EARTH'S INTERIOR

I. EARTH'S STRUCTURE
II. MINERALS
III. ROCKS AND THE ROCK CYCLE

I. EARTH'S STRUCTURE

- Geology: the study of Earth, including its composition and structure
  - Scientists who study the Earth: Geologists.
  - Uniformitarianism: the idea that processes that occur today also operated in the past.

- Cross Section of the Earth
  - Three main layers
    - Crust
    - Mantle
    - Core
  - Crust: the rocky outer layer made of Si, O, Fe, Ca, Al
    - 2 Types:
      - Continental Crust: less dense; made of rocks such as granite.
        - Avg. thickness of 40 km. (Range is 8 to 75 km)
      - Oceanic Crust: more dense; made of rocks like basalt.
        - Avg. thickness of 7 km.
  - Mantle: thickest layer that lies below the crust. (2850 km thick)
    - Temp. and pressure increase the deeper you go.
    - 3 layers:
      - Lithosphere: 100 km thick; rigid
      - Asthenosphere: softer, weaker rock that can flow.
      - Mesosphere: stiff, extending down until the outer core.
  - The Core: large sphere of metal in Earth's center.
    - Composed mostly of Fe (iron), with some Ni.
    - Pressure = 364 x greater than at Earth's surface.
    - Estimated temp. = 5500 ^{o}C
    - 2 parts:
      - Outer Core:
        - Metal liquid
        - Flows, producing Earth's magnetic field
      - Inner Core:
        - Solid due to the great pressure.

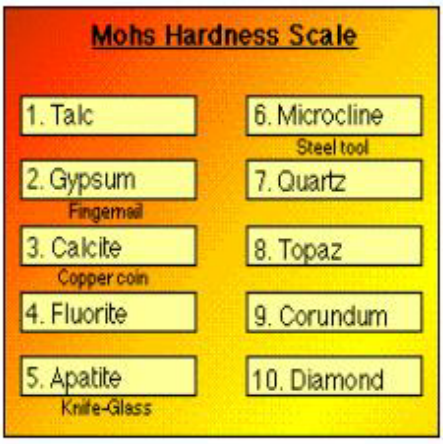
II. MINERALS

- Mineral:
  1. a naturally occurring,
  2. solid with
  3. crystal structure and
  4. characteristic chemical composition.

- Rock: a solid *combination of minerals* and other materials.
  - e.g.) Granite: made of quartz, feldspar, mica, and hornblende.

- Properties of Minerals:
  - 1 - Crystal Structure: atoms are arranged in a particular geometric shape.
    - Prism shape

        - Cube shape
        - Sheets
        - Needles
        - Threads
    - 2 - Color: due to the chemical composition (result in reflection of diff. wavelengths of light)
        - Same mineral may have different colors if there is a slight difference in chem. composition.
    - 3 - Streak: color of a mineral's powder.
        - Scrape the mineral on a white piece of unglazed porcelain (a streak plate)
        - The streak is not always the same color as the mineral itself.
    - 4 - Luster: the way the surface reflects light.
        - (How shiny it is)
        - Various levels:
            - Earthy: rough, crumbly
            - Silky
            - Pearly
            - Glassy
            - Etc.
    - 5 - Density: mass / volume
        - Depends on chemical composition
            - Elements with higher atomic masses can be found in very dense minerals
    - 6 - Hardness: the resistance to scratching.
        - Mohs Hardness Scale: (1 – 10)
            - 1 = softest (Talc)
            - 10 = hardest (Diamond)



        - Scratch test
            - e.g.) fingernail = 2.5
                - penny = 3.5
                - iron nail = 4.5
                - steel file = 6.5
    - 7 - Fracture: how the mineral breaks.
        - Determined by the crystalline structure and the bonds between atoms.
        - When a mineral splits along regular, defined planes, it is said to have Cleavage.

Cleavage in one direction. Example: MUSCOVITE

Cleavage in two directions. Example: FELDSPAR

Cleavage in three directions. Example: HALITE

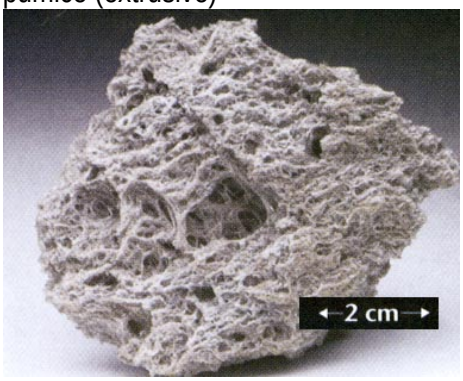
Cleavage in two directions. Example: CALCITE

- 8 - Other:
  - Reaction to acid
  - Magnetic / Electric properties
  - Fluorescent properties
  - Refraction of light

III ROCKS AND THE ROCK CYCLE

- Classifying Rocks
  - By size, shape, and arrangement of crystals and other particles.
    - Give the rock its texture
      - Texture reveals what it's made of, and how and where it was formed.
  - 3 Major Groups
    - Igneous
    - Sedimentary
    - Metamorphic
- Igneous Rock
  - Formed from magma – mixture of molten rock and gases.
    - Magma flowing out of volcanoes is called lava.
  - The rock is formed when magma or lava cools and solidifies.
  - Cooled magma (inside the Earth) is called Intrusive Rock
    - Cools slowly, forming large crystals and coarse texture
  - Cooled lava (outside the Earth) is called Extrusive Rock
    - Cools quickly, forming small, fine crystals and fine-grained texture.
  - E.g.) granite (intrusive),

- pumice (extrusive)



- Sedimentary Rock
  - Formed over time as sediment is squeezed and cemented together.
    - Sediment: small pieces from rocks or living organisms (that were weathered by water and/or wind).
  - 3 groups (based on how they form)
    - Clastic Rock
    - Chemical Rock
    - Organic Rock
  - Clastic Rock
    - Form from broken fragments of other rocks that are cemented together.
      - conglomerate: contain gravel and pebbles.
      - Some Clastics are made of smaller particles. (e.g. sandstone)
      - breccia: contains sharp edged fragments

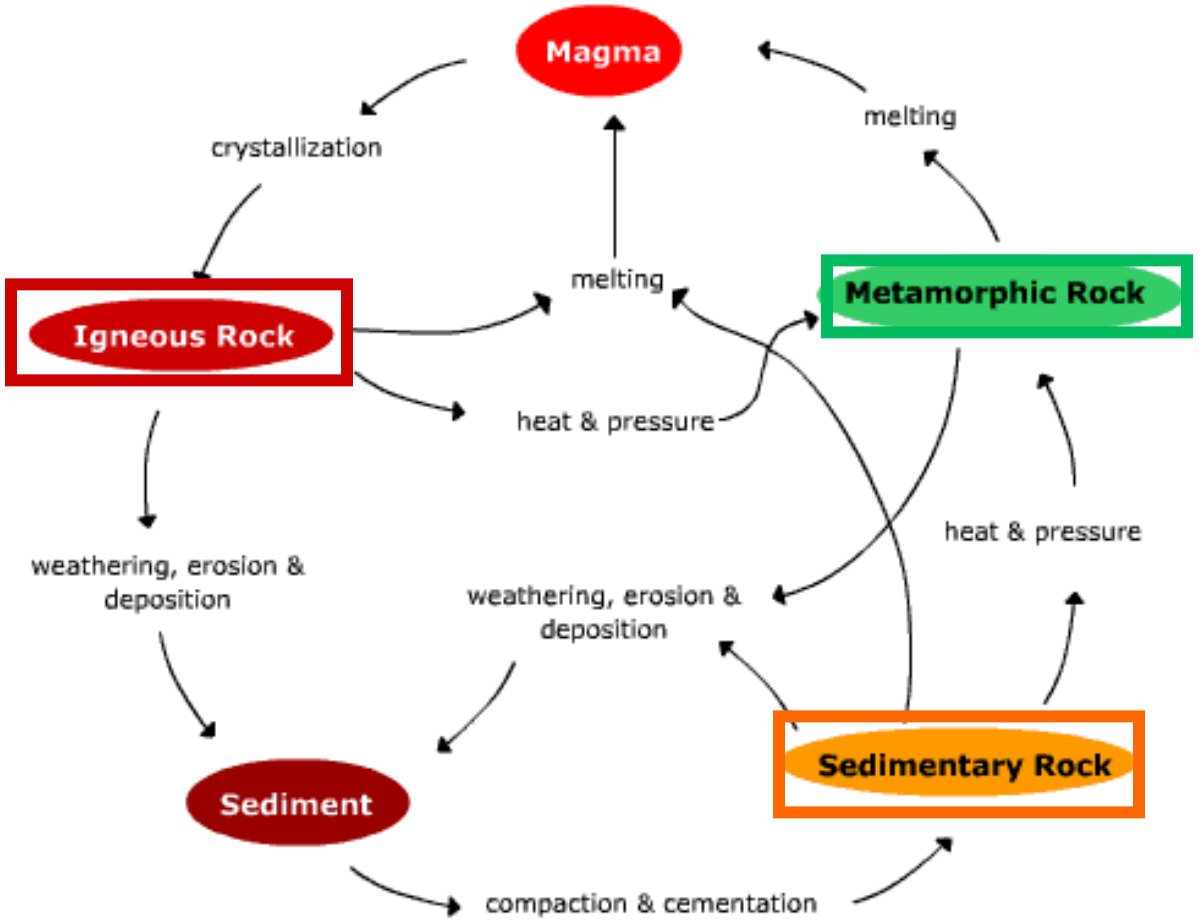
      - shale: made from clay and separates into sheets

- Chemical Rock
  - Form when minerals precipitate out of solution. (A solid forms when two liquids combine and react.)
  - e.g.) limestone (calcium carbonate precipitate), salt rocks (NaCl precipitate)

- Organic Rock
  - Forms as a result of the organic process.
    - a) Organisms die.
    - b) Their shells and skeletons sink to the floor.
    - c) Over time, the fragments compact and cement together
  - e.g.) organic limestone

- Metamorphic Rock
  - Forms when rock is transformed by heat, pressure, or chemical reactions
    - Usually deep underground
    - Can result in a change in mineral composition and texture
      - Shale → Slate
  - Foliated Rock: has particles arranged in parallel bands (lines).

- The Rock Cycle: A series of processes where rocks continuously change from one type to another.


Magma
crystallization
melting
Igneous Rock
melting
Metamorphic Rock
heat & pressure
weathering, erosion & deposition
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Sedimentary Rock
Sediment
compaction & cementation