

GY303 Igneous & Metamorphic Petrology Lab

Lab 1: Felsic Igneous Rock Terms &
Classification

Textural Descriptive Terms

- Degree of Crystallinity
 - Holocrystalline: composed of crystal grains
 - Hypocrystalline: mixture of glass and crystals
 - Holohyaline: essentially all glassy material (pumice, ash, obsidian)
 - Note that all glassy material will revert to (devitrify) to very fine-grained crystalline material over a period of 100,000 years

Grain Size

- **Phaneritic:** composed of crystals large enough to be identified with a hand lens
 - Coarse-grained: $> 5\text{mm}$ diameter (0.2 inches = 5mm)
 - Medium-grained: 1-5mm diameter
 - Fine-grained: $<1\text{ mm}$
- **Aphanitic:** composed of grains too small to be identified with a hand lens
 - Microcrystalline: grains visible with a microscope
 - Cryptocrystalline: grains not visible with a microscope
 - Glassy: composed of glass

Grain Relationships

- Granular: composed of equidimensional grains
- Equigranular: composed of grains of uniform size
- Granitic: composed equidimensional grains, some euhedral and some anhedral (see below)
- Porphyritic: composed of grains with 2 or more distinct size populations that differ by an order of magnitude

Degree of Crystal Face Development

- Terms that apply to individual grains:
 - Euhedral: a grain is bounded by crystal faces
 - Subhedral: a grain is partially bounded by crystal faces
 - Anhedral: no development of crystal faces
- Note that the degree of crystal face development is primarily a function of the order of crystallization in a magma

Degree of Crystal Face Development

- Terms that Apply to Rock Texture
 - Idiomorphic: composed entirely of euhedral crystals
 - Hypidiomorphic: composed of a mix of anhedral and subhedral and/or euhedral grains
 - Allotriomorphic: composed of essentially

Common Volcanic Rock Terms

- **Vesicular:** gas voids (vesicles) are abundant in extrusive rock
- **Amygdaloidal:** secondary minerals form in vesicles
- **Pumiceous:** highly vesicular to the point that the density of the rock is less than water.
- **Scoriaceous:** vesicles compose $>50\%$ by volume but material will not float.

Igneous Rock Classification

- Based on Mineral Composition and Texture
- Name convention:
 - Color, texture, alteration (if any), accessory minerals >10%, root name
 - Example: pink porphyritic medium-grained biotite granite
 - Example: gray fine-grained epidotized hornblende granodiorite

Essential Minerals in Felsic Rocks

- Quartz
 - Clear, conchoidal fracture, doesn't weather, anhedral
- K-feldspar
 - Commonly pink, 2-direction cleavage, not transparent
- Na-Plagioclase
 - White, 2-directions cleavage, not transparent, striations, tabular
- Feldspathoids
 - Nepheline appears similar to quartz but has a more greasy luster because it weathers faster
- Note: it is not possible to have a large amount ($>10\%$) quartz and feldspathoids- they are mutually exclusive

Common Accessories in Felsic Rocks

- Hornblende, biotite, muscovite, pyroxene, sodalite, tourmaline, ilmenite, magnetite, apatite

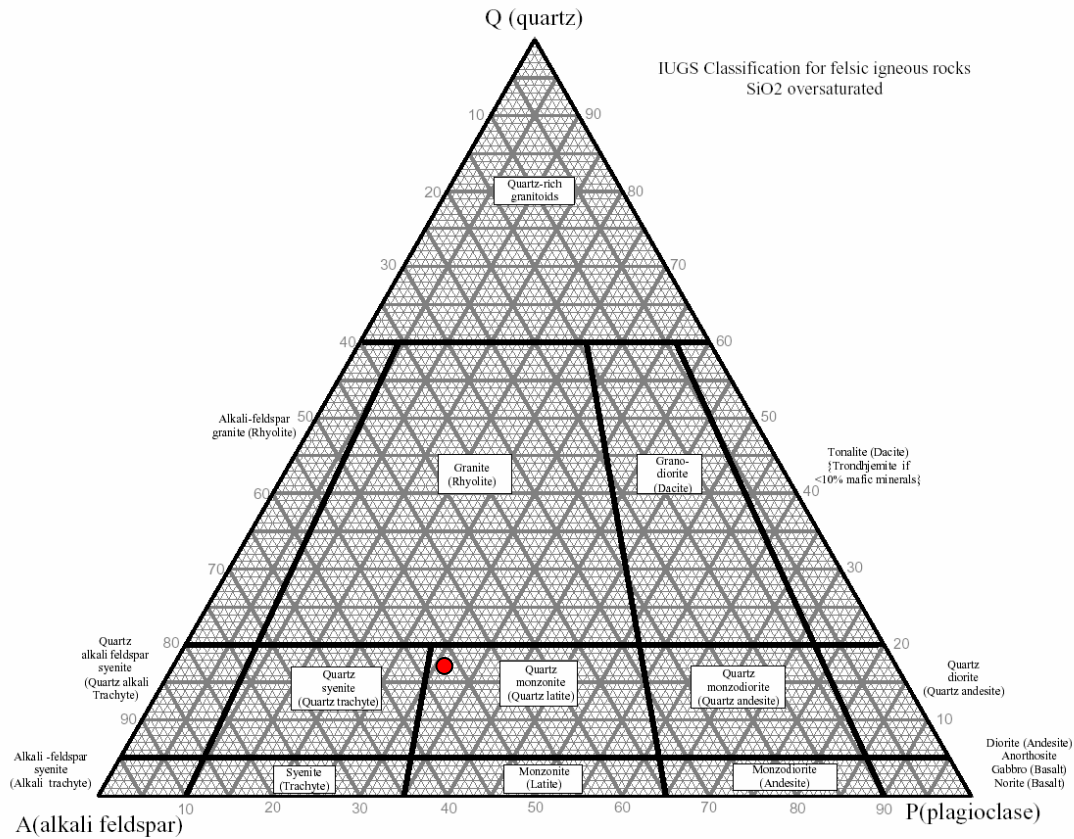
Common Alterations in Igneous Rocks

- Kaolinization: feldspars altered to kaolinite
- Saussuritization: alteration of Ca-plagioclase to albite and epidote
- Chloritization: alteration of ferromagnesian minerals to chlorite
- Uralitization: replacement of pyroxene by hornblende
- Serpentinization: alteration of olivine and pyroxene to serpentine
- Silicification: rock is replaced by silica
- Propylization: alteration of ferromagnesian minerals to chlorite, calcite, serpentine and magnetite; alteration of plagioclase to albite and epidote forming green rock termed propylite. Very common in andesites.

Calculation of Ternary Proportions

- Example: estimated percentages K-feld=45, Plag=27, Qtz=15; Biot=7; Musc=6 (total = 100)
- Ternary Q = $Qtz / (Qtz + K\text{-feld} + Plag) * 100 = 15 / (15 + 45 + 27) * 100 = 15 / 87 * 100 = 17\%$
- Ternary A = $K\text{-Feld} / (Qtz + K\text{-Feld} + Plag) * 100 = 45 / (15 + 45 + 27) * 100 = 52\%$
- Ternary P = $27 / (15 + 45 + 27) * 100 = 31\%$

Ternary Plot



Naming Igneous Samples

- Complete name should include in order: color, texture, alteration (if any), accessory minerals ($\geq 10\%$; in order of increasing abundance), root name.
- Example: pink porphyritic medium-grained biotite granite
- If the ternary proportion example had been coarse-grained, red, with phenocrysts it would be named: red porphyritic coarse-grained quartz monzonite