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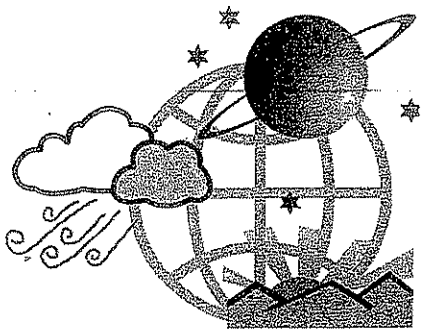

Chapter 5
The Formation of Rocks

CHAPTER 5—LAB 1: IGNEOUS ROCK IDENTIFICATION

Introduction

All igneous rocks were formed by the solidification of molten magma or lava. Volcanic rocks are composed of very small crystals because the molten rock cooled quickly at or near Earth's surface. The rapid cooling does not give the crystals enough time to grow large. Volcanic rock is sometimes called extrusive rock because the molten rock (magma) is extruded, or pushed out, at Earth's surface, where it is known as lava. For this reason, all volcanic rocks have a fine-grained texture. Texture includes such characteristics as the grain size and shape, and any pattern such as layering. Layering is rare in igneous rocks.

Plutonic rocks contain large crystals because they have cooled and solidified slowly, deep underground. (The name comes from Pluto, the Greek god of the underworld.) The slower the magma cools, the larger the crystals can grow and the coarser the texture. Plutonic rocks are also known as intrusive igneous rocks because they form by slow cooling within Earth. The formation of extrusive and intrusive rocks is illustrated in Figure 5-1.

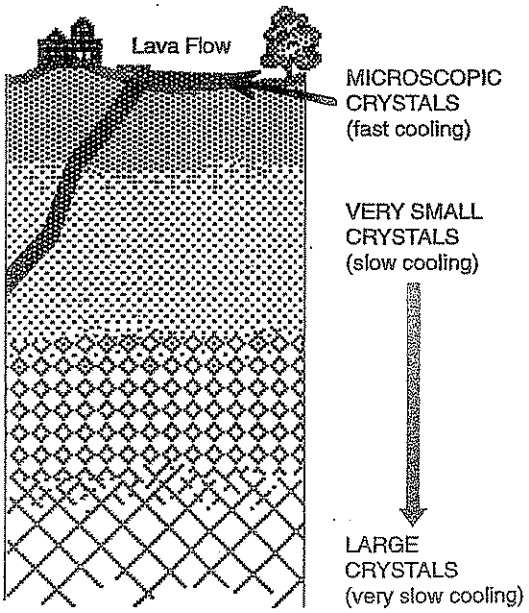

FIGURE 5-1. In general, slow cooling at depth produces larger crystals.

Igneous rocks are classified on the basis of their crystal size and their mineral composition. **Felsic** rocks are light in color and relatively low in density. They are rich in quartz and feldspar, a light-color family of aluminum silicate minerals. **Mafic** rocks contain more iron and magnesium. Therefore, mafic rocks are usually more dense and darker in color than felsic rocks.

Objective

To identify igneous rocks based on their properties.

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Materials

Set of rocks, Scheme for Igneous Rock Identification

Procedure

Take the rocks from your set and lay them on your desk in numerical order. As you read through this activity, compare your rock samples to the descriptions provided so that you will be able to identify your samples. To perform this lab you will need the Scheme for Igneous Rock Identification from the *Earth Science Reference Tables.* In the top part of the chart, igneous rocks are organized by two properties: grain (crystal) size and mineral composition. The coarse-grained rocks are at the bottom, just as they generally form within Earth. The felsic (light-colored) rocks are on the left. Toward the right they become more mafic (dark-colored). This chart contains a wide range of useful information. Locate on this chart each rock named in the descriptions below.

Rocks in the Scheme for Igneous Rock Identification

Obsidian is volcanic glass. The luster is glassy; it often breaks along curved surfaces (conchoidal fracture). Obsidian cools so rapidly that visible crystals cannot form. Due to the dispersal of the dark-colored minerals, both mafic and felsic varieties of obsidian are usually dark in color.

Pumice is so low in density that some samples float on water. As magma rises to the surface, gases trapped in the molten rock expand to form tiny pockets. These openings are called vesicles. The gases released from the magma as it comes to the surface are mostly water vapor and carbon dioxide. Although it does not look like obsidian, pumice is actually a frothy form of volcanic glass.

Rhyolite is light-colored and has a mineral composition similar to granite. However, rhyolite is fine-grained due to rapid cooling and solidification. Magnification is required to see the individual mineral crystals.

Granite is a light-colored, coarse-grained plutonic rock. The large grains (crystals) make the individual minerals readily visible without magnification. Granite is usually pink or gray in overall color because of the large quantity of felsic minerals it contains. See Figure 5-2.

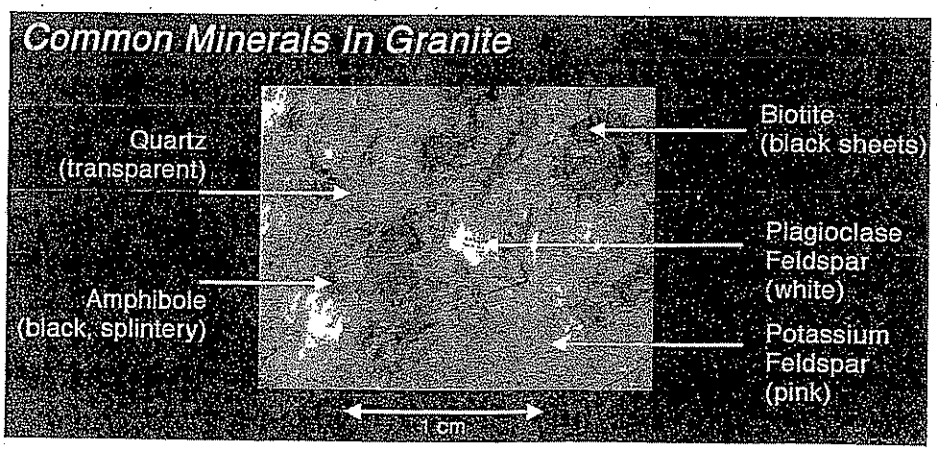

FIGURE 5-2. The primary minerals in granite.

Pegmatite is a very coarse-grained igneous rock. It is usually light in over all color, like granite. But the crystals are larger than 1 cm across. Pegmatite actually cools relatively quickly, not far below the surface. But the crystals grow very large because of the concentration of water in the magma.

Scoria is a rock full of larger vesicles (gas pockets), formed as gases expand within the cooling lava. In scoria the gas holes (vesicles) are big enough to be clearly visible. Scoria, like pumice, is a vesicular igneous rock.

Basalt is a fine-grained, dark-colored volcanic rock. Because it forms near the surface, basalt is composed of very fine crystals. It is rich in iron and magnesium minerals, so it is dark in color and relatively dense.

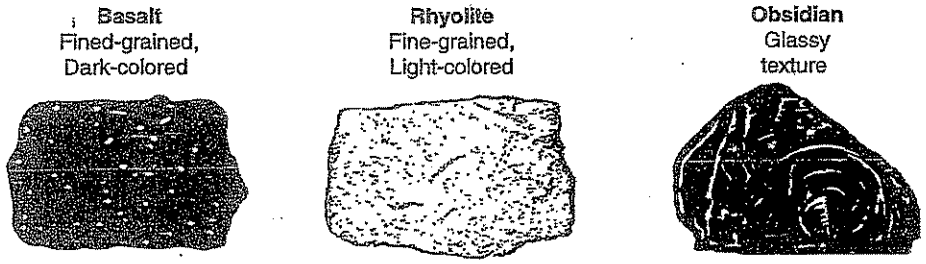

FIGURE 5-3. Textures of igneous rocks.

Gabbro is a dark (mafic) plutonic rock. It is coarse-grained, like granite, but, because it is rich in iron and magnesium minerals, it is dark in color. Gabbro is the coarse-grained equivalent of basalt.

Use the Scheme for Igneous Rock Identification in the *Earth Science Reference Tables* to answer the following questions about igneous rocks.

1. What name is applied to a coarse-grained, felsic igneous rock? _____

2. What rock has the same composition as granite, but smaller crystals? _____

3. Name a coarse-grained, dark-colored igneous rock. _____

4. What feature of pumice and scoria makes them vesicular?

   _____

5. What two rock types are neither felsic nor mafic? (These two rocks have an intermediate composition and color.)

   _____

6. How do the two kinds of rock in question 5 differ from one another?

   _____

7. With respect to Earth's surface, where do extrusive rocks cool and crystallize? (That is, where do they solidify?)

   _____

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8. What is the texture of the very finest grained igneous rocks called?

_____

9. What do gabbro and basalt have in common?

_____

10. How can you tell that gabbro crystallized deeper underground than basalt did?

_____

The lower portion of the Scheme for Igneous Rock Identification helps you to identify the most common minerals found in these igneous rocks. Each mineral is represented by a different pattern. The minerals below the name of each rock indicate the minerals usually present and the percent of the rock that is made up of each mineral.

For example, gabbro, basalt, and scoria are similar in composition. They all contain plagioclase feldspar. However, the percent of plagioclase varies from 0 percent in very mafic samples, to about 55 percent in less mafic rocks. Figure 5-4 shows the first step in

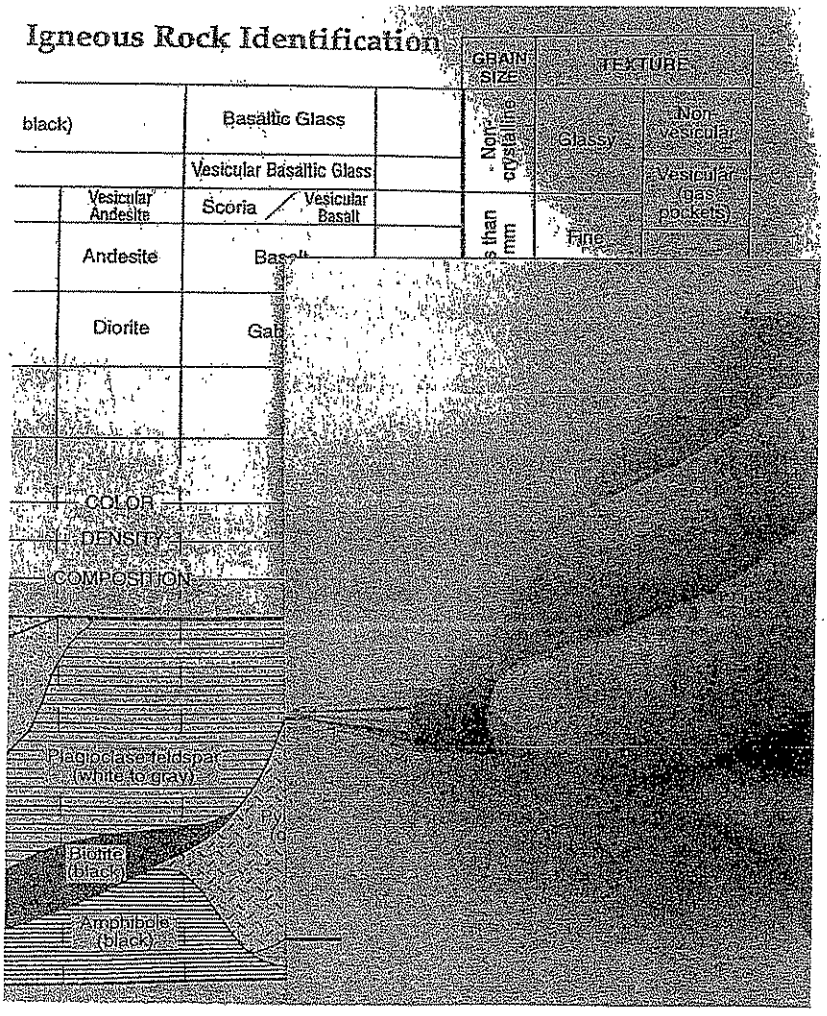

FIGURE 5-4. Marking the percentage of pyroxene in gabbro or basalt.

determining the typical pyroxene content of basalt and gabbro. Line up the edge of a piece of paper with the rock names and mark the top and bottom of the pyroxene section. Move the marked paper to the scale of percentages on the left side of the chart and read the number.

11. What minerals are usually found in granite?

_____

12. What is the percentage of plagioclase in a typical granite?

_____

13. List the four minerals usually found in basalt and the percentage of each mineral.

_____

_____

14. What two minerals tend to be found in the greatest range of igneous rocks?

_____ and _____

15. What igneous rock is generally composed of just one mineral?

_____

16. Unlike some other rocks, igneous rocks such as granite and gabbro are never composed of rounded particles. What are igneous rocks composed of?

_____

17. Do igneous rocks usually have a layered texture? _____

18. What coarse-grained rock is similar in composition to basalt? _____

19. What is the difference between granite and rhyolite?

_____

20. Unlike other kinds of rocks, igneous rocks form from what substance?

_____