

MINERALS AND ROCKS

I. Minerals

- A. Are **naturally occurring, inorganic solid** elements, compounds, or mixtures from which all rocks are made.
- B. Minerals are formed **inorganically** by the process of **crystallization** as a result of specific environmental conditions. These include:
1. cooling and solidification of **magma** (molten rock)
 2. precipitation from water caused by such processes as:
 - a) evaporation
 - b) chemical reactions
 - c) temperature changes
 3. rearrangement of the atoms in existing minerals subjected to conditions of high heat and pressure
- C. Minerals are classified based upon their:
1. chemical composition (see Ref. Tables ... p. 16)
 2. observable properties (see Ref. Tables ... p. 16)
- D. **Observable properties** of minerals are due to the **internal arrangement of the atoms** of each mineral type.
1. Cleavage - breaking along smooth sides (due to weaker bond arrangements)
 2. Fracture - no distinct breaking pattern (due to equal bonds of atoms)
 3. Color - not the best test (some minerals can be more than one color)
 4. Density - each type of mineral has its own density
 5. Hardness - resistance to scratching
 - a) uses a scale of 1 (softest) to 10 (hardest)
 6. Streak - color of the mineral when powdered (use a streak plate)
 7. Luster - how it reflects the light (metallic or nonmetallic)
 8. Crystal shape - number of sides, pattern, etc.
 9. Special tests
 - a) acid test - only CALCITE bubbles when acid is placed on it
 - b) magnetism - only MAGNETITE is magnetic
- E. Mineral uses
1. The chemical composition and physical properties determine how minerals are used by humans.
 2. The use and distribution of mineral resources has important economic and environmental impacts.
 - a) As limited resources, minerals must be used wisely.
- F. Identifying unknown minerals
1. Use a “flow chart” technique along with Ref. Tables (p. 16) to identify a mineral based on its observable properties.

II. Rocks

- A. Are composed of 1 or more minerals.
- B. Rocks are classified as SEDIMENTARY, IGNEOUS, or METAMORPHIC based on their:
 - 1. **origin** - how it formed
 - 2. **texture** - size of the crystals/sediments making up the rock
 - 3. **mineral content** - what minerals are in the rock
- C. Conditions that existed when a rock formed can be inferred from the rock's mineral content and texture
 - 1. Sedimentary rock layers indicate an ancient marine (ocean) environment.
- D. The **properties** of rocks determine how they are used, and also influence land usage by humans.
- E. Identifying rocks
 - 1. Use a "flow chart" technique along with Ref. Tables (p. 6 & 7) to identify rocks based on observable properties.

III. SEDIMENTARY ROCKS - 3 classifications (See Ref. Tables...p. 7)

- A. **Clastic** - (fragmental pieces) are from **land-derived sediments**
 - 1.) Due to **compaction** (squeezing) and **cementation** (cementing by dissolved minerals in water) of **pieces of other rocks**.
 - a) forms in **layers**, called **strata**
 - b) The sediments are always **OLDER** than the actual rock.
- B. **Crystalline** - no pieces of other rock, but rather from chemical sources
 - 1.) **precipitates** - dissolved sea shells sinking to ocean floor to form sedimentary rocks.
 - 2.) **evaporites** - when sea water evaporates, the dissolved minerals in the water are left behind.
- C. **Bioclastic** - from organic (once living) material
 - 1.) **coal** - from plants
- D. **Crystalline or bioclastic**
 - 1.) **limestone** - from fossil sea shells

The **LARGER** the texture of a clastic sedimentary rock, the **closer to the shore** that the rock formed.

IV. IGNEOUS ROCKS (see Ref. Tables... p. 6)

- A. Form due to **solidification** (becoming a solid) and **crystallization** (forming into crystals) of **magma** (molten material below earth's surface) or **lava** (molten material above earth's surface).
- B. Igneous rocks are made up of **intergrown crystals** of minerals.
 - 1.) The *size* of these intergrown crystals is determined by the **cooling rate** of the molten material. Igneous rocks can be extrusive or intrusive:
 - a) extrusive rock - *small* (fine or glassy) **crystal size**, due to **fast cooling** at or near the earth's surface.
 - b) intrusive rock - *large* (coarse) **crystal size**, due to **slow cooling** deep underground under conditions of high temperature and pressure.
 - 2.) **Vesicular** - igneous rock with gas pockets in it.

V. METAMORPHIC ROCK (see Ref. Tables ... p. 7)

- A. Rock that has changed in form due to **HEAT** and/or **PRESSURE**
 - 1.) **Recrystallization** - changing crystal form due to the high heat and/or pressure, but *NOT* high enough to cause melting.
- B. The heat can be:
 - 1.) **Regional** - over a large area
 - 2.) **Contact** - just along the edge of the intruding magma or lava
(causes **CONTACT METAMORPHISM**)
- C. Metamorphic rocks are classified as:
 - 1. **Foliated** - has a banded appearance
 - a) these bands can be greatly distorted from intense pressure in different directions
 - 2.) **Nonfoliated** - no banding present

VI. Distribution of rock types

- A. Sedimentary rocks form a thin veneer (coating) over the surface of the continents (where it hasn't been eroded away). Most surface bedrock in the U.S. is sedimentary rock.
- B. The **deeper** you go into the earth's interior, the more **igneous rock** is present.

VII. The ROCK CYCLE (see Ref. Tables ... p. 6)

- A. A diagram showing how any one rock type can change into any *other* rock type.