical Association**

The information given here is provided by the Commission on New Minerals and Mineral Names, I. M. A. for comparative purposes and as a service to mineralogists working on new species.

Each mineral is described in the following format:

IMA No. (any relationship to other minerals)  
Chemical Formula  
Crystal system, space group  
unit cell parameters  
Colour; lustre; diaphaneity  
Optical properties  
Strongest lines in the X-ray powder diffraction pattern

The names of these approved species are considered confidential information until the authors have published their descriptions or released information themselves.

**No other information will be released by the commission.**

J. A. Mandarino, Chairman Emeritus, and J. D. Grice, Chairman  
Commission on New Minerals and Mineral Names, International Mineralogical Association

## 1996 Proposals

IMA No. 96-001



Triclinic: P1 or P $\bar{1}$

a 8.984, b 10.079, c 8.975 Å,  $\alpha$  102.68°,  
 $\beta$  92.45°,  $\gamma$  70.45°

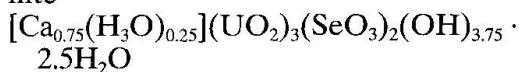
Emerald green; vitreous to adamantine;  
transparent to translucent

Biaxial, indices of refraction calculated from  
reflectance measurements are 1.71–1.73

9.28 (70), 4.65 (70), 3.097 (100), 3.018 (60),  
2.658 (50), 2.468 (50), 1.740 (50)

IMA No. 96-002

The calcium-dominant analogue of guillemite



Orthorhombic: Pmn2<sub>1</sub> or Pmnm

a 7.010, b 17.135, c 17.606 Å

Lemon-yellow; pearly; translucent

Biaxial (–),  $\alpha$  1.54 calc.,  $\beta$  1.73,  $\gamma$  1.75,  
2V(meas.) 33°

8.79 (80), 8.56 (40), 3.51 (100), 3.24 (40),  
3.093 (50), 3.032 (100), 1.924 (40)

IMA No. 96-003

The Fe<sup>3+</sup>-dominant analogue of winstanleyite  
(Fe<sup>3+</sup>, Te<sup>6+</sup>, Ti<sup>4+</sup>, Mg<sup>2+</sup>)Te<sub>3</sub>O<sub>8</sub>

Cubic: Ia $\bar{3}$

a 11.011 Å

Orange; adamantine; translucent

Isotropic, n(calc) = 2.17

4.486 (29), 3.175 (100), 2.943 (23), 2.749 (37),  
2.592 (22), 1.944 (44), 1.658 (45)

- IMA No. 96-004  
 $\text{Al}_2(\text{OH})_5\text{Cl} \cdot 2\text{H}_2\text{O}$   
 Cubic:  $\text{Im}\bar{3}\text{m}$   
 a 19.878 Å  
 Yellow-orange to yellow-brown; vitreous;  
 transparent  
 Isotropic, n 1.53–1.55  
 8.11 (70), 7.03 (50), 4.47 (60), 3.23 (70),  
 2.706 (100), 2.446 (80), 1.957 (70)
- IMA No. 96-005  
 $\text{Mg}_2(\text{CO}_3)\text{Cl}(\text{OH}) \cdot 3\text{H}_2\text{O}$   
 Hexagonal (trigonal):  $\text{R}\bar{3}\text{c}$  or  $\text{R}\bar{3}\text{c}$   
 a 23.163, c 7.221 Å  
 White; lustre and diaphaneity unknown  
 Uniaxial,  $\omega$  1.510,  $\varepsilon$  1.510  
 11.66 (100), 3.396 (17), 3.356 (17), 3.264 (21),  
 3.218 (21), 3.000 (41), 2.657 (22)
- IMA No. 96-006  
 $\text{NaZn}_4(\text{SO}_4)(\text{OH})_6\text{Cl} \cdot 6\text{H}_2\text{O}$   
 Hexagonal (trigonal):  $\text{P}\bar{3}$   
 a 8.359, c 13.059 Å  
 Colourless to white; pearly; translucent  
 Uniaxial (–),  $\omega$  1.5607,  $\varepsilon$  1.5382  
 14.244 (100), 6.501 (23), 4.339 (15), 3.258 (14),  
 2.967 (10)
- IMA No. 96-007  
 $(\text{K},\text{Na})_5\text{Fe}_7^{3+}[\text{Si}_{20}\text{O}_{50}(\text{OH})_6] \cdot 12\text{H}_2\text{O}$   
 Triclinic:  $\text{P}\bar{1}$   
 a 14.86, b 20.54, c 5.29 Å,  $\alpha$  95.6°,  $\beta$  92.3°,  
 $\gamma$  94.4°  
 Pink-brownish; silky to earthy; translucent  
 Biaxial (+),  $\alpha$  1.523,  $\beta$  1.525,  $\gamma$  1.550,  
 2V(meas.) 30°, 2V(calc.) 32°  
 12.36 (100), 11.60 (40), 10.21 (14), 3.411 (37),  
 3.281 (15), 2.896 (12)
- IMA No. 96-008  
 The  $\text{Fe}^{3+}$ -dominant analogue of beryl  
 $(\text{Fe},\text{Mg},\text{Al})_2(\text{Na},\square)[\text{Be}_3\text{Si}_6\text{O}_{18}] \cdot \text{H}_2\text{O}$   
 Hexagonal:  $\text{P}6/\text{mcc}$   
 a 9.387, c 9.202 Å  
 Light-blue; vitreous; transparent  
 Uniaxial (–),  $\omega$  1.625,  $\varepsilon$  1.619  
 8.12 (S), 4.00 (M), 3.278 (VS), 2.903 (S),  
 2.553 (MW), 1.752 (MW)
- IMA No. 96-009  
 $\text{Ca}_3[\text{B}_5\text{O}_6(\text{OH})_7]\text{Cl}_2 \cdot 8\text{H}_2\text{O}$   
 Monoclinic:  $\text{Pn}$   
 a 17.42, b 8.077, c 17.33 Å,  $\beta$  121.48°  
 Colourless to white; vitreous; transparent  
 to translucent  
 Biaxial (–),  $\alpha$  1.506,  $\beta$  1.527,  $\gamma$  1.532,  
 2V(meas.) 56°, 2V(calc.) 51°
- 8.10 (10), 4.04 (4), 3.56 (2), 2.834 (2),  
 2.535 (2), 2.276 (2)
- IMA No. 96-010  
 The  $\text{Fe}^{3+}$ -dominant analogue of tomichite  
 $(\text{Fe}^{3+},\text{Ti})_4\text{Ti}_3\text{AsO}_{13}(\text{OH})$   
 Monoclinic:  $\text{A}2/\text{m}$   
 a 7.184, b 14.289, c 5.006 Å,  $\beta$  105.17°  
 Black; metallic; opaque  
 In reflected light: greyish-white, no bire-  
 flectance, nonpleochroic.  $\text{R}_1$  &  $\text{R}_2$ :  
 (20.1, 20.8%) 460 nm, (18.7, 19.3%) 540 nm,  
 (18.2, 18.9%) 580 nm, (17.5, 18.1%) 660 nm  
 3.117 (30), 2.846 (80), 2.681 (100),  
 2.029 (30), 1.5825 (50)
- IMA No. 96-012  
 $\text{Ca}(\text{H}_2\text{O})_3(\text{C}_2\text{O}_4)$  or  $\text{CaC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$   
 Triclinic:  $\text{P}\bar{1}$   
 a 6.097, b 7.145, c 8.434 Å,  $\alpha$  76.54°,  
 $\beta$  70.30°,  $\gamma$  70.75°  
 Colourless; vitreous; transparent  
 Biaxial (–),  $\alpha'$  1.483,  $\beta$  1.516(calc.),  $\gamma'$  1.533,  
 2V(meas.) 70°, 2V(calc.) 70°  
 7.92 (M), 5.52 (VS), 5.26 (M), 4.99 (M),  
 3.642 (M), 2.834 (S), 2.758 (M), 2.732 (M)
- IMA No. 96-013  
 $\text{Fe}^{2+}(\text{UO}_2)_2(\text{SO}_4)_2(\text{OH})_2 \cdot 3\text{H}_2\text{O}$   
 Orthorhombic:  $\text{Pnmm}$  or  $\text{Pnnm}2$   
 a 15.908, b 16.274, c 6.903 Å  
 Pale yellow to white; vitreous; transparent  
 Biaxial (–),  $\alpha$  1.470,  $\beta$  1.492,  $\gamma$  1.504(calc.),  
 2V(meas.) 73°  
 7.95 (81), 5.91 (100), 3.941 (71), 3.451 (67),  
 3.166 (50), 2.894 (41), 2.596 (70)
- IMA No. 96-014  
 $\text{Pb}_{14}\text{Sb}_{30}\text{S}_{54}\text{O}_{55}$   
 Monoclinic:  $\text{C}2/\text{m}$   
 a 52.00, b 8.148, c 24.311 Å,  $\beta$  104.09°  
 Bluish-black; metallic; opaque  
 In reflected light: black with blue-red reflec-  
 tions, low anisotropism, low bireflectance,  
 nonpleochroic.  $\text{R}_1$  &  $\text{R}_2$ : (40.03, 42.90%)  
 470 nm, (36.46, 40.92%) 546 nm, (35.65,  
 40.25%) 589 nm, (32.40, 36.00%) 650 nm  
 4.04 (m), 3.47 (s), 3.44 (m), 3.04 (m), 2.96 (s),  
 2.296 (m)
- IMA No. 96-015  
 $\text{Cu}_5\text{O}_2(\text{SeO}_3)_2\text{Cl}_2$   
 Monoclinic:  $\text{P}2_1/\text{c}$   
 a 6.045, b 13.778, c 5.579 Å,  $\beta$  95.76°  
 Chestnut to dark brown; very strong vitreous  
 to adamantine; translucent

Biaxial (–),  $\alpha$  2.06,  $\beta$  2.11,  $\gamma$  2.15, 2V(meas.) large, 2V(calc.) 82°  
6.88 (68), 5.511 (50), 2.990 (100), 2.963 (94), 2.566 (67), 2.296 (95)

## IMA No. 96-017

A triclinic polymorph of clinoclase  
 $\text{Cu}_3(\text{AsO}_4)(\text{OH})_3$   
Triclinic: P1  
a 5.445, b 5.873, c 5.104 Å,  $\alpha$  114.95°,  $\beta$  93.05°,  $\gamma$  91.92°  
Green-blue; vitreous; transparent  
Biaxial (–),  $\alpha$  1.760,  $\beta$  1.80,  $\gamma$  1.83, 2V(meas.) 77°, 2V(calc.) 80°  
4.613 (100), 4.580 (50), 3.390 (60), 2.713 (40), 2.543 (40), 2.445 (30)

## IMA No. 96-019

$\text{NaCa}_3(\text{CO}_3)_2\text{F}_3 \cdot \text{H}_2\text{O}$   
Hexagonal (trigonal): P3<sub>2</sub>  
a 6.718, c 15.050 Å  
Colourless to white; vitreous; transparent to translucent  
Uniaxial (+),  $\omega$  1.538,  $\varepsilon$  1.563  
5.809 (30), 5.010 (30), 3.358 (30), 2.791 (50), 2.508 (40), 2.010 (100), 1.939 (40)

## IMA No. 96-020

$\text{Pb}_{12}\text{O}_6\text{Mn}(\text{Mn},\text{Mg})_4(\text{Mg},\text{Mn})_2(\text{SO}_4)(\text{CO}_3)_4\text{Cl}_4(\text{OH})_{12}$   
Tetragonal: P4<sub>2</sub>/nnm  
a 12.627, c 12.595 Å  
Apple green to emerald green; vitreous to adamantine; transparent  
Anomalously biaxial (+),  $\alpha$ ,  $\beta$ , and  $\gamma > 1.92$   
8.95 (20), 7.30 (20), 3.99 (30), 2.975 (100), 2.752 (30), 2.473 (20), 1.716 (20)

## IMA No. 96-022

A polymorph of fluorapatite  
 $(\text{Ca},\text{R})_5(\text{PO}_4)_3\text{F}$  R = Sr, Na, REE  
Hexagonal: P6<sub>3</sub>  
a 9.485, c 7.000 Å  
Pale yellow; vitreous; transparent  
Uniaxial (–),  $\omega$  1.649,  $\varepsilon$  1.637  
3.498 (45), 3.104 (22), 2.838 (100), 2.814 (48), 2.740 (53), 1.963 (21), 1.865 (31)

## IMA No. 96-023

A manganese- and fluorine-rich member of the eudialyte group  
 $(\text{Na},\text{RE})_{15}(\text{Ca},\text{RE})_6\text{Mn}_3\text{Zr}_3\text{NbSi}_{25}\text{O}_{76}\text{F}_2$   
Hexagonal (trigonal): R3m  
a 14.1686, c 30.0847 Å  
Yellow-brown; vitreous; transparent  
Uniaxial (–),  $\omega$  1.628,  $\varepsilon$  1.623

11.362 (43), 7.084 (41), 5.681 (30), 4.296 (34), 3.382 (37), 2.962 (91), 2.840 (100)

## IMA No. 96-024

The scandium-dominant analogue of xenotime-(Y)  
 $\text{ScPO}_4$   
Tetragonal: I4<sub>1</sub>/amd  
a 6.589, c 5.806 Å  
Pale-pink; vitreous; transparent  
Uniaxial (+),  $\omega$  1.790,  $\varepsilon$  1.86  
3.293 (100), 2.464 (8), 2.178 (4), 2.055 (4), 1.693 (6), 1.647 (6)

## IMA No. 96-025

A member of the zeolite group  
 $\text{Na}_3\text{Ca}_4\text{Al}_{11}\text{Si}_{85}\text{O}_{192} \cdot 60\text{H}_2\text{O}$   
Orthorhombic: Pnma  
a 20.223, b 20.052, c 13.491 Å  
Colourless to milky-white; silky to vitreous; opaque to transparent  
Biaxial (–),  $\alpha$  1.485,  $\beta$  1.487,  $\gamma$  1.488, 2V(calc.) 70°  
11.20 (84), 9.98 (35), 3.85 (100), 3.75 (98), 3.67 (27), 3.00 (32)

## IMA No. 96-026

An orthorhombic polymorph of corderoite  
 $\gamma\text{-Hg}_3\text{S}_2\text{Cl}_2$   
Orthorhombic: Ammm, A222 or A2mm (Am2m, Amm2)  
a 9.332, b 16.82, c 9.108 Å  
Canary yellow; glassy; transparent  
Biaxial (+), mean index of refraction 2.25, 2V(meas.) > 70°  
In reflected light: white, anisotropism and bireflectance not observed, R(est.)  $\approx$  15%  
3.65 (90), 3.11 (51), 2.83 (36), 2.60 (49), 2.58 (100), 2.33 (41), 2.11 (31)

## IMA No. 96-027

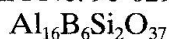
$\text{NaCu}_5\text{O}_2(\text{SeO}_3)_2\text{Cl}_3$   
Orthorhombic: Pbnm  
a 10.482, b 17.732, c 6.432 Å  
Emerald-green; vitreous; transparent  
Biaxial (–),  $\alpha$  1.845,  $\beta$  1.968,  $\gamma$  1.975, 2V(meas.) 20°, 2V(calc.) 31°  
9.01 (10), 8.84 (60), 5.24 (100), 3.251 (40), 2.955 (27), 2.626 (25), 2.513 (12)

## IMA No. 96-028

$\text{NaFe}_4^{2+}(\text{PO}_4)_3$   
Hexagonal (trigonal): R3  
a 14.97, c 41.66 Å  
Very pale amber; waxy; transparent  
Uniaxial (+),  $\omega$  1.72,  $\varepsilon$  1.75

4.13 (80), 3.47 (50), 3.21 (50), 3.01 (90),  
2.93 (50), 2.85 (50), 2.71 (100), 2.57 (50)

IMA No. 96-029



Monoclinic: C2/m, Cm or C2

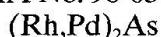
a 14.767, b 5.574, c 15.079 Å,  $\beta$  91.959°

White; vitreous; transparent

Biaxial (+),  $\alpha$  1.629,  $\beta$  1.640,  $\gamma$  1.654,  
2V(meas.) 82°, 2V(calc.) 84°

5.41 (70), 5.19 (100), 4.95 (60), 4.31 (70),  
3.378 (60), 2.162 (40)

IMA No. 96-030



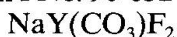
Orthorhombic: Pnma or Pn2<sub>1</sub>a

a 5.866, b 3.893, c 7.302 Å

Colour not observed, metallic, opaque

In reflected light: brownish with a pale green  
tinge, anisotropism moderate-distinct from  
dark brown to pale greyish green, bire-  
flectance weak, pleochroism brownish to  
greenish.  $R_{\text{min}}$ . &  $R_{\text{max}}$ : (45.5, 46.3%)  
470 nm, (47.6, 48.4%) 546 nm, (48.2,  
49.5%) 589 nm, (49.8, 51.2%) 650 nm  
2.426 (7), 2.348 (4), 2.237 (10), 2.067 (8),  
1.935 (6), 1.860 (5)

IMA No. 96-032



Orthorhombic: Pmcn

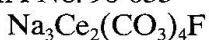
a 6.964, b 9.173, c 6.302 Å

Colourless to pale yellow; vitreous;  
transparent and translucent

Biaxial (–),  $\alpha$  1.457,  $\beta$  1.543,  $\gamma$  1.622,  
2V(meas.) 82°, 2V(calc.) 83°

5.19 (90), 3.477 (100), 2.800 (50), 2.087 (50),  
2.057 (50), 1.966 (50), 1.849 (50), 1.763 (50)

IMA No. 96-033



Hexagonal: P6<sub>3</sub>/mmc

a 5.068, c 22.87 Å

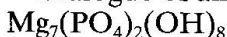
Colourless to slightly beige; vitreous to some-  
what pearly; transparent to translucent

Uniaxial (–),  $\omega$  1.728,  $\varepsilon$  1.542

4.31 (100), 3.169 (70), 2.877 (60), 2.534 (70),  
2.192 (90B), 1.978 (70)

IMA No. 96-034

The magnesium- and phosphate-dominant  
analogue of allactite



Monoclinic: P2<sub>1</sub>/n

a 5.250, b 11.647, c 9.655 Å,  $\beta$  95.93°

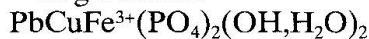
Colourless; pearly; transparent

Biaxial (–),  $\alpha$  1.5945,  $\beta$  1.6069,  $\gamma$  1.6088,  
2V(meas.) 46°, 2V(calc.) 43°

4.436 (75b), 3.521 (80), 3.145 (70), 3.087 (70),  
2.905 (100), 2.794 (75), 2.199 (80)

IMA No. 96-035

The phosphate-dominant analogue  
of gartrellite



Triclinic: P1 or P1̄

a 5.320, b 5.528, c 7.434 Å,  $\alpha$  67.61°,  
 $\beta$  69.68°,  $\gamma$  70.65°

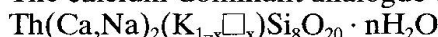
Green; vitreous to adamantine; transparent  
to translucent

Biaxial (+),  $\alpha$  1.90,  $\beta$  1.93 (calc.),  $\gamma$  2.00,  
2V(meas.) 70°

4.720 (67), 4.502 (61), 4.360 (100), 3.250 (70),  
3.138 (57), 2.885 (89), 2.868 (69)

IMA No. 96-036

The calcium-dominant analogue of steacyite



Tetragonal: P4/mcc

a 7.592, b 7.592, c 14.824 Å

Apple-green to dark-green and brown;  
vitreous; transparent

Uniaxial (–),  $\omega$  1.611,  $\varepsilon$  1.606

5.36 (40), 5.31 (70), 3.40 (100), 3.33 (65),  
2.654 (59), 2.231 (50)

IMA No. 96-037



Cubic: I4̄3m

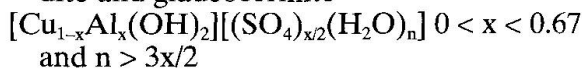
a 15.470 Å

Pale greenish blue; vitreous; transparent  
Isotropic, n 1.566

10.8 (29), 7.73 (34), 3.164 (100), 2.827 (28),  
2.738 (29), 2.582 (37), 2.445 (36)

IMA No. 96-038

The copper-dominant analogue of carrboy-  
dite and glaucocerinite



Hexagonal (trigonal): R3̄m

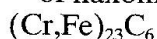
a 3.070, c 31.9 Å

Blue to pale blue; vitreous; translucent  
Uniaxial (+),  $n_{\text{min}}$ . 1.549,  $n_{\text{max}}$ . 1.565

10.5 (100), 5.26 (17), 3.50 (6), 2.60 (5),  
2.46 (2), 2.23 (2), 1.524 (5b)

IMA No. 96-039

The chromium-dominant analogue  
of haxonite



Cubic: Fm3m

a 10.65 Å

- Iron-grey; metallic; opaque  
In reflected light: white. R: (46.5%) 470 nm, (43.7%) 546 nm, (43.2%) 589 nm, (44.4%) 660 nm  
2.38 (3), 2.17 (5), 2.05 (10)
- IMA No. 96-040  
The antimony-dominant analogue of calzirtite  
 $\text{Ca}_2(\text{Zr}, \text{Ti})_5(\text{Sb}^{5+}, \text{Mn}^{3+})_2\text{O}_{16}$   
Tetragonal:  $I4_1/acd$   
a 15.199, c 10.181 Å  
Bright red; adamantine; translucent  
Uniaxial (+),  $\omega$  2.12,  $\varepsilon$  2.16  
3.45 (40), 2.92 (100), 2.539 (60), 1.794 (90), 1.535 (80), 1.0353 (40)
- IMA No. 96-041  
The titanium-dominant analogue of brannockite  
 $\text{KLi}_3\text{Ti}_2\text{Si}_{12}\text{O}_{30}$   
Hexagonal:  $P6/mcc$   
a 9.903, c 14.276 Å  
White; vitreous; transparent  
Uniaxial (-),  $\omega$  1.635,  $\varepsilon$  1.630  
7.15 (40), 4.29 (50), 4.07 (85), 3.57 (80), 3.16 (100), 2.895 (95), 2.742 (30)
- IMA No. 96-043  
The antimony-dominant analogue of fleischerite (with  $\text{AsO}_4$  replacing one  $\text{SO}_4$ )  
 $\text{Pb}_3\text{Sb}^{5+}(\text{SO}_4)(\text{AsO}_4)(\text{OH})_6 \cdot 3\text{H}_2\text{O}$   
Hexagonal:  $P6_322$   
a 8.939, c 11.102 Å  
Colourless; adamantine; transparent  
Uniaxial (+),  $\omega$  1.760,  $\varepsilon$  1.801  
6.35 (44), 3.655 (100), 3.481 (80), 3.175 (31), 2.675 (62), 2.235 (35)
- IMA No. 96-044  
 $\text{Ag}_2\text{Pd}_3\text{Se}_4$   
Monoclinic:  $P2_1/m$  or  $P2_1$   
a 6.350, b 10.387, c 5.683 Å,  $\beta$  114.90°  
Colour unknown, only visible in polished section; metallic; opaque  
In reflected light: buff to slightly grey-green buff; moderate anisotropism, rotation tints rose-brown, grey-green, pale bluish grey and dark steel-blue; bireflectance weak (air), moderate (oil); very weak pleochroism.  $R_1, R_2; {}^{im}R_1, {}^{im}R_2$ : (39.7, 47.2; 26.2, 34.4%) 470 nm, (43.1, 48.8; 29.3, 35.15%) 546 nm, (44.3, 49.4; 30.4, 35.5%) 589 nm, (44.4, 49.2; 31.0, 35.6%) 650 nm  
2.868 (50b), 2.742 (100), 2.688 (80), 2.367 (50), 1.956 (100), 1.829 (30)
- IMA No. 96-045  
 $\text{Pb}_{7.5}\text{B}_{0.5}(\text{OH})_{3.5}\text{O}_{4.5}\text{Cl}_4$  or  $\text{Pb}_8\text{O}_4(\text{OH})_4\text{Cl}_4$   
Monoclinic:  $C2/c$   
a 5.673, b 5.580, c 13.152 Å,  $\beta$  90.47°  
Pale yellow to reddish orange; vitreous, resinous; translucent  
In reflected light: grey; internal reflections ubiquitous, amber to light yellow; anisotropism masked (if present) by the internal reflections; bireflectance weak, non-pleochroic.  $R_1, R_2; {}^{im}R_1, {}^{im}R_2$ : (15.2, 16.3; 4.07, 4.67%) 470 nm, (14.2, 15.3; 3.59, 4.17%) 546 nm, (13.9, 15.0; 3.44, 4.02%) 589 nm, (13.7, 14.7; 3.37, 3.91%) 650 nm  
6.581 (37), 3.785 (48), 3.267 (35), 2.930 (100), 2.825 (43), 2.780 (36), 2.182 (37), 1.980 (33)
- IMA No. 96-047  
The iron-dominant analogue of cuprorhodsite  
 $(\text{Fe}, \text{Cu})(\text{Rh}, \text{Ir}, \text{Pt})_2\text{S}_4$   
Cubic:  $Fd3m$   
a 9.89 Å  
Black; metallic; opaque  
In reflected light: white, isotropic. R: (41.4%) 470 nm, (41.8%) 546 nm, (41.8%) 589 nm, (41.7%) 650 nm  
5.72 (7), 2.99 (10), 2.471 (8), 1.903 (7), 1.750 (9), 1.674 (3), 1.009 (3)
- IMA No. 96-048  
 $\text{Cu}_9\text{O}_2(\text{SeO}_3)_4\text{Cl}_6$   
Monoclinic:  $I2$   
a 14.110, b 6.27, c 12.997 Å,  $\beta$  = 113.0°  
Tobacco-green; strong vitreous; transparent  
Biaxial (-),  $\alpha$  1.87,  $\beta$  1.92,  $\gamma$  1.94,  
2V(meas.) 66°, 2V(calc.) 63°  
11.29 (63), 5.56 (83), 3.450 (100), 3.239 (39), 2.714 (33), 2.486 (61)
- IMA No. 96-049  
 $\text{CaMgNa}_6(\text{IO}_3)_6[(\text{Cr}_{0.84}\text{S}_{0.16})\text{O}_4]_2 \cdot 12\text{H}_2\text{O}$   
Monoclinic:  $C2/c$   
a 23.645, b 10.918, c 15.768 Å,  $\beta$  114.42°  
Pale yellow to bright lemon yellow; vitreous; transparent to translucent  
Biaxial (+),  $\alpha$  1.647,  $\beta$  1.674,  $\gamma$  1.704,  
2V(calc.) 88°  
10.69 (100), 6.36 (50), 5.65 (50), 3.590 (70), 3.121 (80), 3.051 (80)
- IMA No. 96-050  
The cadmium-dominant analogue of briartite  
 $\text{Cu}_2\text{CdGeS}_4$   
Tetragonal:  $I42m$   
a 5.45, c 10.6 Å

Colour unknown, only visible in polished section; metallic; opaque  
 In reflected light: grey with pale violet tint, very weak anisotropism, very weak bireflectance and very weak pleochroism.  
 $R$  and  ${}^{\text{im}}R$ : (24.42, 10.79%) 460 nm, (23.29, 9.85%) 540 nm, (23.04, 9.59%) 580 nm, (23.46, 9.91%) 660 nm  
 3.10 (100), 2.79 (10), 1.92 (80), 1.89 (70), 1.64 (60), 1.60 (20)

## IMA No. 96-051

A polymorph of sibirskite  
 $\text{Ca}_2\text{B}_2\text{O}_5 \cdot \text{H}_2\text{O}$   
 Monoclinic:  $P2_1/m$   
 $a$  6.722,  $b$  5.437,  $c$  3.555 Å,  $\beta$  93.00°  
 White; weak pearly; translucent  
 Biaxial (+),  $\alpha$  1.556,  $\beta$  1.593,  $\gamma$  1.663,  $2V(\text{calc.})$  75°  
 6.73 (70), 3.354 (30), 2.975 (60), 2.855 (20), 2.237 (100), 1.776 (20)

## IMA No. 96-052

The mercury-dominant analogue of černýite and stannite  
 $\text{Cu}_2\text{HgSnS}_4$   
 Tetragonal:  $I\bar{4}$   
 $a$  5.555,  $c$  10.911 Å  
 Dark grey; metallic; opaque  
 In reflected light: greenish-grey to light grey with greenish-brownish tint, moderate anisotropism with faded colour effects form violet-blue to dark-greenish blue, insignificant bireflectance, weakly pleochroic from yellowish-olive-green to brownish-olive.  $R_{\text{max.}}$ : (26.0%) 470 nm, (26.3%) 546 nm, (25.6%) 589 nm, (24.8%) 650 nm  
 3.17 (10), 1.958 (2.5), 1.941 (8), 1.671 (4), 1.646 (3.5), 1.264 (2.5)

## IMA No. 96-053

The sulfate-dominant rhombohedral analogue of hydrocalumite  
 $\text{Ca}_4\text{Al}_2(\text{OH})_{12}(\text{SO}_4) \cdot 6\text{H}_2\text{O}$   
 Hexagonal (trigonal):  $R\bar{3}$  or  $R3$   
 $a$  5.76,  $c$  53.66 Å  
 White; vitreous; transparent  
 Uniaxial (–),  $\omega$  1.504,  $\varepsilon$  1.485  
 8.972 (100), 4.476 (70), 2.362 (40), 2.190 (40), 2.071 (35)

## IMA No. 96-054

The  $\text{Fe}^{2+}$ -dominant analogue of hawthorneite  
 $\text{Ba}[\text{Fe}_6^{2+}\text{Ti}_5\text{Mg}]\text{O}_{19}$   
 Hexagonal:  $P6_3/mmc$   
 $a$  5.926,  $c$  23.32 Å

Colour unknown, only visible in polished section; metallic; opaque  
 In reflected light: light grey; very weak anisotropism, nearly isotropic; bireflectance very weak, but measurable; nonpleochroic.  
 $R_E$ ,  $R_O$ ;  ${}^{\text{im}}R_E$ ,  ${}^{\text{im}}R_O$ ,  $R_{\text{min.}}$ : (16.9, 17.3; 5.13, 5.37%) 470 nm, (16.35, 16.8; 4.90, 5.19%) 546 nm, (16.3, 16.9; 4.92, 5.29%) 589 nm, (16.4, 17.1; 5.00, 5.42%) 650 nm  
 2.963 (44), 2.795 (90), 2.641 (100), 2.437 (46), 1.676 (37), 1.634 (47), 1.481 (47)

## IMA No. 96-055

The cerium-dominant analogue of 96-057, but structurally different  
 $(\text{Ce,Nd,L a})\text{Al}(\text{SO}_4)_2(\text{C}_2\text{O}_4) \cdot 12\text{H}_2\text{O}$   
 Monoclinic:  $C2/c$   
 $a$  8.718,  $b$  18.313,  $c$  13.128 Å,  $\beta$  93.90°  
 Very pale pink (incandescent light) and very pale blue (fluorescent light); vitreous; transparent  
 Biaxial (+),  $\alpha$  1.455,  $\beta$  1.485,  $\gamma$  1.528,  $2V(\text{meas.})$  85°,  $2V(\text{calc.})$  82°  
 7.9 (100), 5.36 (50), 5.01 (40), 3.93 (70), 3.74 (20), 3.29 (20), 3.07 (20)

## IMA No. 96-056

$(\text{Ce,Nd,L a})_2(\text{SO}_4)_2(\text{C}_2\text{O}_4) \cdot 12\text{H}_2\text{O}$   
 Triclinic:  $P\bar{1}$   
 $a$  6.007,  $b$  8.368,  $c$  9.189 Å,  $\alpha$  99.90°,  $\beta$  105.55°,  $\gamma$  107.71°  
 Pale pink (incandescent light), pale blue (fluorescent light), some cream-coloured; vitreous; transparent  
 Biaxial (–),  $\alpha$  1.544,  $\beta$  1.578,  $\gamma$  1.602,  $2V(\text{meas.})$  65°,  $2V(\text{calc.})$  78°  
 8.52 (70), 6.72 (60), 5.48 (100), 4.26 (50), 3.84 (60), 3.35 (40), 2.744 (40)

## IMA No. 96-057

The yttrium-dominant analogue of 96-055, but structurally different  
 $(\text{Y,Nd,Ce})\text{Al}(\text{SO}_4)_2(\text{C}_2\text{O}_4) \cdot 12\text{H}_2\text{O}$   
 Monoclinic:  $P2/n$   
 $a$  10.289,  $b$  19.234,  $c$  11.015 Å,  $\beta$  108.50°  
 Colourless; vitreous; transparent  
 Biaxial (+),  $\alpha$  1.48,  $\beta$  1.49,  $\gamma$  1.55,  $2V(\text{meas.})$  7°,  $2V(\text{calc.})$  46°  
 9.3 (100), 6.28 (90), 5.20 (40), 4.89 (60), 4.63 (30), 4.09 (50), 3.700 (30)

## IMA No. 96-058

The rubidium-dominant analogue of microcline  
 $(\text{Rb,K})\text{AlSi}_3\text{O}_8$   
 Triclinic:  $P\bar{1}$

a 8.81, b 13.01, c 7.18 Å,  $\alpha$  90.3°,  $\beta$  115.7°,  $\gamma$  88.2°

Colourless; vitreous; transparent

Biaxial, indices of refraction slightly higher than host microcline

5.82, 5.77, 4.62, 3.88, 3.61, 3.60, 3.59, 2.94, 2.65, 2.63, 2.61, 2.56 (electron diffraction, no intensities)

IMA No. 96-059

$\text{Fe}^{3+}\text{Mo}_2\text{O}_6(\text{OH})_3 \cdot \text{H}_2\text{O}$

Triclinic:  $\text{P}\bar{1}$

a 5.878, b 7.536, c 9.436 Å,  $\alpha$  71.66°,  $\beta$  83.43°,  $\gamma$  72.85°

Green with a yellowish tinge; vitreous to earthy; transparent to opaque

Biaxial (-),  $\alpha$  1.91,  $\beta$  2.03,  $\gamma$  2.11,  $2V(\text{meas.}) \sim 90^\circ$ ,  $2V(\text{calc.}) 74^\circ$

5.620 (70), 4.711 (50), 4.095 (70), 3.319 (100), 3.232 (90), 2.614 (50), 1.956 (50)

IMA No. 96-060

The scandium-dominant analogue of overite and segelerite

$\text{CaMgSc}(\text{PO}_4)_2(\text{OH}) \cdot 4\text{H}_2\text{O}$

Orthorhombic:  $\text{Pbca}$

a 15.03, b 18.95, c 7.59 Å

Colourless, light yellow to yellowish brown; vitreous; transparent

Biaxial (-),  $\alpha$  1.574,  $\beta$  1.579,  $\gamma$  1.582,  $2V(\text{meas.}) \sim 50^\circ$ ,  $2V(\text{calc.}) 75^\circ$

9.49 (100), 4.75 (17), 3.440 (31), 2.942 (27), 2.912 (44), 2.890 (35), 2.018 (15)

IMA No. 96-062

$(\text{Ti,Cr,Fe})[\text{O}_{2-x}(\text{OH})_x]$

Monoclinic:  $\text{P}2_1/c$

a 7.688, b 4.5495, c 20.147 Å,  $\beta$  92.27°

Black; metallic; translucent to opaque

Biaxial, mean n 2.47 (calc.). In reflected light: grey, with R lower than that of rutile, crichtonite, and srilankite and higher than that of pyrope

3.766 (66), 2.835 (100), 2.660 (73), 1.6842 (94), 1.6760 (73), 1.6574 (71)

IMA No. 96-063

The sodium-dominant analogue of lemoynite with additional  $\text{H}_2\text{O}$

$\text{Na}_4\text{Zr}_2\text{Si}_{10}\text{O}_{26} \cdot 9\text{H}_2\text{O}$

Monoclinic:  $\text{C}2/m$

a 10.5150, b 16.2534, c 9.1029 Å,  $\beta$  105.46°

Colourless to white; vitreous; transparent to translucent

Biaxial (-),  $\alpha$  1.533,  $\beta$  1.559,  $\gamma$  1.567,  $2V(\text{meas.}) 63^\circ$ ,  $2V(\text{calc.}) 57^\circ$

8.832 (30), 8.135 (100), 5.975 (40), 3.974 (35), 3.693 (30), 3.564 (40), 3.490 (35), 2.804 (30)