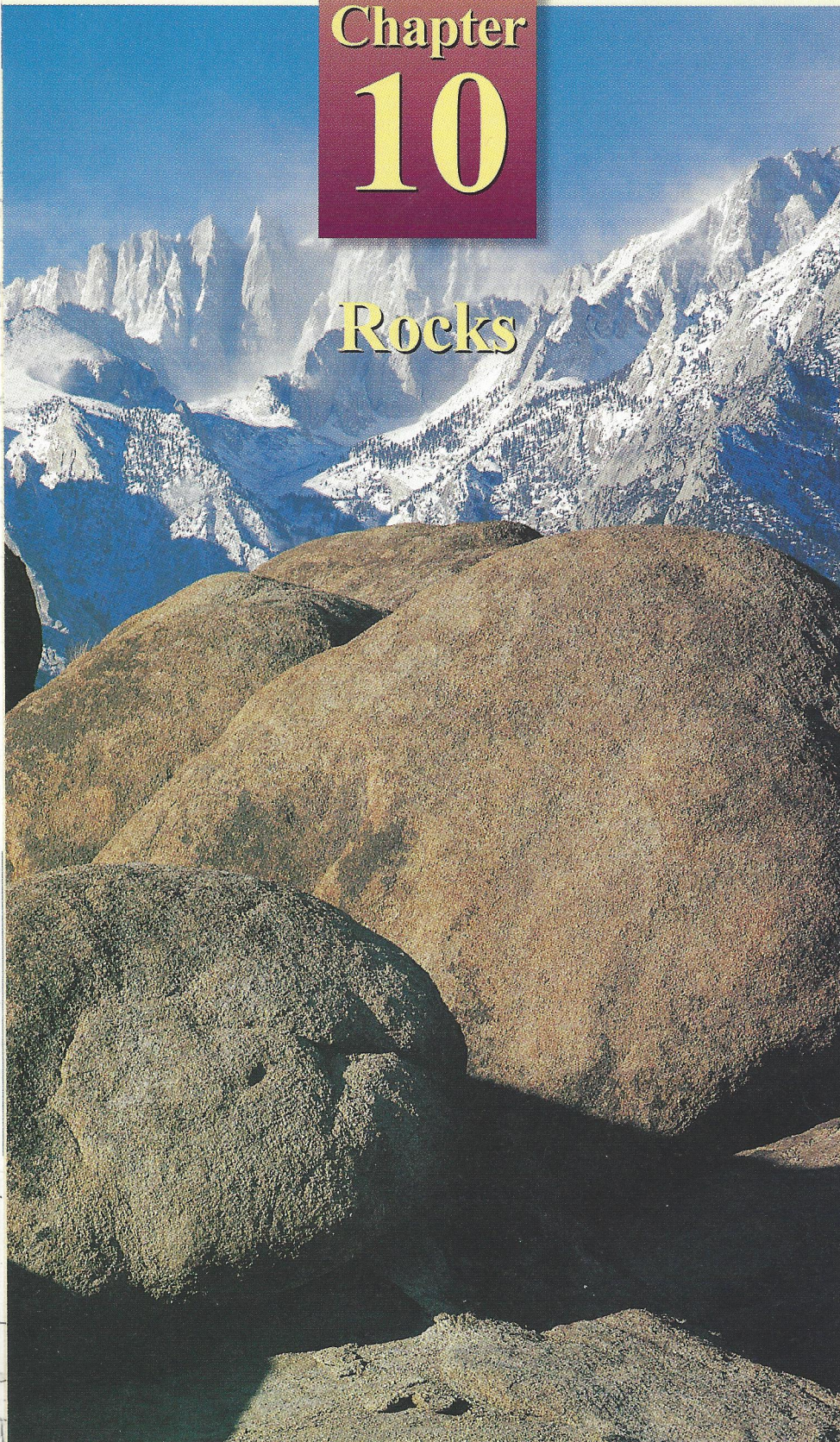


# Chapter 10

## Rocks



*Have you ever collected rocks? Sooner or later, as the rock collection grows, even a casual collector finds a need to organize the collection. Rock samples may be grouped by color, shape, or size. They may also be organized into scientific categories used by geologists. This chapter describes these scientific categories and explains how each kind of rock forms and changes.*

### Chapter Outline

#### 10.1 Rocks and the Rock Cycle

- Three Major Types of Rock
- The Rock Cycle

#### 10.2 Igneous Rock

- Texture of Igneous Rocks
- Composition of Igneous Rocks
- Igneous Rock Structures

#### 10.3 Sedimentary Rock

- Formation of Sedimentary Rocks
- Sedimentary Rock Features

#### 10.4 Metamorphic Rock

- Formation of Metamorphic Rocks
- Classification of Metamorphic Rocks

◀ Mount Whitney is in the Sierra Nevada of California.



## 10.1 Rocks and the Rock Cycle

Hot, molten rock, or *magma*, from the earth's interior is the parent material for all rocks. From the time magma cools and hardens at or near the surface of the earth, the resulting rock begins to change. In time, the rock formed from the original magma is altered many times. Geologists study not only the crust of the earth but also the forces and processes that act upon the rocks of the crust. Based on these studies, geologists have classified rocks into three major types based on the way the rocks are formed.

### Three Major Types of Rock

Studies of volcanic activity provide information about the formation of one rock type—**igneous rock**. The word *igneous* is derived from a Latin term meaning “from fire.” Igneous rock forms when magma cools and hardens. Magma is called *lava* if it cools at the earth's surface.

Forces such as wind and waves break down all types of rock into small fragments. Rock, minerals, and organic matter that have been broken into fragments are known as **sediment**. Sediment is carried away and deposited by water, ice, and wind. When sediment deposits harden after being compressed and cemented together, they form a second type of rock. This type of rock is called **sedimentary rock**.

Certain forces and processes, including tremendous pressure, extreme heat, and chemical processes, also can change the form of existing rock. The existing rock can thus be changed into a third

### Section Objectives

- Identify the three major types of rock, and explain how each is formed.
- Summarize the steps in the rock cycle.

**Figure 10-1.** When hot molten rock, or magma, reaches the surface of the earth, it is called *lava*.





type of rock, called **metamorphic rock**. The word *metamorphic* means “changed form.” Figure 10–2 shows an example of each major type of rock.

Any of the three major types of rock can be changed into another type. Various geological forces and processes cause rock to change from one major type to another and back again. This series of changes is called the **rock cycle**.

## The Rock Cycle

As you have read, cooled and hardened magma forms igneous rock. Igneous rocks thus provide a good beginning for an examination of the rock cycle. Study Figure 10–3, which shows the steps in the rock cycle.

Once a body of igneous rock has formed, a number of processes on the earth’s surface break down the igneous rocks into sediments. When the sediments from the igneous rocks are compacted and hardened, they form sedimentary rocks. If the resulting sedimentary rocks are subjected to extremely high temperature and great pressure within the earth, they become metamorphic rocks. If the heat and pressure become even more intense, the metamorphic rock will melt and form magma. This magma may then cool and form new rock. What kind of rock—igneous, sedimentary, or metamorphic—will this new rock be?

All the rocks in the earth’s crust have probably passed through the rock cycle many times during the earth’s history. However, as

**Figure 10–2.** Examples of the three major rock types. Rhyolite (left) is an igneous rock. Sandstone (center) is a sedimentary rock. Marble (right) is a metamorphic rock.





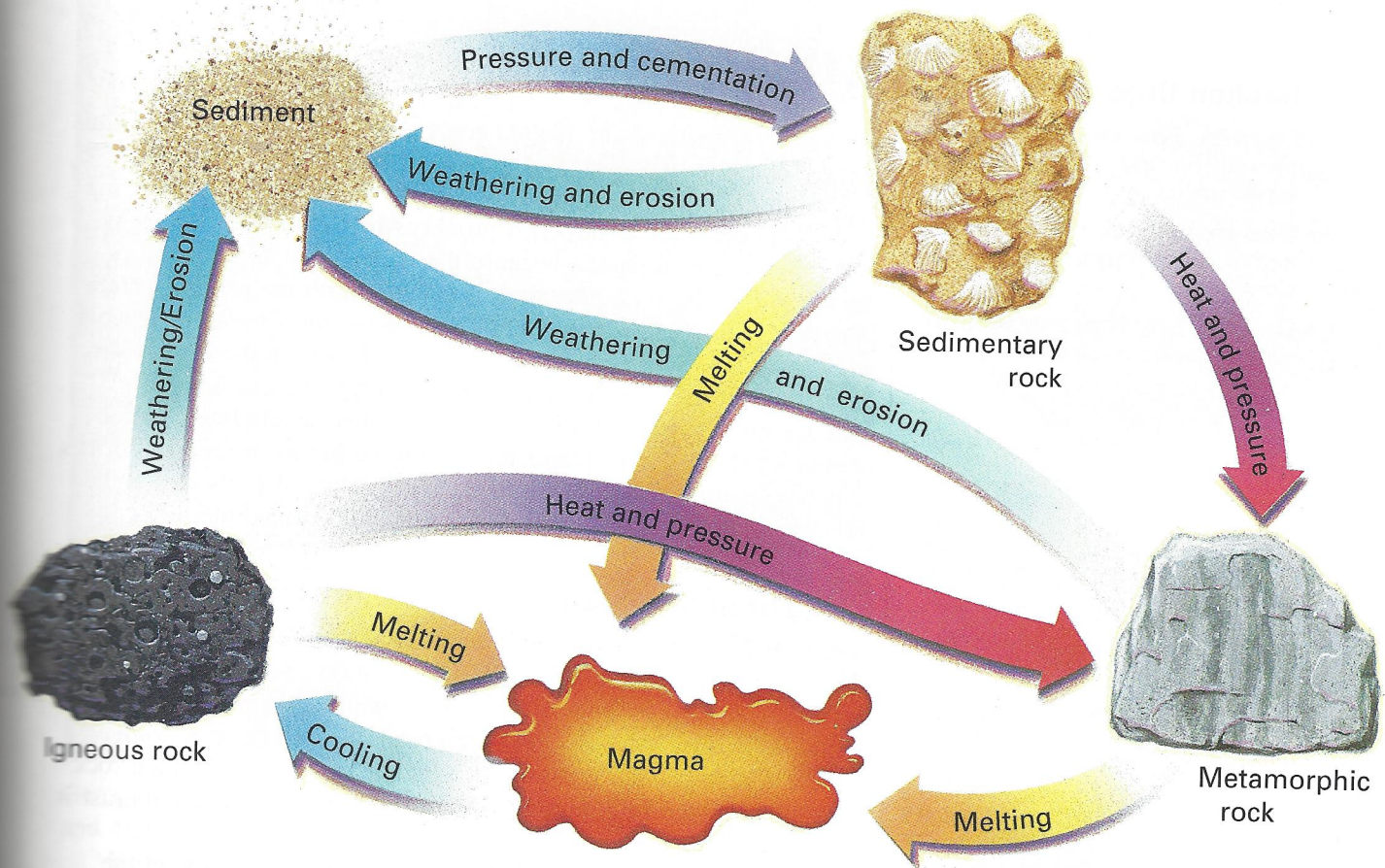


Figure 10-3 shows, a particular body of rock does not always pass through each stage of the complete rock cycle. For example, igneous rock may never be exposed at the earth's surface where it would be changed into sediments. Instead, the igneous rock may be changed directly into metamorphic rock while still beneath the earth's surface. Igneous and sedimentary rock may melt and become magma without first becoming metamorphic rock. All three of the major rock types may form sediments when they are exposed to processes at the surface of the earth.

**Figure 10-3.** The rock cycle illustrates the changes that sedimentary, igneous, and metamorphic rocks undergo.

## Section 10.1 Review

1. Which major type of rock—igneous, sedimentary, or metamorphic—forms from magma that cools and hardens?
2. Which major type of rock is composed of cemented fragments of rock or minerals?
3. Which major type of rock forms from other rocks as a result of intense heat, pressure, or chemical processes?
4. What is the rock cycle?
5. Does every rock go through the complete rock cycle, from igneous rock to sedimentary rock to metamorphic rock and back to igneous rock, each time around? Explain your answer.
6. The sedimentary rock limestone is changed into marble, a metamorphic rock. Name the three processes that cause this change.