Igneous Rocks
Born of Fire

Igneous rocks get their name from the latin word for fire "igneus". The name is appropriate because these rocks are born of fire. Beneath the thin rocky crust of the earth is the inferno of the mantle! The mantle is the origin of this rock type.

The Mantle
Under the crust is the fiery hot mantle. Saying that the mantle is fiery hot does it injustice. The coolest outer part of the mantle is about 1000 degrees Celsius (1800 degrees Fahrenheit). Here the rock is molten liquid, white hot.

All Magma is made up of a fairly uniform mixture of elements. Some of the major elements present are silica, iron, sodium, potassium, aluminum, magnesium, and gasses including water vapor, oxygen, carbon dioxide, nitrogen, hydrogen and sulfur dioxide. These elements form chemical combinations that crystallize in patterns to form **eight basic rock forming minerals**. These eight minerals form most rock. They are **olivine, pyroxene, amphibole, orthoclase, plagioclase, muscovite, biotite, and quartz.**

The Formation of Igneous Rock
Igneous rocks are formed from this molten magma. These rocks form when the magma cools and crystallizes. This can happen above ground as with volcanoes it is then called **extrusive.**

There are many kinds of volcanoes around the world. The materials that come from a volcano are different as well. We tend to lump them all under the term lava but rocks ranging from the very dense basalt to the very light pumice are just a part of what can come from a volcano. There is also ash, volcanic glass or obsidian, and the gem stone peridot to name a few.

The molten magma can also crystalize below the surface. When the molten rock rises in the crust but cools before it reaches the surface it is **plutonic** igneous rock and is categorized as **intrusive**. **Pegmatite** is an example of an intrusive rock.

How Cool
When the magma reaches the surface it cools quickly, a matter of days or weeks. When the magma forms pockets underground it cools much more slowly. This could take thousands or even millions of years.

The rate at which the magma cools determines the kind of rocks that are formed. Faster cooling surface lava creates rock that is fine grained or **aphanitic**. The rapid cooling doesn't allow large crystals to form. I addition most of the gasses are driven off into the atmosphere. The slower cooling that takes place underground allows larger crystal formation. Granite is an example of this type of rock formation. Other igneous rocks are pumice, scoria, gabbro, basalt, ryolite, dacite, andesite and obsidian.

All rocks begin as igneous rocks. Before rocks can be transformed by sedimentation and weathering or metamorphosed by the heat and pressure of plate tectonics they must first be cooled from the intense heat of the mantle. Whether they are formed from plutonic rocks deep within the crust of the earth or extruded onto the surface of the earth by volcanoes all rocks have a fiery beginning as igneous rocks.

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An Example of Igneous Rocks

The following is an **example of igneous rocks**. It is not an all inclusive list but a brief pictorial list of some common igneous rocks.

Andesite is a gray to black volcanic rock. It is generally erupted from stratovolcanoes as thick lava flows. It can also generate strong explosive eruptions to form pyroclastic flows.

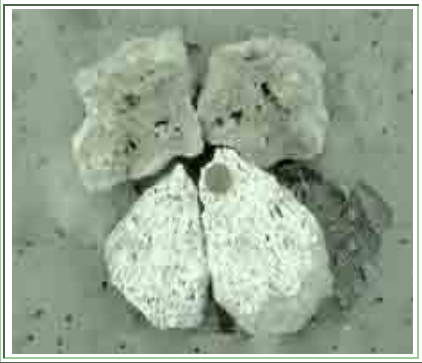
- Andesites erupt at temperatures between 900 and 1100° C.
- Andesite contains crystals composed of plagioclase feldspar, pyroxenes, and hornblende.
- The word andesite comes from the Andes Mountain Range where andesite is common.

Basalt Lava - Basalt is a hard, black volcanic rock. Less than ½ of the weight of basalt is silica (SiO_2). Because of basalt's low silica content, it has a low viscosity (resistance to flow). This enables basaltic lava to flow quickly and allows volcanic gases to escape without explosive events.

- The minerals in basalt include olivine, pyroxene, and plagioclase.
- Basalt is erupted at temperatures between 1100 to 1250° C.
- Basalt is the most common rock type in the Earth's crust most of the ocean floor is made of basalt.
- Basaltic magma is commonly produced by direct melting of the Earth's mantle

Dacite lava is most often light gray, but can be dark gray to black. It is one of the most common rock types associated with enormous Plinian-style eruptions.

- Dacite lava consists of about 63 to 68 percent silica (SiO_2).
- Dacite generally erupts at temperatures between 800 and 1000°C
- Common minerals include plagioclase feldspar, pyroxene, and amphibole
- Dacite has a high crystal content. This combined with a high silica content makes it viscous and prone to explosive eruptions.
- Dacite was erupted from Mount St. Helens 1980-86



Pumice is light and porous. It forms during explosive eruptions. Pumice is full of holes caused by expanding volcanic gases. It is composed of volcanic glass and minerals, and can form in all types of magma: basalt, andesite, dacite, and rhyolite.

	**Obsidian** is usually black in color though it can also be red or have a greenish tint. It is a dense volcanic glass, usually composed of rhyolite, rich in iron and magnesium. Obsidian is formed when the lava cools so quickly that crystals do not have time to grow. Obsidian fractures with very sharp edges. It was used by Stone Age cultures for making knives, arrowheads, and other tools where sharp edges are important.
	**Rhyolite** is a light-colored volcanic rock. It has a high silica content which makes it very viscous. This prevents gases from escaping causing rhyolite eruptions to be explosive. • Rhyolite has a silica (SiO_2) content greater than about 68 percent by weight. • Common mineral types include quartz, feldspar and biotite • Rhyolite is erupted at temperatures of 700 to 850° C. • Rhyolite eruptions often produce pumice or obsidian

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