IGNEOUS ACTIVITY AND ROCKS
EXTRUSIVE (Volcanic)- Fine-grained
INTRUSIVE (Plutonic)- Coarse-grained

MAGMA
- Molten Rock
  - Usually with dissolved gasses
- Generated at depth
- Works its way upward
  - in blobs or
  - through fractures
- Eruptions if magma (lava) reaches surface
- If doesn’t reach surface, Solidifies underground

VOLCANISM
- Lava = Magma at earth surface
  - Silica content controls “explosiveness”
- Pyroclasts = Fragments of rock due to explosion
- Gases
  - Primarily H₂O
  - Also CO₂, SO₂
  - sometimes toxic gases (HCl, HF, CO)

Volcanic Hazards
- Lava flows
- Pyroclastic (Ash, cinder, etc.) fall (tephra)
- Pyroclastic flows
- Toxic gases
- Mudflows
- Tsunamis
- Indirect- especially famine

VOLCANOES
- Cone-shaped
- Crater
- Caldera
- SHIELD VOLCANOES
  - Fluid lava flows
  - Low silica magma
  - Basalt
  - Tend to be very large
  - slopes of 2 to 10 degrees
  - Hawaiian examples
  - Pahoehoe vs. aa
- CINDER CONE
  - Formed of pyroclasts
Pyroclasts
- ash, cinder, bombs, blocks
- Steep sides - ~33 degrees
- Relatively small

**COMPOSITE VOLCANO**
- Alternating pyroclastic layers & lava flows
- Mostly *Andesite*
- Intermittent eruptions of long time (~100,000 years)
- Circum-Pacific Belt ("Ring of Fire")

**VOLCANIC DOMES**
- Usually high silica (or cooler magma)
- Associated with violent eruptions
  - e.g. Pinotubo, St. Pierre, Montserrat
- Obsidian - volcanic glass
  - Uses
- Pumice - frothy volcanic glass
  - Uses

**LAVA FLOWS**
- Low in silica
- Basalt
- Fissure flows
  - basalt plateaus
- Columnar jointing
- Lava tubes (also found in shield volcanoes)
- Pillow basalt-
  - Underwater eruptions

**IGNEOUS ROCKS**
- Names based on *mineral* composition (which reflects chemical composition of the magma) and...
- Grain size
  - Course-grained: > 1 mm.
  - Fine-grained: < 1 mm.
  - Refers to Average grain size

**Common Igneous Rocks**
- **Course-grained**
  - GRANITE*
  - Diorite
  - Gabbro
- **Fine-Grained**
  - Rhyolite
  - ANDESITE*
  - BASALT*
  - Granite (& Rhyolite)
  - High in silica (Si + O)
- Low in Fe + Mg
- Mostly *feldspar* & *quartz*
- Light-colored
- Basalt (& Gabbro)
  - “Low” in silica (Si + O)
  - High in Fe + Mg
  - no quartz, abundant ferromagnesian minerals
  - Dark colored
- Andesite- intermediate

**INTRUSIVE STRUCTURES**

- Bodies that solidified underground
- Volcanic neck- shallow intrusion
- Fills cracks- *tabular* bodies
  - DIKE-
    - If no layering in *country rock*
    - If country rock is layered - *Discordant*
  - Sill- less common
    - *Concordant*- parallel to layering in country rock
- BATHOLITH-
  - Large intrusive body
  - (Exposed over an area greater than 100 square Km.)
- smaller bodies are called stocks
- Batholith is a gathering of smaller blobs

**Origin of magmas**

- Partial melting
- From asthenosphere
- From lower crust

**PLATE TECTONICS**

- DIVERGENT BOUNDARY
  - Mid-Oceanic ridges
    - Iceland
  - Sea floor Spreading
  - Magma wells up from asthenosphere
    - Partial melting of mantle
    - Produces basaltic magma
- CONVERGENT BOUNDARY
  - Subduction zone
  - Magma generated from partial melting of asthenosphere above subducted plate
    - Andesite magma for composite volcanoes
  - Magma generated from partial melting of lower crust.
    - granitic magma for batholiths