Rocks are naturally-occurring aggregates of minerals and mineraloids. There are three main classifications of rocks based on how they were formed.

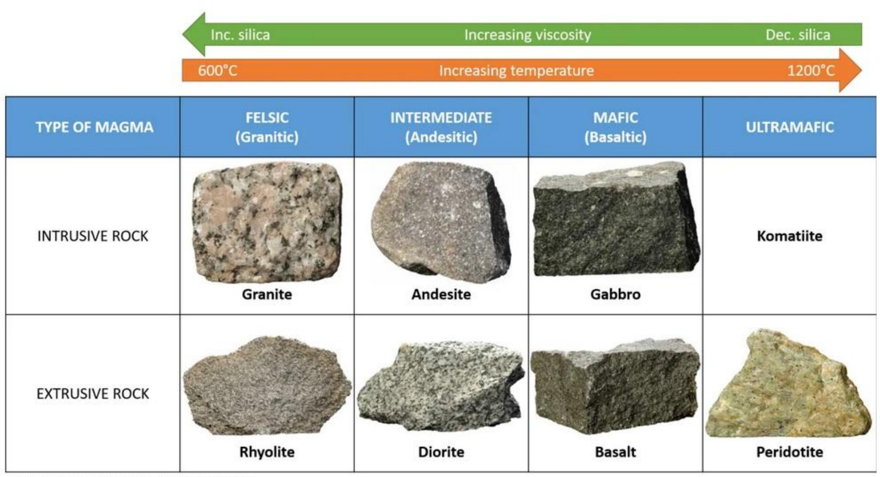
1. Igneous rocks.

Igneous rocks (from Latin word *ignis* meaning "fire") are formed when molten material cools and solidifies.

When igneous rocks formed below the surface of the Earth, they are called **intrusive igneous rocks** or **plutonic rocks**. When they form on the surface, they are called **extrusive igneous rocks** or **volcanic rocks**.

Intrusive and extrusive rocks can generally be distinguished using the size of their mineral grains. Intrusive rocks have bigger or coarser grain crystals, while extrusive rocks have smaller or finer crystals. This is because higher temperatures beneath the Earth's surface slow down the cooling rate of minerals, giving more time for larger crystals to form.

The composition of igneous rocks largely depends on what type of magma or lava they form from. The composition of magma is dependent on the **amount of silica (SiO_2)**, which affects its viscosity, and the **temperature**.



Images from: The University of Auckland

Komatiite is a very rare type of extrusive igneous rock which forms when extremely hot lava cools rapidly and was common during the Archean eon. However, current surface conditions do not allow komatiite to form anymore.

Other more common types of extrusive rocks are **obsidian** (formed when lava rapidly cools; also known as **volcanic glass**), **bombs** (rounded solidified lava fragments), **blocks** (angular solidified lava fragments), and volcanic ash.

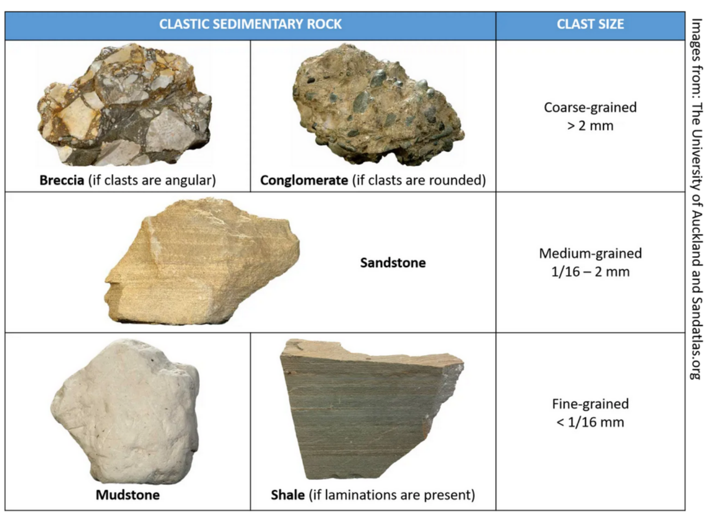
2. Sedimentary rocks.

Sedimentary rocks are formed from loose material called **sediments** that have been eroded in a process called **weathering** and then buried and compacted in a process called **diagenesis**.

The sediments that make up sedimentary rocks can come from pre-existing rocks and materials or from the remains of living things. Because of this, there are two main classifications of sedimentary rocks:

a. Clastic sedimentary rocks.

Sediments come from pre-existing rocks. Clastic sedimentary rocks are classified based on the characteristics of their clasts such as **size**, angularity/roundedness, and sorting.

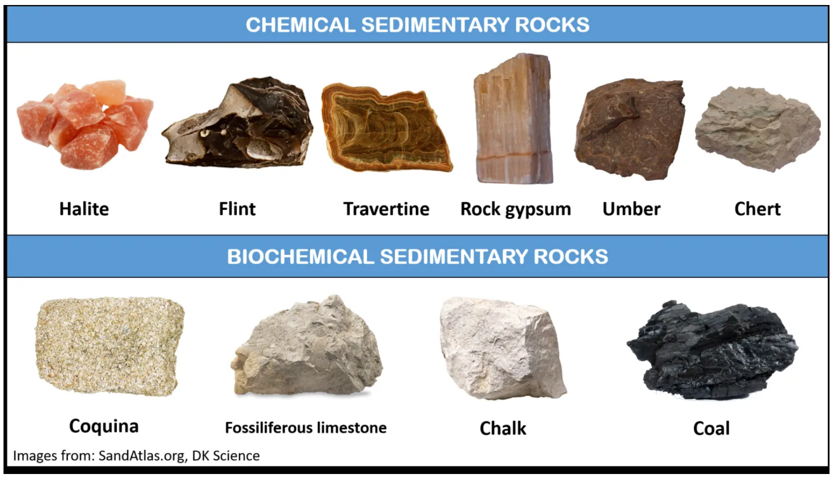


CLASTIC SEDIMENTARY ROCK		CLAST SIZE
Breccia (if clasts are angular)	**Conglomerate** (if clasts are rounded)	Coarse-grained > 2 mm
Sandstone		Medium-grained 1/16 – 2 mm
Mudstone	**Shale** (if laminations are present)	Fine-grained < 1/16 mm

Images from: The University of Auckland and Sandatlas.org

b. Non-clastic sedimentary rocks.

Chemical sedimentary rocks are formed when water evaporates, leaving behind dissolved minerals. Common examples include **halite** or **rock salt**, **rock gypsum**, **flint**, **chert**, **travertine**, **umber**, and some **limestone rocks**.

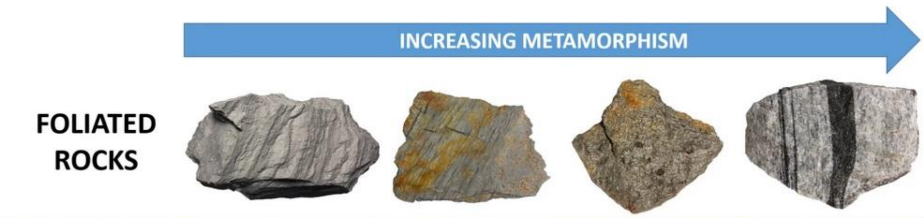


Another type called **biochemical** or **organic sedimentary rocks** are composed of the remains of living things (shells, bones, plant fragments, etc.). Common examples include some **fossiliferous limestone** (contains fossils), **chalk** (composed of very tiny marine organisms called coccolithophores and foraminifera), **coquina** (composed of >2 mm shell fragments and grains), and **coal** (altered rock from remains of plant life).

3. Metamorphic rocks.

When a rock is subjected to certain chemical (addition or removal of chemicals) or physical (change in temperature or pressure) processes that alter its chemical composition, mineralogy, and/or texture, a metamorphic rock is formed.

The original rock or "parent rock" that was altered is called a **protolith**. Metamorphic rocks are divided into two types based on their texture.



ROCK NAME	Slate	Phyllite	Schist	Gneiss
PROTOLITH	Shale, mudstone, or siltstone	Shale, mudstone, or siltstone	Shale, mudstone, or siltstone	Shale, granite, or volcanic rocks

Images from: SandAtlas.org

The first type is characterized by the appearance of planar arrangement of mineral grains called **foliation** or **foliated rocks**.

Foliation in rock is the result of deformation and the more foliated a rock, the higher the grade of metamorphism.

ROCK NAME	Marble	Hornfels	Quartzite	Metapelite
PROTOLITH	Limestone, dolostone	Variety of sed, ign, and other met rocks	Quartz sandstone	Mudstone, claystone, and other clay-rich rocks

Nonfoliated rocks usually develop in environments where deformation is minimal and other factors such as chemically-active fluids play a larger part in altering the rock. Some common examples of non foliated rocks are **marble**, **hornfels**, **quartzite**, **metapelite,** and others.

Rocks continually go through changes that alter its characteristics, ultimately changing it into a different rock.

Here's a good illustration of the **rock cycle** which shows what kind of processes can happen to a rock over spans of geological time: