

# ESSENTIALS OF PHYSICAL GEOLOGY P.D. Lowman 1991

- Geology:** The study of the Earth and Earth-like bodies (Moon, Mars, etc.)
  - Physical:** Minerals, rocks, and structures. Tectonics concerns regional and global structure. Plate tectonics: Explains mountain-building, volcanism, & earthquakes in terms of ridges (spreading centers), trenches (subduction zones), and transform faults.
  - Historical:** History of Earth and inhabitants thereof (dinosaurs, etc.)

## Essentials: Elements Minerals Rocks Structures

**Elements:** Order of abundance in Earth's crust:: (memorize)

Oxygen Silicon Aluminum Iron Calcium Sodium Potassium Magnesium  
O Si Al Fe Ca Na K Mg

**Minerals:** Most minerals are silicates ; others : oxides, carbonates, sulfides.

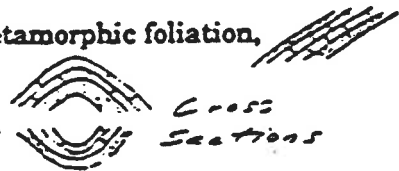
- Quartz:** ( $\text{SiO}_2$ ) - Most abundant simple mineral in Earth's crust
- Feldspars** (Al silicates of K, Na, Ca in solid solution); main rock-forming minerals (in granites, basalts, gabbros, etc.)
- Calcite:** ( $\text{CaCO}_3$ ) - main mineral of limestone, chalk, marble
- Olivine, Pyroxene, Amphibole :** Main Fe, Mg silicates in basalt, peridotite; olivine main component of upper mantle
- Clay minerals:** Formed chiefly by weathering of silicates

**Rocks:** Composed of one or more minerals

- Igneous** - Formed from lava (extrusive) or magma (intrusive). Most common types: basalt, granite, gabbro, rhyolite, andesite, anorthosite
- Sedimentary** - Deposited by water, wind, or ice, or by evaporation of water. Most common types: sandstone, shale, limestone, conglomerate
- Metamorphic** - Chiefly formed by solid-state recrystallization of pre-existing rocks; e.g., marble is recrystallized limestone. Shock metamorphism may destroy crystal structure. Most common types: gneiss, schist, marble, amphibolite, serpentine

**Structures:** Rock layers - sedimentary bedding, metamorphic foliation, lava flows, volcanic ash deposits

**Folds** - anticlines, arch-like upfolds  
synclines, trough-like down folds



**Faults:** fractures along which there has been movement

normal (tensional)



Cross Sections

reverse or thrust (compressional)



strike-slip or wrench (horizontal shear)  
(San Andreas is this type)

**Joints:** simple fractures, movement away from fracture

**Geologic Time** (years before present);

- Precambrian: 4.5 b.y. to 570 m.y.;
- Paleozoic: 570 m.y. to 240 m.y.
- Mesozoic: 240 to 65 m.y.;
- Cenozoic: 65 m.y. to present.
- Pleistocene Epoch: 2 m.y. to 10,000 years ago.