COLLECTING ROCKS

United States Department of the Interior
Geological Survey

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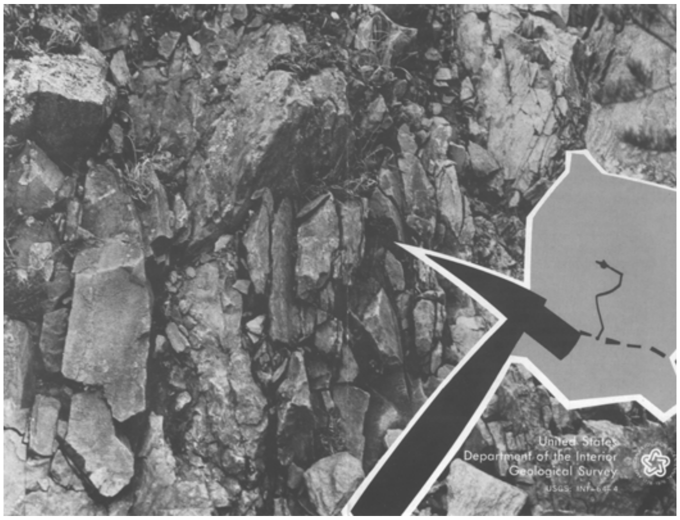


THE EARTH'S STORY IN ROCKS

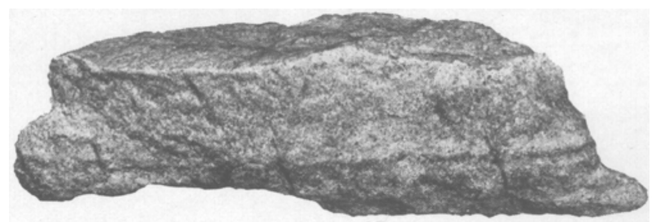
Rocks are the very substance of the Earth. They are composed of the same elementary particles as all other matter in the universe, but the particles are so arranged in rocks that the aggregate masses are very extensive. Individual rock bodies commonly occupy hundreds or thousands of cubic miles of the Earth's volume. Even so, they differ greatly from place to place because of the many different rock-forming processes.

What rocks are like at depths within the Earth is known only imperfectly from indirect measurements made by various techniques. Rocks near the surface, however, have been studied for many years, and their characteristics are well known. Studies of rocks have taught much about the structure, composition, and history of the Earth. In fact, the success of geologists in reconstructing the Earth's story by piecing together information from rocks is one of the wonders of science.

Geologists classify rocks in three great groups according to the major Earth processes that formed them. The three groups are *igneous rocks*, *sedimentary rocks*, and *metamorphic rocks*. Anyone who wishes to build a meaningful rock collection should become familiar with the characteristics and interrelationships of these great groups. To transform a random group of rock specimens into a true collection, application of the geologic principles on which rock classification is based is necessary.

Igneous rock.

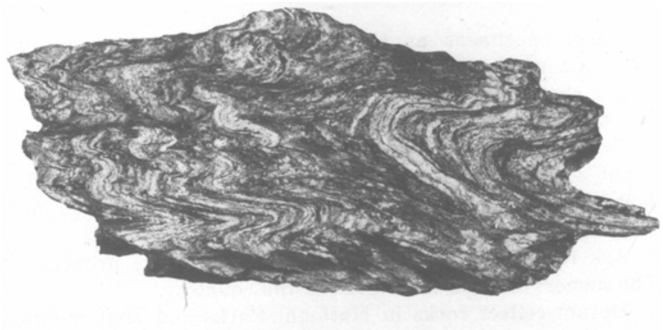
Igneous rocks are formed from molten material that has cooled and solidified. Molten rock material originates deep within the Earth and ascends to lesser depths or even, in volcanic eruptions, to the Earth's surface. When it cools slowly, usually at depths of thousands of feet, crystals separate from the molten liquid, and a coarse-grained rock results. When it cools rapidly, usually at or near the Earth's surface, the crystals are extremely small, and a fine-grained rock results. Separate bodies of molten rock material have, or acquire, unlike chemical compositions and solidify to different kinds of igneous rocks. Thus, a wide variety is formed by different cooling rates and chemical compositions. Dissimilar as they are, obsidian, granite, basalt, and andesite porphyry are all igneous rocks.



Sedimentary rock.

Sedimentary rocks are formed at the surface of the Earth, either in water or on land. They are layered accumulations of sediments—fine to coarse fragments of rocks, minerals, precipitated chemical matter, or animal or plant material. At no time during their formation are temperatures or pressures especially high, and their mineral constitutions and physical appearances reflect this fact. Ordinarily, 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 deposition.

Most people visualize more easily the formation of sedimentary rocks than that of igneous or metamorphic rocks because the process occurs around us all the time. Sand and gravel layers on beaches or in river bars resemble sandstone and conglomerate. Mud flats need only to be compacted and dried to become shale. Scuba divers who have seen mud and shells settling on the floors of lagoons find it easy to under stand the formation of sedimentary rock.



Metamorphic rock.

Sometimes sedimentary and igneous rocks are subjected to pressures so intense or to heat so high that they are completely changed. They become metamorphic rocks, which form while deeply buried within the Earth's crust, usually during the long continued series of gigantic events that produced mountain systems. The process of metamorphism does not melt the rocks, but instead transforms them into denser, more com pact, *foliated* rocks. (Foliated means the parallel arrangement of certain mineral grains that gives the rock a laminated appearance.) 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. Other kinds, such as hornfels and quartzite, are massive. Stress or temperature can even change previously metamorphosed rocks into new types.

A peculiarity of metamorphic rocks is that, with increasing metamorphism, a related but unlike series of rocks is formed. Thus, in favorable localities, one can trace a formation from shale through slate, to phyllite, to biotite-muscovite schist, and then to biotite gneiss, and know that all the rock types evolved from the same shale. Elsewhere, it may be impossible to tell which of two such dissimilar rocks as basalt and limy shale was the parent rock of hornblende schist.

Rock-forming and rock-destroying processes have been active for several billion 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, California, which now rises nearly 8,800 feet above sea level, is composed of quartz monzonite, an igneous rock that was emplaced and solidified several thousand feet within the Earth. To realize that a simple collection of rocks can illustrate this tremendous sweep of Earth history is an inspiring thought.

STARTING A COLLECTION

A good rock collection consists of selected, representative specimens, properly labeled and attractively housed. It 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 re placed by better ones.

A rock collection might begin with stones picked up from the ground near one's home. These stones may have little value in the collection 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 one becomes more familiar with collecting methods and with geology, the collection will probably take one of two directions. One may try to obtain representative specimens of igneous, sedimentary, and metamorphic rocks, or to collect all the related kinds of rocks from particular geologic provinces.

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, unsurpassed as collecting guides, 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 book reports.

Most geologic maps are issued by public or private scientific agencies. The most prolific publisher in the United States is the U.S. Geological Survey. State lists of geologic maps and reports are available from the Survey (Public Inquiries Office, 302 National Center, Reston, Virginia 22092, for areas east of the Mississippi River and the Branch of Map Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, Colorado 80225, for areas west of the River). Geologic organizations of several States also publish geologic maps, as do many universities and scientific journals. Geologic maps can be located through public, research, 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. Smaller rock collections abound in libraries, schools, public buildings, small museums, and private homes.

WHERE TO FIND ROCKS

Collections usually differ markedly depending on where the collector is able to search for rocks. In the great interior plains and lowlands of the United States, the sedimentary rocks are exposed in wide variety. Igneous and metamorphic rocks are wide spread 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 and locally elsewhere, loose and unconsolidated rocks are widespread; in northern areas 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. Almost any exposure of rock provides some collection opportunities, but fresh, unweathered outcrops or man-made excavations offer the best. Where feasible, it is a good plan to visit several exposures of the same rock to be sure a representative sample is selected.

COLLECTING EQUIPMENT

The beginning collector needs two pieces of some what specialized equipment—a geologist's hammer and a hand lens.

The hammer is used to dislodge 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. This kind of hammer is aptly called a geologist's pick. Another popular style—the chisel type—has one chisel end; it is used mostly in bedded, 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 neither unusual nor expensive: a knapsack to carry specimens, equipment, and food; paper sacks and wrapping paper in which to wrap individual specimens; a note book for keeping field notes until more permanent records can be made; and a pocket knife, helpful in many ways, especially to test hardness of mineral grains.

On some collecting trips, additional equipment is desirable. Sledge hammers can be used to break especially durable ledges. Cold chisels often make it possible to loosen specimens. Dilute hydrocholric acid assists 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 are ones that every collector must consider. If desired, housing arrangements can be very simple because rocks are durable and do not require special treatment. Cigar 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. Many people paint a small oblong of white lacquer on a corner of each specimen and paint a black number on the white oblong. A notebook is used to enter the number, rock name, collector's name, date collected, description of collection site, geologic formation, geologic age, and other pertinent data. 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 countrywide organization of rock collectors exists, though local clubs and individual collectors are numerous throughout the United States.

It may be necessary to buy some specimens, but this should be done selectively because good specimens are expensive.

HINTS FOR ROCK COLLECTORS

1. 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 confused because the collector did not do this.

2. 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.

3. Ask for permission to collect rocks on private property. The owners will be thankful for the courtesy.

4. Do not collect rocks in National Parks and Monuments or in State parks, where it is illegal. Similar rocks commonly crop out on land nearby, and can be collected there.

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

6. Join a mineral club or subscribe to a mineral magazine. They occasionally discuss rocks.

7. Do not collect a rock from each State or one from each country since this has no scientific meaning. The distribution of rocks, a natural phenomenon, is not related to political divisions.

(From material supplied by Rachel Barker)

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through out door recreation. The Department assesses our energy and mineral re sources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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