

## MINERALOGICAL COMPOSITION OF IGNEOUS ROCKS

The common igneous rocks are composed usually of three to six-phase combinations of a few widely distributed minerals. These essential constituents are: feldspars, quartz, pyroxenes, amphiboles, micas, olivines, feldspathoids and glass. The accessory minerals occurring in amounts less 5% contain the elements excluded from or not completely accommodated in the principal phases (apatite, sphene, zircon, rutile, etc.).

The other division is based on colour of minerals. Felsic minerals are light and of relatively low density, about 2.5 – 2.7 (quartz, feldspars, feldsphenoids). Mafic minerals are dark and with densities mostly from 3.0 to 3.6 (olivines, pyroxenes, amphiboles, biotite).

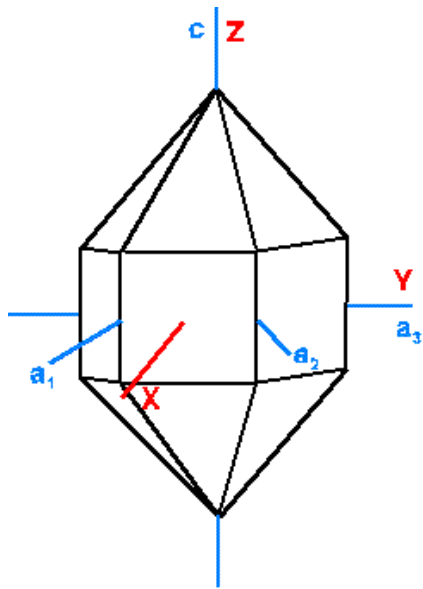
TABLE 2.1 Common Igneous Minerals

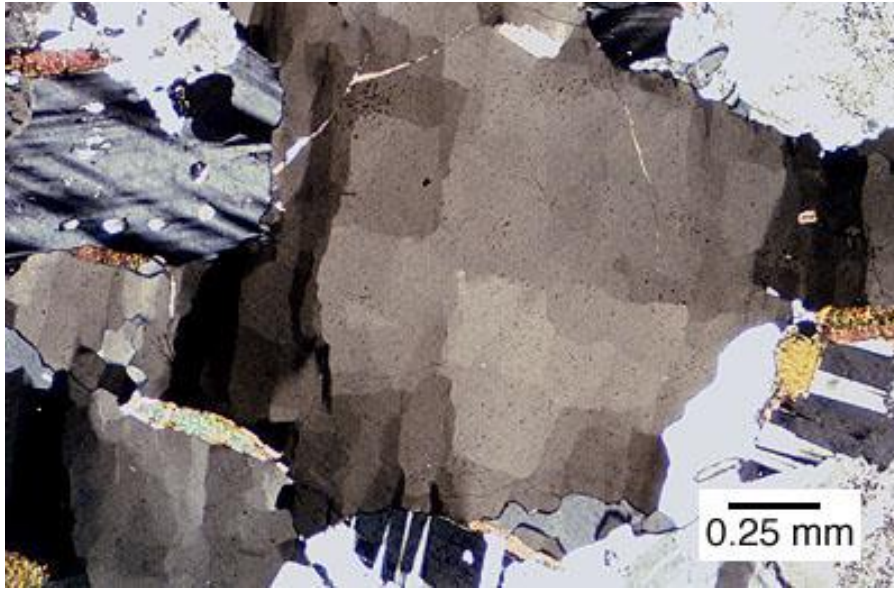
Mineral	Composition	Appearance
Olivine	Fe, Mg silicate	rounded, glassy, green to yellow-green grains
Pyroxene (commonly augite)	Fe, Mg silicate (with Ca, Na, and Al)	dark green to black; blocky grains with 2 cleavages @ 90°
Amphibole (commonly hornblende)	Ca, Fe, Mg, Al silicate	dark green to black; slender crystals with 2 cleavages @ 60° & 120°
Biotite	K, Fe, Mg, Al silicate	black, platy crystals with 1 perfect cleavage; flakes when scratched
Plagioclase (albite [Na] to anorthite [Ca])	Ca, Na, Al silicate	gray or white (Na) to dark gray (Ca); rectangular to irregular grains; striations common on cleavage planes
K-feldspar (orthoclase or microcline)	K, Al silicate	pink or gray to white; irregular grains with 2 cleavages @ 90°; no striations
Muscovite	hydrous K, Al silicate	white to silvery plates with 1 perfect cleavage; flakes when scratched
Quartz	SiO <sub>2</sub>	clear gray to milky; glassy, irregular grains; no cleavage

Apart from the above mentioned primary minerals, crystallizing directly during the magmatic processes, there is the group of the secondary minerals, formed during the postmagmatic deuteric processes or simply during the weathering. Their list includes: sericite, kaolinite, chlorite, epidote, chalcedony, calcite, Fe-hydroxides, etc.

There is the short list of more important minerals below, together with their chemical formulas and short characteristics:

### Quartz $\text{SiO}_2$

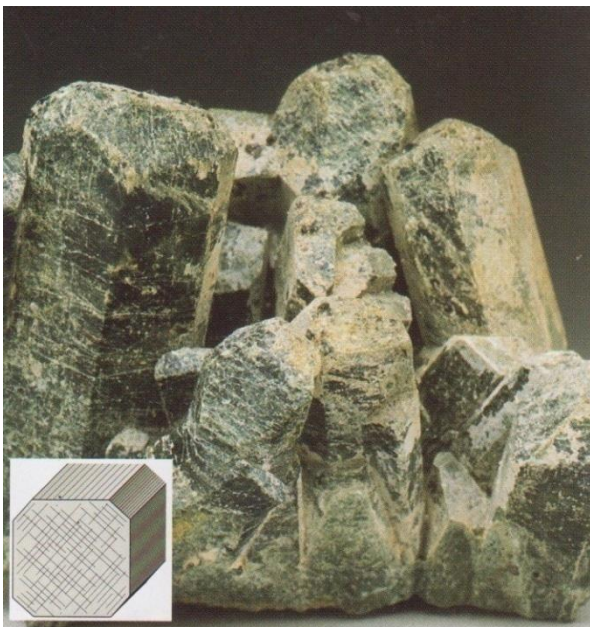


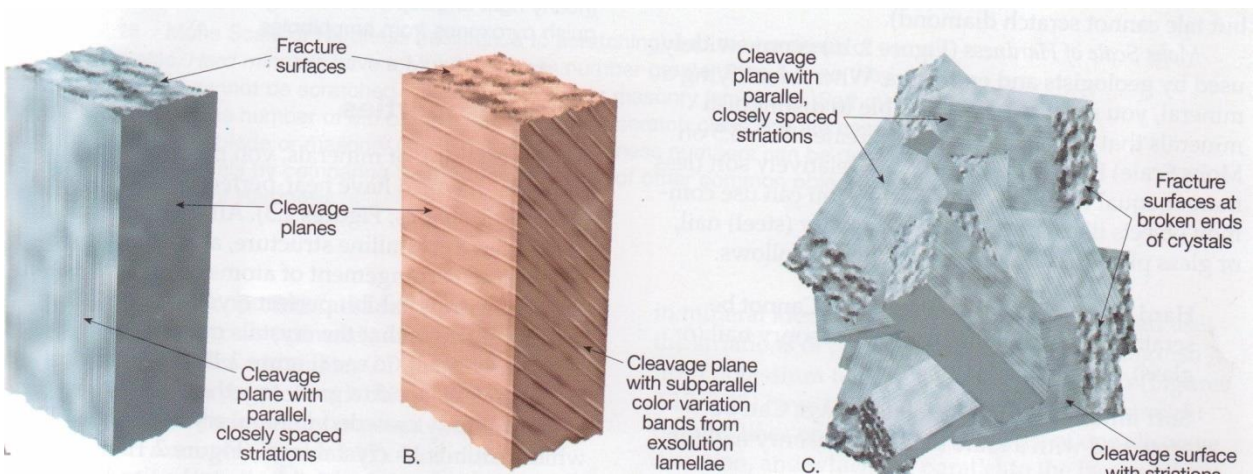


*Figure 37 Quartz*

## **Feldspars**

K-feldspars and Na/Ca-feldspars (plagioclases) sanidine – anorthoclase (K, Na)  $(\text{AlSi}_3\text{O}_8)$  – (Na, K)  $(\text{Si}_3\text{O}_8)$  disordered high-temperature varieties, monoclinic at the potassic and triclinic towards the sodic end,

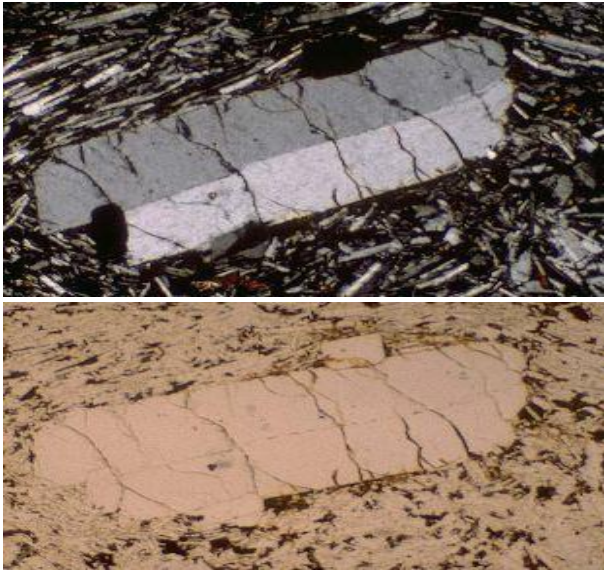




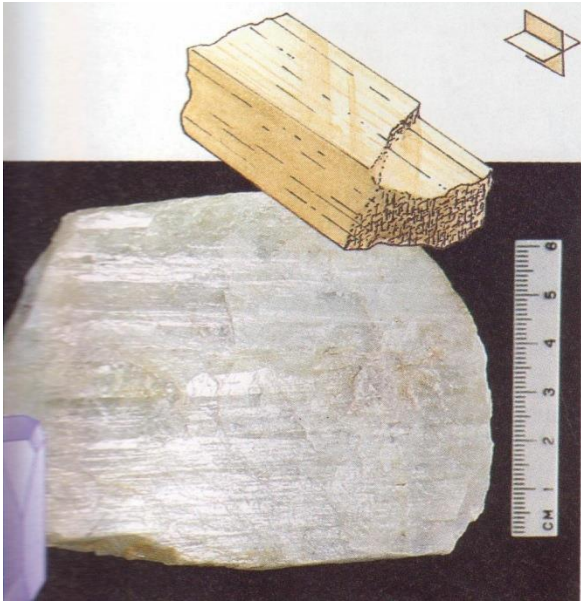
**Figure 38** *Feldspars*



**Figure 39** Potassium (K) feldspar exhibiting two directions of cleavage at  $90^{\circ}$



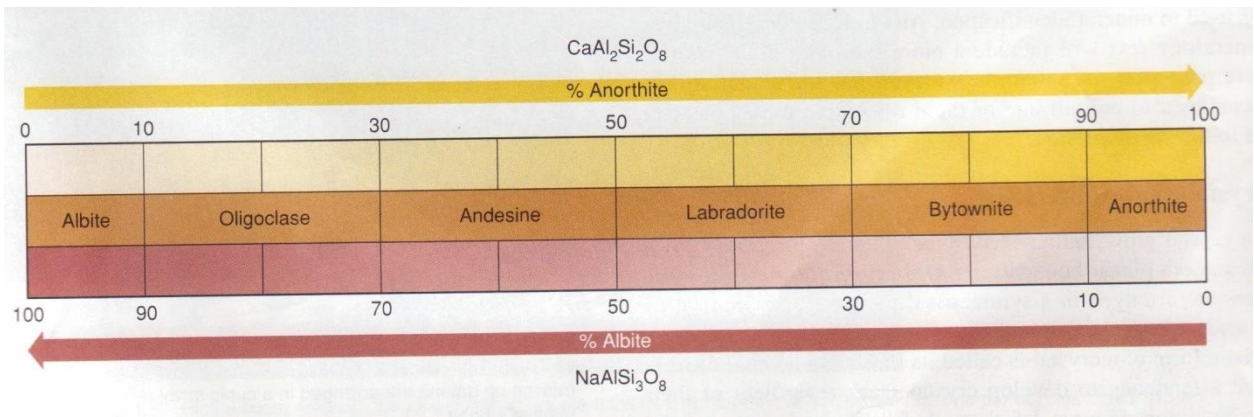
**Figure 40** Plagioclase feldspar showing twinning



*Figure 41* Plagioclase feldspar



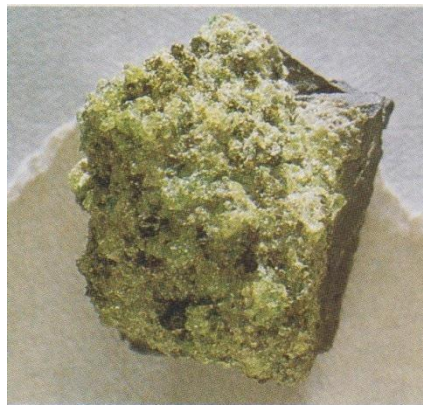
*Figure 42* Plagioclase feldspar showing twinning



**Figure 43** Plagioclase series

## Feldspathoids

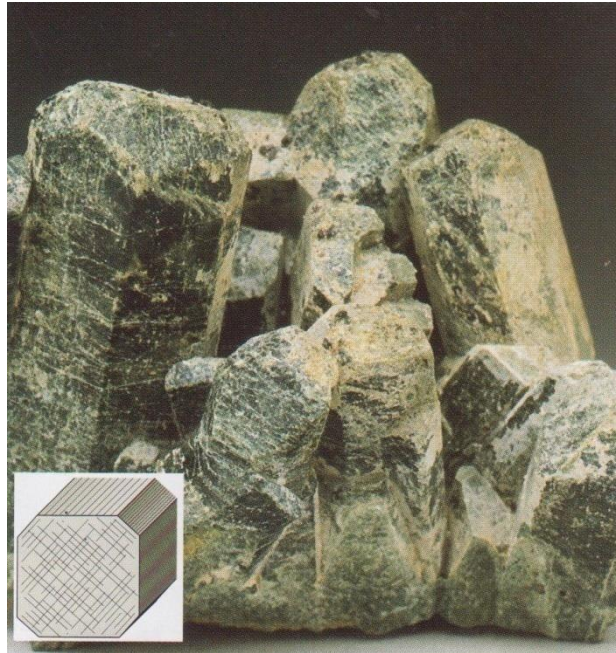
### Olivines



**Figure 44** Olivine

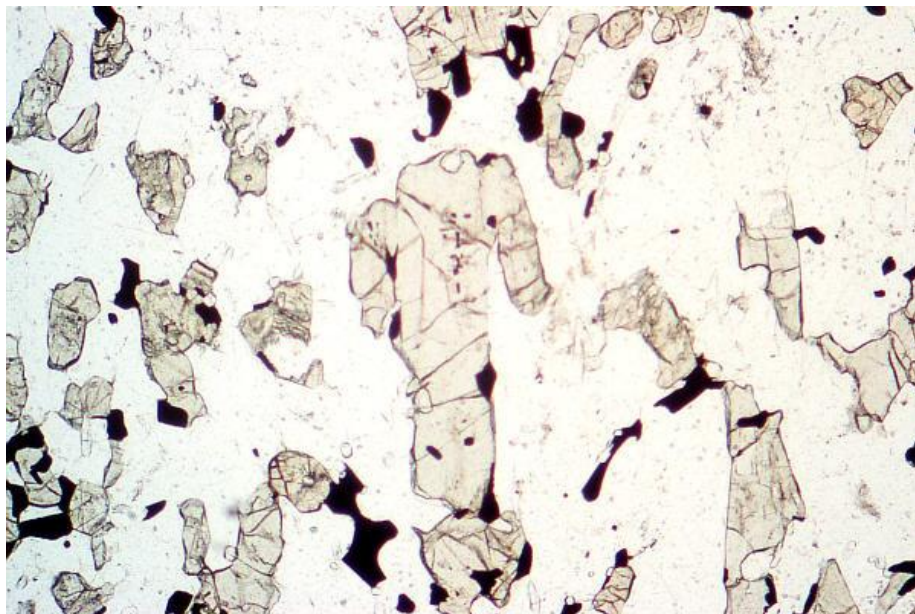
### Pyroxenes

orthopyroxenes  $(\text{Mg,Fe})_2(\text{Si}_2\text{O}_6)$ , namely enstatite, bronzite, hypersthene, up to 50% of Fe-molecule.

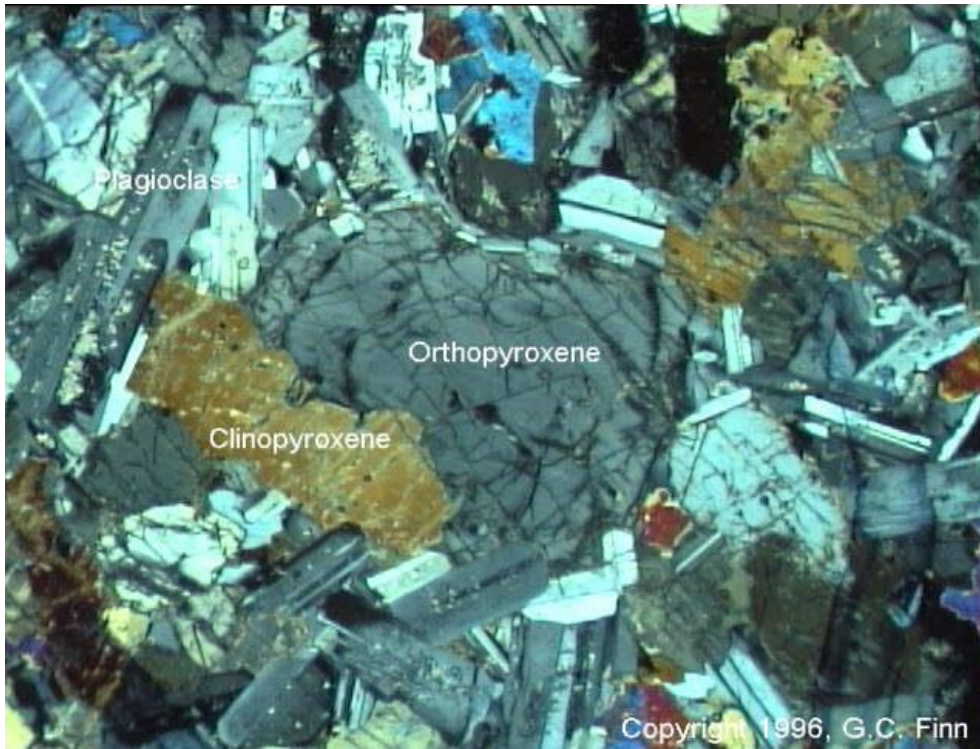


*Figure 44 Pyroxene*

clinopyroxenes of mainly augite-pigeonite group (Ca-Mg-Fe, sometimes also with Ti), sometimes aegirines (Na-Fe bearing).

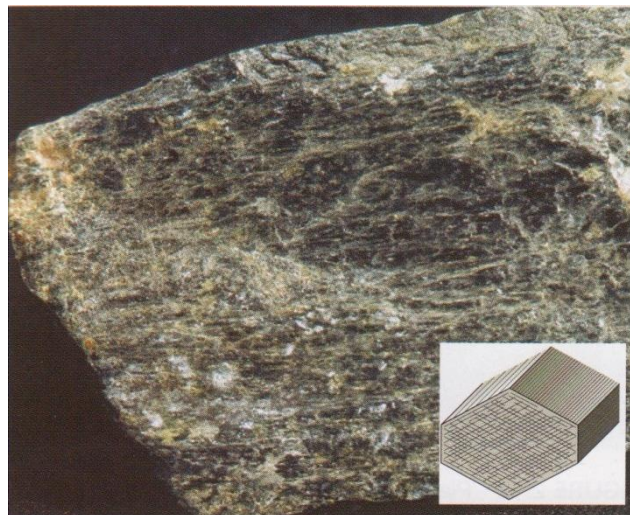


*Figure 45 Augite in thin section*

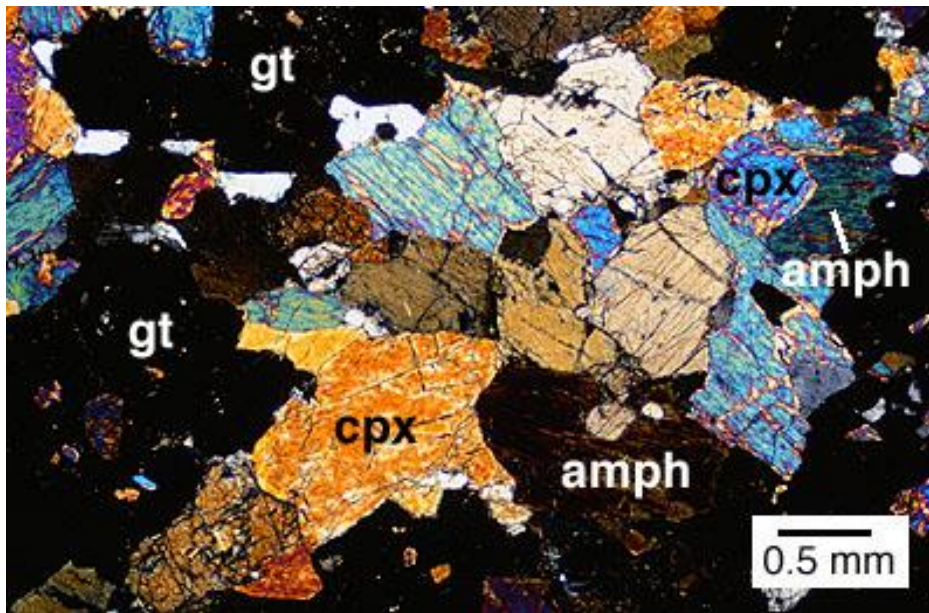
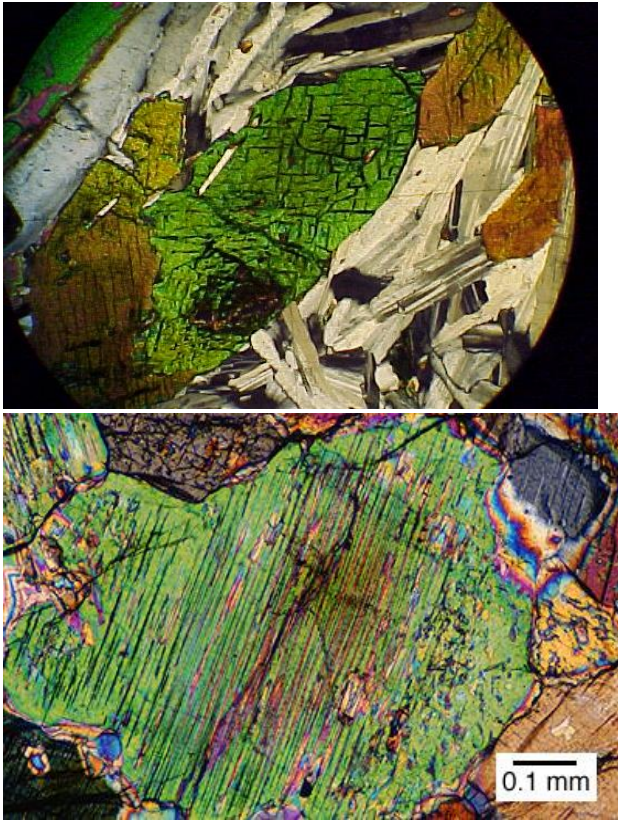


*Figure 46 Pyroxenes in thin section*

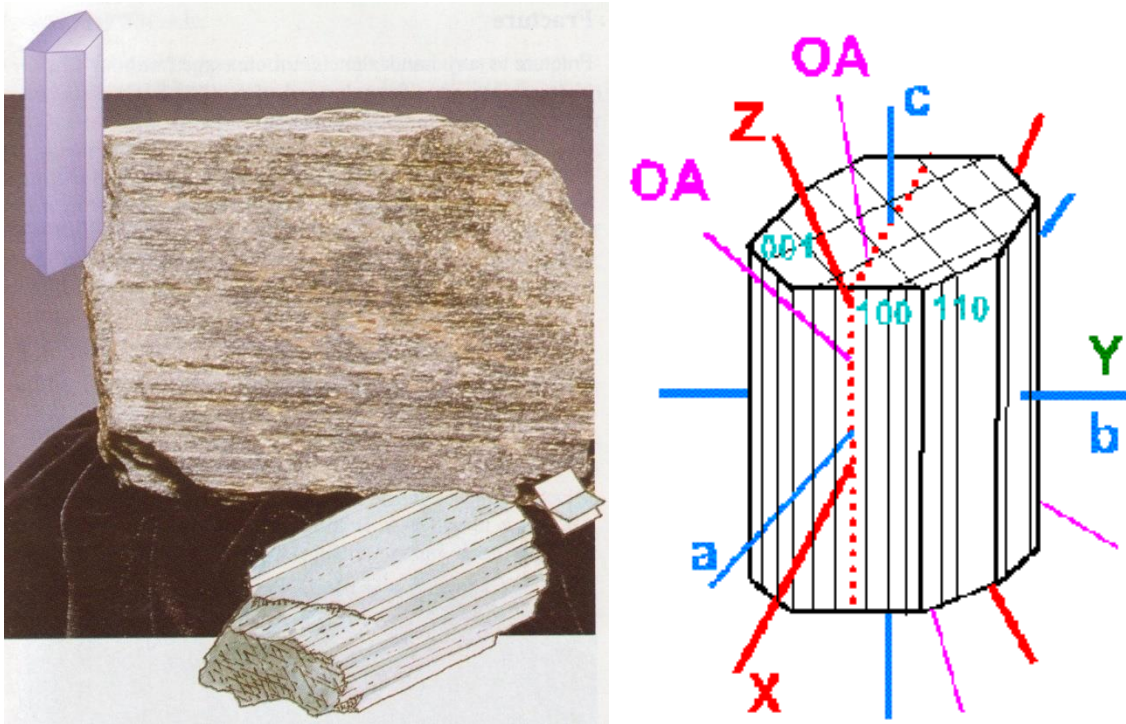
## **Amphiboles**



*Figure 47 Amphibole*



*Figure 48 Amphibole in thin section*

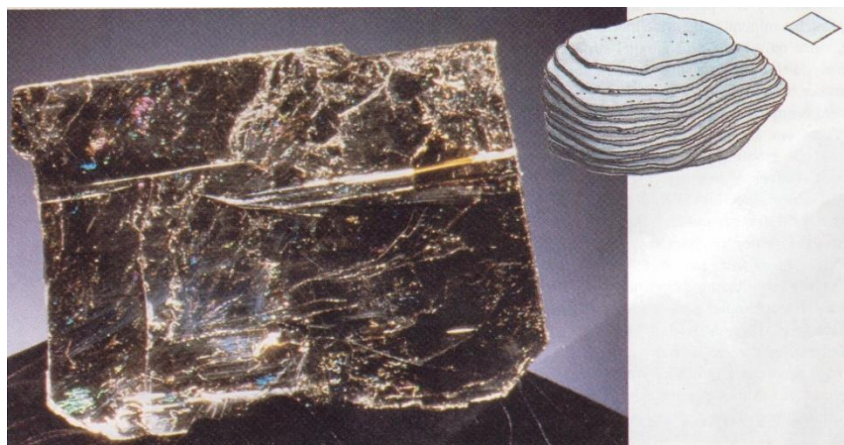


*Figure 49 Hornblende specimen and crystal*

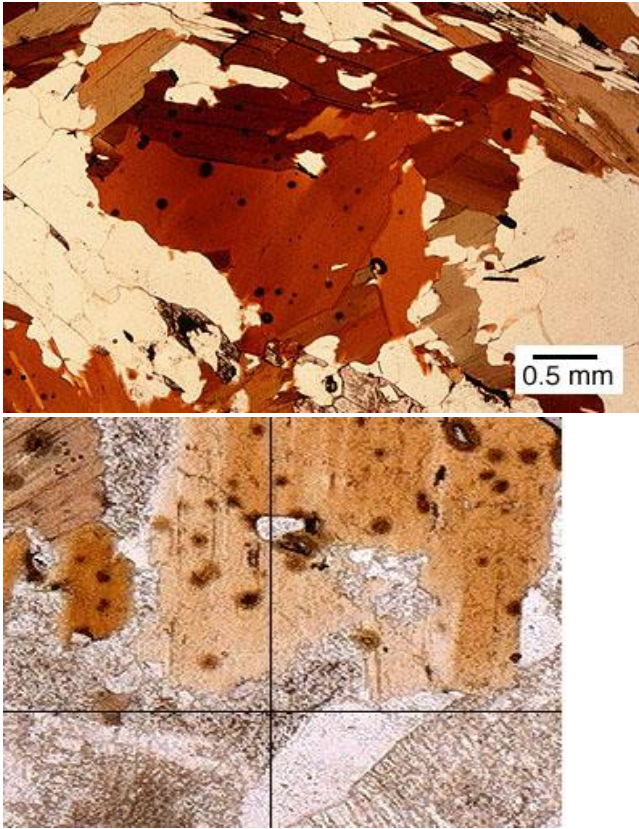
hornblendes Na = Ca = Mg = Fe bearing and Ti-rich variety kaersutite

## Micas

biotite  $K(Fe,Mg)_3(AlSi_3O_{10})(OH)_2$

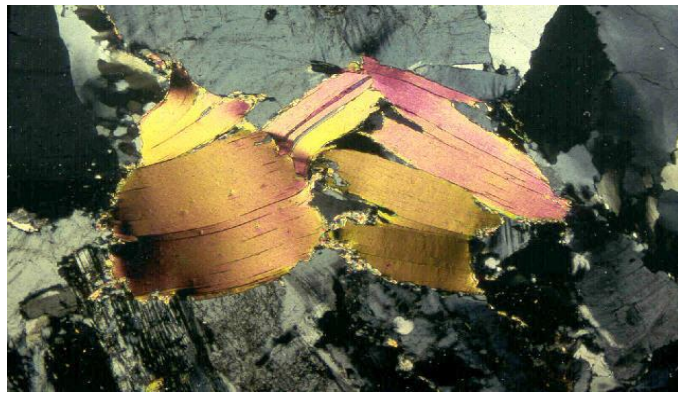


*Figure 50 Biotite specimen*



*Figure 51 Biotite in thin section*

**Muscovite**  $\text{KA}_2(\text{AlSi}_3\text{O}_{10})(\text{OH})_2$



*Figure 52 Muscovite specimen and in thin section*

## Glass



*Figure 53 Glass*