

## Most Important Minerals—the Big Eight

1. quartz
2. potassium feldspar (K-spar)
3. plagioclase feldspar
4. biotite mica
5. muscovite mica
6. amphibole
7. pyroxene
8. olivine

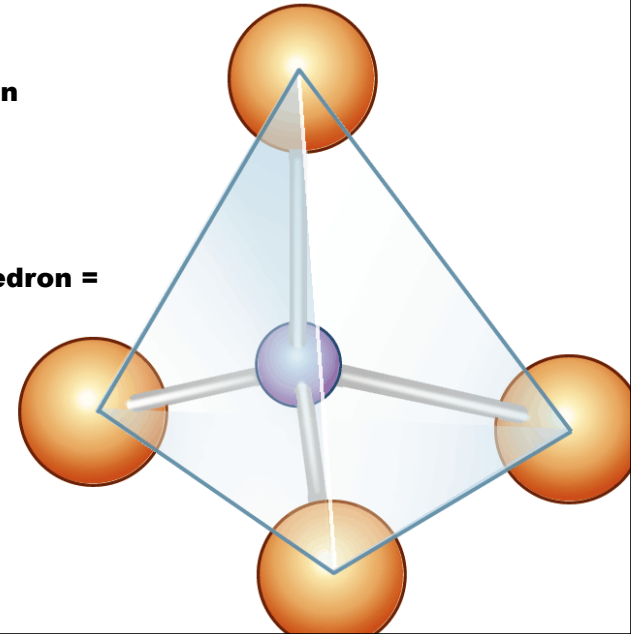


## All Silicates

silicon + oxygen  
 $\text{Si} + \text{O}$

$\text{SiO}_2$ ,  $\text{SiO}_4$

silicate tetrahedron =



## quartz

$\text{SiO}_2$

hard (Moh's 7)  
translucent



## quartz

if sufficient space,  
forms points

6-sided (hexagonal)



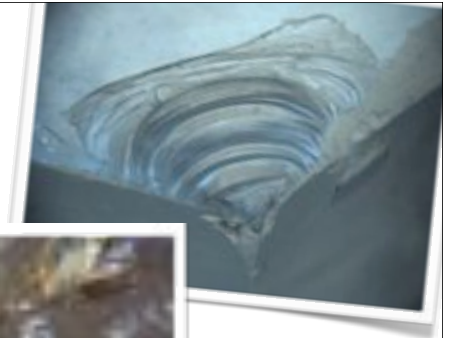


Quartz  
With elbaite inclusions

**quartz**

**fractures like glass  
(conchoidal)**

**no cleavage**



**quartz colors**

**purple (amethyst)  
radiation**

**citrine  
Fe**

**rose  
Ti, Mn**

**smoky (black)  
radiation**





Quartz (after analysis)



Quartz  
With pyrite  
SiO<sub>2</sub>



Quartz  
With rutile



Quartz (var. smoky)



## Sidebar: Crystal "Energy"

**lowest energy state**



## K-spar, potassium feldspar

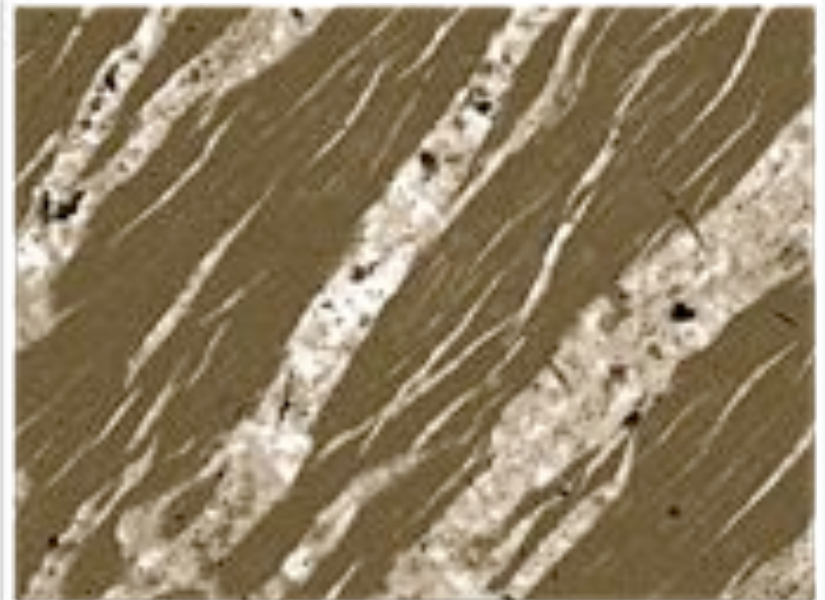
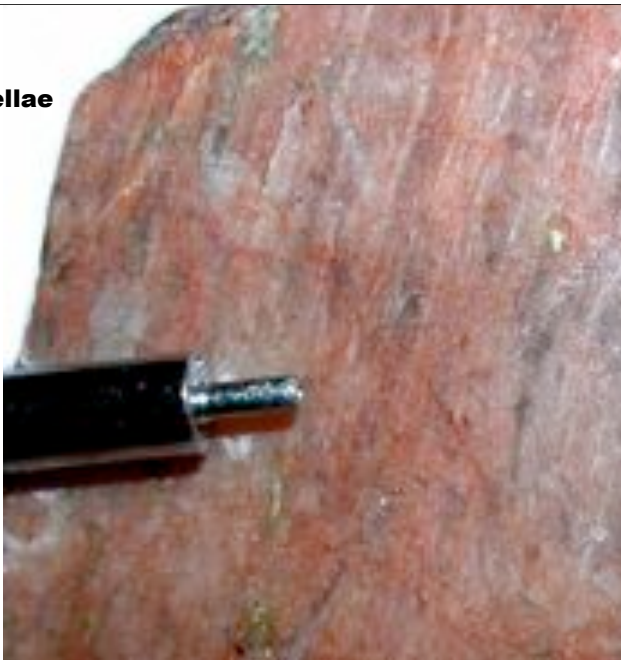
**$\text{KAlSi}_3\text{O}_8$ , aluminosilicate  
orthoclase, microcline, sanidine**

**2 cleavages @ 90°  
relatively hard, opaque  
grey, white, green, pink**



**K-spar has  
exsolution lamellae**

**wavy, irregular  
not parallel**



**plagioclase**

**(Ca, Na)AlSi<sub>3</sub>O<sub>8</sub>  
albite, labradorite, oligoclase, anorthite  
aluminosilicate**

**2 cleavages @ 90°  
relatively hard  
opaque  
grey, white**

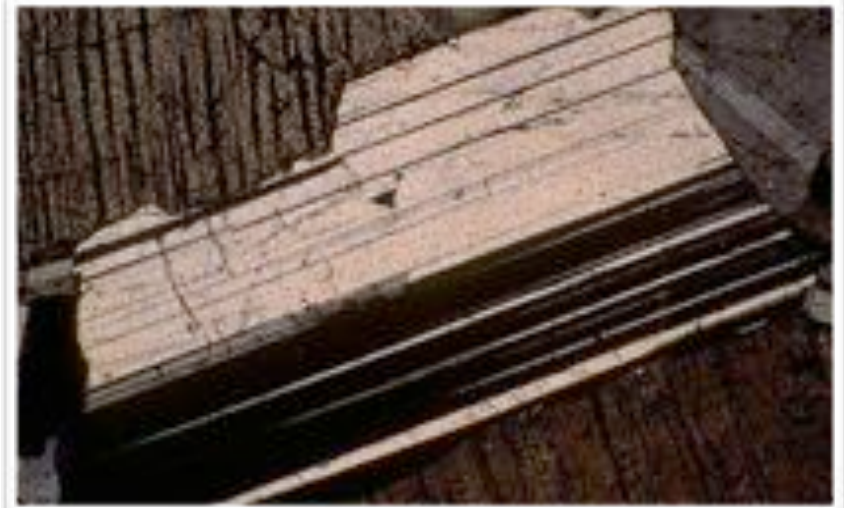
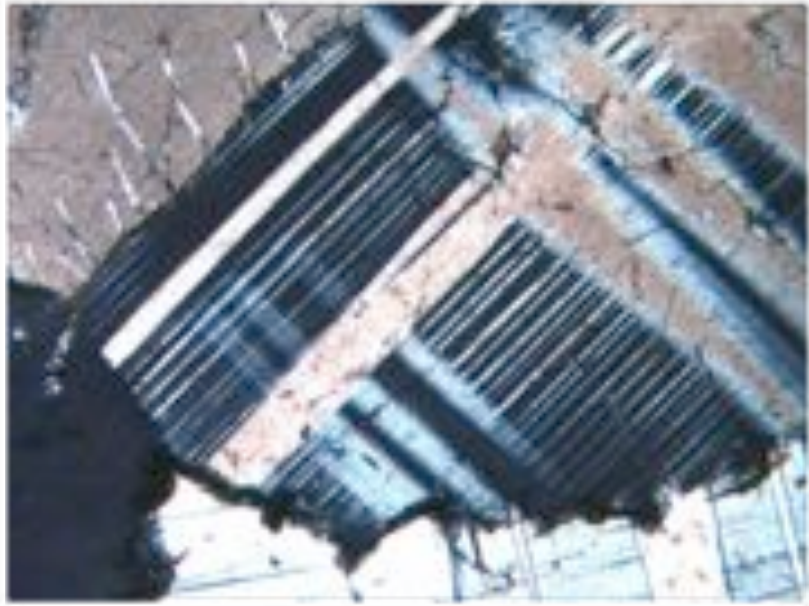


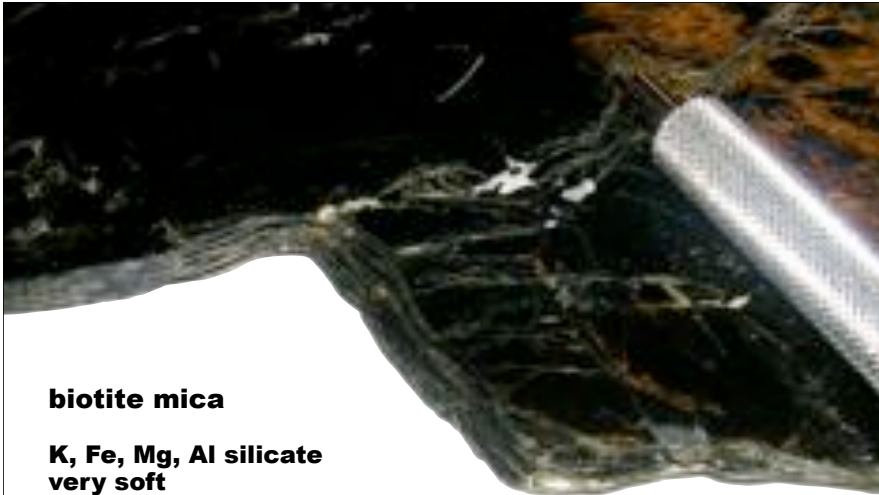
**plagioclase**

**twinning lines**

**very parallel  
regular**

**but often  
destroyed by  
weathering**





**biotite mica**

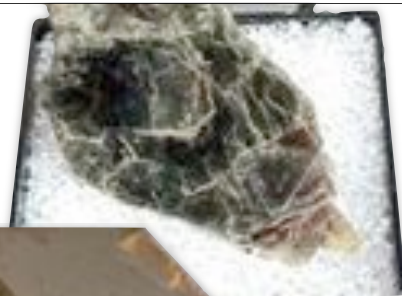
**K, Fe, Mg, Al silicate  
very soft  
shiny, jet black**

**flaky w/ 1 excellent cleavage**

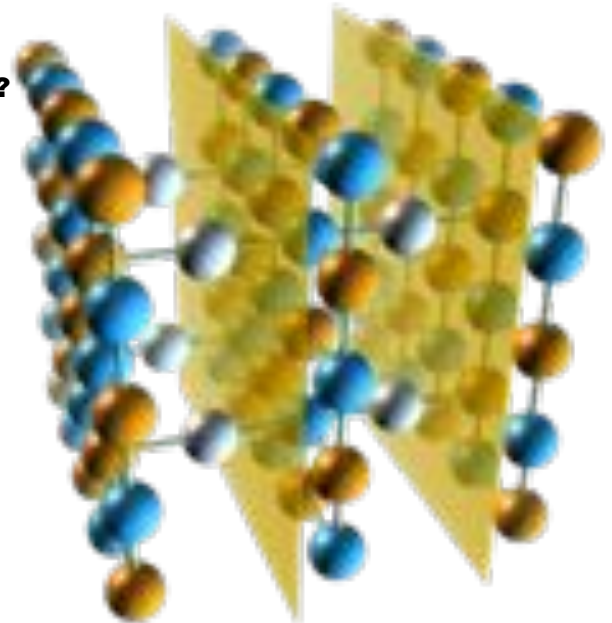


**muscovite mica**

**K, Al silicate  
very soft  
shiny golden  
flaky w/ 1 excellent cleavage**



**Why does mica  
break in sheets?**



**amphibole**

**hornblende**  
**Ca, Fe, Al silicate**

**black**  
**elongated crystals**

**2 directions of**  
**cleavage @ 120°/60°**



**pyroxene**

**augite**  
**Ca, Na, Fe, Al, Mg silicate**

**2 directions of**  
**cleavage @ 90°**

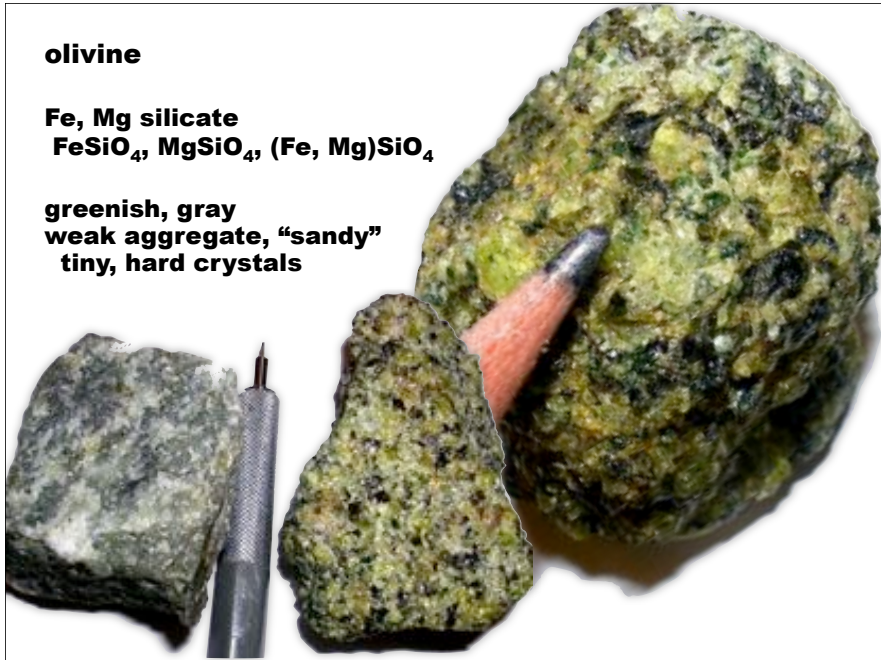
**dull, stubby**  
**greenish**



**olivine**

**Fe, Mg silicate**  
**FeSiO<sub>4</sub>, MgSiO<sub>4</sub>, (Fe, Mg)SiO<sub>4</sub>**

**greenish, gray**  
**weak aggregate, "sandy"**  
**tiny, hard crystals**

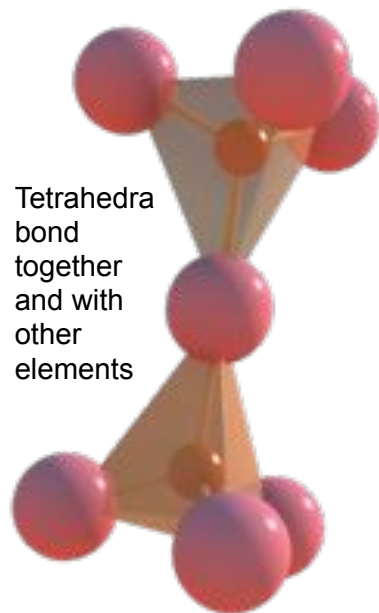


**Silicate Tetrahedra**  
**like to link together**

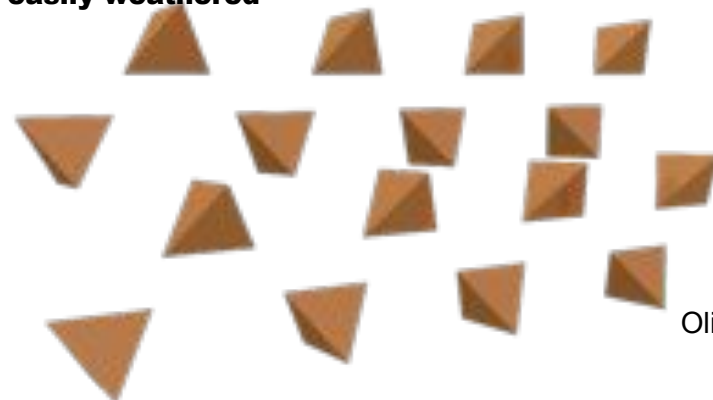
Silicate tetrahedron



Tetrahedra bond together and with other elements



**Independent Tetrahedra (olivine)**  
**easily weathered**

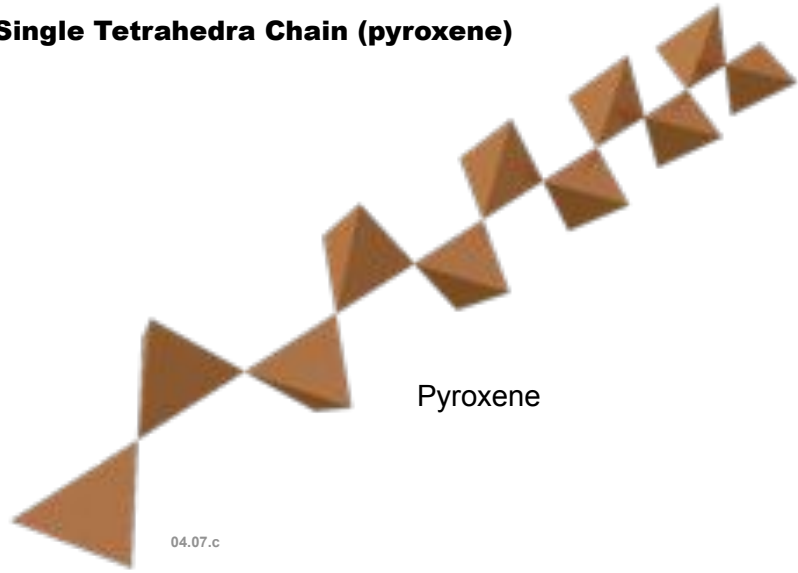


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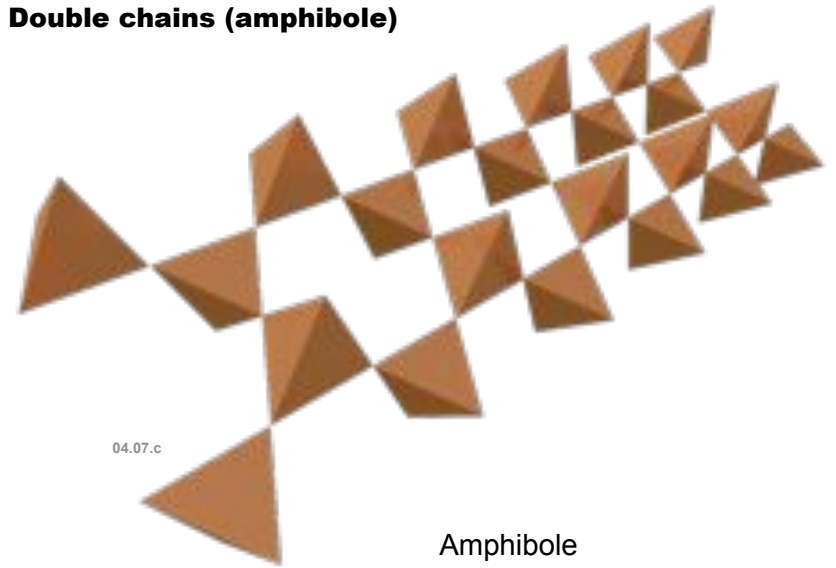
Olivine

Tetrahedra bond to other elements, not other tetrahedra

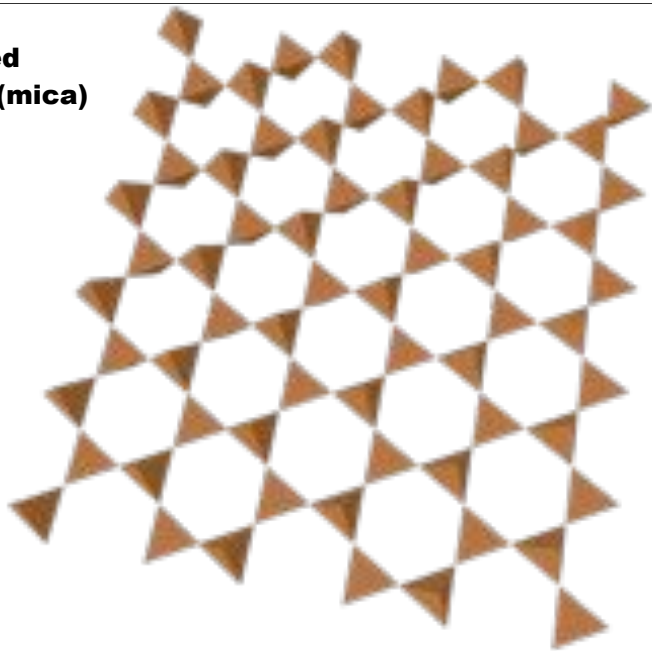
**Single Tetrahedra Chain (pyroxene)**



**Double chains (amphibole)**



**Chains linked into sheets (mica)**



**“Framework” tetrahedra  
strongest, most resistant to weathering (feldspar, quartz)**



**Other Minerals:**

- 1. calcite  
sediments**
- 2. garnet  
metamorphic**
- 3. asbestos  
metamorphic**



**Calcite**

**CaCO<sub>3</sub>  
important mineral  
in sediments**

**3 directions  
of cleavage  
not @ 90°**

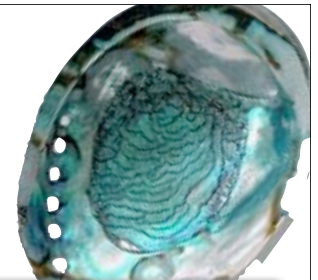
**soft, translucent**



**Calcite**

**two forms (polymorphs)**

**shells:  
first aragonite, then calcite**



**Calcite:  
Double Refraction**



**Calcite: Acid Reaction**



**garnet**  
**secondary min**  
**metamorphics**  
**iron-Al-silicate**



**asbestos**

**6 minerals  
stringy cleavage**

**fire resistant**



**asbestos: carcinogen**

**chrysotile (green)**



**asbestos: carcinogen**

**amosite (brown)**



**Grunerite (var. amosite)**  
 $(Mg, Fe)_3Si_2O_7(OH)_2$

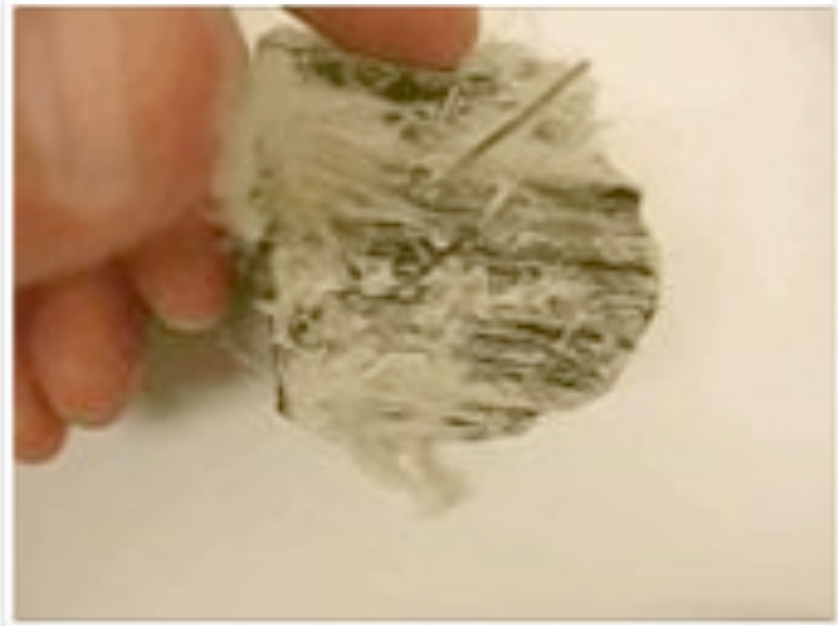
**asbestos: carcinogen**

**crocidolite (blue)**



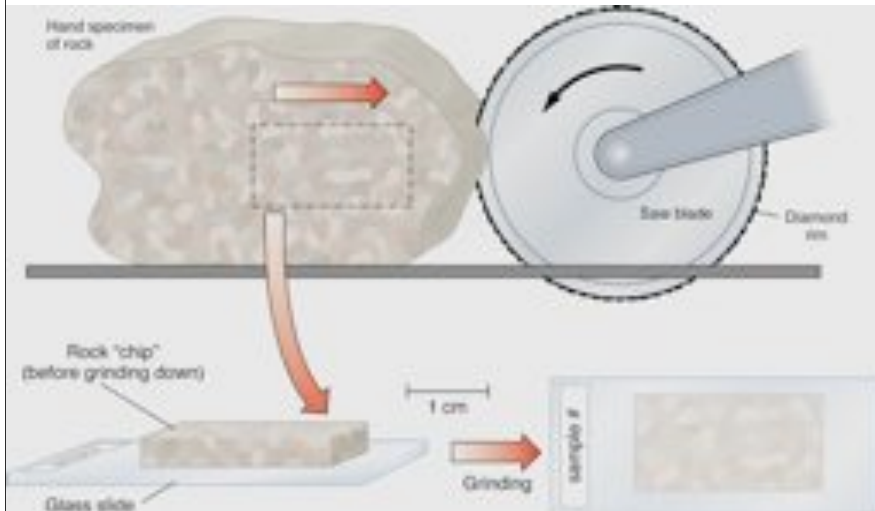
**Riebeckite (var. crocidolite)**  
 $Na_2Fe_3Mg_2Si_8O_{22}(OH)_2$   
Cape Blue mine, Prankla district,  
Cape Province, South Africa

**Riebeckite (var. crocidolite)**  
 $Na_2Fe_3Mg_2Si_8O_{22}(OH)_2$   
Tudor mine, Cuthbertsville,  
Delaware

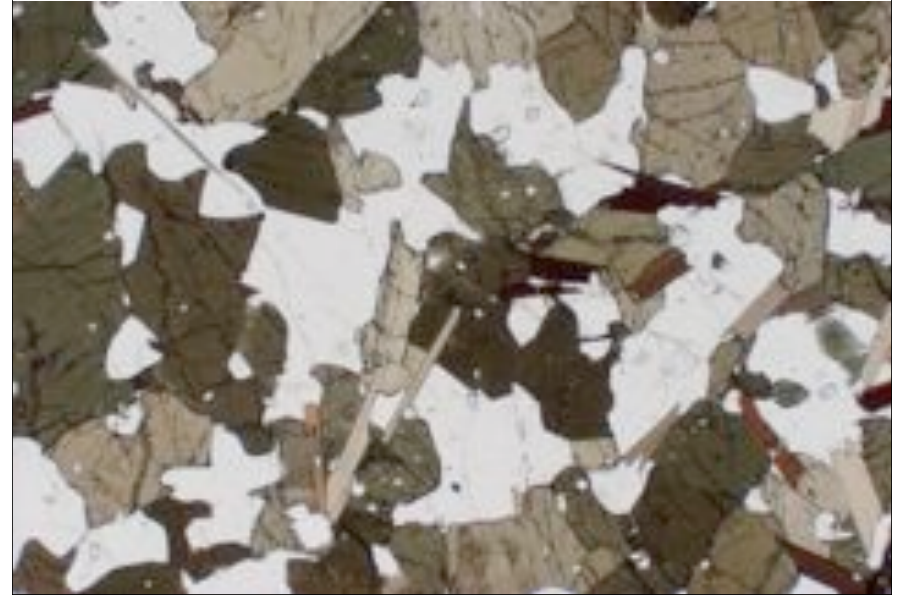


**A Problem: most minerals too small to see**

**the solution: thin sections, microscopic slides  
0.03 mm thick**



**plane light**



**polarized light**

