Introduction to Earth Science
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Igneous Rock Classification and Worksheet

You will recall that complex definition of minerals, and will likely be relieved to note that rocks are a lot simpler. A **Rock** is an aggregate of one or more minerals.

We have three different rock types, metamorphic, sedimentary, and igneous. **Metamorphic** rocks are those formed by altering an existing rock with that application of heat and pressure. **Sedimentary** rocks are those formed by combining bits and pieces of other rocks to make a new one. **Igneous** rocks formed by crystallization from molten mass of melted rocks.

Through some combination of melting, heating, application of pressure, weathering, transport, sedimentation, and crystallization, you can get any of the three rock types from any other. This idea will be covered in your lecture class as the **Rock Cycle**.

No matter what type of rock we are looking at, we must consider texture and composition to identify it.

Texture

Texture is defined as the size and arrangement of mineral grains (or other material) in a rock. Texture is critical to rock identification and it is where you should begin the process. Each of the three rock types has different kinds of texture, and part of the process is learning to identify them. The textures tell us something about how the rocks formed.

Igneous rocks form when a molten mass begins to cool. The minerals begin to crystallize as the temperature drops, literally building a solid one atom at a time. Where the temperature is dropping slowly, crystallization begins at a relatively few spots in the melt, and the minerals have a chance to grow larger over some period of time. The large crystals, those that you can see without a microscope, result in a rock with a **phaneritic** texture. Where would the melt cool slowly enough? How about deep underground? This is essentially the counterpart to a volcano, and in another lab we will learn that these underground bodies are called plutons. So we can call the coarse-grained igneous rocks **plutonic**. These bodies are squeezed into place by plate tectonic forces and the rocks are known as **intrusive** igneous rocks.

In other cases, where the melt is cooling more quickly, the minerals start to crystallize all over the rock and there is not enough time or room for them to grow large enough to be seen with the naked eye. This fine-grained texture is called **aphanitic**. Where would the melt cool so quickly? How about on the ground or even in the air? These fined-grained rocks are associated with volcanoes and so are called **volcanic**. Because the material is squirted out on the ground these rocks are also known as **extrusive** igneous rocks.

Some rocks show a mixed cooling history, slow then fast for example. You can imagine a melt cooling slowly and producing large crystals and then being erupted to cool quickly. Where a rock has two-distinct textures it is called a **porphyry**, or is said to have a porphyritic texture. When this is the case you need to make sure to include porphyry in the rock name, such as "dacite porphyry".

In some cases the melt solidifies so quickly that no minerals actually form, and this is called a **glassy** texture. In one case the texture is very obvious and the rock looks like glass. In another case the rock is made of glass froth (think igneous latte), and you would need a microscope to see that the rock is made of thousands of little glass bubbles. Because there are no actual minerals in these rocks, it is an exception to the definition of rock above. These rocks change subtly over time to become less glassy or devitrify.

Having giant cauldrons of molten rock underneath volcanoes is bound to get violent and stuff is going to get broken! That is why we have the **fragmental** or **pyroclastic** (literally fire-broken) texture. This texture occurs where the rocks are made of bits and pieces of pre-existing rocks. An example is a rock formed from compacted volcanic ash or other pieces. We give these different names based on the size of fragments.

Composition

Composition is a description of what is in the rock. Perhaps the rock is made of muscovite, quartz, and orthoclase (you knew it was too soon to forget all those mineral names), or maybe it is all olivine, both are compositions. We may not know the minerals in a rock but can still determine a composition based primarily on color. Looking at the Igneous Rock table you can see the compositions run along the bottom. On the left are rocks rich in quartz and orthoclase but with few darker-colored minerals like biotite and augite. These are known as **Felsic** (feldspar and silica) rocks and they are rich in silica, have a lower melting point, and are of a lower density.

On the right are rocks that are rich in olivine, biotite, and augite. These are called the ferromagnesian minerals and are generally dark in color (olivine is the exception). Because they have lots of magnesium (Mg) and iron (Fe) we call them **Mafic**. Mafic rocks are poor in silica, have a high melting point, and are higher in density.

Use of the Rock Table

You can see from the Igneous Rock Table that texture is the place to start. To use the table, pick up a sample and try to identify the texture. Once you have that done you can estimate the percentage of dark (mafic) and light (felsic) minerals to identify the rock (the "dark" minerals are augite, biotite, hornblende, and olivine). Yes, I know olivine is not very dark, but it is mafic because it has a lot of iron and magnesium.

If the rock is in part volcanic, it gets the volcanic name. Don't forget to add "porphyry" to the name if appropriate.

Use the Descriptions part of the lab to help with identification and learn about texture, color, minerals and occurrence.

IGNEOUS ROCK IDENTIFICATION WORKSHEET

Sample	Texture	Family	Origin/Cooling	Occurrence	Rock Name
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