

Study Guide 1

Geology - study of the Earth.

Catastrophism - 17 - 18th century doctrine - Earth's landscape shaped primarily by great catastrophes.

James Hutton - late 18th century - father of modern geology

Uniformitarianism - physical, chemical, and biological laws that have operated today also operated in the geologic past. "The present is the key to the past".

Charles Lyell - produced various versions of Principles of Geology (1830-1872) where he championed uniformitarianism.

Meteorites are believed to represent the primitive material of the solar system.

The universe believed to be 15 - 18 Ga.

Big Bang - origin of the universe. matter was concentrated with infinite density at a single point, from which it exploded (~15-18 Ba); hypothetical release of all the energy, matter, and antimatter in existence.

Nebular hypothesis - the bodies of the solar system formed from an enormous cloud of H and He

Earth divided into distinct shells or spheres: **Inner Core, Outer Core, Mantle, Crust**

Two principle divisions of the earth's surface: • **continents** • **ocean basins**

Igneous Rock - originates when molten material - **magma** cools and solidifies - **crystallization**. **intrusive** if cooled at depth; **extrusive** if cooled at the surface.

When exposed at the surface, they undergo **weathering** - disintegration and decomposition.

Eventually transported as sediment; may be lithified into **sedimentary rock**.

If buried and subjected to heat and pressure, can be turned into **metamorphic rock**.

Atomic Structure: Nucleus (positively charged protons and neutral neutrons); orbiting the nucleus are negatively charged electrons; Electrical Charge: $P = +1$; $N = 0$; $E = -1$;
Atomic weight: $P = 1$; $N = 1$; $E = 0$

Atomic number - number of protons; gives name of element; Atomic weight - number of protons and neutrons

Bonding: Combining of two or more elements into a compound; two major types of bonds.

Ions - atoms with an electrical charge because of unequal number of electrons and protons.

Structure of Minerals: Orderly stacking of atoms- crystals; **Polymorphs:** same chemical composition but different atomic arrangement and properties; ex: C (diamond or graphite)

Physical Properties of Minerals: Crystal form, Color, Streak, Hardness (Mohs Scale), Cleavage, Fracture, Luster, taste, magnetism, smell, chemical reaction to HCl

Mineral Groups: Silicates -most common mineral group; All silicates contain O and Si; other important elements: Al, Fe, Ca, Na, K, Mg.

Structure of Silicates: Silicon-oxygen tetrahedron; can be linked to form a variety of configurations: single chain, double chain, sheet, framework, isolated structures

Silicate Minerals: olivine - $(Mg,Fe)_2SiO_4$; pyroxene - $(Fe,Mg)SiO_3$; Amphiboles; biotite; muscovite; feldspar; quartz **Nonsilicate minerals:** calcite, halite, gypsum

Igneous Rocks: classified according to *texture* and *mineral composition*.

Bowen's Reaction Series: As magma cools, minerals with higher melting points crystallize out before those with lower melting points.

Magmatic Differentiation - process of developing more than one rock type from a common magma.

Mafic Rocks: Basaltic Rocks; **Intermediate Rocks:** Andesitic Rocks; **Felsic Rocks:** Granitic Rocks

Occurrence: Most magma is emplaced at depth in plutons (batholiths), dikes or sills.

Volcanic Activity: Lava Flows; Gases; Pyroclastic Material;

Three types: shield volcanoes, cinder cones, and composite cones (stratovolcanoes).

nuée ardente - a fiery cloud of hot gases infused with incandescent ash.

Sedimentary Rocks: two main groups: Detrital Rocks; Chemical Sedimentary Rocks

Clastic Rocks - detritus or fragments of minerals and rocks; *subdivided on the size of the clasts*

Conglomerates - lithified gravel; Angular particles are termed a breccia; Sands; Mud; Silt

Shale - rock composed of *clay minerals*; thin layers called *laminae*. Ability to split into thin layers - *fissility*.

Bedforms - deviation from flat lying: *graded bedding, cross bedding, ripple marks*

Chemical Sedimentary Rocks: Limestone; Evaporites (halite, gypsum)

Lithification: Turning Sediment Into Rock; *Compaction; Cementation*

Metamorphic Rocks: transformation of pre-existing rocks by heat, pressure, and chemically active fluids.

Settings: Mountain building - **regional metamorphism**; **Contact metamorphism:** changed by contact with magma

Textural and mineralogical changes: *foliation- preferred mineral alignment; schistosity;*

gneiss. Progressive metamorphism of a shale:

slate→phyllite→schist→gneiss

Nonfoliated Rocks: Marble; Quartzite