

**Geol. 111G Survey of Geology**  
**Review for Lecture Exam 1, Thursday, September 18, 2008**

**INTRODUCTION TO GEOLOGY**

Interior structure of the earth

Subdivision based on layers of different composition

Core, mantle, crust

Subdivision based on layers characterized by different physical properties

Core, mesosphere, asthenosphere, lithosphere

Plate tectonics overview and definition

Divergent plate boundaries -mid-ocean ridges, rifts

Convergent plate boundaries-subduction zones

Transform or Strike-slip boundaries

**ATOMIC STRUCTURE AND BONDING OF ELEMENTS**

Atomic structure

Components of an atom: Nucleus (protons + neutrons), Electrons

Elements: atomic number versus atomic mass

Isotopes: stable versus radioactive

Ions: cations, anions, complex anions

Atomic Bonds: compounds

Ionic bonds

Covalent bonds

Metallic bonds

Van der Waals bonds

**MINERALS**

Definition of a Mineral

Properties of Minerals: crystal habit, cleavage, hardness (Moh's hardness scale), density, color, streak, luster

Rock-Forming Minerals

Native Elements

Halides

Oxides

Sulfides

Sulfates

Carbonates

Phosphates

Silicates: silica tetrahedron

Ferromagnesian silicates:

Olivine Group - isolated tetrahedron

Pyroxene Group-single chain

Amphibole Group-double chain

Biotite Group-continuous sheet

Non-ferromagnesian silicates

Quartz-3-D framework (conchoidal fracture)

Feldspar Group-3-D framework (orthoclase & plagioclase)

Muscovite Group-continuous sheet

## IGNEOUS ROCKS AND MAGMA

### Magma

- Geothermal Gradient

- Magma generation (decompression melting, flux melting)

- Magma types (mafic, intermediate, and felsic/silicic)

- Origins of magma types: fractionation, partial melting, magma mixing, assimilation)

- Crystallization of magma

### Igneous Rock Textures

- Phaneritic

- Aphanitic- glassy/obsidian

### Igneous Rock Classification

- Based on texture and composition (mafic, intermediate, and felsic):

  - aphanitic texture: basalt, andesite, rhyolite,

  - phaneritic texture: gabbro, diorite, granite

Intrusive/plutonic versus extrusive/volcanic - vary in where they form and relative cooling rates

## INTRUSIVE/PLUTONIC ROCKS

### Definition of Plutonic Rocks

#### Types of Plutons

- Tabular: sill, dike

- Massive: stock, batholith,

How plutons rise: assimilation, stoping (xenoliths)

## VOLCANIC ROCKS

### Definition of volcanic rocks

#### Volcanoes

- Crater vs. caldera

- Eruption mechanism- viscosity and gas content of magma

- Viscosity: controlled by composition, temperature, % dissolved gas

- Lava flows: Surface texture types: Pahoehoe, Aa

- Pyroclastic debris: tephra and pyroclastic flows

- Classification of Volcanoes - shape and % lava vs. pyroclastic debris

  - Shield volcanoes

  - Strato volcanoes/ Composite volcanoes

  - Cinder cones

Volcanism in New Mexico: Controlled by Jemez lineament and Rio Grande Rift

- Jemez volcanic field, Valles Caldera

- Potrillo volcanic field - Aden crater, Kilbourne Hole

- Organ Mountain batholith and caldera

#### Other Volcanic Systems

- Mount St. Helens

- Iceland

## IGNEOUS ROCKS AND PLATE TECTONICS

### Divergent Plate Boundaries

- Rifts and spreading centers: Fractionation and partial melting of crust and mantle by decompression melting, generates mafic (basaltic) and felsic (rhyolitic) magmas that form shield volcanoes and cinder cones.

### Convergent plate Boundaries

- Subduction zones and arcs: Partial melting of the crust and upper mantle by flux melting, generates intermediate (andesitic) magmas that form stratovolcanoes