

Metamorphic Rocks

Reading Preview

Key Concepts

- Under what conditions do metamorphic rocks form?
- How do geologists classify metamorphic rocks?
- How are metamorphic rocks used?

Key Term

- foliated

Target Reading Skill

Previewing Visuals Before you read, preview Figure 17. Then write two questions that you have about metamorphic rocks in a graphic organizer like the one below. As you read, answer your questions.

Metamorphic Rocks

Q. Why do the crystals in gneiss line up in bands?

A.

Q.

Lab zone Discover Activity

How Do Grain Patterns Compare?

1. Using a hand lens, observe samples of gneiss and granite. Look carefully at the grains or crystals in both rocks.
2. Observe how the grains or crystals are arranged in both rocks. Draw a sketch of both rocks and describe their textures.

Think It Over

Inferring Within the crust, some granite becomes gneiss. What do you think must happen to cause this change?

Every metamorphic rock is a rock that has changed its form. In fact, the word *metamorphic* comes from the Greek words *meta*, meaning "change," and *morphosis*, meaning "form." But what causes a rock to change into metamorphic rock? The answer lies inside Earth.

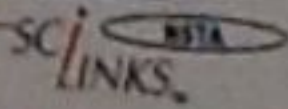
Heat and pressure deep beneath Earth's surface can change any rock into metamorphic rock. When rock changes into metamorphic rock, its appearance, texture, crystal structure, and mineral content change. Metamorphic rock can form out of igneous, sedimentary, or other metamorphic rock.

Sometimes, forces inside Earth can push the rock down toward the heat of the mantle. Pockets of magma rising through the crust also provide heat that can produce metamorphic rocks. The deeper a rock is buried, the greater the pressure on that rock. Under high temperature and pressure many times greater than at Earth's surface, the minerals in a rock can be changed into other minerals. The rock has become a metamorphic rock.

Types of Metamorphic Rocks

While metamorphic rocks are forming, high temperatures change the size and shape of the grains, or mineral crystals, in the rock. Extreme pressure squeezes rock so tightly that the mineral grains may line up in flat, parallel layers. Geologists classify metamorphic rocks according to the arrangement of the grains that make up the rocks.

Go Online



For: Links on metamorphic rocks

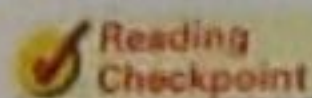
visit: www.SciLinks.org

Web Code: scz-1055

Foliated Rocks Metamorphic rocks that have their grains arranged in parallel layers or bands are said to be **foliated**. The term *foliated* comes from the Latin word for “leaf.” It describes the thin, flat layering found in most metamorphic rocks. Foliated rocks—including slate, schist, and gneiss—may split apart along these bands. In Figure 17, notice how the crystals in granite have been flattened to create the foliated texture of gneiss.

One common foliated rock is slate. Heat and pressure change the sedimentary rock shale into slate. Slate is basically a denser, more compact version of shale. During the change, new minerals such as mica form in the slate.

Nonfoliated Rocks Some metamorphic rocks are nonfoliated. The mineral grains in these rocks are arranged randomly. Metamorphic rocks that are nonfoliated do not split into layers. Marble and quartzite are two metamorphic rocks that have a nonfoliated texture. Quartzite forms out of sandstone. The weakly cemented quartz particles in the sandstone recrystallize to form quartzite, which is extremely hard. Notice in Figure 17 how much smoother quartzite looks than sandstone.



Reading
Checkpoint

What is a foliated rock?

FIGURE 17

Forming Metamorphic Rocks

Great heat and pressure can change one type of rock into another. **Observing** How does slate differ from shale?

A Sequined Rock

1. Make three balls of clay about 3 cm in diameter. Gently mix about 25 sequins into one ball.
2. Use a 30-cm piece of string to cut the ball in half. How are the sequins arranged?
3. Roll the clay with the sequins back into a ball. Stack the three balls with the sequin ball in the middle. Set these on a block of wood. With another block of wood, press slowly down until the stack is about 3 cm high.
4. Use the string to cut the stack in half. How are the sequins arranged?

Making Models What do the sequins in your model rock represent? Is this rock foliated or nonfoliated?

Granite
igneous



Heat
and
pressure

Gneiss

metamorphic, foliated



Sandstone
sedimentary



Heat
and
pressure

Quartzite

metamorphic, nonfoliated



Shale
sedimentary



Heat
and
pressure

Slate

metamorphic, foliated



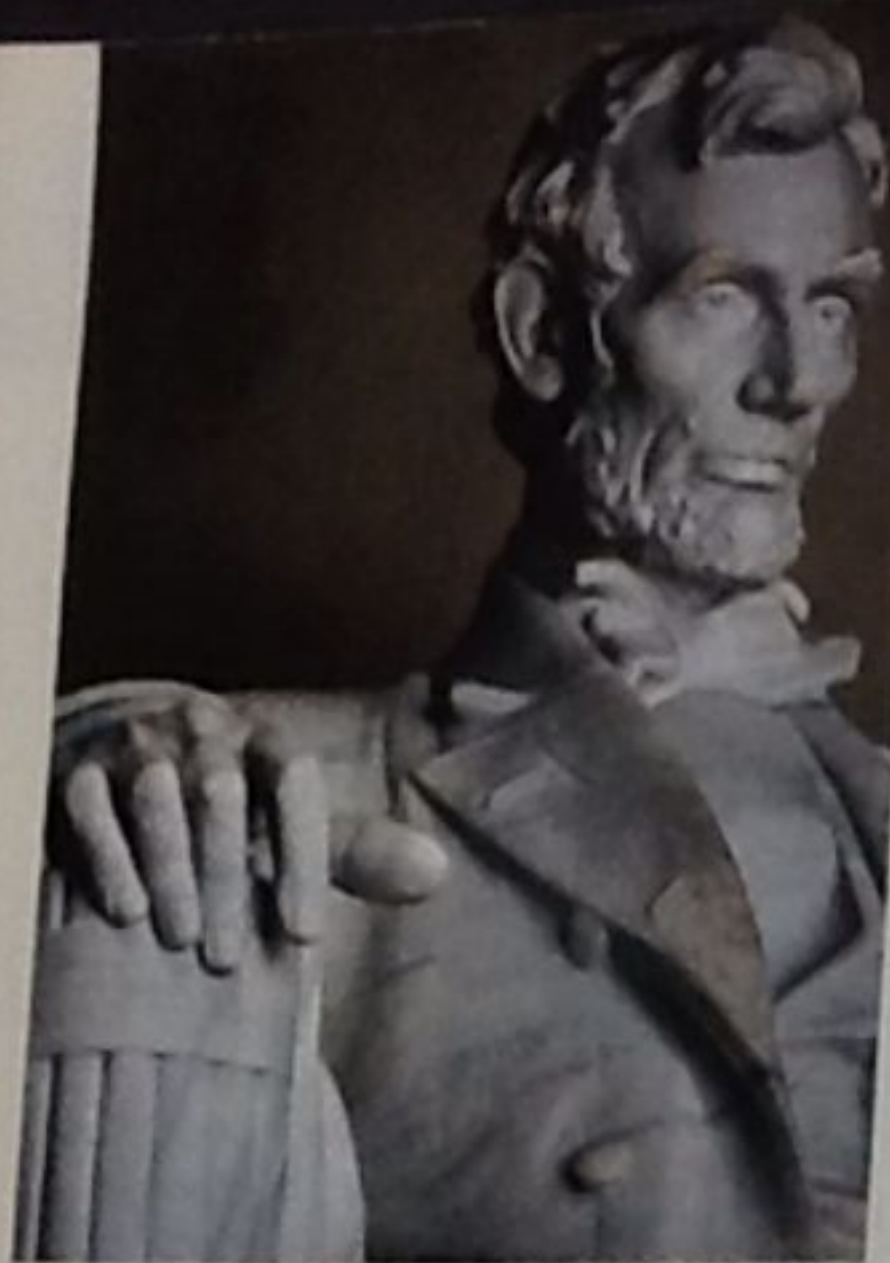
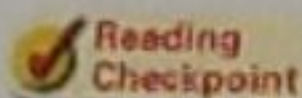


FIGURE 18
The Lincoln Memorial
The statue of Abraham Lincoln in the Lincoln Memorial in Washington, D.C., is made of gleaming white marble.

Uses of Metamorphic Rock

Certain metamorphic rocks are important materials for building and sculpture. Marble and slate are two of the most useful metamorphic rocks. Marble usually forms when limestone is subjected to heat and pressure deep beneath the surface. Because marble has a fine, even grain, it can be cut into thin slabs or carved into many shapes. And marble is easy to polish. These qualities have led architects and sculptors to use marble for many buildings and statues. For example, one of America's most famous sculptures is in the Lincoln Memorial in Washington, D.C. Sculptor Daniel Chester French carved this portrait of Abraham Lincoln in gleaming white marble.

Like marble, slate comes in a variety of colors, including gray, black, red, and purple. Because it is foliated, slate splits easily into flat pieces. These pieces can be used for flooring, roofing, outdoor walkways, chalkboards, and as trim for stone buildings.



What characteristics of slate make it useful?

Section 5 Assessment

Target Reading Skill *Previewing Visuals* Compare your questions and answers about Figure 17 with those of a partner.

Reviewing Key Concepts

- Explaining** What does *metamorphic* mean?
 - Relating Cause and Effect** Where and under what conditions are metamorphic rocks formed?
- Identifying** What characteristic of metamorphic rocks do geologists use to classify them?
 - Explaining** How does a foliated metamorphic rock form?
 - Classifying** Which of the rocks in Figure 17 is foliated? How can you tell?
- Identifying** What is the main use of metamorphic rocks?
 - Making Judgments** Which might be more useful for carving chess pieces—marble or slate? Explain your answer.

Lab zone

At-Home Activity

Rocks Around the Block How are rocks used in your neighborhood? Take a walk with your family to see how many uses you can observe. Identify statues, walls, and buildings made from rocks. Can you identify which type of rock was used? Look for limestone, sandstone, granite, and marble. Share a list of the rocks you found with your class. For each rock, include a description of its color and texture, where you observed the rock, and how it was used.