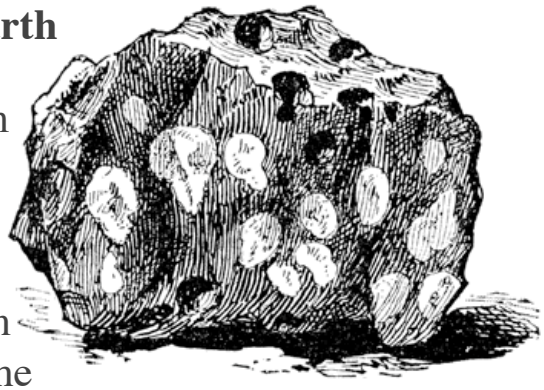
Collecting Rocks By Rachel M. Barker

Rocks Tell the Story of the Earth



The Earth is made of rock, from the tallest mountains to the floor of the deepest ocean. Thousands of different types of rocks and minerals have been found on Earth. Most rocks at the Earth's surface are formed from only eight elements (oxygen, silicon, aluminum, iron, magnesium, calcium, potassium, and sodium), but these elements are combined in a number of ways to make rocks that are very different.

Rocks are continually changing. Wind and water wear them down and carry bits of rock away; the tiny particles accumulate in a lake or ocean and harden into rock again. The oldest rock that has ever been found is more than 3.9 billion years old. The Earth itself is at least 4.5 billion years old, but rocks from the beginning of Earth's history have changed so much from their original form that they have become new kinds of rock. By studying how rocks form and change, scientists have built a solid understanding of the Earth we live on and its long history.

Types of Rocks

Geologists classify rocks in three groups, according to the major Earth processes that formed them. The three rock groups are igneous, sedimentary, and metamorphic rocks. Anyone who wishes to collect rocks should become familiar with the characteristics of these three rock groups. Knowing how a geologist classifies rocks is important if you want to transform a random group of rock specimens into a true collection.

Igneous rocks are formed from melted rock that has cooled and solidified. When rocks are buried deep within the Earth, they melt because of the high pressure and temperature; the molten rock (called magma) can then flow upward or even be erupted from a volcano onto the Earth's surface. When magma cools slowly, usually at depths of thousands of feet, crystals grow from the molten liquid, and a coarse-grained rock forms. When magma cools rapidly, usually at or near the Earth's surface, the crystals are extremely small, and a fine-grained rock results. A wide variety of rocks are formed by different cooling rates and different chemical compositions of the original magma. Obsidian (volcanic glass), granite, basalt, and andesite porphyry are four of the many types of igneous rock.

Sedimentary rocks are formed at the surface of the Earth, either in water or on land. They are layered accumulations of sediments-fragments of rocks, minerals, or animal or plant material. Temperatures and pressures are low at the Earth's surface, and sedimentary rocks show this fact by their appearance and the minerals they contain. Most sedimentary rocks become cemented together by minerals and chemicals or are held together by electrical attraction; some, however, remain loose and unconsolidated. The layers are normally

parallel or nearly parallel to the Earth's surface; if they are at high angles to the surface or are twisted or broken, some kind of Earth movement has occurred since the rock was formed. Sedimentary rocks are forming around us all the time. Sand and gravel on beaches or in river bars look like the sandstone and conglomerate they will become. Compacted and dried mud flats harden into shale. Scuba divers who have seen mud and shells settling on the floors of lagoons find it easy to understand how sedimentary rocks form.

Sometimes sedimentary and igneous rocks are subjected to pressures so intense or heat so high that they are completely changed. They become metamorphic rocks, which form while deeply buried within the Earth's crust. The process of metamorphism does not melt the rocks, but instead transforms them into denser, more compact rocks. New minerals are created either by rearrangement of mineral components or by reactions with fluids that enter the rocks. Some kinds of metamorphic rocks–granite gneiss and biotite schist are two examples–are strongly banded or foliated. (Foliated means the parallel arrangement of certain mineral grains that gives the rock a striped appearance.) Pressure or temperature can even change previously metamorphosed rocks into new types.

Rock-forming and rock-destroying processes have been active for billions of years. Today, in the Guadalupe Mountains of western Texas, one can stand on limestone, a sedimentary rock, that was a coral reef in a tropical sea about 250 million years ago. In Vermont's Green Mountains one can see schist, a metamorphic rock, that was once mud in a shallow sea. Half Dome in Yosemite Valley, Calif., which now stands nearly 8,800 feet above sea level, is composed of quartz monzonite, an igneous rock that solidified several thousand feet within the Earth. In a simple rock collection of a few dozen samples, one

can capture an enormous sweep of the history of our planet and the processes that formed it.

Starting a Collection

A good rock collection consists of selected, representative, properly labeled specimens. The collection can be as large or as small as its owner wishes. An active collection constantly improves as specimens are added or as poor specimens are replaced by better ones. A rock collection might begin with stones picked up from the ground near your home. These stones may have limited variety and can be replaced later by better specimens. Nevertheless, this first step is helpful in training the eye to see diagnostic features of rocks (features by which rocks can be differentiated). As you become more familiar with collecting methods and with geology, the collection will probably take one of two directions. You may try either to collect as many different types of igneous, sedimentary, and metamorphic rocks as possible or to collect all the related kinds of rocks from your own particular area.

Identifying Rocks

Many books about geology explain the identification and classification of rocks and describe the underlying geologic principles. Almost any recent general book on geology would help a rock collector. Geologic maps, which are useful guides for collecting, are also excellent identification aids. They show the distribution and extent of particular rock types or groups of rock types. Depending on size and scale, the maps may cover large or small areas. Most have brief descriptions of the rock types. Some are issued as separate publications; others are included in books.

Most geologic maps are issued by public or private scientific agencies. The most prolific publisher of geologic maps in the United States is the U.S. Geological Survey (USGS). "Geologic and Water-Supply Reports and Maps, (State)," a series of booklets published by the USGS, provides a ready reference to these publications for 13 States. The booklets also list libraries in the subject State where USGS reports and maps may be consulted. These booklets are available for less than $5.00 and may be obtained from:

USGS Information Services
Box 25286
Denver, Co 80225
Residents of Alaska may write to:

US Geological Survey
Room 101
4230 University Drive
Anchorage, AK 99508-4664

Older catalogs are available free of charge at the locations listed above. Geologic organizations of many States also publish geologic maps, as do many universities and scientific journals. Geologic maps may be located through public or university libraries.

Comparing one's own specimens with those in a museum collection can help in identifying them. Most large rock collections are well labeled. Small rock collections abound in libraries, schools, public buildings, small museums, and private homes.

Where to Find Rocks

Collections usually differ depending on where the collector is able to search for rocks. In the great interior plains and lowlands of the United States, a wide variety of sedimentary rocks are exposed. Igneous and metamorphic rocks are widespread in the mountains and piedmont areas of New England, the Appalachians, the Western Cordillera, and scattered interior hill lands; igneous rocks make up almost all the land of Hawaii. Along the Atlantic and Gulf Coastal Plains, loose and unconsolidated rocks are widespread; in the northern United States, glaciers deposited many other unconsolidated rocks.

The best collecting sites are quarries, road cuts or natural cliffs, and outcrops. Open fields and level country are poor places to find rock exposures. Hills and steep slopes are better sites. Almost any exposure of rock provides some collection opportunities, but fresh, unweathered outcrops or manmade excavations offer the best locations. If possible, visit several exposures of the same rock to be sure a representative sample is selected.

Collecting Equipment

The beginning collector needs two pieces of somewhat specialized equipment-a geologist's hammer and a hand lens. The hammer is used to break off fresh rock specimens and to trim them to display size. It can be purchased through hardware stores or scientific supply houses. The head of a geologist's hammer has one blunt hammering end. The other end of the most versatile and widely used style is a pick. Another popular style-the chisel type-has one chisel end; it is used mostly in soft sedimentary rocks and in collecting

fossils.

The hand lens, sometimes called a pocket magnifier, is used to identify mineral grains. Hand lenses can be purchased in jewelry stores, optical shops, or scientific supply houses. Six-power to ten-power magnification is best. Optically uncorrected hand lenses are inexpensive and quite satisfactory, but the advanced collector will want an optically corrected lens.

Other pieces of necessary equipment are inexpensive and easy to find: a knapsack to carry specimens, equipment, and food; bags and paper in which to wrap individual specimens; a notebook for keeping field notes until more permanent records can be made; and a packet knife, helpful in many ways, especially to test the hardness of mineral grains.

On some collecting trips, additional equipment is needed. Sledge hammers can be used to break especially hard ledges of rock. Cold chisels often make it possible to loosen specimens. Dilute hydrochloric acid helps in identifying limestone and dolomite. A long list could be made of such equipment; the collector must decide for each expedition which tools are really worth the weight.

Housing and Enlarging a Collection

The practical problems of cataloging and storing a collection must be considered by every collector. Housing arrangements can be very simple because rocks are durable and do not require special treatment. Shoe boxes and corrugated cardboard boxes are often used. Ordinary egg cartons can be used if the specimens are rather small. Shallow wall cases for rock collections are available commercially.

It is important to have a careful system of permanent labeling so that specimens do not get mixed up. Many people paint a small oblong of white lacquer on a corner of each specimen and paint a black number on the white oblong. The number, rock name, collector's name, date collected, description of collection site, geologic formation, geologic age, and other pertinent data are entered in a small notebook. If rocks are kept on separate trays, a small card containing some data is usually placed in the tray.

Extra specimens are sometimes used for trading with other collectors. Few people have the opportunity to obtain all varieties of rock types, and exchanging can fill gaps in a collection. Collectors interested in trading are usually located by word of mouth. No nationwide organization of rock collectors exists, though local clubs and individual collectors are found throughout the United States. It may be necessary to buy some specimens, but good specimens are expensive.

Hints for Rock Collectors

. Label specimens as they are collected. Identification can wait until later, but the place where the rocks were found should be recorded at once. Many collections have become mixed up because the collector did not do this.
. Trim rocks in the collection to a common size. Specimens about 3 by 4 by 2 inches are large enough to show rock features well. Other display sizes are 2 by 3 by 1 inch, or 3 by 3 by 2 inches.
. Ask for permission to collect rocks on private property. The owners will appreciate this courtesy on your part.
. Be careful when collecting rocks. Work with another person, if possible, and carry a first aid kit. Wear protective clothing–safety glasses, hard-toed shoes, hard hat, and gloves–when

dislodging specimens. Avoid overhanging rock and the edges of steep, natural or quarried walls.

. Do not collect rocks in national parks and monuments or in State parks; it is illegal. Similar rocks commonly crop out on land nearby.

. Look for unusual rocks to study in large buildings or in cemeteries. Dimension stone blocks and monument stone are often transported long distances from where they are quarried. Polished stone sometimes looks different from unpolished rock. This provides good identification practice.

. Join a mineral club or subscribe to a mineral magazine. They occasionally discuss rocks. Collecting rocks from each State or country has no scientific significance. The distribution of rocks is a natural phenomenon and is not related to political divisions.