

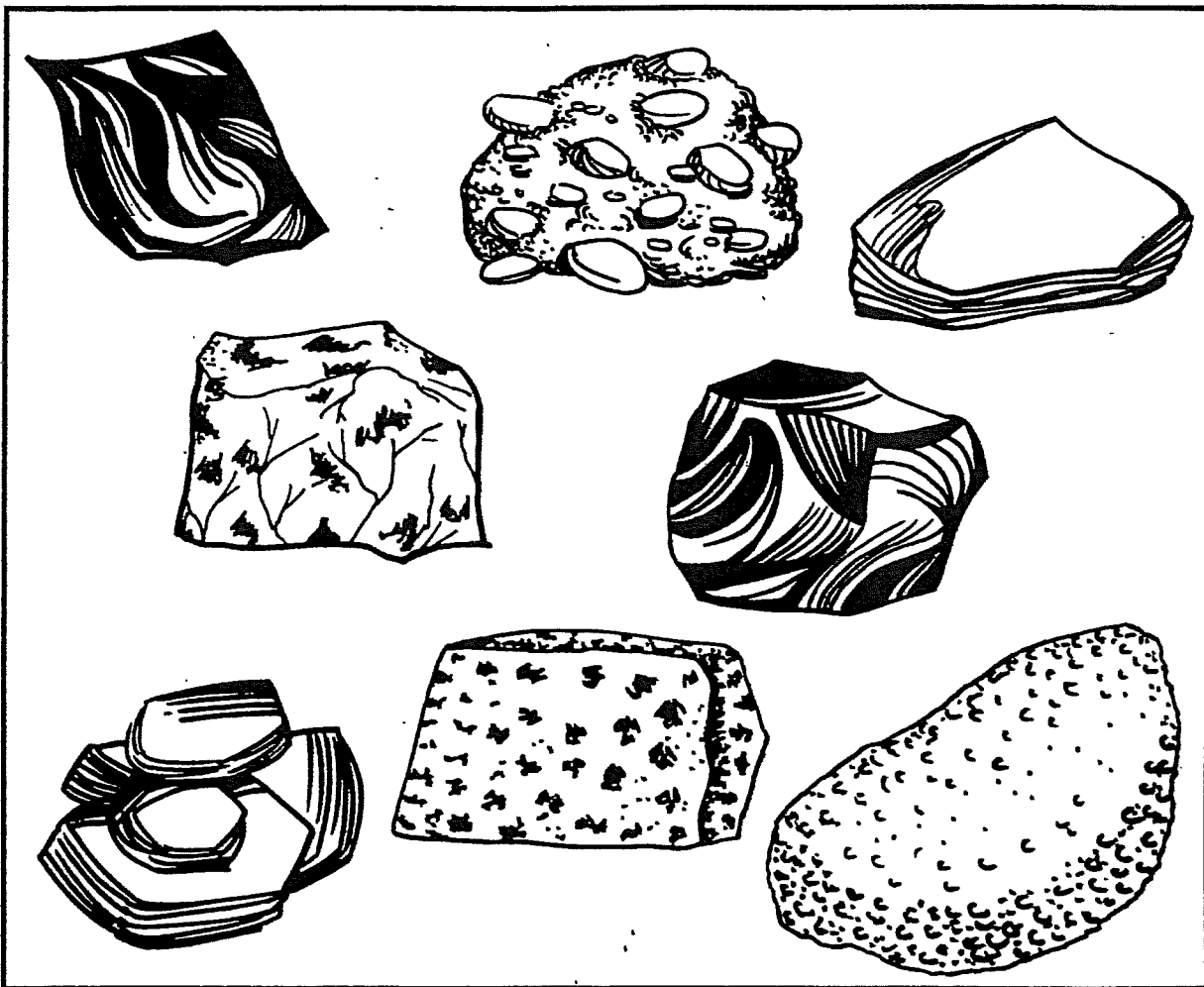
# Rocks: An Introduction

Rocks are made up of a mineral or a mixture of minerals. They can also contain some sediments and the fossilized remains of plants and animals. Rocks aren't very rare. In fact, the Earth is made up of about six sextillion tons of rock.

There are many different rock types on Earth. They are the result of the different natural forces at work on this planet. Rocks are so varied in color, texture, and composition that it seems impossible to identify them. It seems even harder to unlock the secrets of how they originated and how they came to be where you found them!

The study of rocks is called petrology. With some careful observation and study, you can learn to read a rock like a book. Rocks are the record of our planet's past. They tell us where rivers used to flow, where huge inland seas were located, and what lived in these waters. The Earth's rocks tell us stories of the glaciers and of how the Ice Age changed the planet.

The combinations of temperature, pressure, and chemical interactions at work within the Earth and on the surface have produced this huge variety of rocks. All rocks, however, fall into one of three basic groups: igneous rocks, sedimentary rocks, or metamorphic rocks.



Rocks are easy to find, and they come in many different shapes, sizes, colors, textures, and compositions.

Name \_\_\_\_\_ Date \_\_\_\_\_

For the student:

1. What is a rock?

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2. What forces on Earth cause rocks to form?

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3. What can rocks tell us about the Earth's past?

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4. What are the three basic types of rock?

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5. What is the study of rocks called?

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## Types of Rock: Igneous

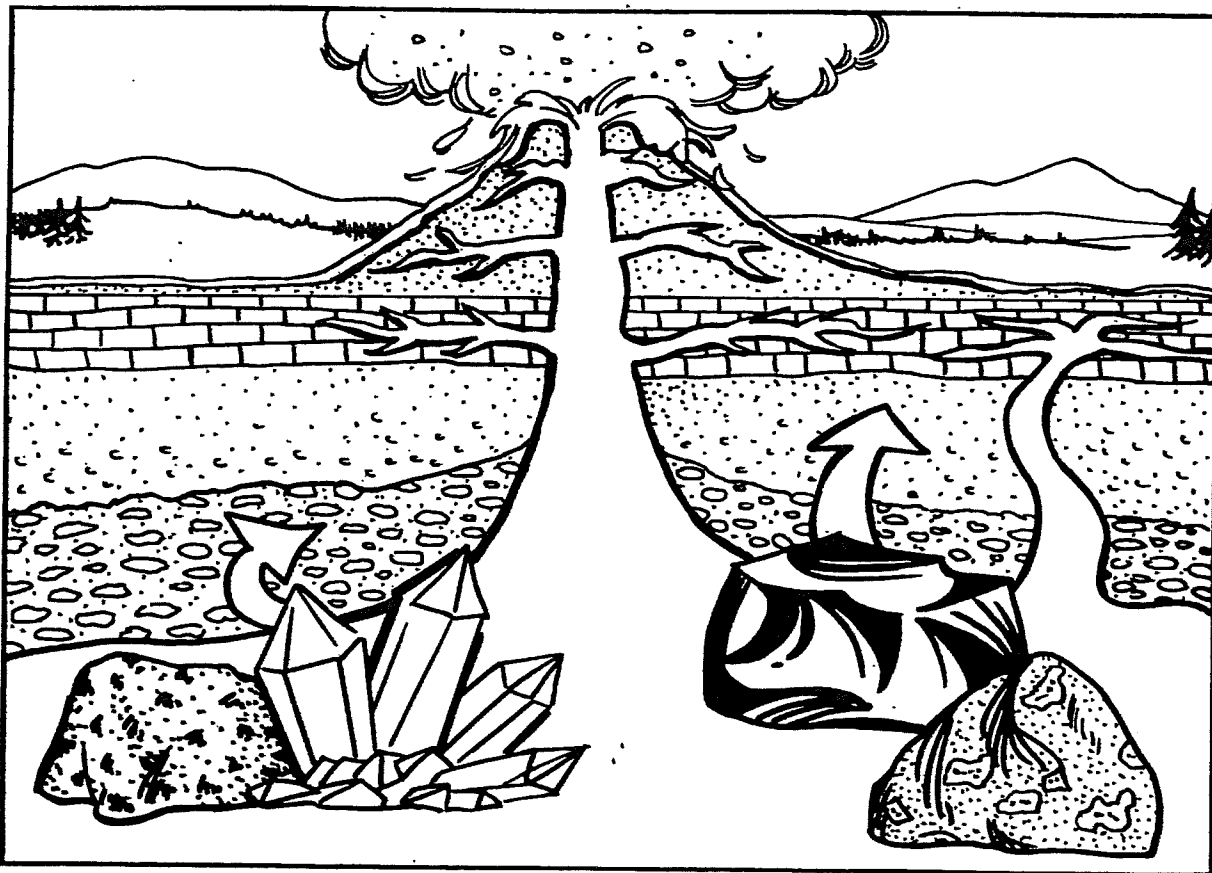
Igneous rock is the most common material in the Earth's crust. In fact, 95 percent of the first ten miles of the Earth's crust is igneous rock. We don't always see igneous rock because it is often hidden by a thin layer of sedimentary rock.

Igneous rocks form from liquid rock, which is called magma. Most igneous rocks crystallize and solidify below the Earth's surface. They are called intrusive igneous rocks. Rocks that form on the surface from volcanic lava are called extrusive igneous rocks.

All igneous rocks are identified on the basis of composition and texture. There are only about a dozen minerals that determine the composition of these rocks. The rate at which the rocks cool from the liquid magma determines their texture. Slow cooling produces coarse-textured minerals, and fast cooling causes fine-textured minerals. Granite, for example, cools very slowly, maybe over a period of 10,000 years. Basalt, on the other hand, which forms from lava, cools fairly rapidly. Basalt's cooling process may take only days or even hours.

Igneous rocks can be further divided into two groups: acidic rocks and basic rocks. Acidic rocks are those that have a high silica content. They are light in weight and color. Basic rocks are rich in iron and magnesium. These rocks are dark and heavy.

Granite is the most abundant igneous rock. It can be made up of a variety of minerals. A single specimen may be made up of feldspar, quartz, mica, and hornblende.

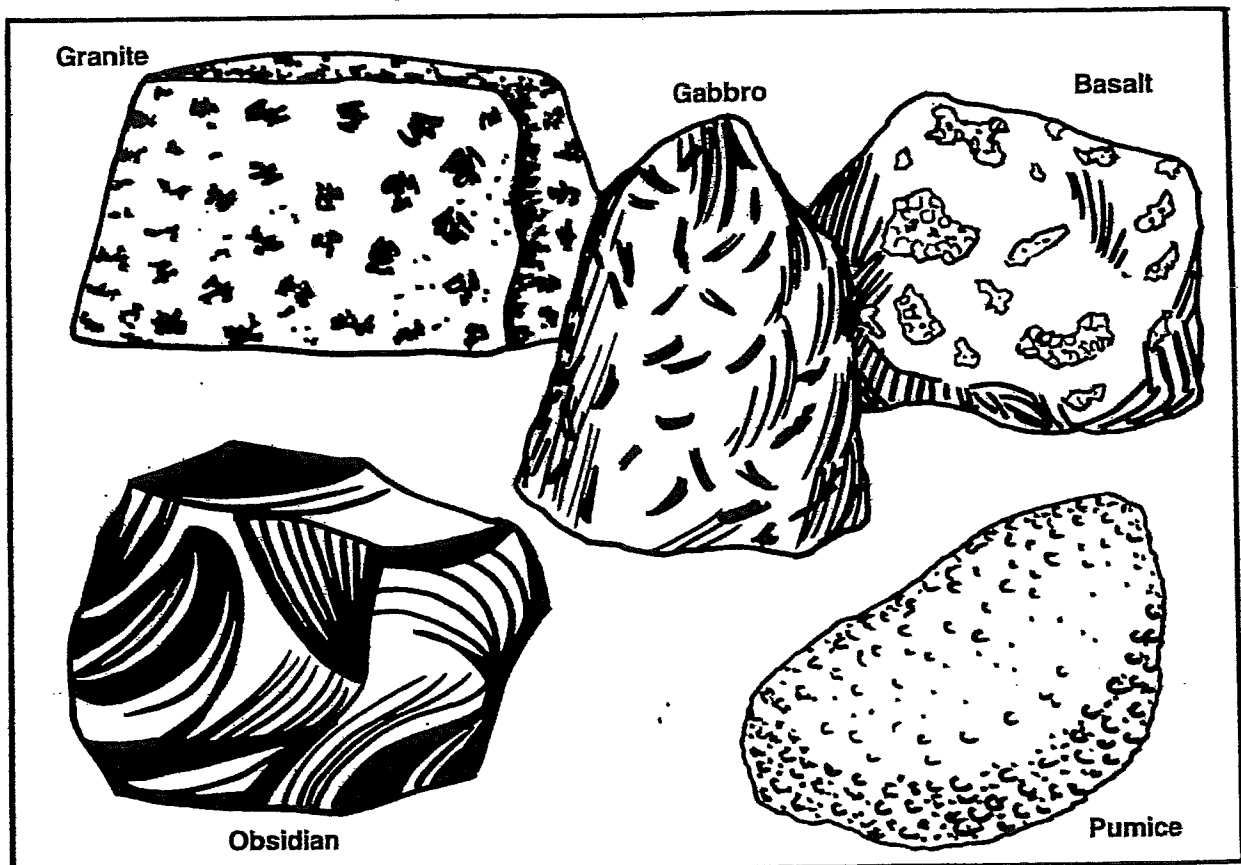


Granite and quartz (left) are intrusive igneous rocks, while obsidian and basalt (right) are extrusive igneous rocks.

## Igneous Rocks: Examples

Some examples of igneous rocks are:

- Granite**            the most abundant igneous rock; color varies according to the type of feldspar present
- Gabbro**            an intrusive igneous rock containing ore of iron or titanium
- Obsidian**           an extrusive igneous rock formed when lava has cooled too quickly to permit crystal formation; looks like black glass
- Basaltic lava**        the most common form of extrusive igneous rock; often shows gas bubble and flow patterns
- Pumice**            a highly porous rock formed by escaping gases, which cause lava to foam up; will float on water.

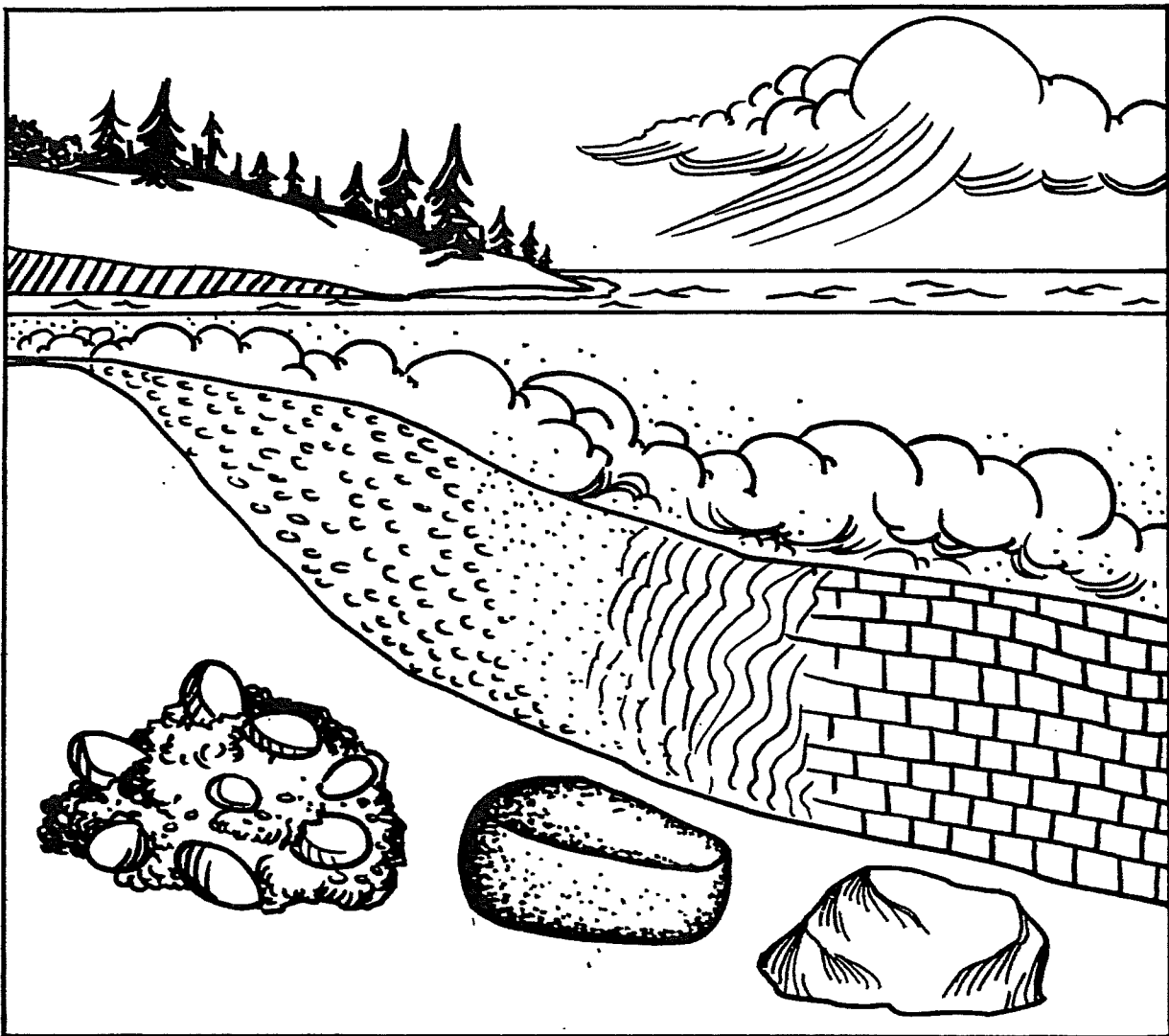


## Types of Rock: Sedimentary

What happens to mud or silt or gravel or sand when it is subjected to pressure, heat, or chemical change? It becomes rock—actually a particular type of rock called sedimentary rock. Sand becomes sandstone, gravel becomes conglomerate, and mud and clay become shale. All of these are types of clastic sedimentary rocks. That means they formed from particles of rock. Nonclastic rocks are formed by chemical precipitation or by organic activity. Limestone, gypsum, and coal are examples of nonclastic rocks.

Water, wind, waves, and gravity are always at work on the Earth's surface. Rocks are slowly being broken down. These broken pieces are called sediments. They can be fairly large, gravel-sized, or very small, as fine as powder.

Sediments often accumulate in layers at the bottoms of lakes or oceans. Layers upon layers stack up. The lower layers, under all the pressure from the layers above them, form rock. This sedimentary rock covers much of the North American continent.



Sedimentary rocks form when mud, silt, gravel, or sand is subjected to pressure, heat, or chemical change.

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For the student:

1. How is igneous rock formed?

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2. How does the rate of cooling affect the type of igneous rock formed?

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3. What is the most common igneous rock?

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4. What is the difference between acidic and basic igneous rocks?

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5. Why would lava cool more quickly than magma?

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## Sedimentary Rocks: Examples

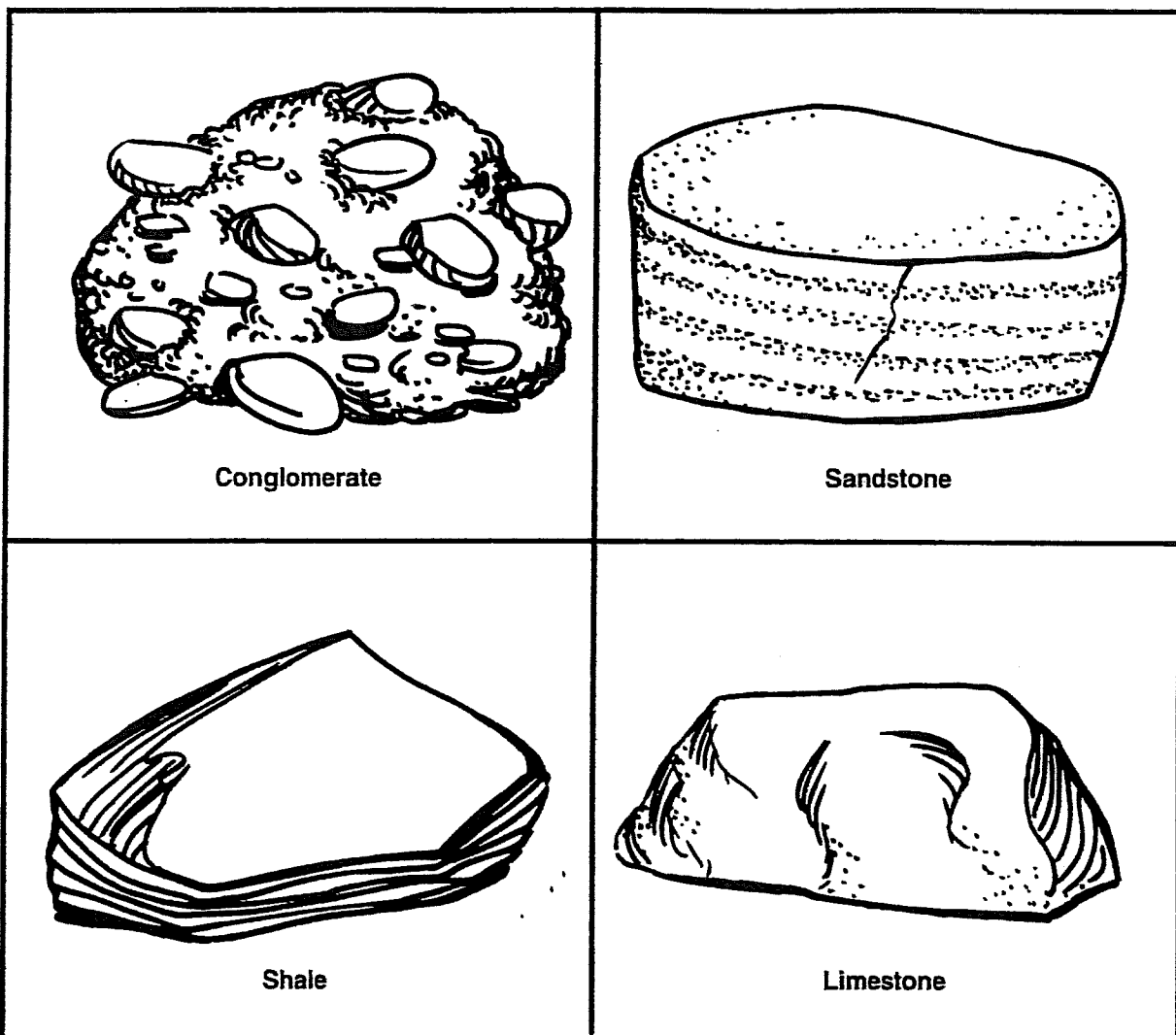
Some examples of sedimentary rocks are:

**Conglomerate**      rounded, water-worn pebbles cemented together

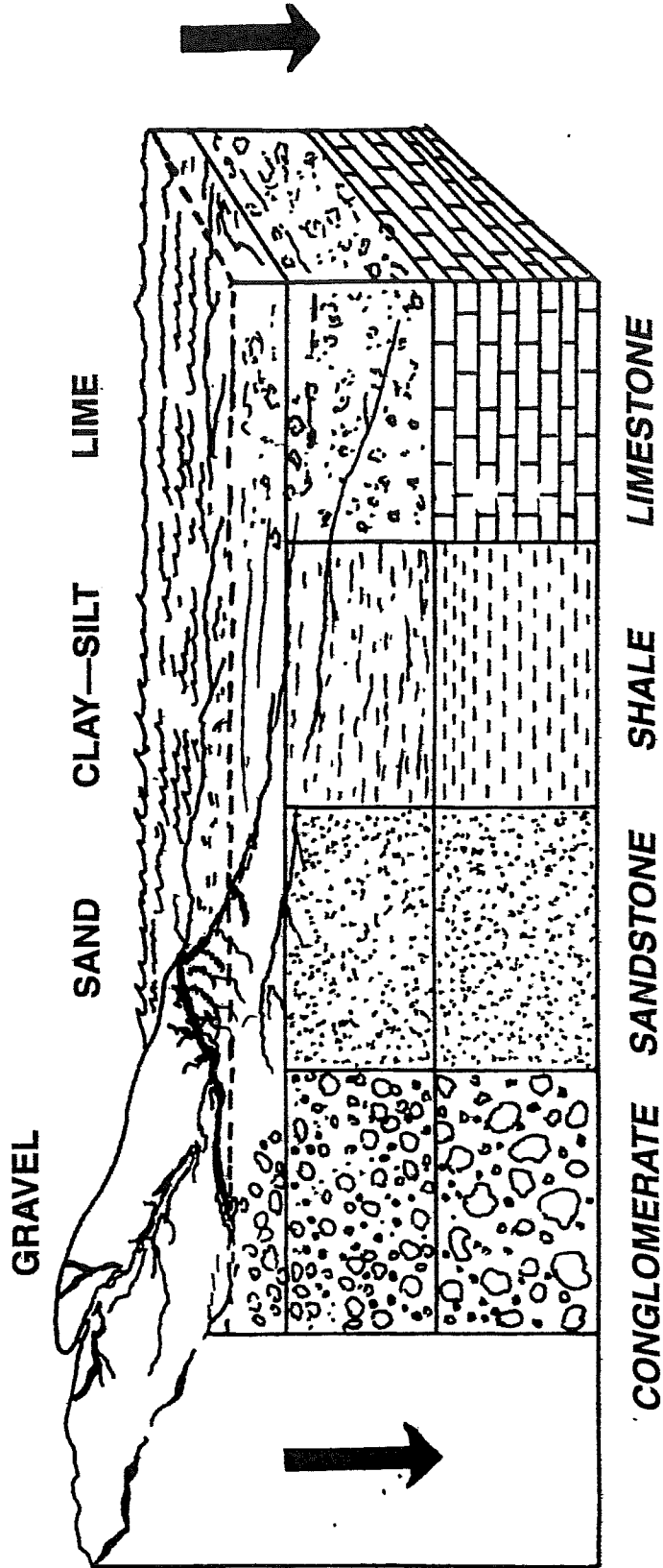
**Sandstone**      a very common rock made up of cemented grains of sand

**Shale**      mud and clay sediments that have hardened into rock

**Limestone**      formed from deposits of calcium carbonate dissolved in water; good source of fossils



### From Sediments to Sedimentary Rock: A Diagram



**PRESSURE, HEAT, DRYING, AND CEMENTING AGENTS FORM SEDIMENTARY ROCK FROM DIFFERENT KINDS OF SEDIMENTS.**



Name \_\_\_\_\_ Date \_\_\_\_\_

For the student:

1. Where is sedimentary rock found?

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2. What natural activities work to break down rock?

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3. What do sand and mud become when they form sedimentary rock?

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4. How does limestone form?

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5. Where do many sedimentary rocks form?

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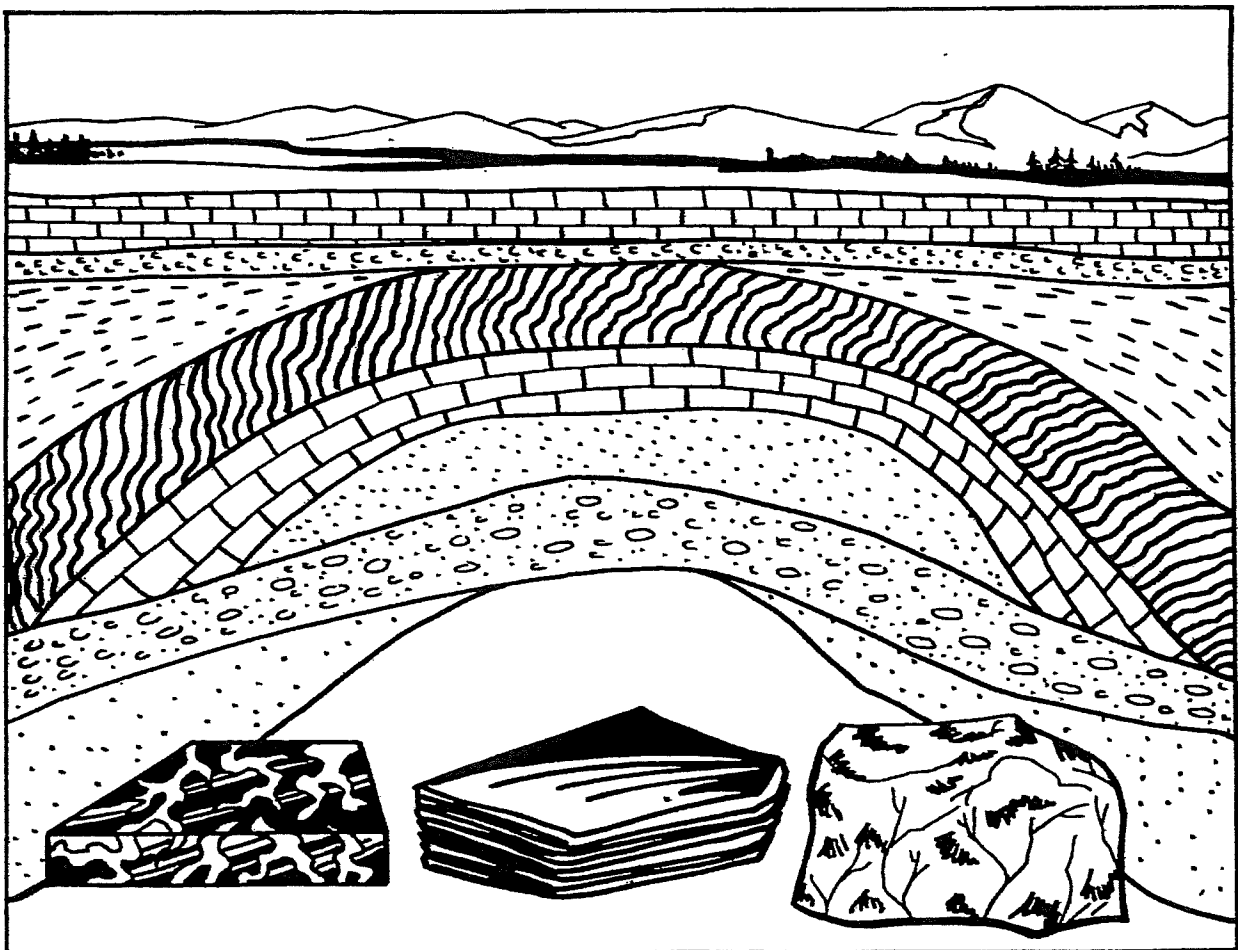
## Types of Rock: Metamorphic

Metamorphic rocks were originally either sedimentary or igneous rocks. Later, they were changed. Metamorphosis means a noticeable or complete change of character, appearance, or condition. With a combination of heat, pressure, and chemical action, some sedimentary and igneous rocks become metamorphic rocks. These forces and actions cause a recrystallization of the original rock, resulting in a different mineral composition.

Meta-sedimentary rocks are metamorphic rocks formed from sedimentary rocks, and meta-igneous rocks are those changed from igneous rocks. Sometimes the transformation is so radical and complete that the parent rock cannot be determined.

Sedimentary rocks that have been metamorphosed (changed) form conglomerates or cemented-together masses. Sandstone often forms quartzite, and shale becomes slate. Limestone can become marble. Igneous rocks become gneiss, schist, phyllite, or serpentine.

Rocks can be subjected to additional forces and be metamorphosed more than once. Many metamorphic rocks contain flat minerals, such as mica, and some have needle-like crystals, such as hornblende.

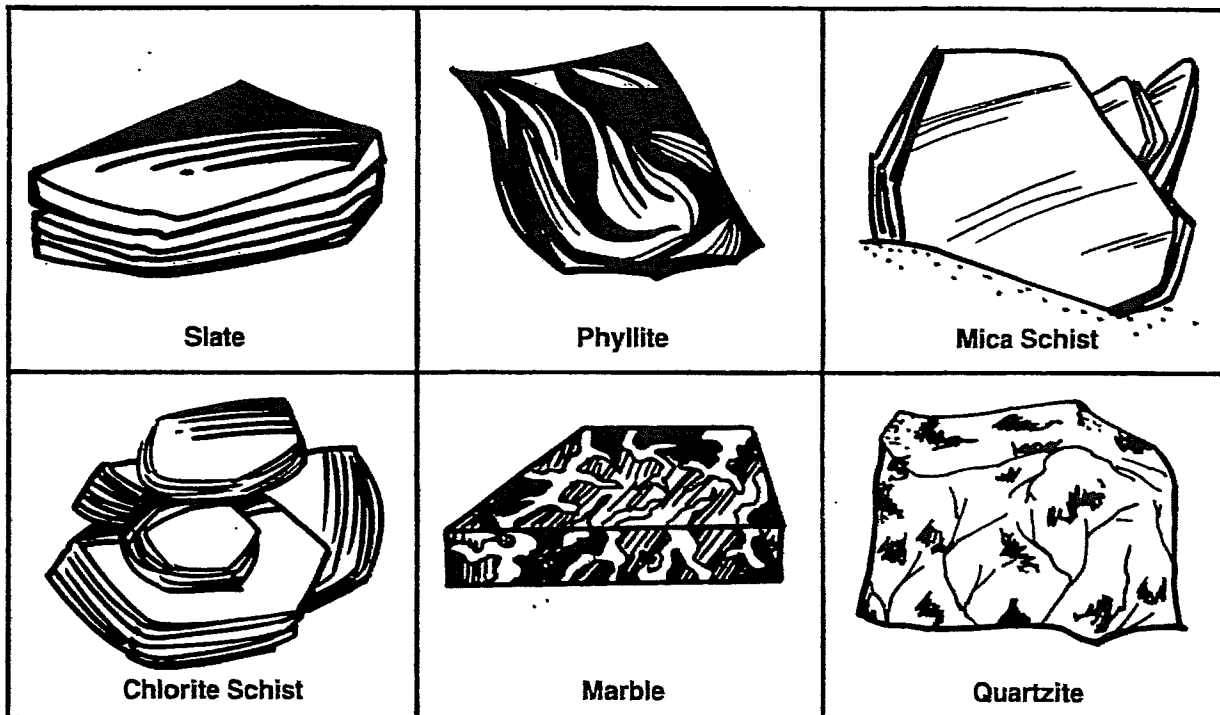


Metamorphic rocks such as marble, slate, and quartzite are formed when heat, pressure, and chemical action change igneous and sedimentary rocks.

## Metamorphic Rocks: Examples

Some examples of metamorphic rocks are:

- Slate**                    a metamorphic rock that splits into thin sheets
- Phyllite**                produced from slate; will often have a glossy luster caused by the mineral mica
- Mica Schist**            composed by severe metamorphic activity on sedimentary rock; made up of mica and quartz
- Chlorite Schist**        produced by metamorphism of gabbro or basalt; often called greenstone
- Marble**                    formed from limestone or dolomite; its high luster makes it useful in art and architecture
- Quartzite**                formed from sandstone; the cement between the grains of sand is harder than the grains of sand themselves



Name \_\_\_\_\_ Date \_\_\_\_\_

For the student:

1. What does *metamorphosis* mean?

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2. What Earth forces cause metamorphic rocks to form?

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3. What do we call metamorphic rock formed from sedimentary rock? from igneous rock?

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4. What are some examples of metamorphic rocks?

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5. Conglomerates form from what kind of rocks?

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