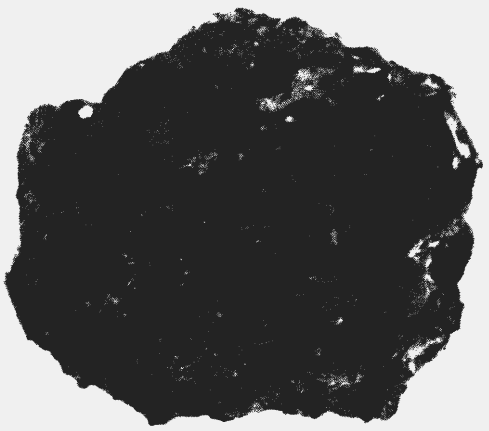
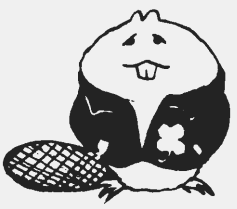
THREE KINDS OF ROCK





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THE BASIC TYPES OF ROCK

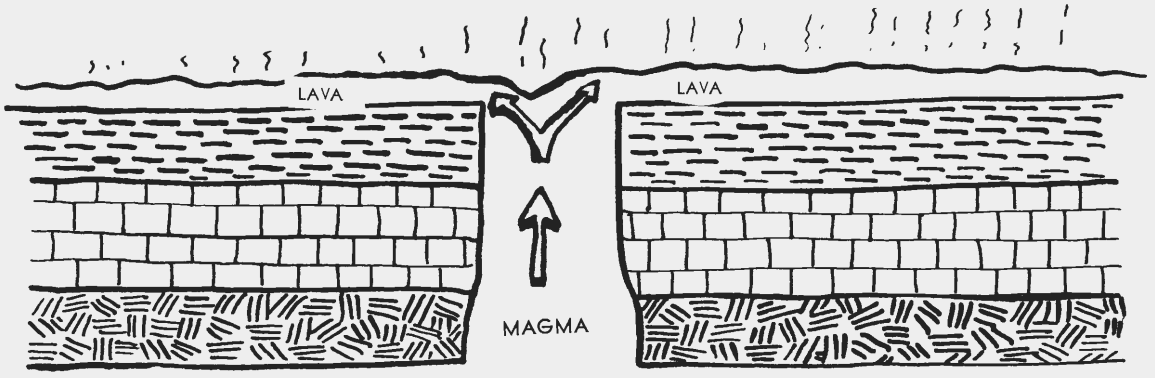
All rocks, whether they are found deep beneath the sea, in the deserts, high in the peaks of the highest mountains, or far below the surface of the earth, can be divided into three basic types: igneous, sedimentary, and metamorphic.

Igneous Rock

Igneous rocks are molten rock formed deep below the earth's surface. These are the kinds of rocks we think of when we talk about volcanoes.

Before we discuss igneous rocks, perhaps it would be better to discuss volcanoes. Did you know that there are two main types of volcanoes? They are the fissure and the central vent.

A fissure is a huge crack in the earth's crust. As you can see by the illustration below, the molten (very hot) material flows up through the crack almost like water and then runs out onto the surrounding countryside.



The central vent is much more familiar to us. It is the cone shaped type of volcano. Mt. Rainier is a dormant (sleeping) central vent volcano.

There are three kinds of central vent volcanoes: the shield, the cone, and the composite volcano.

The shield looks like the type of shield used in ancient battles. It has wide sloping sides and is almost all rock. Usually, it is perfectly shaped.

The cone is a steeper sided volcano. It is made up of ashes and cinders, but no solid rock.

The composite cone is a combination of the other two types. It is made up of stones, ashes, cinders, and contains much solid rock. It has fairly steep sides. Mt. Rainier and other volcanoes of the Western United States are composite, central vent volcanoes.

But if all volcanoes come from the same place, the middle of the earth, why are they different? To answer this question, we must learn some new words.

The molten rock inside the earth's surface is called magma. When this same material reaches the surface and flows out, it is called lava.

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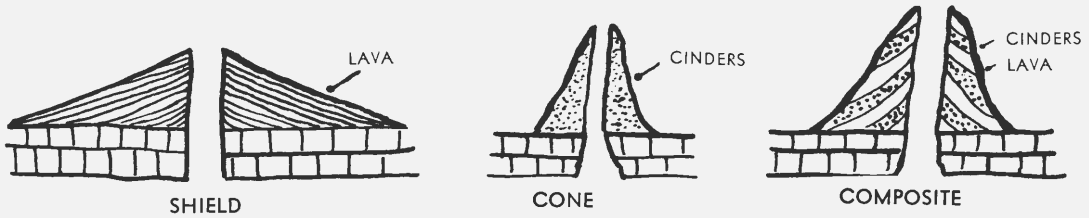
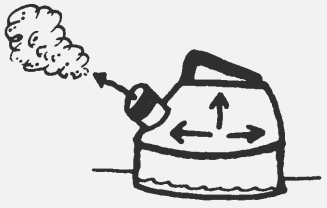


SHIELD CONE COMPOSITE

When the volcano is blowing up (erupting) it throws out small cinders and ashes, larger rocks called bombs, and steam and smoke.

Have you ever filled a tea kettle with water and set it on a stove? For awhile nothing happens. Then it starts to boil slowly. Finally, when it reaches a high boil and steam has formed inside, it begins to push against the side of the kettle. This pushing is called pressure. You know when this pressure gets very high because the steam comes out of the little safety hole at the spout of the kettle.


TEA KETTLE

The molten rock works its way into cracks and weak zones until it reaches the earth's surface.

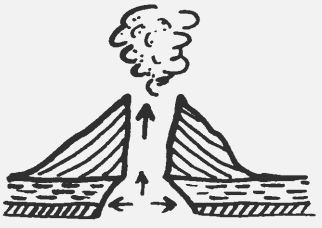
Sometimes the magma is thin and sometimes it is thick. This is one of the clues to the type of volcano that will form.

If the magma is thin, it just runs out and flows by gravity over the surrounding countryside. If it is thick, it explodes and is thrown out.

Think of a pan of water on a stove. Add to the pan two or three teaspoons full of oat cereal. What happens? Not much. It comes to a boil and boils away without much splattering.

A volcano works very much the same way. Only it does not have a little safety hole, as the tea kettle, until it makes one.

Inside the earth there is extreme heat. This heat causes everything to stretch (expand). This expanding causes the pressure. The pressure pushes in all directions, trying to find a weak spot in the layers of rock (strata) inside the earth.


VOLCANO

But, if you added a whole box of oat cereal, you would have a thick, sluggish liquid. When it comes to a boil it splatters and sputters and throws cereal all over the stove, the wall, and, perhaps, the ceiling!

In the case of the fissure, the magma is very thin, like the water with very little cereal in it. When it comes through the fissure it runs out without any explosion.

The central vent is made up of much thicker magma, like the water filled with all of the cereal. Being so thick, the magma does not run as easily. It bubbles and explodes its way out of the crack in the earth. As it

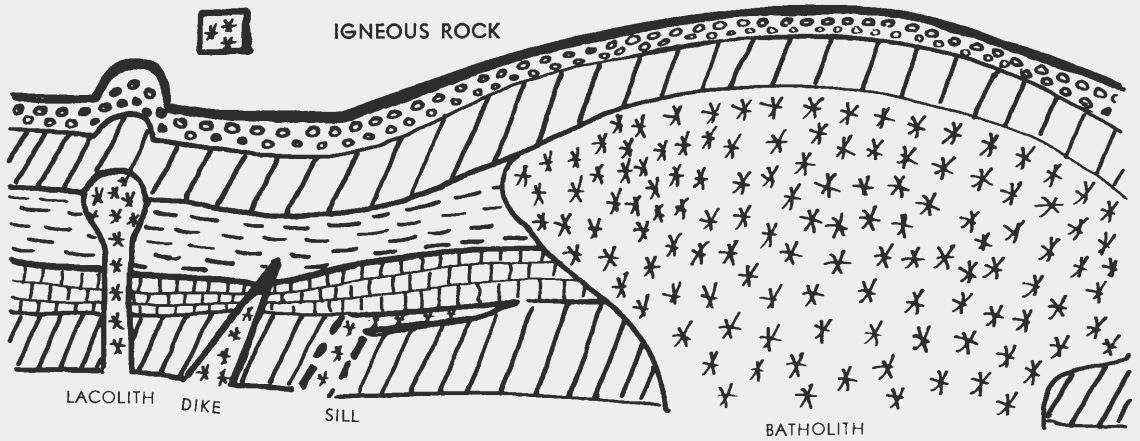
comes out it builds up around the sides of the crack. So, each time it erupts, the cone gets bigger around.

In the shield, central vent volcano, the magma is a little thicker than a fissure volcano. So it builds up. It is not as thick as the cone or composite type and does not run out for miles around the crack in the earth. It contains only lava. The volcanoes in Hawaii are shield volcanoes.

Sometimes the pressures are not great enough to force the magma out to the surface. There may be a layer of very tough rock which will not give to the pressure of the magma. This magma would have been a volcano had it come to the surface.

Any large chunk of rock or earth like a mountain or hill is called a geologic structure. The type mentioned in the last paragraph would be called an intrusive structure. Volcanoes are called extrusive structures. Notice the one inside begins with the word "in." The one outside the earth is an extrusive structure. "Ex" means out. (Exit means to go out; Extinguish means to put a fire out.)

There are four main intrusive, igneous structures; a lacolith, a batholith, a dike, and a sill.



A dike is magma that tried to break through strata but came to a layer that it could not get through. It stopped there. It looks like a finger of igneous rock and usually comes up at a slant.

A sill forms on the end of a dike. When the magma cannot break through a layer, yet has enough push and force to run along the bottom of that layer it forms a sill.

Sometimes the up-coming magma reaches a layer it cannot get through, and it forms a huge ball at its end which bends up all the strata above it. On the surface it looks like a hill. This formation is called a lacolith.

A batholith is a huge lacolith, being perhaps 50 miles across. It, too, arches the strata above it, but over such a large area that we cannot see the bulge it makes on the surface. It is round in much the same way as the earth is. We know it, but we cannot see it. We must go high in the sky before the curve is noticeable.

All of these intrusive and extrusive structures are the igneous rocks which

form deep beneath the surface of the earth.

Some of the more common igneous rocks are the types of lava, pumice, basalt, and obsidian.

Sedimentary Rock

Another basic type of rock is sedimentary rock. This is a type of rock that has been formed by the wearing away of other rock, moving of the worn-away particles, and hardening of them into rock, after they have been deposited (dropped).

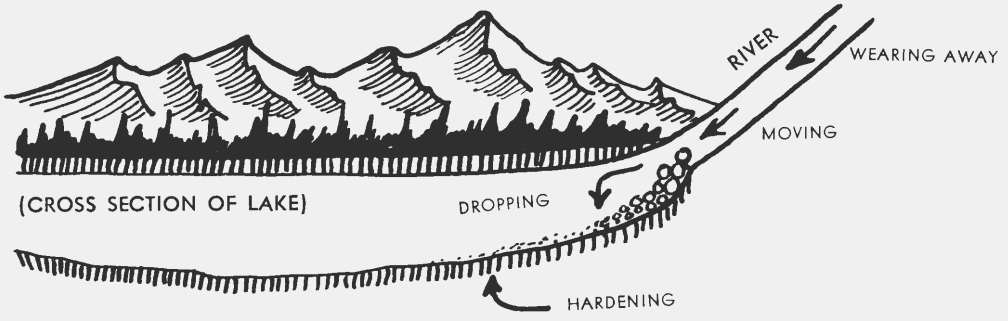
There are several ways that sedimentary rock can form, but all of them follow the steps given in the above definition. Sedimentary rock is formed by ocean, wind, and river erosion (wearing away).

Ocean sedimentary rock forms when the tide steadily wears away the shoreline. Small particles which are worn away are carried out into deeper water. Then they fall to the bottom. After enough particles have piled up, the pressure caused by the weight of the particles above pushes and squeezes the lower particles into rock.

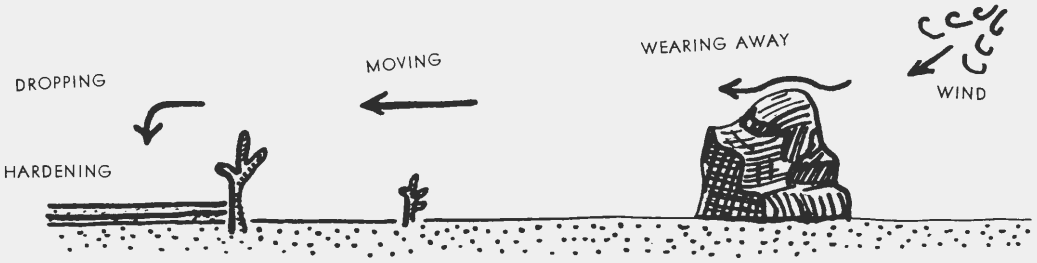
Any dead sea life trapped in the rock become fossils. Usually the type of sedimentary rock found here will be sandstone.

River sedimentary rock forms when rivers coming down from higher elevations wear away the ground and rocks under them. They deposit the particles of silt, gravel, and so on, in the body of water into which they flow. Rivers may flow into bays, an ocean, or lakes and ponds.

The particles have been worn away, moved, and laid down in a larger body of water. Again, the weight of the topmost particle presses the bottom ones into rock.



Wind sedimentary rock is formed most commonly in desert regions. The wind blows, picking up small particles of sand. This sand is blown against rocks and mountains and like sandpaper, wears away the rock. The wind carries the particles to another spot where they are dropped. Again, in time, the tremendous pressure from the weight above causes the lower deposits to harden to rock.



There are other kinds of sedimentation you might wish to explore. Animal, glacial, gravity, and chemical sedimentation are less important, but they do occur.

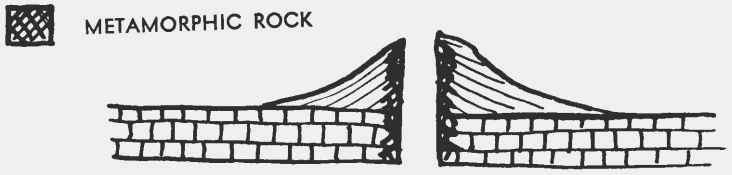
Because sedimentary rock forms layer by layer, it is sometimes called "layered rock." Any rocks you find which seem to be in layers, more than likely, are sedimentary rocks. Some of the most common types of sedimentary rocks are: sandstone, shale, and agate.

Metamorphic Rock

The third basic type of rock, metamorphic rock is rock that has been changed in color or shape or kind by heat, stress, or pressure.

There are two basic types of metamorphic rock: Contact and dynamic metamorphic rock.

Contact metamorphic rock is rock that is changed by coming in contact with heat.



Perhaps the best example of how this happens is the volcanic eruption. Imagine how terrific heat given off from the molten magma would bake the different layers of rock it passes by on its way to the surface. Any rock it comes in contact with is changed by the white-hot heat of the magma. This contact often changes the color and kind of rock that was there before.

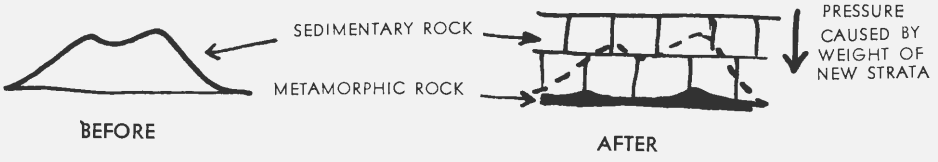
Dynamic metamorphic activity can be best explained by two examples. A fault-zone and sedimentary, dynamic metamorphic rock.

Fault-zone dynamic metamorphism happens when the earth slips along a fault-zone (crack in the earth). Imagine a crack in the earth which travels through several hundred feet of strata. All of a sudden, the earth on one side of the crack slips moving millions of tons along the crack. Heat caused by friction (rubbing together of two surfaces) changes the rock.

You can demonstrate how this works in a small way be rubbing your hands together. Do you feel the heat? Multiply that heat millions of times and you can understand the terrific heat given off by the earth's slippage.

Another way that dynamic metamorphic activity takes place is by pressure of sedimentation.

Imagine sedimentary rock thousands of feet thick. The more layers dropped on the top, the heavier the whole mass is. The rock at the bottom cannot take the pressure, so it is squeezed into another kind of rock.



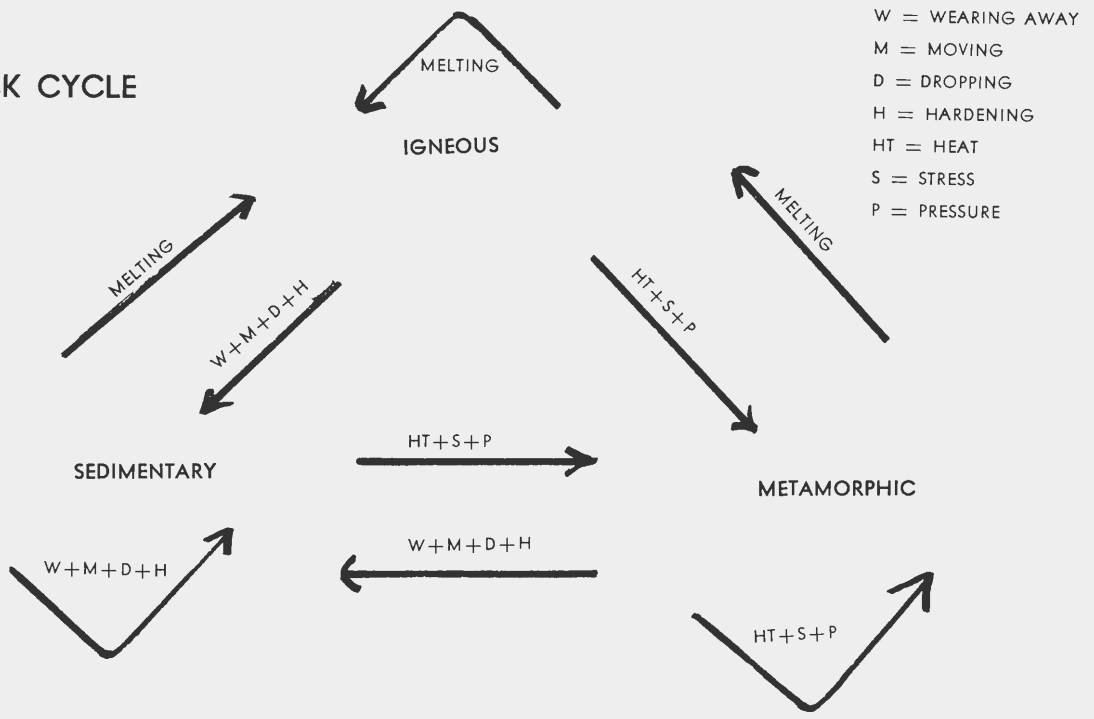
Now that we know the three kinds of rocks, we should understand how any one kind can change to any other.

Almost all scientists agree that the earth was formed when it was thrown off another planet or star. They believe that it was in a red-hot, molten state.

All existing rock was igneous. But through millions of years of cooling and wearing away and being subjected to pressures, the igneous rock was changed and moved and hardened into new kinds of rock.

In short, the following rock changes are possible. Metamorphic and sedimentary rock could become igneous. Igneous metamorphic rock could become sedimentary and sedimentary igneous rock could become metamorphic. Furthermore, any one can re-form into itself. To show this clearly, let us examine the rock cycle.

THE ROCK CYCLE

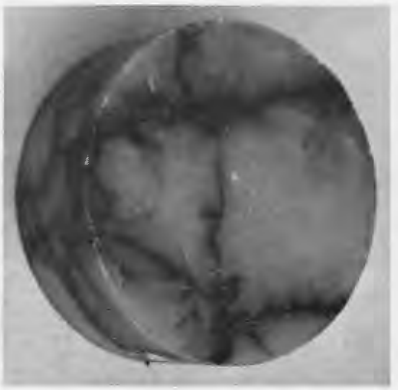


Study the rock cycle. Notice the three kinds of rock and the arrows running from each to the other. The explanation on the arrow tells us how a rock can form into another type.

For example, look at the arrow running from igneous to sedimentary. It says that igneous rock can change into sedimentary rock by wearing away, moving, dropping and hardening. Follow the other arrows and see how the rocks can change.

WHAT DO YOU THINK?

1. Here is a good example of erosion. What type do you think it is? Why?



2. This is marble. What have you learned about it?

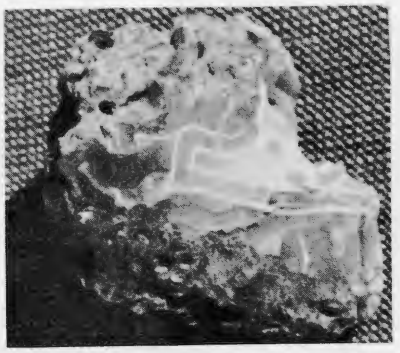
3. What kind of rock would you say this is? What might you conclude about its temperature?

4. Why would you say that this "thunderegg" would be sedimentary?

5. Do you know what a hollow rock lined with crystals is called?

6. What kind of rock would you say this is? Why?

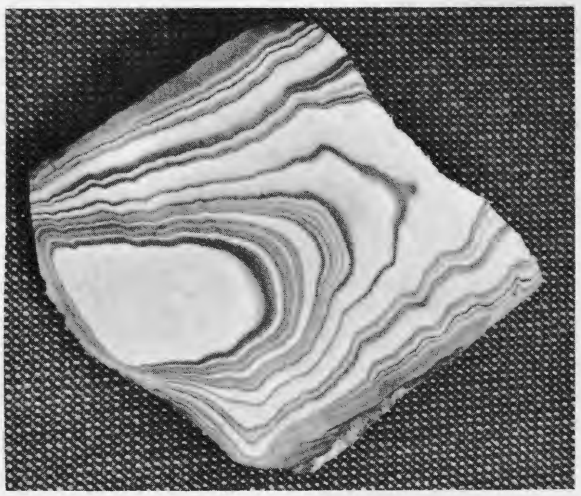
7. What type of formation do you think this is? Why?



8. What kind of rock do you think this is?

9. What kind of rock is this? How do you know?

10. If you found a rock like this, what would you guess caused its shape?



11. What kind of rock do you think this is--igneous, sedimentary, or metamorphic? Why?

12. If you found many rocks like these, what would you think caused them?

ACTIVITIES

1. Make collections of 5 to 10 common rocks. Identify and label as to:

    a. type of rock (Igneous, Sedimentary, and Metamorphic)
    b. location found
    c. suspected identity (Granite, Mica, Feldspar, Quartz, etc.)

2. Make collection of 5 to 10 rocks indicating chief minerals found in each rock (Granite, Mica, Quartz, etc.).

3. Sample collection of products made from rocks (concrete, core drill, cut rock for building, etc.).

4. These are a few, use your own ideas.

Displays

1. Make a map of a local area, using samples of common rocks to illustrate points of interest.

2. Make a chart showing the rock cycle using specimens of the types of rocks.

3. Make a drawing showing the formation of a type of rock (add sample of rock if possible).

4. Display representing 4 or more Igneous rocks. Identify each specimen and give location where found.

5. Display representing 4 or more Metamorphic rocks. Identify each specimen and give location where found.

6. Display representing 4 or more Sedimentary rocks. Identify specimen and show where found.

7. Specimens display representing a combination of three kinds of rocks illustrating rock cycle.

8. Make a model (plaster or paper mache) showing step in the formation of any one or all three types of rock.

9. Be sure and study your local fair premium list for others.

Notebook Projects (these may also be displays) showing:

1. How three types of rock are formed.

2. Famous volcanoes in history.

3. Formation of Grand Canyon.

4. How Cascades or Olympics were formed.

5. Any other geological formation found in state or other area.

6. Study of any famous geologist.

7. Commercial uses of rocks.

8. Photos showing one of the above or other geological studies.

9. Log and map of field trip containing drawings and/or photos giving descriptions of location and materials found. These should also show tools needed, safety points and any other suggestions for rock hunters to follow.

Demonstration

1. Flip posters (newspaper print or posterboard) to show and tell about any of the ideas listed in above activities, or other resource literature.

2. Using rocks to show and tell about any phase of rock development.

3. How to make a collection box.

4. How to use rock hound tools.

5. Tell and show about rock hunting trips.

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