EWCE 203

Geology and Geomorphology

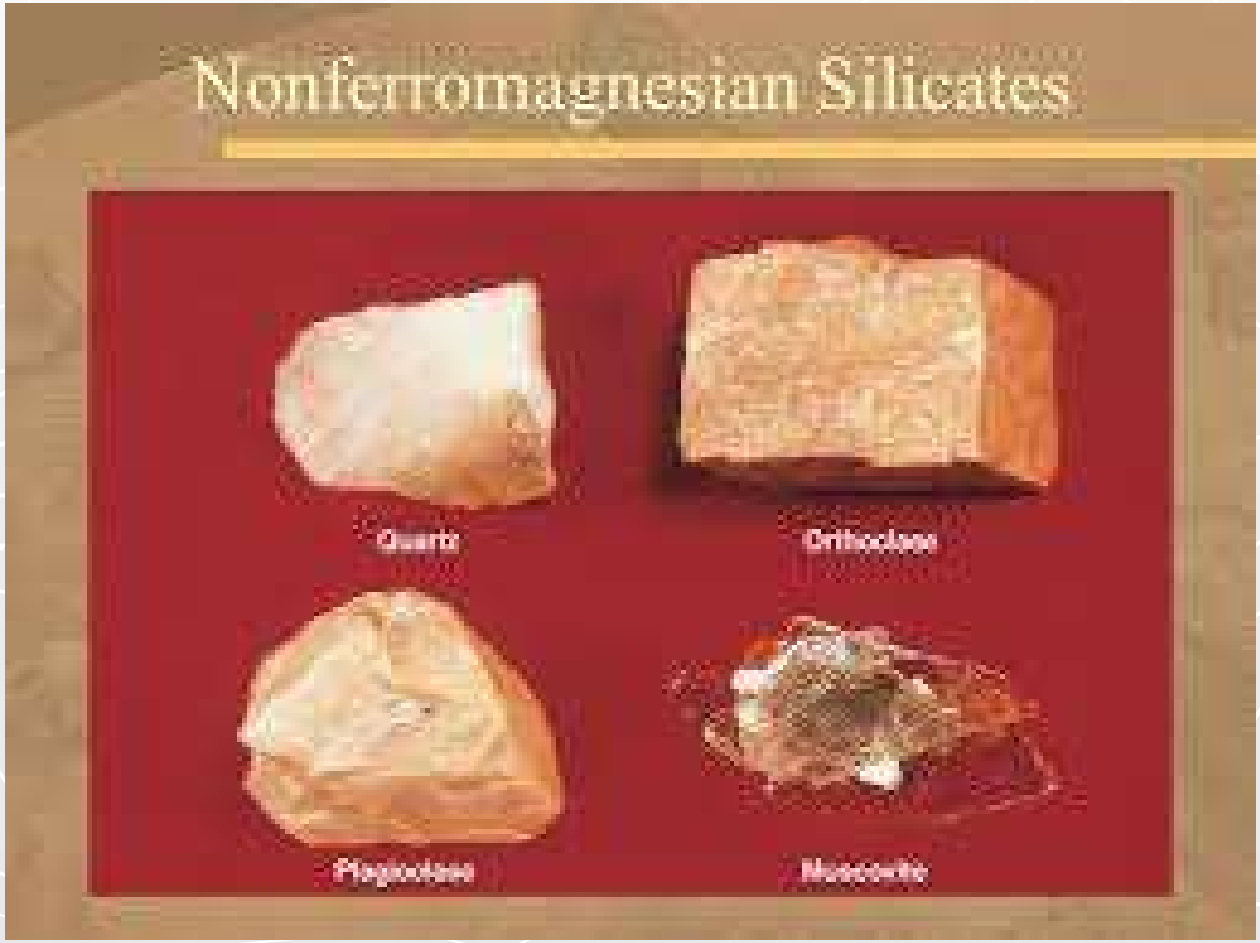
Geology

Classification of Minerals



Non-ferromagnesian Silicates:

- Do **not contain** Mg and Fe
- **Light colored** minerals
- Sp Gr 2.6 to 2.9
- **Examples**: Muscovite, Feldspar and Quartz



Muscovite:

- Known as **white mica**, because it was once used as a substitute of glass in old Russia (Muscovy).

- **Double sheet mica** form a pattern like wire netting.

- **$KAl_2[AlSi_3O_{10}(OH)_2]$**

- **Color**: Light yellow, brown, green or red.

- **Easily split into very thin**, flexible sheets along one direction

- **Sp Gr**. 2.8 to 3.1



Uses of Muscovite:

- Muscovite can be cleaved into very thin transparent sheets that can **substitute for glass**, particularly for high-temperature applications such as industrial furnace or oven windows.

- Also used in the manufacture of a **wide variety of electronics** and as a filler in paints, plastic, and wallboard.

- Commonly used as a **component in cosmetics**, like eyeshadow, to produce shimmer.



Differences between Biotite and Muscovite

- Composed of **single sheet**, like wire netting. (**double sheet**)
- Known as **black mica** (Light yellow, brown, green or red)
- **$K(Mg, Fe)_3[AlSi_3O_{10}(OH)_2]$** **($KAl_2[AlSi_3O_{10}(OH)_2]$)**
- Each **tetrahedron sheets are held together loosely by K ions**, along which **cleavages are easily take place**. (**easily split** into very thin, flexible sheets along one direction)



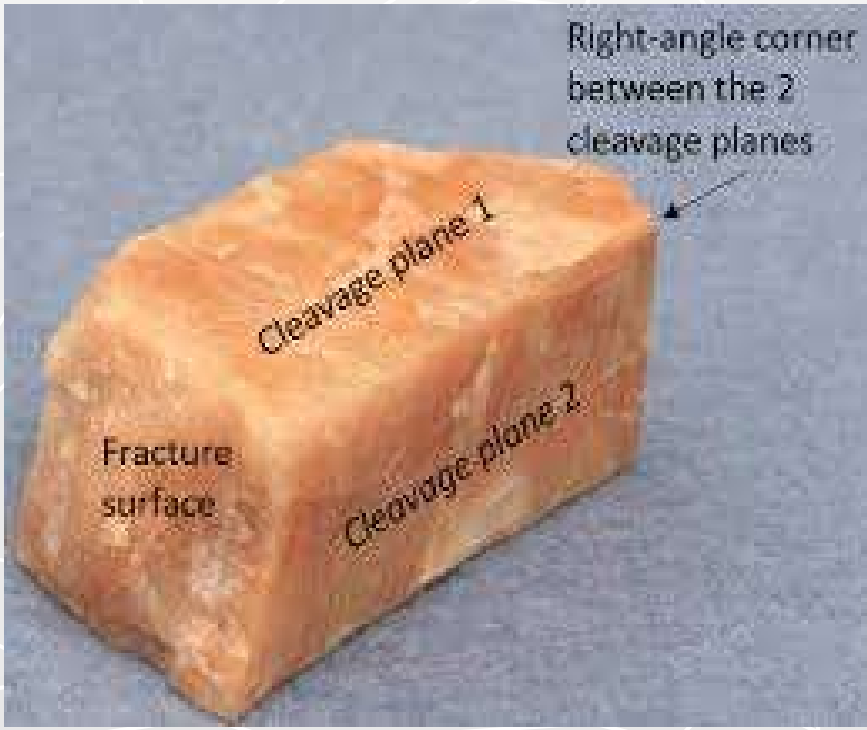


FIGURE 1.7
Biotite mica has one direction of cleavage (basal cleavage).



Feldspar:

- **Most abundant** rock forming silicate mineral.
- Names come from **German 'feld'** meaning 'field' and '**spath**' , a term used by miners for **various non-metalic minerals**.
- Feldspar are **silicate minerals of Al with K, Na or Ca**.
- Can be **colorless**, white, or nearly any color if impure.
- Sp Gr. 2.55 to 2.76



How Feldspars are easily identified?

- Feldspar **shows good cleavages in two directions**, which makes an angle of 90º or to close 90º to each other.

Uses of feldspar

- Feldspar is an important **source of alumina** in the glassmaking and the ceramics industries.
- In ceramics, it acts **as a flux** and provides the **vitreous luster** of chinaware and ceramic tiles.
- Also used in **glazes and enamels** and is an important mineral **filler** in paints, plastics, sealants, and adhesives.

Types of Feldspar

Orthoclase Feldspar:

- Known **as K Feldspar**
- Named from the Greek '**orthos**' **meaning 'straight' and 'klasis, meaning 'breaking',** because of **two dominant cleavages intersect at right angles** when a piece of orthoclase is broken.

- **Color**: White, Gray or Pinkish,
- **Streak** is white
- Sp Gr 2.57



Plagioclase:

- **Oblique breaking** Feldspar.
- Have **cleavage planes that intersect at about 68^{o}**.
- One of the cleavage planes **marked by striations.**
- **Color:** Colorless, white, blue or black.
- Two types:
  Na Plagioclase-Albite and
  Ca Plagioclase-Anorthite.




Albite


Anorthite

Quartz:

- **Most common** rock forming silicate minerals that is composed of **exclusively silicon-oxygen tetrahed**rons.
- **Relatively harder mineral** (H=7.0), there are no planes of weakness in its crystalline structures.
- **Do not show cleavages** but fractures along curved surfaces when struck a blow.
- **Color**: smoky to clear
- Sp Gr 2.65



Uses of Quartz

- **Glass** is made from quartz sand.
- And many other objects from **our daily lives** use quartz, such as **watches and clocks**, **kitchen countertops**, **electronics** in radios, GPS and computers, even toothpaste.
- One of the most widely used **gem materials**





Non-silicate Mineral

Oxide Minerals:

- Formed by the **direct union of an element with O_2.**
- **Harder** any other minerals except silicate minerals.
- **Heavier** than other minerals other than sulfide.
- Common oxide minerals are **Corundum (Al_2O_3), Hematite** (Fe_2O_3), **Magnetite** (Fe_3O_4).







Sulfide Minerals:

- Formed by the direct **union of element with S.**
- Some sulfide minerals occurs as **valuable ores**.
- Examples: Pyrite (FeS_2), Galena (PbS)



Pyrite- Superficial resemblance of gold







Carbonate and Sulfate Minerals:

Carbonate Minerals:

- Composed of **complex ions Co_3^{2-} with other ions**.

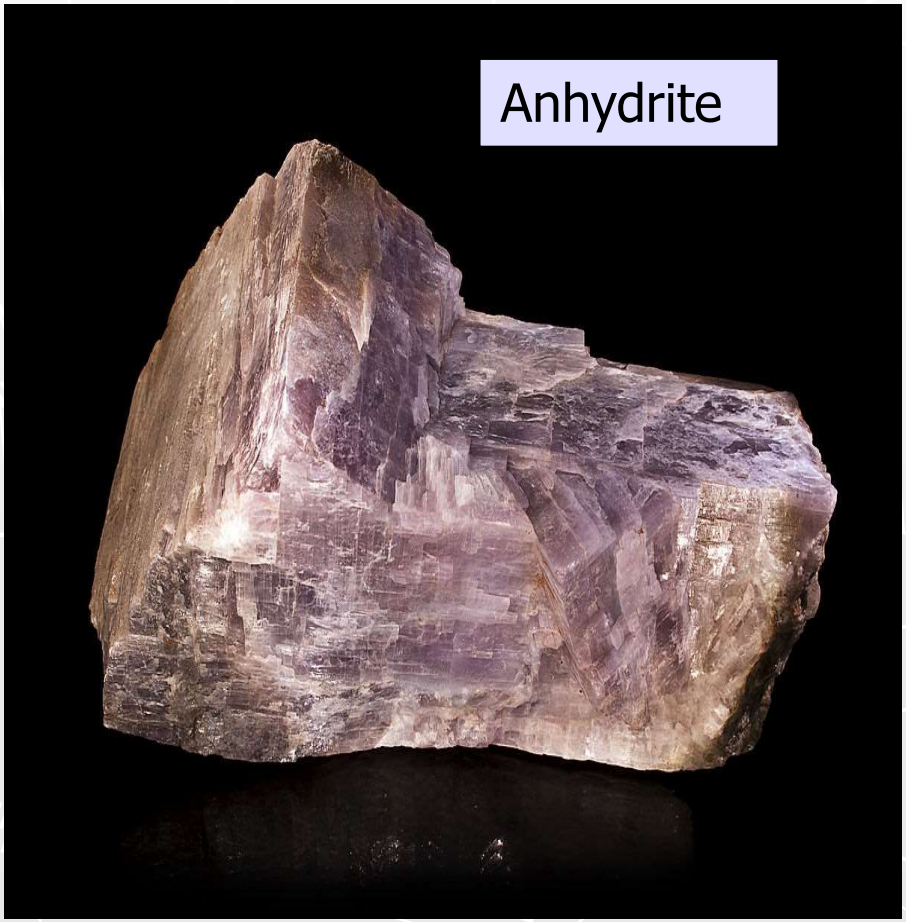
- Examples: **Calcite** ($CaCo_3$), principle component of the common **sedimentary rocks**.

- **Color**: Milky white



Sulfate Minerals:

- Composed of **ions** So_4^{2-} with other ions.
- Examples: **Anhydrite** ($CaSo_4$). **Gypsum** ($CaSo_4, nH_2O$)





Halide Minerals:

- Combination of certain elements (+ve ions) **with the halogen elements** ie Chlorine, iodine, bromine, and fluorine.

- Common Halide Minerals:

  -**Halite**, NaCl, common salt

  -**Sylvite**, **KCl**

Halides occur as precipitate from **evaporating ponds**, **salt flats** and **natural brine**.





Halide Minerals



Fluorine



Chlorine



Bromine



Iodine



Thanks