

Topic 4 Notes: Rocks and the Rock Cycle (workbook p. 45-59)

Rocks are naturally-occurring, solid mixtures of one or more minerals; certain rocks can also be made from organic matter. Rocks are classified by their origin (how they formed) into three types: **igneous, sedimentary and metamorphic**.

Rocks change over time through various processes that occur in Earth's crust. These processes are summarized in the **Rock Cycle**.

IGNEOUS ROCKS



Igneous rocks form from hot, molten rock lying deep within the Earth's crust called **magma**. Outside the Earth's crust, this material is known as **lava**.

When magma rises to Earth's surface, it cools and solidifies into solid rock (solidification or crystallization). Several different characteristics are used to identify igneous rocks: texture, color, density and composition.

Rock texture

shows how and where an igneous rock cooled and solidified.

Extrusive igneous rocks form above the surface of the Earth (volcanic eruptions, lava flows). Because these rocks cool and solidify quickly, they show **glassy, vesicular or fine-grained texture**. Rocks with vesicular texture have tiny holes or pores made when gases escaped as the rock cooled. Fine-grained texture displays tiny crystals that grew as the rock solidified.

glassy



vesicular



fine-grained



Intrusive igneous rocks form when magma cools and solidifies beneath Earth's surface.

Because these rocks cool and solidify slower than extrusive igneous rocks, mineral crystals have more time to grow, making them larger and more visible. Intrusive igneous rock texture is **coarse-grained**, with **visible inter-grown crystals**.



granite



diorite



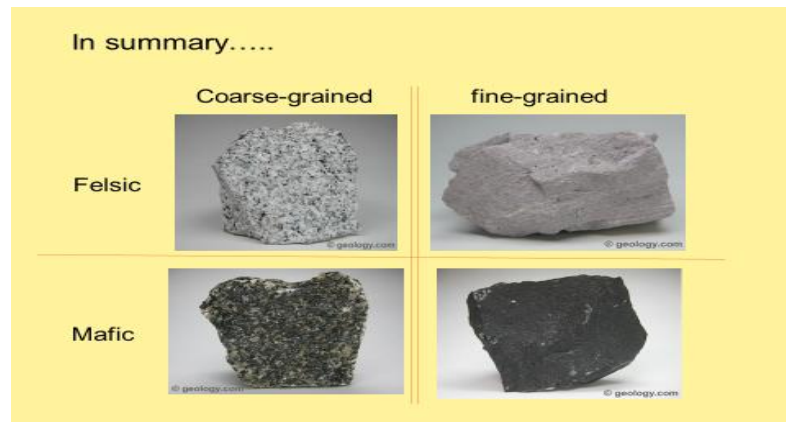
gabbro

An igneous rock's **mineral composition** gives the rock certain properties.

Felsic igneous rocks are rich in silicon and aluminum, making them light-colored and lower in density.

Mafic igneous rocks are rich in iron and magnesium, making them dark-colored and higher in density.

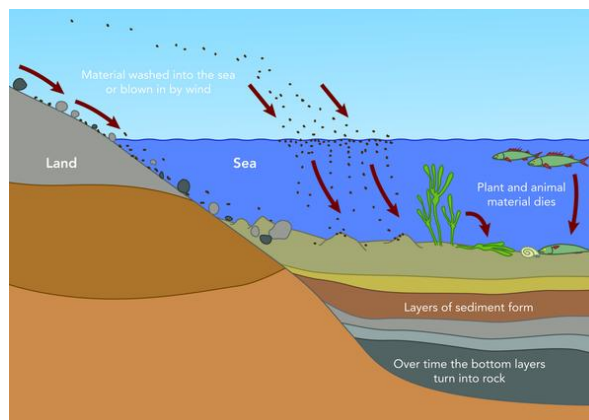
See page 6 of the ESRT for the "Scheme for Igneous Rock Identification" chart.



SEDIMENTARY ROCKS

Sedimentary rock forms at or near Earth's surface when:

- ❖ rock material breaks apart or weathers into fragments called sediment
- ❖ sediment is transported by various agents (wind, water, glaciers, waves) and deposited under water
- ❖ over time, these sediments build up, forming layers. Sediment or "clasts" in these layers become compacted, and then cemented together when dissolved minerals "glue" them together.



Clastic sedimentary rock is identified by the size of the sediment, or "clast," that forms them. Rounded boulders, cobbles or pebbles embedded in sand, silt or clay forms **conglomerate**. When these large clasts are angular, and not rounded, the rock is identified as **breccia**.

conglomerate



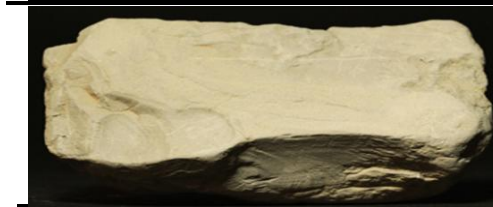
breccia



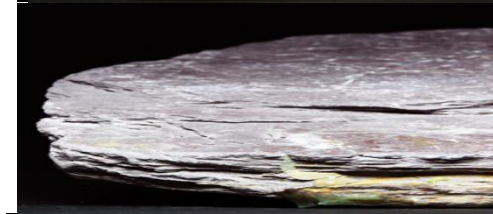
Sand compacted and cemented together forms sandstone---->



Silt forms siltstone-->



and clay forms shale->



Chemically-formed sedimentary rock forms when minerals dissolved in the water are left behind when the water evaporates, or when an increase in concentration causes these minerals to precipitate out of the water. Rock salt and dolostone are formed in this manner.

Rock salt



Dolostone



Bioclastic sedimentary rock is made of material from once-living organisms.

Coal formed from the remains of ancient dead plant life that accumulated over time, became compressed, and turned into rock (lithified).

Limestone is a sedimentary rock chiefly composed of the mineral calcite. It usually forms in clear, warm, shallow marine seas from the accumulation of shell, coral, algae and other material.

Coquina is a sedimentary rock formed from shell and other marine fragments compacted and cemented together.

Coal



limestone



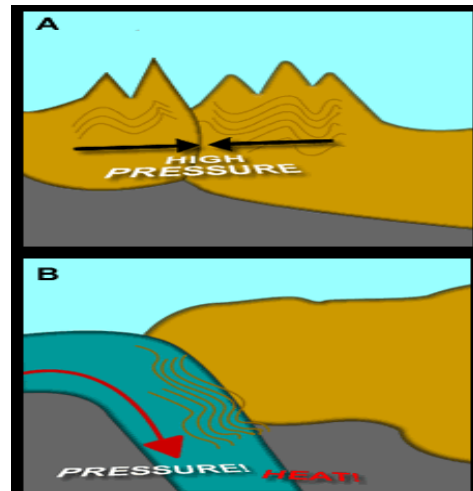
coquina



METAMORPHIC ROCKS

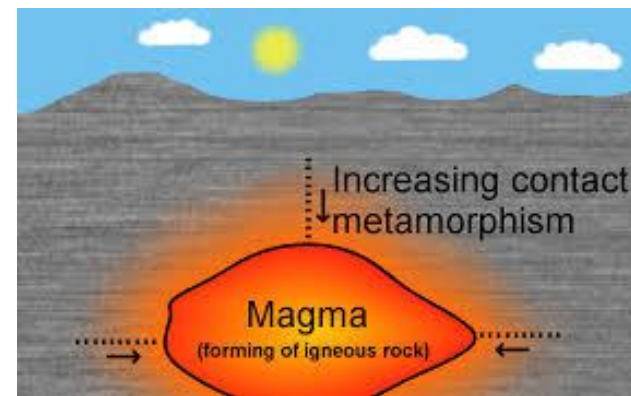
Rocks that change when exposed to intense heat and pressure are **metamorphic rocks**. The word comes from the Greek: meta = change, morph = shape or form.

Heat and pressure applied to existing rock causes the minerals in the rock to soften, move, and recrystallize. Imagine chocolate chip cookie dough before and after baking—the dough undergoes changes

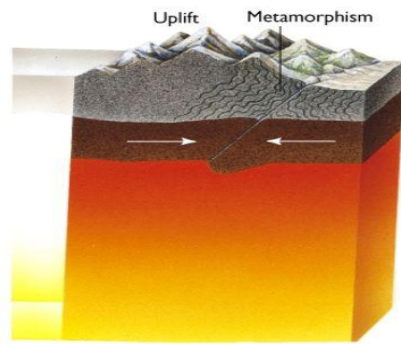


CONTACT OR REGIONAL METAMORPHISM

Contact metamorphism occurs when hot, molten magma comes in contact with existing rock, causing its minerals to soften and recrystallize.



Regional metamorphism occurs when existing rock is subjected to the intense pressure and heat that results from large crustal movement, such as when plates collide to build mountains.



Convergence of plates causes deformation, uplift, and regional metamorphism.

Texture in Metamorphic Rocks

The process of metamorphism occurs deep within the Earth's crust. Metamorphic rocks are more dense than the original rocks from which they formed.

When exposed to intense pressure and heat during regional metamorphism, minerals in the rock soften, migrate and realign to form layers. This texture is known as **foliation**. Metamorphic rock resulting from contact metamorphism shows **non-foliated** texture.

banded foliation



slaty foliation



non-foliated texture



THE ROCK CYCLE

The rock cycle is a diagram that shows how rock types—igneous, sedimentary and metamorphic—are formed and how they are interrelated.

It depicts the Earth processes that can change one rock type to another. Page 6 in the ESRT includes the Rock Cycle diagram.

