# Rock Classification

**Chapter 2, pp. 17-26**

## Basis for Classification

- **Minerals present in the rock**
  - **Best for coarse-grained rocks**
  - **Useful for field work**
- **Chemical Composition**
  - **Works for fine-grained rock**
  - **Expensive and takes time**

## Mineralogical Classification

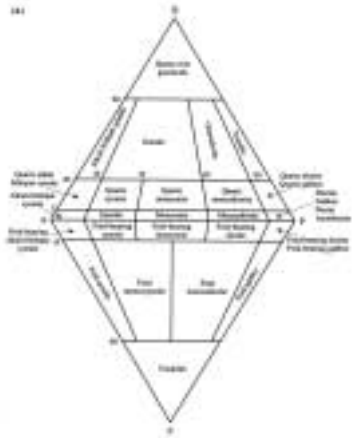
- **Color Index = % of dark minerals**
- **Felsic < 35% mafic minerals**
- **Mafic = 35% – 90% mafic minerals**
- **Ultramafic > 90% mafic mineral**

## Monomineralic Rocks

| | |
|---|---|
| • **Plagioclase** | **Anorthosite** |
| • **Olivine** | **Dunite** |
| • **Augite** | **Clinopyroxenite** |
| • **Hypersthene** | **Orthopyroxenite** |

## QAPF Diagram

- **Useful for most Common rocks**
- **Recalculate the minerals to 100% QAP or FAP**



## Chemical Classification

- **CIPW norm**
  - **Calculated minerals from chemical analysis**
- **Saturation concept**
  - **Si saturation**
    - **Acid to basic**
  - **Al saturation**
- **Harker-Peacock index**
  - **Alkalies vs calcium**

## Silica Saturation

| | |
|---|---|
| **Acid** | **$SiO_2$ > 66 %** |
| **Intermediate** | **$SiO_2$ 52 to 66 %** |
| **Basic** | **$SiO_2$ 45 to 52 %** |
| **Ultrabasic** | **$SiO_2$ < 52 %** |

## Aluminum Saturation

Based on the feldspar ratio 1:1:3 ($NaAlSi_3O_8$)

Peraluminous $Al_2O_3 > (CaO + Na_2O + K_2O)$

Peralkaline $(Na_2O + K_2O) > Al_2O_3$

## Classification of Igneous Rocks

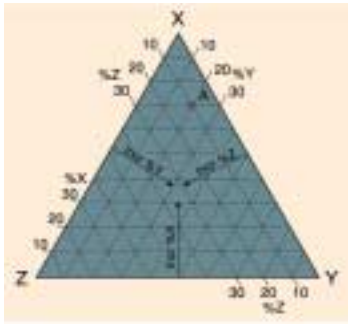



**Figure 2-1a**. Method #1 for plotting a point with the components: 70% X, 20% Y, and 10% Z on triangular diagrams. An Introduction to Igneous and Metamorphic Petrology, John Winter, Prentice Hall.

## Classification of Igneous Rocks

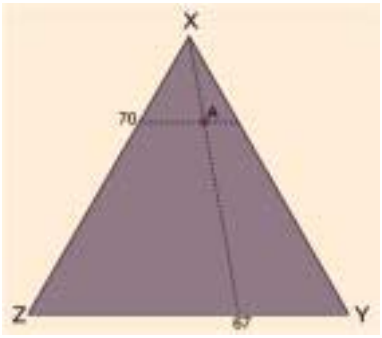
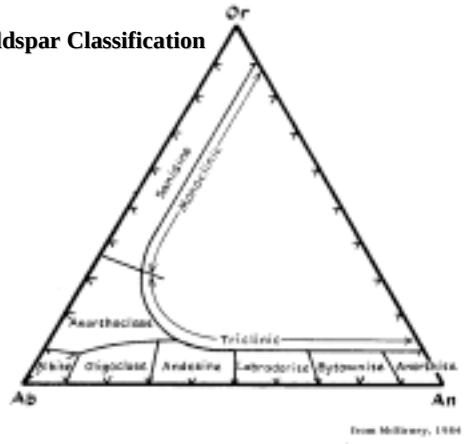
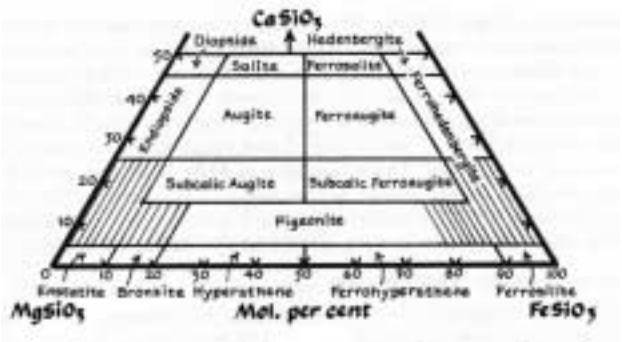



**Figure 2-1b**. Method #2 for plotting a point with the components: 70% X, 20% Y, and 10% Z on triangular diagrams. An Introduction to Igneous and Metamorphic Petrology, John Winter, Prentice Hall.

**Feldspar Classification**



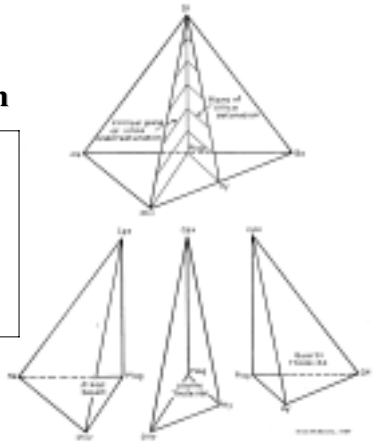

## Pyroxene Classification



## Basalt Classification

**Phases:**

**Augite (Cpx)**
**Hypersthene (Hy)**
**Olivine (Oliv)**
**Plagioclase (Plag)**
**Nepheline (Ne)**



## Classification of Igneous Rocks

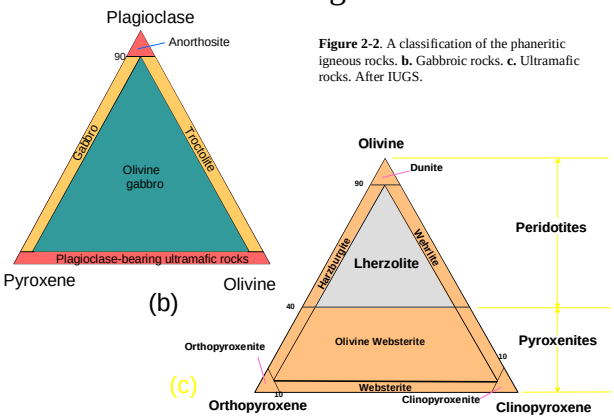



**Figure 2-2**. A classification of the phaneritic igneous rocks. **b.** Gabbroic rocks. **c.** Ultramafic rocks. After IUGS.

## Classification of Igneous Rocks

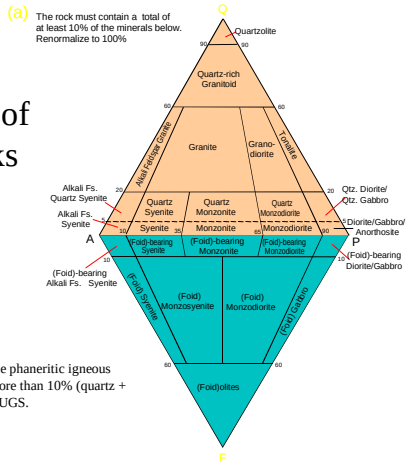



**Figure 2-2**. A classification of the phaneritic igneous rocks. **a.** Phaneritic rocks with more than 10% (quartz + feldspar + feldspathoids). After IUGS.

## Classification of Igneous Rocks

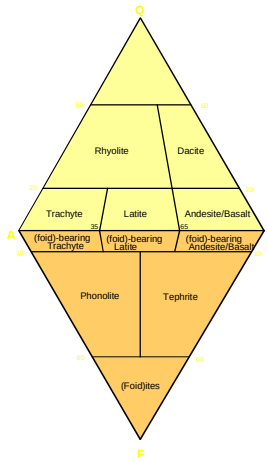
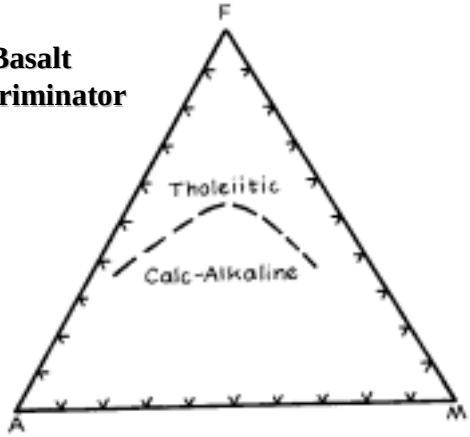
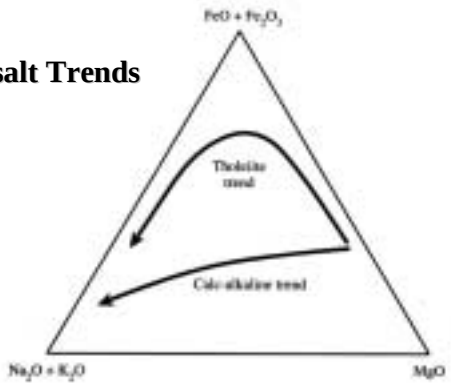



**Figure 2-3**. A classification and nomenclature of volcanic rocks. After IUGS.

## Basalt Discriminator




## Basalt Trends



## Classification of Igneous Rocks

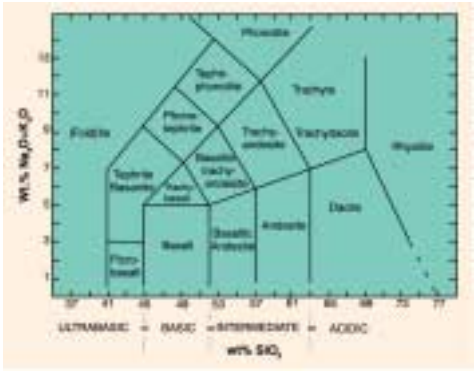
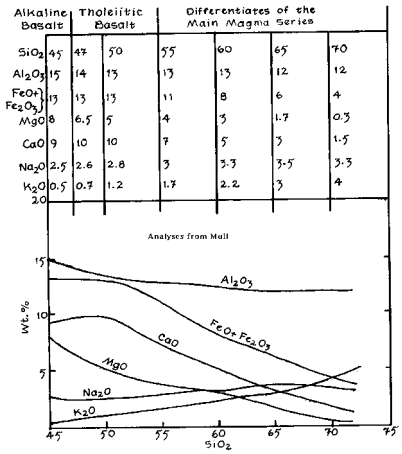



**Figure 2-4**. A chemical classification of volcanics based on total alkalis vs. silica. After Le Bas *et al.* (1986) J. Petrol., **27**, 745-750. Oxford University Press.




## Si Activity

- $\alpha_{SiO2}$
- Based on s set of reactions
- Limits three main magma series