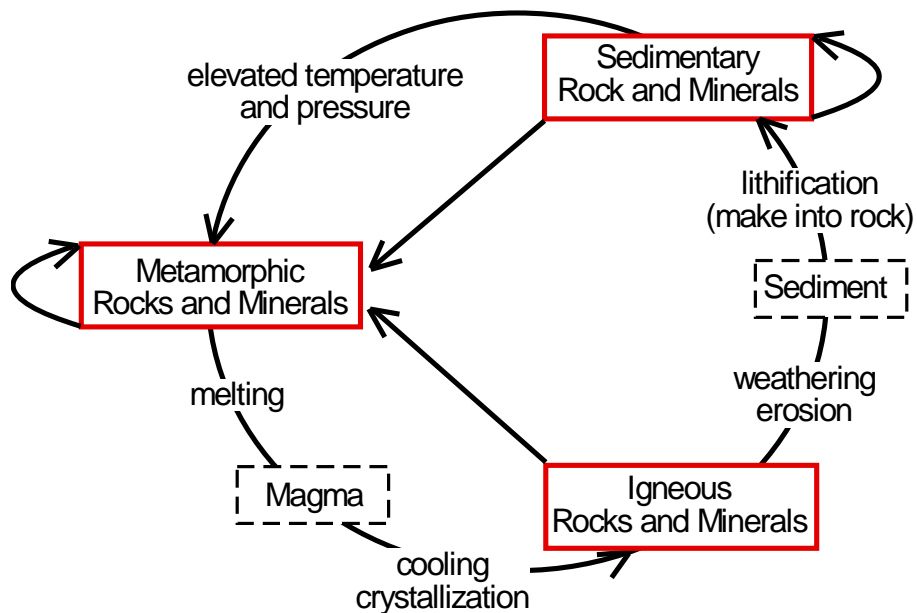


THE ROCK CYCLE SIMPLIFIED



Igneous Rocks

Most igneous rocks crystallize from molten silicate (oxygen and silicon) magmas and thus, the minerals in them are most often silicate or oxide minerals such as olivine, pyroxene, feldspar, mica, amphibole, quartz, and iron-titanium oxides. There are two subtypes of igneous rocks, those that crystallize below the surface of the Earth (called intrusive) and those that are erupted and crystallize on or above the surface (called volcanic). Those that crystallize below the surface cool slowly resulting in larger grains of minerals whereas those that crystallize on or above the surface cool quickly resulting in fine grain size or if quenched resulting in glass. There are different names for igneous rocks based on whether it is intrusive or volcanic and its chemical composition which determines the type of minerals in the rock.

Sedimentary Rocks

Most sedimentary rocks form from the products of weathering (by water, wind, and ice) of other rocks at the surface of the Earth which are either solid minerals or solid minerals that are dissolved into ions in water. There are two subtypes of sedimentary rocks, those are dominantly composed of the solid weathering products (called clastic) and those that form from the dissolved ions precipitating from water (precipitates). Those clastic sedimentary rocks are made up of the clasts of minerals in the rock being weathered that are not dissolved and new minerals formed from the breakdown of original minerals during weathering. The precipitates are made up of minerals precipitated from water (ocean or fresh). Loose sedimentary mineral grains become rock during burial through processes termed lithification.

Metamorphic Rocks

Metamorphic rocks form when a pre-existing rock is changed in response to application of significant temperature and pressure (above those found at the surface of the Earth) in the presence of water based fluids over long periods of time. The minerals in a metamorphic rock depends on the original minerals in the pre-existing rock and the new minerals that grow during metamorphism. The new minerals that grow during metamorphism depend on the chemical components available in the rock being metamorphosed and the temperature and pressure conditions and metamorphic rocks are divided by the new metamorphic minerals and the texture of the rock. Metamorphic temperatures and pressures range from those conditions found near the surface to hot enough and deep enough that the pre-existing rock melts to become magma.

Cycling of Rocks

The rock cycle describes the progression of rocks that we see on the surface of the Earth. The entire outer skin of the Earth was once all molten and as the Earth cooled igneous rocks began to form from crystallization of magmas. The process of plate tectonics cycled early formed rocks back into the Earth where they underwent metamorphism and some of them melted to form magmas. As the atmosphere developed weathering began and sedimentary rocks became part of the cycle.

Today the outer ring of the rock cycle is best described as igneous rocks forming from crystallization of magmas and at the surface of the Earth these igneous rocks are weathered to form the clastic and precipitates of sedimentary rocks. These sedimentary rocks are progressively buried and undergo metamorphism and at high enough temperature and pressure melt to form magmas and the cycle starts over again. The cycle can be short cut too. Igneous rocks can undergo metamorphism skipping the weathering step and metamorphic rocks rather than melting can be brought back up to the surface to be weathered into sedimentary rocks.

Rocks of Intermediate Type

Rocks are not always easily placed into the categories, igneous, sedimentary, and metamorphic. For example, there is no exact cutoff for when the temperature and pressure is significant enough that a rock is said to be metamorphic. When a sand is buried it becomes compressed and heated above surface air temperature and during this process it becomes lithified into sandstone. If it is heated too high then it becomes a metamorphic rock.