

# Rocks, Part I

## The three fundamental kinds of rock:

**Igneous rocks:** rocks that form via the cooling and crystallization of molten mineral material (magma).

These include

Volcanic rocks, which form when magma rises to the Earth surface and thus cools quickly to make rocks with microscopic crystals.

Plutonic rocks, which form when magma only rises to a position within Earth's crust and thus cools slowly to make rocks with crystals of a size visible to the naked eye.

**Sedimentary rocks:** rocks that form via compaction and cementation of sediments that are deposited onto the solid Earth surface from water, wind, and ice.

These form from

Siliciclastic sediments, which form via the mechanical breakdown of pre-existing rocks, largely silicate-bearing igneous and metamorphic rocks, to yield particles ranging in size from clay to silt to sand to gravel.

Biochemical sediments that consist largely of the tests, shells, and skeletons of organisms, which generate those mineralized parts from solutes in seawater or lake water.

Chemical sediments that form via direct precipitation from seawater or lakewater that is supersaturated with respect to the minerals precipitated.

**Metamorphic rocks:** rocks so transformed by recrystallization caused by increased temperature and pressure that their original nature as an igneous or sedimentary rock can no longer be discerned

These include rocks altered by

Regional metamorphism, which is metamorphism of vast volumes of rock at depth within large proportions of a continent, so that exhumation exposes "regions" of metamorphic rock

Contact metamorphism, which results from heating by magmas and thus is found at the "contact" between a body of igneous rock and the surrounding rock into which it intruded or onto which it was extruded.

Geologists recognize three fundamental kinds of rocks, as outlined at left. We do not find these kinds of rocks in equal abundance. If we examine the surface of the continental crust, three quarters of its area are covered by sedimentary rocks, and igneous and metamorphic rocks seem comparatively scarce. On the other hand, if we consider the entire continental crust by volume, the overwhelming majority is igneous and metamorphic rock, and only a small proportion is sedimentary.

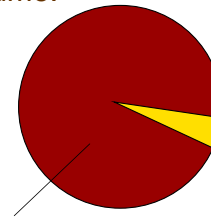
All of that should make sense if one remembers that any sedimentary rock buried to more than about ten kilometers (six miles) will undergo metamorphism and so become a metamorphic rock. Sedimentary rocks thus cannot exist in most of a crust that

is tens of kilometers thick, and so sedimentary rocks must necessarily be only a veneer, if a widespread veneer.

What one makes of all this depends on one's perspective. For those interested in the entire volume of the earth, the predominance of igneous and metamorphic rock in the continental crust (and their total dominance of the mantle) make them most significant, and sedimentary rocks conversely of little interest. On the other hand, for those interested in the rocks on which most of us live, from which we most commonly extract groundwater, and from which we extract fossil fuels, sedimentary rocks are the most significant rocks to study and understand.

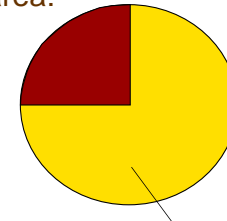
## Proportions of rock types in the continental crust:

By volume:



Igneous & Metamorphic

By area:



Sedimentary

## Locations of rock types in the continental crust:

In cross-section:

