

Lecture 3: Igneous Textures & Rock Geometry

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Igneous Texture

- Texture: size, shape and arrangement of constituent mineral grains
- Crystallinity: percentage of crystals versus glass, depends on:
 - Rate of cooling
 - SiO₂ content of magma
 - Viscosity of magma
 - Volcanic Glass: metastable; will persist for a maximum of 100,000 years; devitrification



Granularity

- Granularity: the grain size of the igneous rock, depends on:
 - Rate of cooling of the magma (most important factor)
 - Composition (SiO_2 content)
 - Viscosity
 - Number of crystal nucleation sites
 - Movement dynamics of the magma



Grain Size Ranges

- Aphanitic: crystals are too small to be identified with unaided eye ($< 0.1\text{mm}$)
- Phaneritic fine-grained: 0.1 to $<1\text{mm}$
- Phaneritic medium-grained: $1-5\text{mm}$
- Phaneritic coarse-grained: $>5\text{mm}$



Crystal Form

- Euhedral: perfectly or near-perfectly formed crystal faces (implies that crystal formed early in crystallization sequence)
- Subhedral: some crystal faces are expressed
- Anhedral: possesses no identifiable crystal faces (implies that crystal forms late in crystallization sequence).



Descriptive Igneous Textural Terms

- Idiomorphic: composed of mainly euhedral grains
- Hypidiomorphic: composed of a mixture of euhedral and anhedral grains
- Allotriomorphic: composed of mainly anhedral grains
- Equigranular: grains are consistently equidimensional
- Porphyritic: composed of 2 or more distinct size populations resulting from complex cooling history
- Vitrophyric: phenocrysts surrounded by glass groundmass matrix
- Glomeroporphyritic: phenocrysts in a porphyry clustered as large masses of crystals
- Poikilolitic: characterized by phenocrysts that contain abundant inclusions of smaller crystals



Descriptive Igneous Textural Terms cont.

- Vesicular: contains significant void space that represents trapped magmatic gases
- Scoriaceous: vesicles make up $> 50\%$ of rock by volume
- Amygdaloidal: contains vesicles that have been filled by secondary minerals termed amygdules
- Miariolitic: medium to coarse grained rock containing angular gas voids bounded by the crystal faces of euhedral crystals
- Cumulate: texture resulting from the settling of early-formed magmatic phases during fractional crystallization
- Corona: reaction rims or overgrowths that surround individual phenocrysts
- Tectonite: a rock that contains a pervasive foliation or lineation due to tectonic deformation
- Spinifex: texture of an ultramafic lava containing large skeletal olivine phenocrysts formed during rapid cooling



Intrusive Geometry

- Batholith: discordant intrusion with exposed area $> 100 \text{ km}^2$
- Stock: discordant intrusion with exposed area $1\text{-}100 \text{ km}^2$
- Pluton: discordant intrusion with exposed surface area $< 1 \text{ km}^2$
- Dike: discordant tabular intrusion
- Sill: concordant tabular intrusion
- Laccolith: concordant intrusion that has a “mushroom” shape in cross section
- Lopolith: concordant intrusion that is “saucer” shaped in cross section



Extrusive Geometry

- Shield Volcanoes: result from the extrusion of mafic (low viscosity) lava
- Composite Volcanoes (Stratocone): result from pyroclastic eruptions of intermediate and felsic (high viscosity) magma
- Pahoehoe: mafic lava cooling to form a smooth glassy surface
- Aa: mafic lava cooling to form a broken fragmental surface
- Pillow lava: results from the submarine extrusion of mafic lava
- Volcanic bombs: result from the explosive blasting of magma into the atmosphere
- Welded Tuff: pyroclastic rock that results from the compaction of ash and rock fragments during pyroclastic eruptions
- Ash flow tuff: pyroclastic fragmental rock created by a debris flow during an eruption
- Air fall tuff: stratified and graded pyroclastic deposit of ash and volcanic rock fragments

