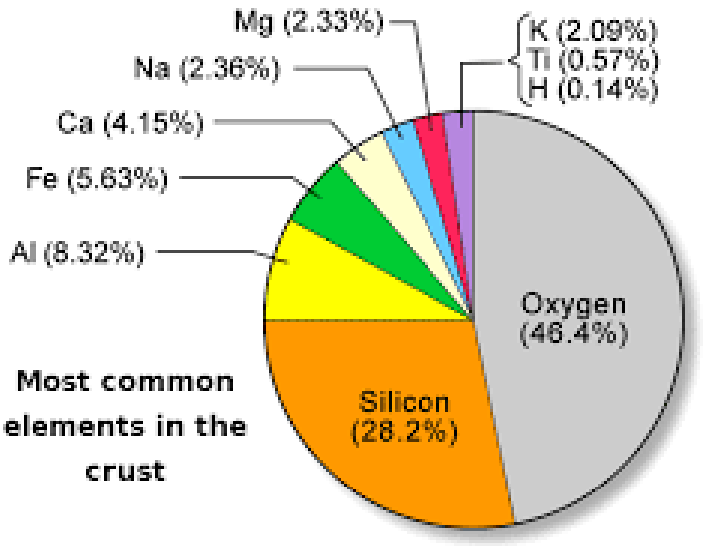
Rock forming minerals

Rocks are assemblies of minerals, it is formed by various minerals or rock fragments come to gather or consist of a large number of accumulations of a single mineral.

•It is found in the majority of 8 element minerals as rock builder, representing more than 98% of the weight of the continental crust.

Oxygen	%46.6
Silisium	%27.72
Aluminum	%8.13
Iron	%5
Calcium	%3.63
Sodium	%2.83
Potassium	%2.59
Magnesium	%2.09



The rocks that makeup the Earth's crust are the various minerals or single minerals, rock fragments, or both mineral and rock fragments.

Deformations: a general term that refers to all changes in the original form and/or size of a rock body.

Deformation involves
Force: that which tends to put stationary objects in motion or changes the motions of moving objects
Stress: force applied to a given area
»Compressional stress shortens a rock body.
»Tensional stress tends to elongate or pull apart a rock unit.
»Shear stress produces a motion similar to slippage that occurs between individual playing cards when the top of the stack is moved relative to the bottom.
Strain: changes in the shape or size of a rock body caused by stress

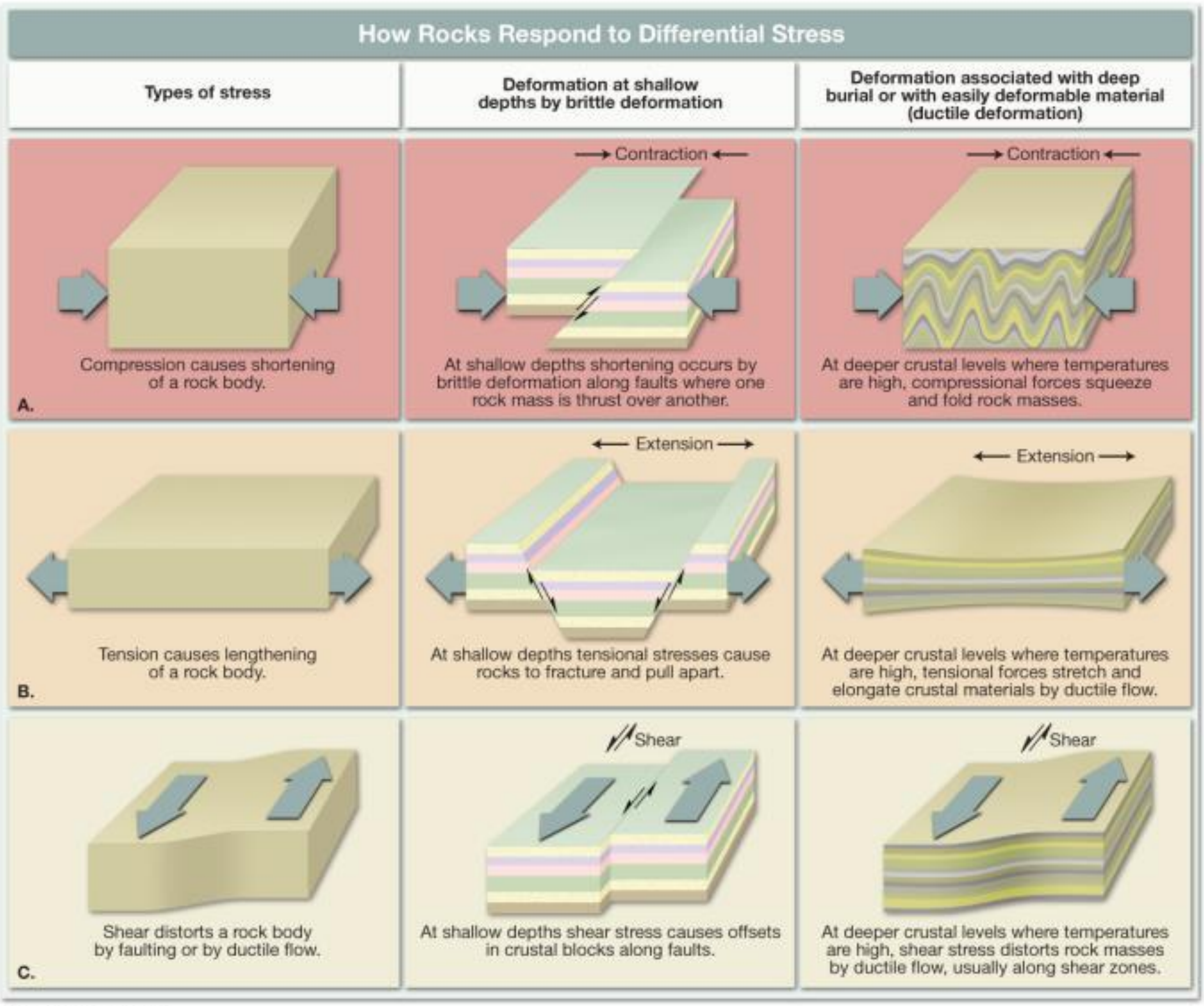
How rocks deform

Rocks subjected to stresses greater than their own strength begin to deform by folding, flowing, or fracturing.

General characteristics of rock deformation

Elastic deformation: The rock returns to nearly its original size and shape when the stress is removed.

Once the elastic limit (strength) of a rock is surpassed, it either flows (ductile deformation) or fractures (brittle deformation).



Factors that influence the strength of a rock and how it will deform

1. Temperature. 2. Confining pressure 3. Rock type 4. Time

During crustal deformation, rocks are often bent into a series of wave-like undulations called folds.

Characteristics of folds

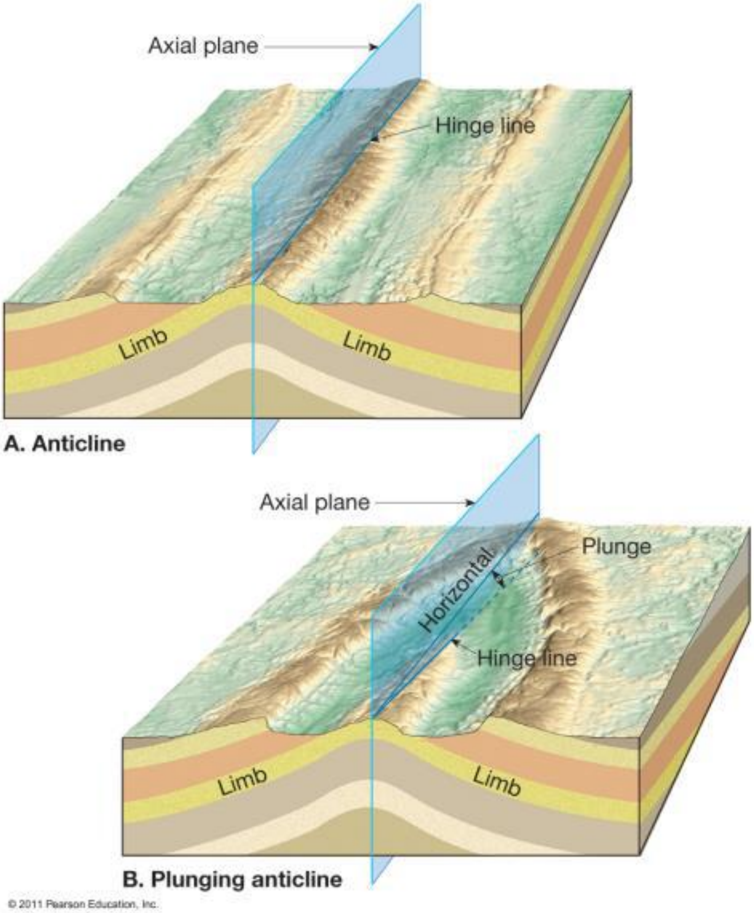
•Most folds result from compressional stresses that shorten and thicken the crust.

•Parts of a fold

–**Limbs** refers to the two sides of a fold.

–An **axis** is a line drawn down the points of maximum curvature of each layer.

–An **axial planeis** an imaginary surface that divides a fold symmetrically.



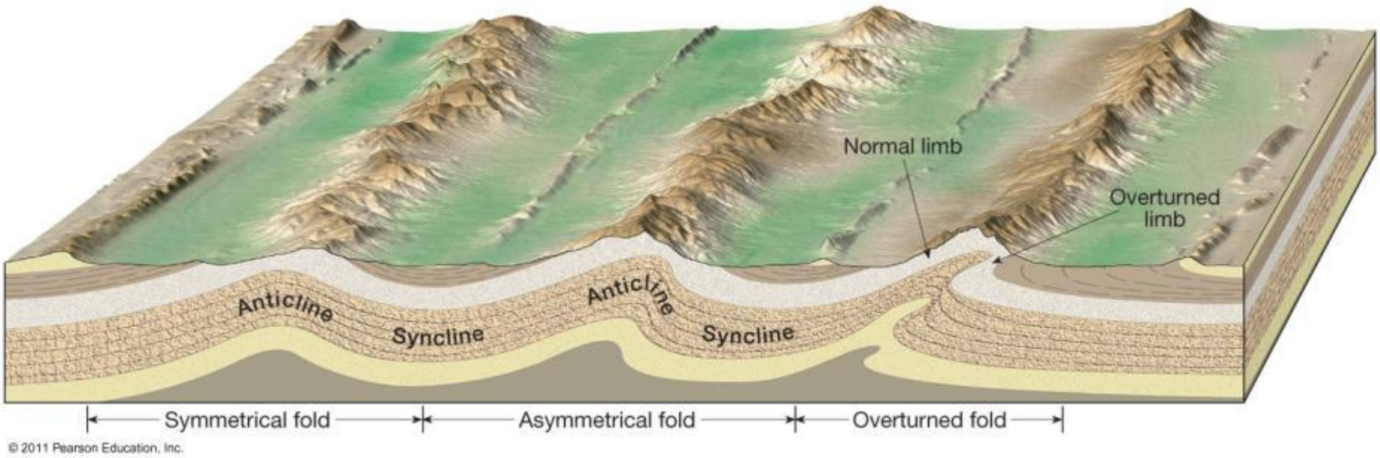
Common types of folds

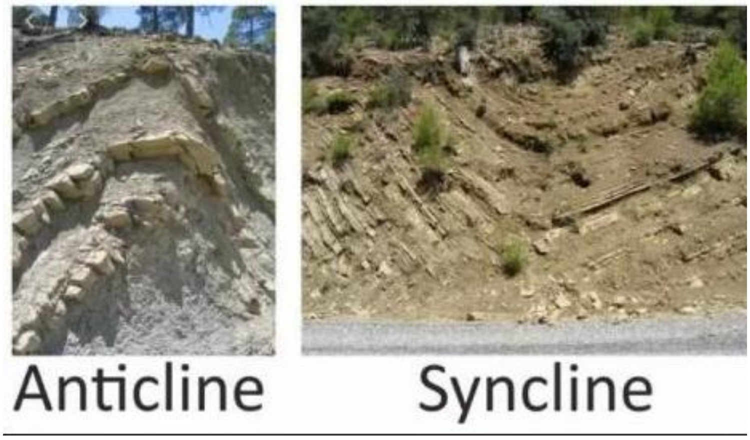
•**Anticline**—upfoldedor arched rock layers

•**Syncline**—downfoldsor troughs of rock layers

•Depending on their orientation, anticlines and synclines can be described as:

Symmetrical or asymmetrical





Faults:

•Faults are fractures in rocks, along which appreciable displacement has taken place.

•Sudden movements along faults are the cause of most earthquakes.

•Classified by their relative movement, which can be horizontal, vertical, or oblique.

•Types of faults

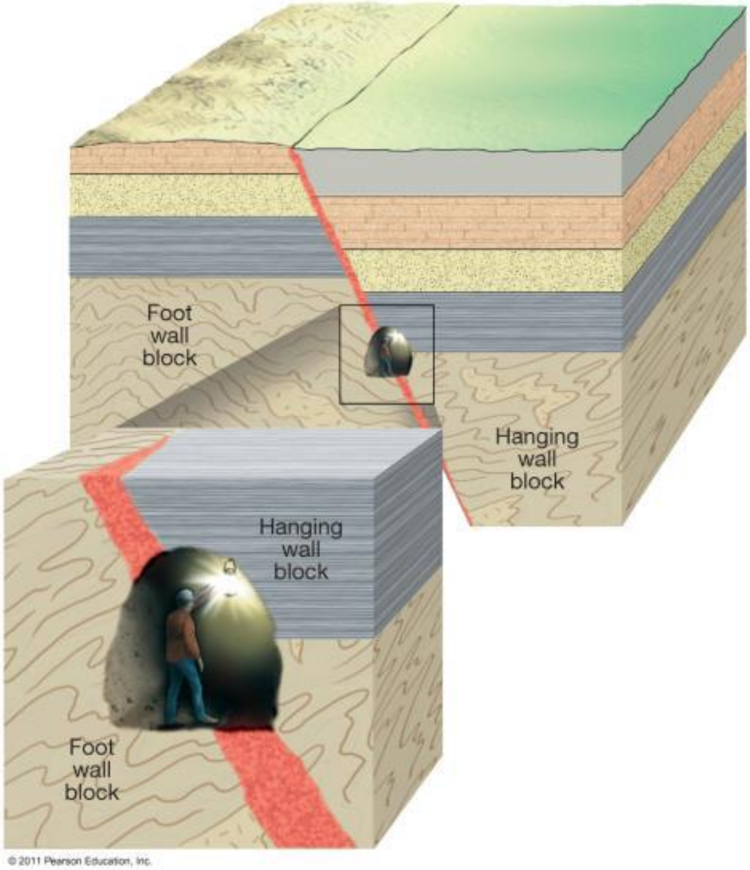
1. Dip-slip faults

–Movement is mainly parallel to the dip of the fault surface

–May produce long, low cliffs called **fault scarps**

–Parts of a dip-slip fault include the **hanging wall** (rock surface above the fault) and the **footwall** (rock surface below the fault).

Hanging wall and foot wall along a fault surface



Types of dip-slip faults

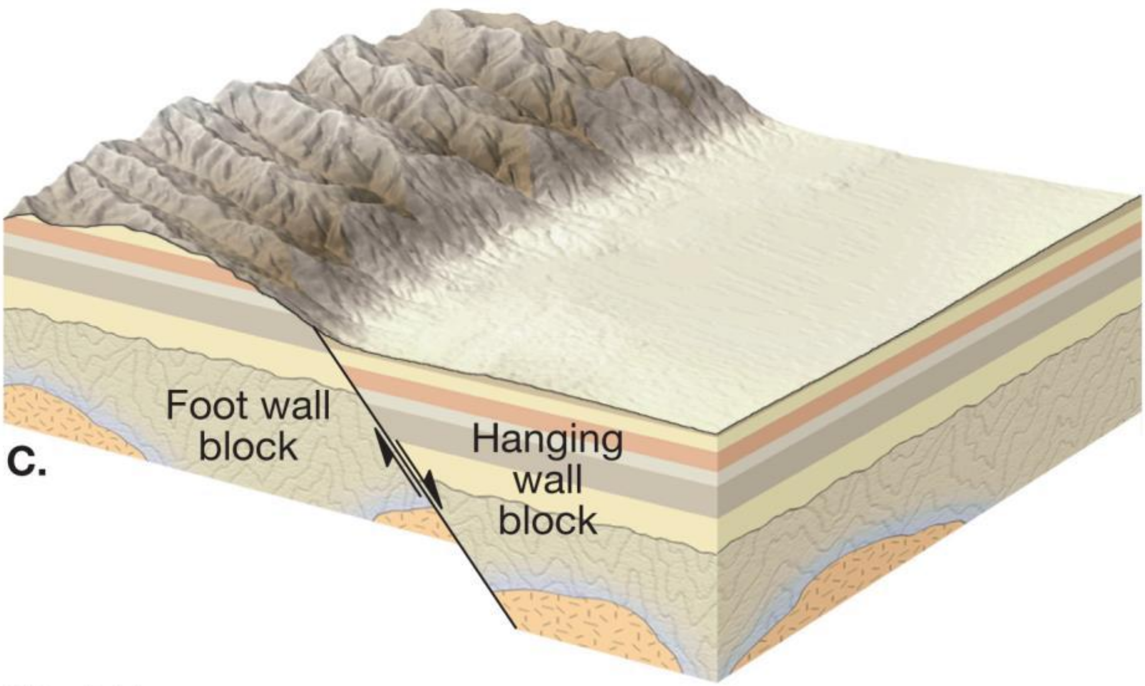
a- Normal faults

»The hanging wall moves down relative to the footwall.

»Accommodate lengthening or extension of the crust

»Most are small with displacements of 1 meter or so.

»Larger scale normal faults are associated with structures called **fault-block mountains**.



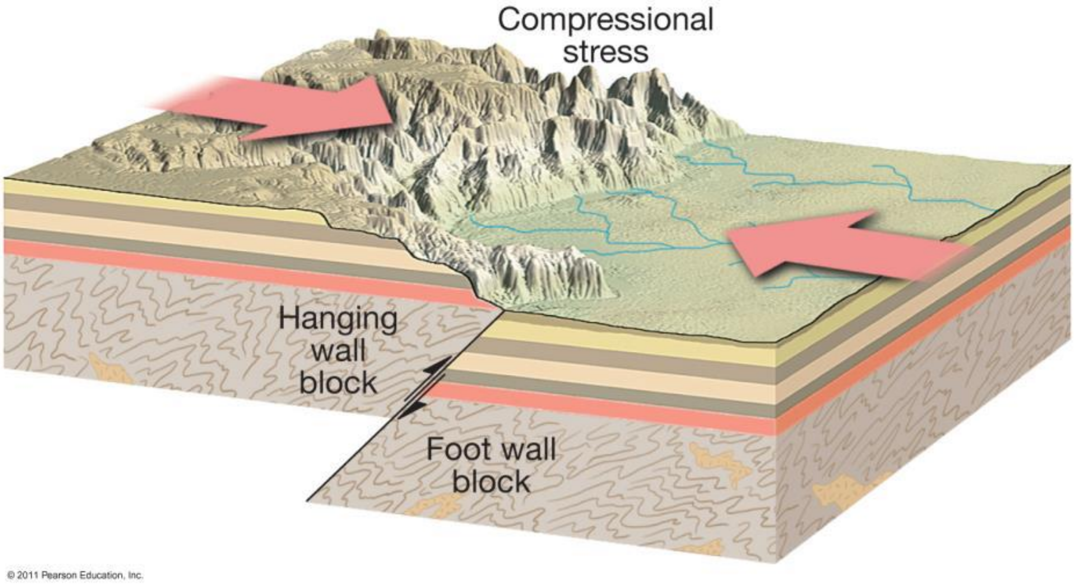
b- Reverse and thrust faults

»The hanging wall block moves up relative to the footwall block.

»Reverse faults have dips greater than 45degrees and thrust faults have dips less than 45degrees.

»Accommodate shortening of the crust

»Strong compressional forces



2. Strike-slip faults

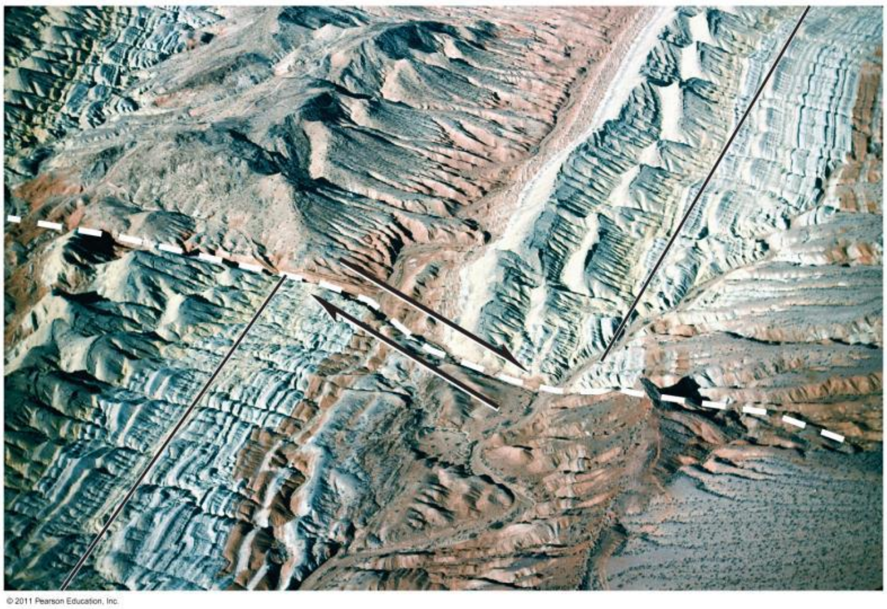
•Dominant displacement is horizontal and parallel to the strike of the fault

Types of strike-slip faults

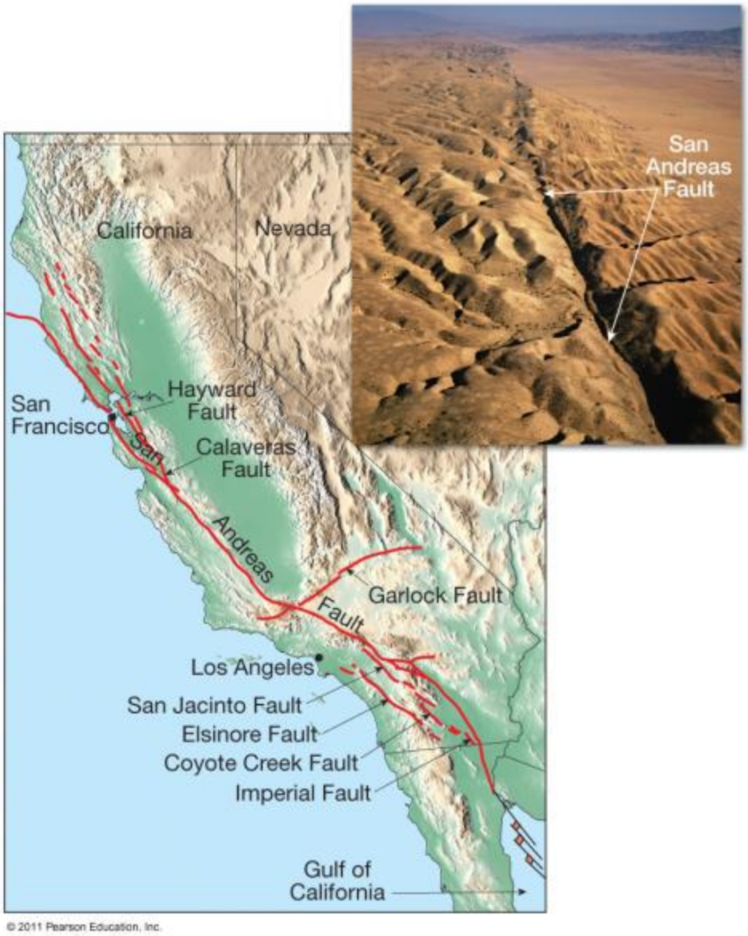
–**Right-lateral**: As you face the fault, the opposite side of the fault moves to the right.

–**Left-lateral**: As you face the fault, the opposite side of the fault moves to the left.

–**Transform faults:** Large strike-slip faults that cut through the lithosphere, Accommodate motion between two large crustal plates



Aerial view of a strike-slip fault in Nevada



The san Andrea’s fault system

Joints

•Among the most common rock structures, technically, a joint is a fracture with no movement. Most occur in roughly parallel groups.

Significance of joints

•Chemical weathering tends to be concentrated along joints.
•Many important mineral deposits are emplaced along joint systems.
•Highly jointed rocks often represent a risk to construction projects.

Nearly parallel joints in arches national park, Utah

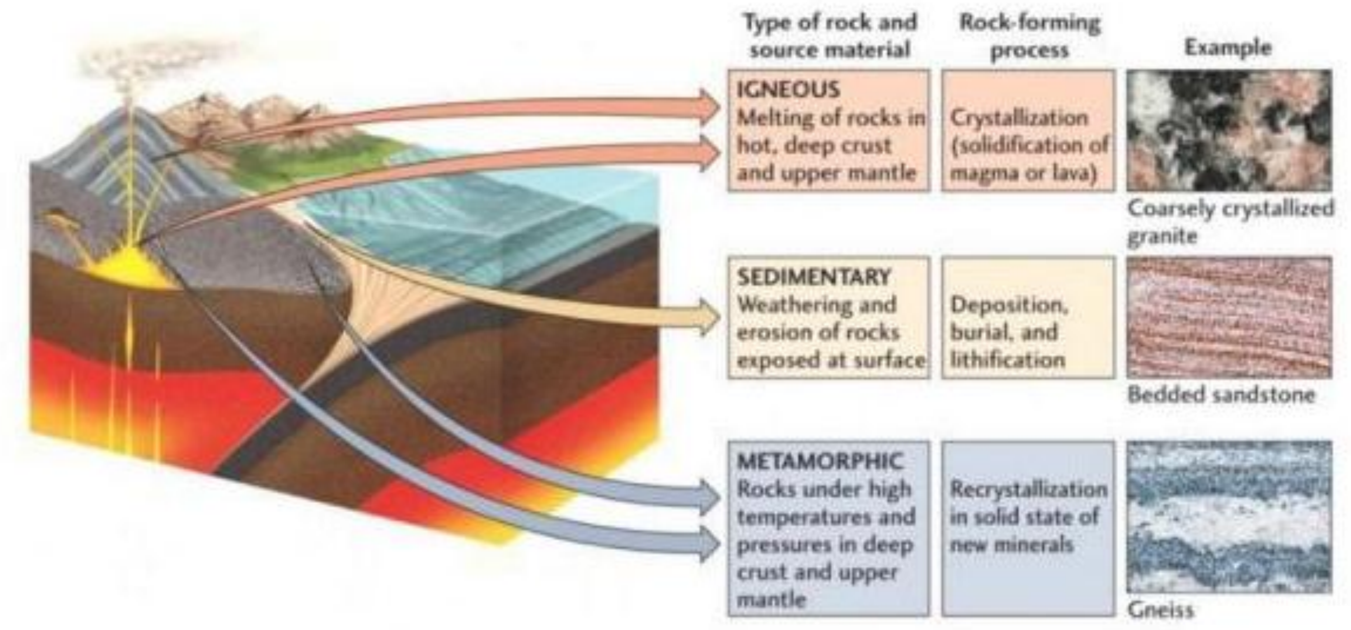
Types of Rocks

To start to understand the rock cycle we must first understand the three primary types of rocks: sedimentary, igneous, and metamorphic. These rocks are differentiated by their physical properties, chemistry, biology (fossils), but mostly by their origin.

Sedimentary rocks are rocks formed from the compression of sediments, dirt, or sand we see on the surface of Earth today. As you bury sediment deeper and deeper into the crust, temperatures and pressures increase to the point that the individual grains are cemented together or lithification. Sediments can be either a biogenic or biogenic ally sourced. Sedimentary rocks often contain fossils from marine organisms or are entirely made up of fossils in the case of many carbonates around the world.

Igneous rocks are formed from cooling magma deep in Earth's crust or mantle. This cooling magma crystalizes to form rocks like the granite in your house. A rock that cools within Earth's crust will cool very slowly and form larger crystals and is called an intrusive igneous rock. Magma that is ejected to the surface of Earth a volcanic eruption or at a spreading center cools very quickly, contains small crystals typically and is called an extrusive igneous rock.

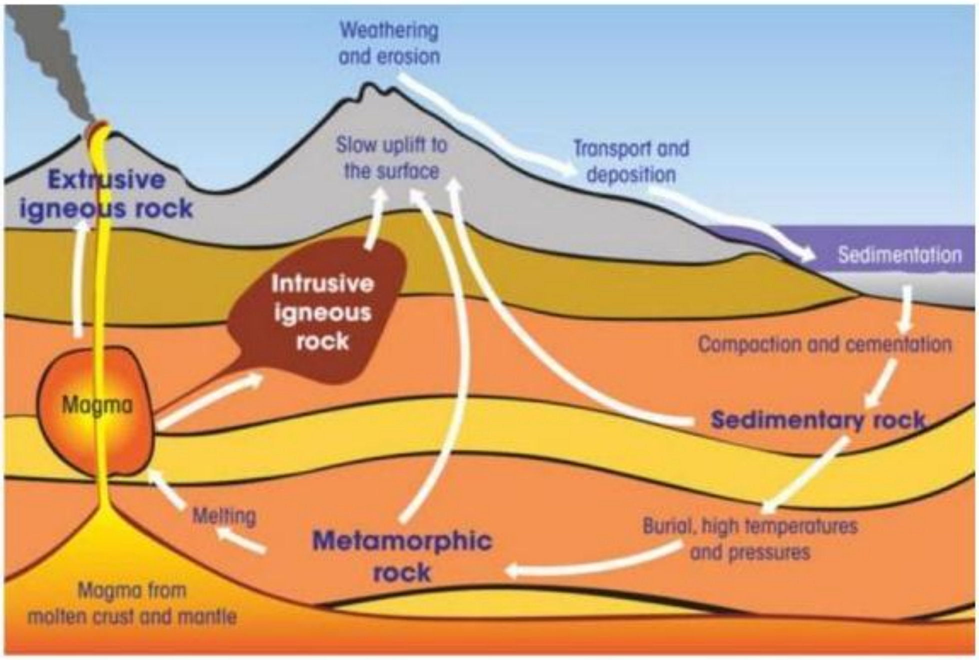
Metamorphic rocks are a formed from the partial melting of previously existing material, either sedimentary, igneous, or older metamorphic rocks. Metamorphic rocks are dependent on the degree of melting, where complete melting "resets" the rock to magma and will then form igneous rocks when cooled.

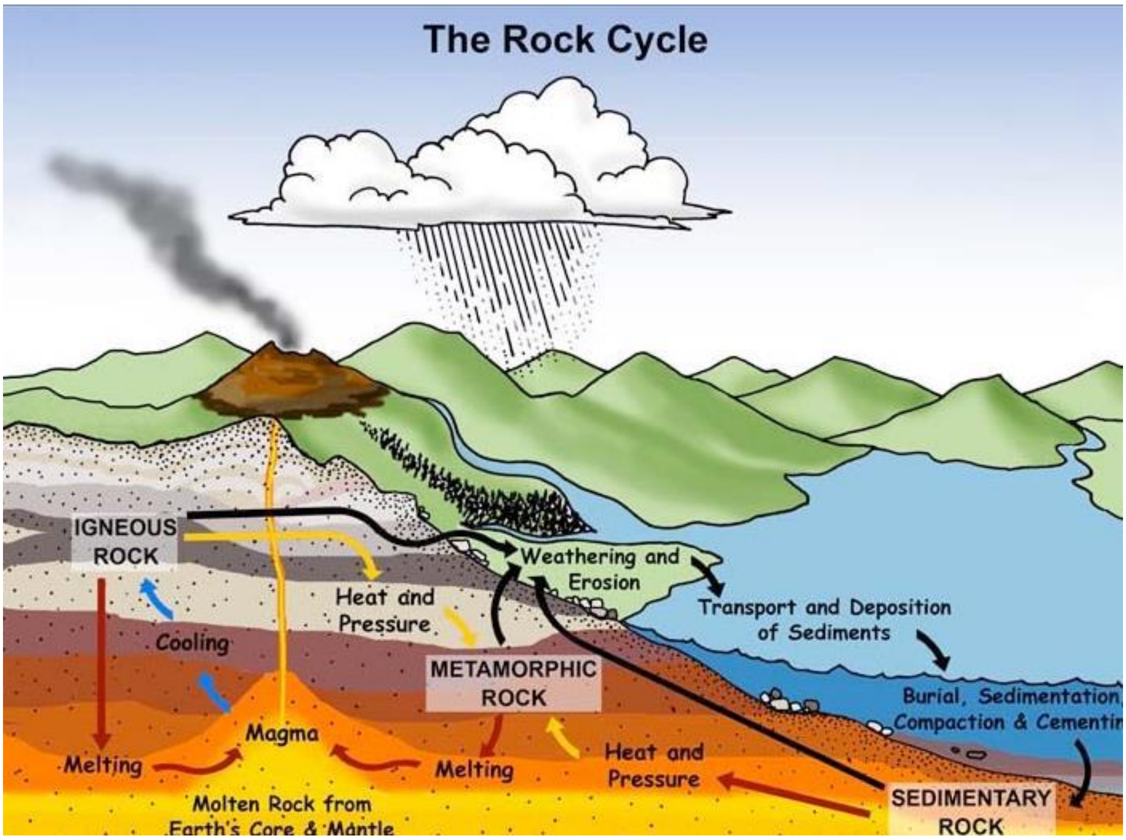


The three types of rocks above can each form one another by melting or erosion and subsequent lithification. This process helps to bring nutrients from deep in Earth's mantle to the surface. This continual recycling of nutrients and elements helps to sustain life on Earth and maintain its biogeochemical processes.

The rock cycle by definition is a natural process by which sedimentary, igneous, and metamorphic rocks are created, changed from one type to another, and destroyed. But how do we go from the dirt you feel under your feet or the sand on a beach to a metamorphic rock? Where does sand on a beach come from and why are all the sand grains uniform in size, color, and shape? These are all questions that the rock cycle answers.

As mentioned above the rock cycle acts to recycle rocks and the minerals that make up rocks. The best way to explain the cycle is with the rock cycle diagram below and with examples of how each rock type can transform into another rock type.





Igneous or metamorphic rocks to sedimentary rocks - As igneous rocks weather and erode from mountains they are transported by water and wind down slope to sedimentary basins such as lakes or oceans. This process results in an accumulation of sediment that continually buries deeper sediment. This sediment continually piles on top of one another. Eventually the sediment originally from eroded igneous rocks gets buried deep enough that the sediments begin to lithify. High temperatures and pressures compact the sediment enough to expel water and cement the grains into a sedimentary rock. The same process applies for metamorphic rocks, which weather and erode to form sediments that are then lithified.

Igneous or sedimentary rocks to metamorphic rocks - Igneous rocks can form metamorphic rocks by either local contact metamorphism or regional metamorphism. Imagine a granite that finds itself all of a sudden in contact with magma from a nearby volcanic eruption. This contact with extremely hot magma will alter the granite chemically and physically to form gneiss, the metamorphic form of granite.

Metamorphic or sedimentary rocks to igneous rocks - The process of forming igneous rocks from metamorphic or sedimentary rocks requires complete melting. If you do not fully melt the metamorphic or sedimentary rock it will just be a metamorphic rock. The primary way that you can present a rock with high enough temperatures and pressures to melt completely is to bury it to mantle or near mantle depths. This often happens from subduction of an oceanic plate underneath a continental plate. This process formed the Rocky Mountains, Andes, and Aleutian and Japan Island chains. With complete melting you "reset" the clock and the newly formed igneous rock is a brand new mixture of elements and minerals.