

Geology 284 - Mineralogy, Fall 2008
Dr. Helen Lang, West Virginia University

Micas and Minerals of Pegmatites

Biotite and Muscovite

- Micas (one kind of sheet silicate)
- Low on Bowen's Reaction Series
- Common only in lower temperature, felsic igneous rocks, like granite
- Also common in metamorphic rocks

Mica Formulas

- **Biotite**
 - $\text{K}(\text{Mg}^{2+}, \text{Fe}^{2+})_3(\text{AlSi}_3\text{O}_{10})(\text{OH})_2$
 - (complete solid solution)
- **Muscovite**
 - $\text{KAl}^{3+}_2(\text{AlSi}_3\text{O}_{10})(\text{OH})_2$

Mica Structures

Simple Mica Structure from Text - see handout

**Show Muscovite Movie,
thanks to Dr. Jillian Banfield, U of Wisconsin**

[Muscovite Movie](#) -

<http://socrates.berkeley.edu/~eps2/wisc/geo360/muscovite.mov>

Biotite is a **Trioctahedral** Mica - 3/3 of the octahedral spaces are filled with divalent Fe²⁺ or Mg²⁺ cations

Biotite Properties

- Light tan (Mg-rich) to black (Fe-rich) color
- Hardness 2.5-3
- Platy habit
- Perfect basal cleavage
- Flexible cleavage sheets
- May occur in pseudo-hexagonal "books"

Biotite

Biotite (note hexagonal "books")

Biotite Optical properties

- Brown, red-brown, tan or green in thin section
- Strongly pleochroic
- Perfect basal cleavage
- Parallel or near-parallel extinction
- "Bird's-eye" extinction (photo coming)
- Pleochroic haloes around zircon (see photo)

Biotite Pleochroism

"Bird's-eye" Extinction in Biotite
(typical of all micas)

Muscovite is a **dioctahedral** Mica - 2/3 of octahedral spaces are filled with trivalent Al^{3+} cations

Muscovite Properties

- White to gray or silvery
- Hardness 2 to 2.5
- Platy habit
- Perfect basal cleavage
- Flexible cleavage sheets
- Occurs as "books," massive aggregates or scattered in a quartz-feldspar matrix

Muscovite

Muscovite with Quartz

Large cleavage plates of Muscovite are used for:

- Insulation in electrical apparatus
- "Isinglass" windows in furnace and stove doors

Muscovite Optical Properties

- Clear and colorless in thin section (PPL)
- Perfect basal cleavage
- Moderate to high birefringence
- "Bird's-eye" extinction (like all micas)

Muscovite in thin section

Minerals of Pegmatites

Large crystals of Quartz, Alkali Feldspar and Muscovite

(which are low on Bowen's Reaction Series)

Some Pegmatites contain

Graphic Granite

Some Pegmatites contain **rare and interesting minerals** like:

- Beryl and Tourmaline (6-membered ring silicates with Be, B, Li)
- Topaz (a fluorine-bearing mineral) $(Al_2SiO_4(F,OH)_2)$
- Lepidolite (purple Li mica)
- Spodumene (Li pyroxenoid)

Tourmaline $(Na,Ca)(Li,Fe,Mg,Al)_3Al_6(BO_3)_3Si_6O_{18}(OH)_4$

color varies based on variation in chemical composition

rounded triangular or hexagonal cross-section

striated sides

Beryl $(Be_3Al_2Si_6O_{18})$

View [Beryl](#) Structure Movie -

<http://socrates.berkeley.edu/~eps2/wisc/geo360/beryl.mov>

Beryl $(Be_3Al_2Si_6O_{18})$

Topaz $(Al_2SiO_4(F,OH)_2)$

an isolated tetrahedral silicate

Tourmaline, Topaz, Quartz, Albite from Pegmatite