## Sheet Silicates (Phyllosilicates)

| | | | | |
|---|---|---|---|---|
| Antigorite | $Mg_3Si_2O_5(OH)_4$ | Mon | LGM | 528 |
| Talc | $Mg_3Si_4O_{10}(OH)_2$ | Tric | LGM | 531 |
| Kaolinite | $Al_2Si_2O_5(OH)_4$ | Tric | LGM | 530 |
| Biotite | $K(Mg,Fe)_3AlSi_3O_{10}(OH)_2$ | Mon | BIR | 537 |
| Muscovite | $KAl_2AlSi_3O_{10}(OH)_2$ | Mon | SIR | 534 |
| Chlorite | $(Mg,Fe)_6AlSi_3O_{10}(OH)_2$ | Mon | LGM | 540 |

## Framework Silicates

### *Silica Group*

| | | | | |
|---|---|---|---|---|
| Quartz | $SiO_2$ | Trig | SIR,DSD | 543 |
| *Tridymite | $SiO_2$ | Tetr | SIR | 547 |
| *Cristobalite | $SiO_2$ | Cubic | SIR | 547 |
| Opal | SiO2.nH2O | Amor | LTH | 548 |

### *Feldspar Group*

*Alkali Feldspar*

| | | | | |
|---|---|---|---|---|
| Orthoclase | $KAlSi_3O_8$ | Tric | SIR | 551 |
| Microcline | $KAlSi_3O_8$ | Tric | SIR | 551 |
| Sanidine | $KAlSi_3O_8$ | Mon | SIR | 552 |
| Albite | $NaAlSi_3O_8$ | Tric | SIR | 553 |

*Plagioclase Feldspars*

| | | | | |
|---|---|---|---|---|
| Albite | $NaAlSi_3O_8$ | Tric | SIR | 553 |
| Oligoclase | $An_{10-30}$ | | | |
| Andesine | $An_{30-50}$ | | | |
| Labradorite | $An_{50-70}$ | | | |
| Bytownite | $An_{70-90}$ | | | |
| Anorthite | $CaAl_2Si_2O_8$ | Tric | BIR | 554 |

### *Feldspathoid Group*

| | | | | |
|---|---|---|---|---|
| Leucite | $KAlSi_2O_6$ | Tetr | BIR | 554 |
| Nepheline | $NaAlSiO_4$ | Hex | BIR | 555 |
| Sodalite | $Na_6Al_6Si_6O_{24}{\cdot}2(NaCl)$ | Cubic | BIR | 556 |

### *Zeolite Group*

| | | | | |
|---|---|---|---|---|
| Analcime | $NaAlSi_2O_6{\cdot}H_2O$ | Cubic | LTH | 558 |
| Stilbite | $NaCa_2Al_5Si_{13}O_{36}{\cdot}14H_2O$ | Mon | LTH | 562 |
| Natrolite | $Na_2Al_2Si_3O_{10}{\cdot}2H_2O$ | Orth | LTH | 559 |

## Orthosilicates

### *Olivine Group*

| | | | | |
|---|---|---|---|---|
| Forsterite | $Mg_2SiO_4$ | Orth | BIR | 493 |
| Fayalite | $Fe_2SiO_4$ | Orth | BIR | 493 |
| Humite Group | Mg hydrous silicates | OrMon | BIR | 503 |

### *Garnet Group*

| | | | | |
|---|---|---|---|---|
| Pyrope | $Mg_3Al_2Si_3O_{12}$ | Cubic | HGM | 495 |
| Almandine | $Fe_3Al_2Si_3O_{12}$ | Cubic | HGM | 495 |
| Spessartine | $Mn_3Al_2Si_3O_{12}$ | Cubic | HGM | 495 |
| Grossular | $Ca_3Al_2Si_3O_{12}$ | Cubic | HGM | 495 |
| Andradite | $Ca_3Fe_2Si_3O_{12}$ | Cubic | HGM | 495 |
| Uvarovite | $Ca_3Cr_2Si_3O_{12}$ | Cubic | HGM | 495 |

### *Aluminosilicate Group*

| | | | | |
|---|---|---|---|---|
| Andalusite | $Al_2SiO_5$ | Orth | HGM | 499 |
| Sillimanite | $Al_2SiO_5$ | Orth | HGM | 500 |
| Kyanite | $Al_2SiO_5$ | Tric | HGM | 500 |
| Topaz | $Al_2SiO_4(F,OH)_2$ | Orth | HGM | 501 |
| Staurolite | $Fe_2Al_9Si_4O_{23}(OH)$ | Mon | HGM | 502 |
| Zircon | $ZrSiO_4$ | Tetr | SIR | 498 |
| Titanite (Sphene) | $CaTiSiO_5$ | Mon | SIR | 504 |

## Sorosilicates

| | | | | |
|---|---|---|---|---|
| Epidote | $Ca_2Al_2FeSi_3O_{12}(OH)$ | Mon | LGM | 507 |
| Vesuvianite | $Ca_{10}(Mg,Fe)_2Al_4(SiO_4)_5$-$(Si_2O_7)_2(OH)_4$ | Tet | HGM | 509 |

## Cyclosilicates (Ring Silicates)

| | | | | |
|---|---|---|---|---|
| Tourmaline | $NaMg_3Al_5B_3Si_6O_{27}(OH)_4$ | Trig | PEG | 513 |
| Beryl | $Be_3Al_2Si_6O_{18}$ | Hex | PEG | 511 |

## Chain Silicates (Inosilicates)

### *Pyroxene Group (Single-Chains)*

*Orthopyroxene*

| | | | | |
|---|---|---|---|---|
| Enstatite | $Mg_2Si_2O_6$ | Orth | BIR | 514 |
| Ferrosilite | $Fe_2Si_2O_6$ | Orth | BIR | 514 |

*Clinopyroxene*

| | | | | |
|---|---|---|---|---|
| Diopside | $CaMgSi_2O_6$ | Mon | BIR | 517 |
| Hedenbergite | $CaFeSi_2O_6$ | Mon | BIR | 517 |
| *Jadeite | $NaAlSi_2O_6$ | Mon | HGM | 518 |
| Spodumene | $LiAlSi_2O_6$ | Mon | PEG | 519 |

### *Pyroxenoids (Single-Chains)*

| | | | | |
|---|---|---|---|---|
| Wollastonite | $Ca_3Si_3O_9$ | Tric | HGM | 520 |
| Rhodonite | $Mn_5Si_5O_{15}$ | Tric | HTH | 521 |
| Pectolite | $Ca_2NaH(SiO_3)_3$ | Tric | HTH | 523 |

### *Amphibole Group (Double-Chains)*

| | | | | |
|---|---|---|---|---|
| Anthophyllite | $(Mg,Fe)_7Si_8O_{22}(OH)_2$ | Orth | HGM | 523 |
| Tremolite | $Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$ | Mon | HGM | 525 |
| Hornblende | $(Na,Ca)_2(Mg,Fe,Al)_5(Al,Si)_8O_{22}(OH)_2$ | Mon | HGM | 526 |

## Oxides

| | | | | |
|---|---|---|---|---|
| Corundum | $Al_2O_3$ | Trig | HGM | 379 |
| Hematite | $Fe_2O_3$ | Trig | OHY,HGM | 380 |
| Ilmenite | $FeTiO_3$ | Trig | BIR | 383 |
| Spinel | $MgAl_2O_4$ | Cubic | HGM | 388 |
| Magnetite | $FeFe_2O_4$ $Fe_3O_4$ | Cubic | BIR | 389 |
| Chromite | FeCr2O4 | Cubic | BIR | 389 |
| Rutile | $TiO_2$ | Tetr | HGM | 383 |
| Pyrolusite | $MnO_2$ | Tetr | LTH | 384 |
| Cassiterite | $SnO_2$ | Tetr | HTH | 385 |
| Cuprite | $Cu_2O$ | Cubic | OHY | 378 |
| Zincite | ZnO | Hex | OHY | 378 |

## Hydroxides

| | | | | |
|---|---|---|---|---|
| Brucite | $Mg(OH)_2$ | Trig | LGM | 393 |
| Gibbsite | $Al(OH)_3$ | Mon | LGM | 397 |
| Bauxite | Al hydroxides | | DSD | 397 |
| Goethite | FeO(OH) | Orth | OHY | 395 |
| Limonite | $FeO(OH)nH_2O$ | Amor | OHY | 396 |

## Halides

| | | | | |
|---|---|---|---|---|
| Halite | NaCl | Cubic | EVP | 399 |
| Sylvite | KCl | Cubic | EVP | 400 |
| Fluorite | $CaF_2$ | Cubic | LTH | 401 |

## Carbonates

| | | | | |
|---|---|---|---|---|
| Calcite | $CaCO_3$ | Trig | EVP | 411 |
| Aragonite | $CaCO_3$ | Orth | HGM | 416 |
| Siderite | $FeCO_3$ | Trig | LTH | 414 |
| Rhodochrosite | $MnCO_3$ | Trig | LTH | 415 |
| Dolomite | $CaMg(CO_3)_2$ | Trig | EVP | 419 |
| Malachite | $Cu_2CO_3(OH)_2$ | Mon | OHY | 421 |
| Azurite | $Cu_3(CO_3)_2(OH)_2$ | Mon | OHY | 421 |

## Borates

| | | | | |
|---|---|---|---|---|
| Kernite | Hydrous Na-borate | Mon | EVP | 422 |
| Borax | Hydrous Na-borate | Mon | EVP | 423 |

## Sulfates

| | | | | |
|---|---|---|---|---|
| Barite | $BaSO_4$ | Orth | LTH | 425 |
| Celestine | $SrSO_4$ | Orth | LTH | 427 |
| Anhydrite | $CaSO_4$ | Orth | EVP | 428 |
| Gypsum | $CaSO_4 2H_2O$ | Mon | EVP | 429 |

## Tungstates

| | | | | |
|---|---|---|---|---|
| Wolframite | $(Fe,Mn)WO_4$ | Mon | HTH | 431 |
| Scheelite | $CaWO_4$ | Tetr | HTH | 432 |

## Phosphates

| | | | | |
|---|---|---|---|---|
| Apatite | $Ca_5(PO_4)_3(OH,F,Cl)$ | Hex | SIR,BIR | 434 |
| Amblygonite | $LiAlFPO_4$ | Tric | PEG | 437 |
| Turquoise | $CuAl_6PO_4(OH)_2 4H_2O$ | Tric | OHY | 438 |

# GEOL 3010 Mineralogy Laboratory

## Mineral List

The following is a list of the most important minerals to be covered in this course. You will be expected to identify these minerals in goo-quality hand specimens, and you will be expected to know their chemical formulae as they are listed below. You should be familiar with the section on each mineral in the text (Klein, 2002). You will not be responsible for hand specimen identification of those marked with an asterix.

Also listed with each mineral is a three-letter abbreviation for the most mineral environment for each.

LTH - Low Temperature Hydrothermal
HTH - High Temperature Hydrothermal
OHY - Oxidized Hydrothermal
BIR - Basic Igneous Rocks
SIR Silicic Igneous Rocks
PEG - Pegmatites
HGM - High Grade Metamorphic
LGM - Low Grade Metamorphic
DSD - Detrital Sedimentary
EVP - Evaporite

| Mineral | Formula | Cryst | Env | Klein page# |
|---|---|---|---|---|
| **Native Elements** | | | | |
| Gold | Au | Cubic | HTH | 342 |
| Silver | Ag | Cubic | HTH | 343 |
| Copper | Cu | Cubic | OHY | 344 |
| Sulfur | S | Orth | OHY,EVP | 346 |
| Diamond | C | Cubic | HGM | 347 |
| Graphite | C | Hex | HGM | 351 |
| **Sulfides** | | | | |
| Pyrite | $FeS_2$ | Cubic | HTH | 364 |
| Marcasite | $FeS_2$ | Orth | LTH | 366 |
| Pyrrhotite | FeS | Hex | HTH | 359 |
| Covellite | CuS | Hex | LTH | 361 |
| Chalcocite | $Cu_2S$ | Orth | LTH | 352 |
| Chalcopyrite | $CuFeS_2$ | Tetr | LTH | 357 |
| Bornite | $Cu_5FeS_4$ | Cubic | LTH | 352 |
| Sphalerite | ZnS | Cubic | LTH | 356 |
| Galena | PbS | Cubic | LTH | 355 |
| Cinnabar | HgS | Hex | LTH | 362 |
| Realgar | AsS | Mon | LTH | 362 |
| Orpiment | $As_2S_3$ | Mon | LTH | 363 |
| Stibnite | $Sb_2S_3$ | Orth | LTH | 363 |
| Molybdenite | $MoS_2$ | Hex | HTH | 367 |
| Enargite | $Cu_3AsS_4$ | Orth | HTH | 369 |
| Tetrahedrite | $Cu_{12}Sb_4S_{13}$ | Cubic | HTH | 370 |
| Arsenopyrite | FeAsS | Mon | HTH | 368 |