

Introduction to Rocks

The Father of Geology

- James Hutton 1795
- Scotland
- First person who tried to explain PHYSICAL FEATURES of the earth as an ongoing process.

Hutton's Theory"

- UNIFORMITY OF PROCESS -- "THE PRESENT IS THE KEY TO THE PAST"
- 1. THE GEOLOGIC PROCESSES NOW IN OPERATION ON THE EARTH WERE ALSO ACTIVE AT ABOUT THE SAME RATE IN THE PAST.
- Examples:

Hutton's Theory cont.

- 2. THE PRESENT PHYSICAL FEATURES OF THE EARTH CAN BE EXPLAINED IN TERMS OF THESE GEOLOGIC PROCESSES OPERATING OVER LONG PERIODS OF TIME IN THE PAST.



First Look...

- **BEDROCK** - SOLID ROCK THAT IS ATTACHED TO EARTH'S CRUST
- **OUTCROP / EXPOSURE** - WHEN BEDROCK CAN BE SEEN AT THE SURFACE
- **SEDIMENTS** – Broken pieces of rock

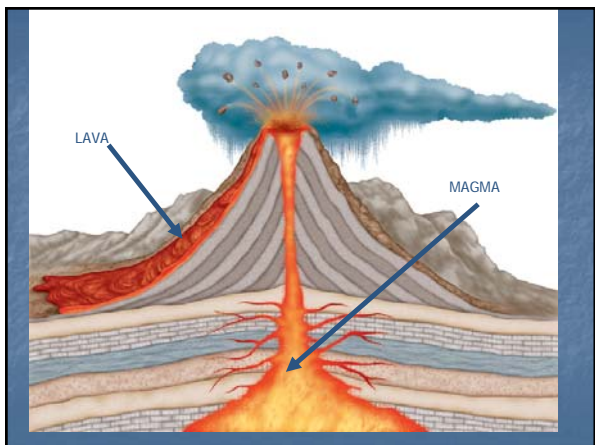


Rock Classification

- ALL ROCKS ARE GROUPED ACCORDING TO THE MANNER IN WHICH THEY ARE FORMED.
- How do they form?

Igneous Rocks

- ROCKS FORMED FROM THE COOLING AND HARDENING OF MOLTEN (HOT LIQUID) ROCK.
- **LAVA** - LIQUID ROCK FOUND ON THE SURFACE OF THE EARTH.
- **MAGMA** - LIQUID ROCK FOUND BELOW THE SURFACE OF THE EARTH.



Composition of Magma

- Magma - a slushy mix of molten rock, gases, and mineral crystals.
- The elements found in magma are the same major elements found in Earth's crust: oxygen (O), silicon (Si), aluminum (Al), iron (Fe), magnesium (Mg), calcium (Ca), potassium (K), and sodium (Na).

Composition of Magma

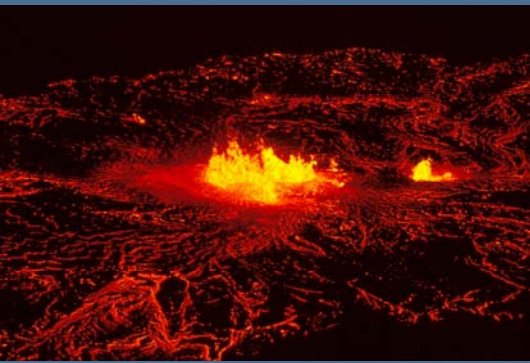
- Silica (SiO₂) is the most abundant and has the greatest effect on magma characteristics.
- Silica content affects melting temperature and also impacts how quickly magma flows.

Group	SiO ₂ content
Rhyolitic	70 percent
Andesitic	60 percent
Basaltic	50 percent

TWO GROUPS OF IGNEOUS ROCK

- 1. *EXTRUSIVE* - ROCKS FORMED WHEN LIQUID ROCK (LAVA) COOLS AND HARDENS ON THE EARTH'S SURFACE.

Basalt and Obsidian



- 2. *INTRUSIVE* - ROCKS FORMED WHEN LIQUID ROCK (MAGMA) COOLS AND HARDENS BELOW THE SURFACE.
- Granite, Gabbro, Diorite

Granite



Gabbro



Diorite

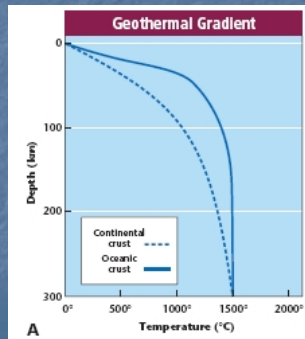


Factors that affect Magma Formation (melting of rock)

- Temperature
 - Pressure
 - Water Content
 - Mineral Composition
- The right combo of each must be present for melting to occur

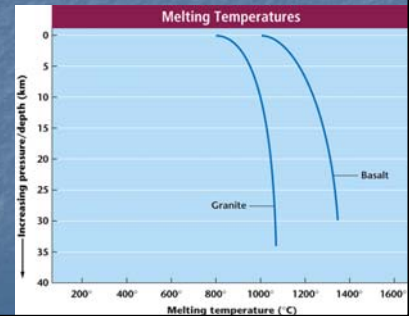
Geothermal Gradient

- Increase of temperature with depth



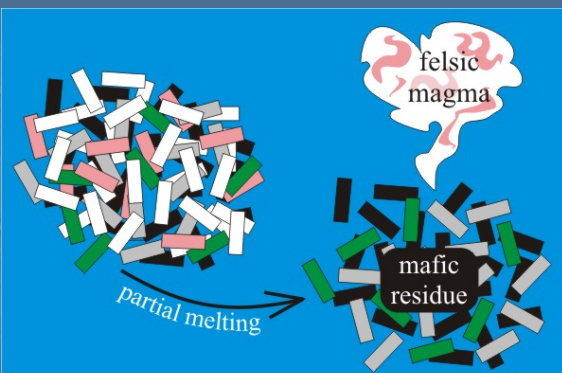
Melting Point impacted by...

Increasing pressure causes melting point to increase



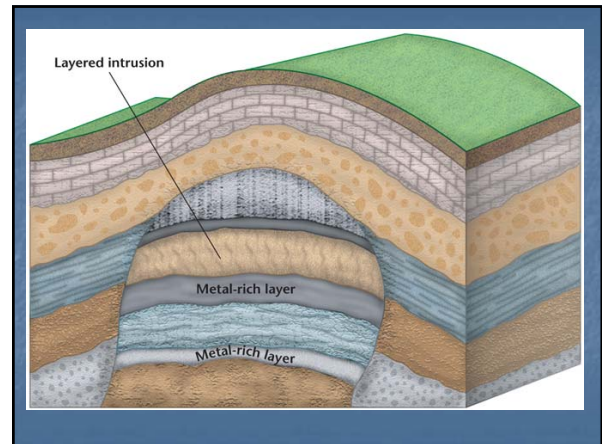
From Rock To Magma

- 1. Partial Melting
 - Start out with a mix of minerals
 - Different minerals have differing melting points
 - Some minerals melt while others remain solid
 - Minerals can separate and reform as different rocks



From Magma to Rock cont.

- 2. Fractional Crystallization
 - Reverse of partial melting
 - Minerals crystallize at different temperatures
 - This helps to sort/change composition of rock
 - Left over substances squeeze into existing rock as a vein
 - (often a source of rare resources like diamond or gold etc..)



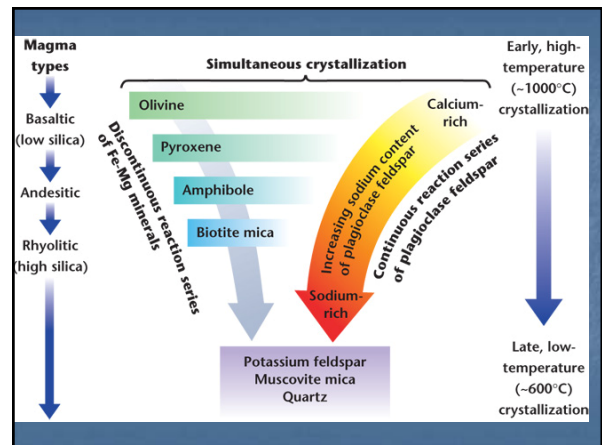
Bowen's reaction series

- illustrates the relationship between cooling magma and mineral formation.
- Bowen discovered two main patterns, or branches, of crystallization.

As cooling takes place different minerals will turn solid (crystallize)

Feldspar group → continuous change

Iron –magnesium group → abrupt change

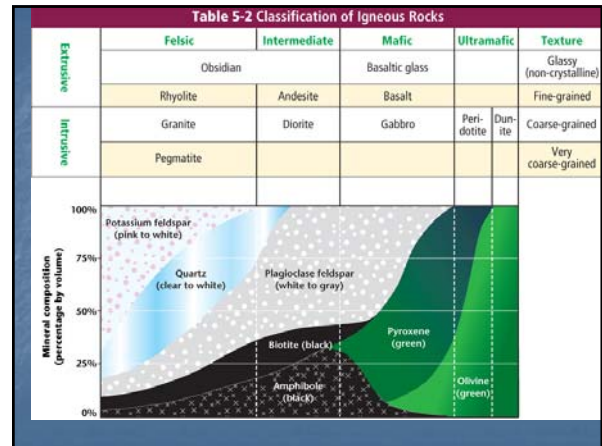
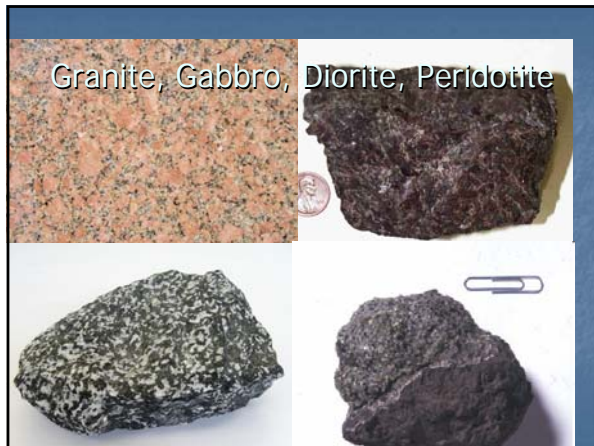


Classifying Igneous Rocks

- Where they form
 - Intrusive
 - Extrusive

Mineral Composition

- **Felsic** such as granite, light-colored, have high silica contents.
- **Mafic** such as gabbro, dark-colored, have lower silica contents, rich in iron and magnesium.
- **Intermediate** such as diorite, have some characteristics of both felsic and mafic rocks.
- **Ultramafic** unusual, they have low silica contents and very high levels of iron and magnesium.



Grain Size

- Size of the crystal
- Impacted by cooling rate
- Fast – no grains
- Slow- larger grains

Textures

- Glassy – no mineral grains
- Fine – small mineral grains
- Intermediate – medeium grains
- Coarse – large grains
- Porphyritic – large and small grains
- What could cause a porphyritic texture?

SECTION 5.2 Classifying Igneous Rocks

Ore Deposits

- Ores are minerals that contain a useful substance that can be mined at a profit.
- Valuable ore deposits are often associated with igneous intrusions.
- These deposits sometimes occur as veins.