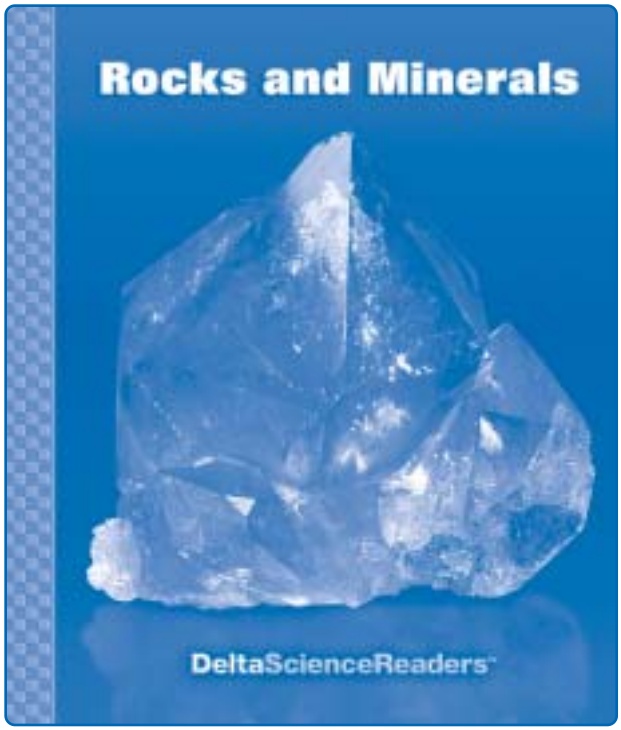
DELTA SCIENCE READER

Rocks and Minerals



Delta Science Readers *are nonfiction student books that provide science background and support the experiences of hands-on activities. Every* ***Delta Science Reader*** *has three main sections: Think About . . . , People in Science, and Did You Know?*

Be sure to preview the reader Overview Chart on page 4, the reader itself, and the teaching suggestions on the following pages. This information will help you determine how to plan your schedule for reader selections and activity sessions.

Reading for information is a key literacy skill. Use the following ideas as appropriate for your teaching style and the needs of your students. The After Reading section includes an assessment and writing link.

OVERVIEW

In the Delta Science Reader *Rocks and Minerals*, students read about the types, properties, and uses of various rocks and minerals. They learn how a mineral's properties help with its identification. They also read about a pioneering geologist—Florence Bascom—and her contributions to the field of geology. Finally, students learn about fossils.

Students will

- discover facts about the properties and uses of different types of rocks and minerals
- learn about the crystal structure of minerals
- investigate the three main types of rocks—sedimentary, igneous, and metamorphic—and how they form
- read about the rock cycle
- examine nonfiction text elements such as table of contents, headings, and glossary
- interpret photographs and diagrams to answer questions
- complete a KWL chart

READING IN THE CONTENT AREA SKILLS

- Set a purpose for reading
- Describe the sequence of events in the formation of minerals and rocks
- Compare and contrast crystal shapes, types of sedimentary rock
- Identify main ideas and supporting details of text sections
- Draw conclusions about the usefulness of mineral properties in identifying particular minerals
- Recognize causes and effects in rock formation
- Demonstrate critical thinking
- Interpret graphic devices
- Summarize

NONFICTION TEXT ELEMENTS

Rocks and Minerals includes a table of contents, headings, photographs, illustrations, captions, labels, boldfaced terms, diagrams, charts, and a glossary.

CONTENT VOCABULARY

The following terms are introduced in context and defined in the glossary: *cementation, chemical rock, clastic rock, cleavage, compaction, core, crust, crystal, crystal structure, deposition, erosion, fossil, fossil fuel, fracture, gemologist, gemstone, geologist, hardness, igneous rock, lava, luster, magma, mantle, metallic luster, metamorphic rock, mineral, Mohs scale, nonmetallic luster, nonrenewable resource, ore, rock, rock cycle, sedimentary rock, sediments, streak, weathering.*

BEFORE READING

Build Background

Access students' prior knowledge of rocks and minerals by displaying and discussing the cover. Ask, *What do you think this object is?* (crystal, gem, amethyst) Read the title aloud, and invite students to share what they know about the topic from their personal experiences and hands-on explorations in science.

To stimulate discussion, ask questions such as these: *What are the names of some rocks and minerals? How do you think rocks and minerals were formed? How are rocks and minerals useful or valuable to us?*

Begin a group KWL chart by recording facts students know about rocks and minerals in the K column. You may want students to copy the KWL chart so they can maintain their own charts as they read.

K What I Know	W What I Want to Know	L What I Learned	+ What I Want to Explore Further

Preview the Book

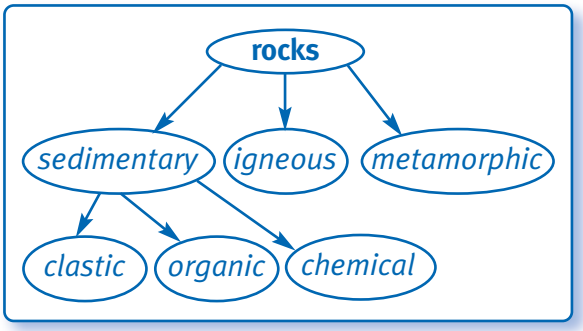
Explain that when students preview nonfiction, they should look at the title, the table of contents, headings, boldfaced words, photographs, illustrations, charts, graphics, and captions.

Then preview the book with students. Call attention to the various nonfiction text elements, and explain how they can help students understand and organize what they read. Ask questions such as these: *How do the headings help you predict what you will read about? What do you see in this picture? How do you think it will help you understand the text?* Explain that the words in boldface type are important words related to rocks and minerals. Point out that these words are defined in the glossary. Choose one word and have students find its definition in the glossary.

Preview the Vocabulary

You may wish to preview some of the vocabulary words before reading, rather than waiting to introduce them in the context of the book. Possibilities include creating a word wall, vocabulary cards, sentence strips, or a concept web.

For example, have students create a concept web such as the one that follows.



▲ *A concept web for* ***rocks.***

Set a Purpose

Discuss with students what they might expect to find out from the book, based on their preview. Encourage them to use the questions on the KWL chart to set an overall purpose for reading.

GUIDE THE READING

Preview the book yourself to determine the amount of guidance you will need to give for each section. Depending on your schedule and the needs of your class, you may wish to consider the following options:

- **Whole Group Reading** Read the book aloud with a group or the whole class. Encourage students to ask questions and make comments. Pause as necessary to clarify and assess understanding.
- **Shared Reading** Have students work in pairs or small groups to read the book together. Ask students to pause after each text section. Clarify as needed and discuss any questions that arise or have been answered.
- **Independent Reading** Some students may be ready to read independently. Have them rejoin the class for discussion of the book. Check understanding by asking students to explain in their own words what they have read.

Tips for Reading

- If you spread out the reading over several days, begin each session by reviewing the previous day's reading and previewing what will be read in the upcoming session.
- Begin each text section by reading or having a volunteer read aloud the heading. Have students examine any illustrations or graphics and read accompanying captions and labels. Discuss what students expect to learn, based on the heading, illustrations, and captions.
- Help students locate context clues to the meanings of words in boldface type. Remind them that these words are defined in the glossary. Provide help with words that may be difficult to pronounce.
- As appropriate, model reading strategies students may find helpful for nonfiction: adjust reading rate, ask questions, paraphrase, reread, visualize.

Think About . . . (pages 2–13)

Pages 2–8 *What Are Minerals?*

- Have students read the text in the first column on page 2. *Ask, How could you tell someone in your own words what a mineral is?* (Possible response: A solid substance that is not alive that you can find on or in the ground.) *What makes each kind of mineral unique?* (Each kind of mineral has its own chemical makeup and physical structure.)
- Have students read the first two paragraphs in the second column. Then ask them to study the diagram of Earth's layers and read the caption. Discuss what the diagram shows. Ask, *How does the diagram help you understand the text?*

(It shows in picture form what the words describe.)

- Ask students to describe the sequence of events in the formation of minerals. (Hot, melted rock forms inside the Earth. Minerals form as the melted rock cools and hardens.)

- Before having students read the last paragraph, invite them to speculate about where they can see minerals in their everyday lives. If necessary, remind them that they have learned that chalk and the "lead" in pencils are minerals. (Accept reasonable responses.)

- After students finish reading page 2, ask, *What is the most surprising or interesting fact you learned from reading this page?* (Responses will vary.)

Pages 3 *Crystals*

- Have students read the text on page 3 and look at the photographs and captions. Assess understanding by having students summarize the information in the text. (The atoms in minerals are arranged in a regular pattern called the crystal structure. Each mineral has a unique crystal structure and chemistry. The different shapes created by the crystal structure are called crystals. There are six basic crystal shapes. Some crystals are huge, and some are tiny.)

- Then have students look at the illustration of the six crystal shapes and their labels. Explain: *All the crystals of a particular mineral will always have the same shape*. Guide students to compare and contrast the crystal shapes. Point out that no matter how big a crystal grows, the proportions of its faces and angles stay the same.

- If necessary, provide help with the pronunciation of *tetragonal* (teh-TRAG-uh-nuhl), *hexagonal* (hek-SAG-uh-nuhl), *orthorhombic* (or-tho-ROM-bik), *monoclinic* (mon-uh-KLIN-ik), and *triclinic* (tri-KLIN-ik).

Pages 4, 5, 6 *Mineral Properties*

Page 4

- Before students begin reading, ask whether any of them has ever peeled layers off a piece of mica. Explain that this characteristic of mica is an example of one property that helps us tell minerals apart. Then have students read the text in the first column on page 4. Ask, *What are the two ways in which minerals break?* (Some minerals break along smooth, flat surfaces. This is called cleavage. Some minerals break with uneven or jagged surfaces. This is called fracture.)

Further Facts

Different types of minerals exhibit different types of cleavage:

  - Platy: Some minerals, such as graphite and mica, break along one plane only.

  - Two-way: Some minerals, such as feldspar, break apart in two directions.

  - Cubic: Some minerals, such as halite, break into cubic blocks along three planes at right angles.

  - Rhombic: Calcite breaks along three planes but not at right angles.

- Have students read the text in the second column on page 4, look at the photograph, and read the caption. Ask, *What is the main idea—the most important idea—expressed in this section about color?* (Color is not a very useful way to identify minerals.) *What detail supports this main idea?* (The same mineral can often be found in different colors.)

  The Hope Diamond, pictured on page 4, gets its color from the presence of traces of boron in its carbon crystals. Other famous colored diamonds include the Black Amsterdam Diamond, which appears black because graphite impurities absorb much of the light that reaches it; the Tiffany Yellow Diamond, whose color is

due to traces of nitrogen; and the Steinmetz Pink Diamond, whose color was caused by structural deformation.

- If necessary, provide help with the pronunciation of *hematite* (HE-muh-tite), *amethyst* (AM-uh-thist), and *citrine* (sih-TREEN).

Page 5

- Before students read the text about streak on page 5, make a chalk mark on the board. Ask, *How did the chalk make this mark on the board?* (Material was rubbed off the chalk and onto the board.) Explain: *The end of the chalk powdered when I rubbed the chalk against the board. The powdered chalk left a streak. What color streak did the chalk leave?* (white) The color of the streak a mineral leaves is one way to identify the mineral.

- Have students read the text in the first column and look at the photograph. Assess understanding by having students summarize the main ideas of the section. (A mineral's streak is always the same regardless of the mineral's color. The streak test is helpful for identifying minerals. Very hard minerals such as topaz and diamond have no streak.)

- Ask, *What conclusion can you draw about when the streak test would not be helpful in telling one mineral from another?* (It would not be helpful when two minerals leave the same color streak, such as the black streaks left by pyrite and graphite, or when the minerals leave no streak.) Explain: *Many minerals produce the same color streak. Scientists often must use the streak test together with other tests to positively identify a particular mineral.*

- Before students read the second column on page 5, write the word *luster* on the board. Ask, *What do you think* luster *means?* (Accept reasonable responses.) Explain that the term *luster* refers to the appearance of an object's surface and the way the object reflects light.

- After students finish reading, ask, *What minerals other than gold and pyrite have a metallic luster?* (Responses may include copper, silver, brass, and aluminum.) You may wish to point out that while it is easy to distinguish between metallic and nonmetallic luster, distinguishing among the different types of nonmetallic luster may be difficult. Ask, *In addition to quartz, what mineral do you think has a glassy luster?* (diamond) *What minerals might have a dull luster?* (chalk) *What mineral most likely has a pearly luster?* (talc)

  Minerals with metallic luster reflect light from only the surface. Minerals with nonmetallic luster reflect light from many particles, including those below the surface.

Page 6

- Have students read the text about hardness on page 6 and study the Mohs Scale of Hardness. Assess understanding by having students summarize the main ideas. (Hardness is a mineral's resistance to being scratched. Diamond is the hardest mineral, and talc is the softest. The Mohs Scale of Hardness ranks minerals from 1 to 10 according to their hardness. Minerals with higher numbers can scratch minerals with lower numbers.)

- Explain that the Mohs scale identifies the relative hardness of minerals—how hard a mineral is in relation to another mineral. Scientists use sensitive instruments to measure a mineral's true hardness. You may wish to display the following table showing the true hardness of the example minerals in the Mohs scale.

Mineral	Mohs Scale	True Hardness
Talc	1	0.1
Gypsum	2	0.4
Calcite	3	0.6
Fluorite	4	0.8
Apatite	5	1.3
Feldspar	6	1.4
Quartz	7	1.5
Topaz	8	2.2
Corundun	9	3.2
Diamond	10	8.5

Ask, *What do you notice about the difference between the relative hardness of minerals on the Mohs scale and the true hardness of the minerals?* (Relative hardness increases in equal amounts. True hardness increases in unequal amounts.) Invite students to speculate about what makes the Mohs scale useful even though it does not show true hardness. (It does not require special instruments and is easy to use. Relative hardness gives enough information to help in classifying and identifying minerals.)

- If necessary, provide help with the pronunciation of *gypsum* (JIP-sum), *calcite* (KAL-site), *fluorite* (FLOR-ite), *apatite* (AP-uh-tite), and *corundum* (kuh-RUN-duhm).

Further Facts

- Despite their differing degrees of hardness, graphite, coal, and diamonds are all forms of carbon. Diamonds and graphite are crystalline forms of carbon; their difference is related to their atomic structure. Diamonds were crystallized under great pressure at depths up to 200 km (about 125 mi). Coal is a noncrystalline form of carbon formed from organic matter.
- On the Mohs scale, graphite has a hardness of 1–2—about the same hardness as a human fingernail.
- The precious metals are relatively soft. On the Mohs scale, gold ore ranges from 2.5 to 3, silver is 2.5–3, and platinum is 4–4.5.

Pages 7, 8 *Mineral Resources*

- Before students read page 7, challenge them to name as many things as they can that they use or see every day that are made of minerals. List correct answers on the board. Then have students read to learn about mineral resources.
- Ask, *What makes a mineral deposit worth mining?* (It has to contain enough of a substance to permit a company to make money from it.) *What are some useful or valuable minerals that come from ores?* (iron, copper, aluminum, lead)
- Assess comprehension by having students describe the steps in the process of obtaining metals from mineral deposits. (First, the metal-containing ore is dug out of the ground. Then the ore is heated. The heat causes the metal to separate from other substances in the ore.)
- After reading, have students compare the list of uses of minerals on the board with uses presented in the text. Add to the list uses of which students were not aware.
- Direct attention to the photograph of an open-pit copper mine and its caption. You may wish to inform students that open-pit mining such as this is often criticized because of the damage it does to the environment.
- If necessary, provide help with the pronunciation of *chalcopyrite* (kal-kuh-PIE-rite).
- Before students read page 8, write the word *gemstones* on the board. Ask students to name gemstones with which they are familiar. (Students may name diamonds, rubies, emeralds, sapphires, and opals.) Ask, *What is the most common use of gemstones?* (jewelry) *What are gemstones?* (minerals)

- Have students read the first paragraph. You may wish to display a globe or a map of the world and have students locate the countries mentioned: Australia, Russia, South Africa, Colombia, Burma, and Thailand.

- Have students finish reading the page and look at the photograph and caption. Remind students that crystals can range in size from microscopic to the huge gypsum crystals shown on page 3. You may want to explain that extremely large gemstone crystals are frequently cut into smaller stones.

- Direct attention to the chart of birthstones. Students may enjoy discovering which gem is their birthstone. You may wish to explain that birthstones are related to ancient beliefs and that wearing the gemstone associated with the month of a person's birth was thought to bring good luck or health. The ancient list of birthstones was altered to reflect present-day availability and cost. For example, aquamarine has been substituted for the ancient March birthstone bloodstone and the more-available peridot for the August birthstone sardonyx or carnelian.

Further Facts

- Many diamonds are found in an igneous rock called kimberlite, named after Kimberley, South Africa.

- The Cullinan diamond, the largest ever found, weighed 3,106 carats (1.4 pounds). It was cut into 9 large and 96 smaller stones. The largest of these—the pear-shaped 530.2-carat Star of Africa—was mounted in a British royal scepter.

- Rubies and sapphires are gem forms of corundum, which is an aluminum oxide second only to diamond in hardness. Red corundum gemstones are called rubies. Corundum gemstones of all other colors are called sapphires.

- Opal is a noncrystalline form of quartz. It can be colorless, white, mottled, or iridescent and can range in color from greenish yellow to brick red.

Pages 9–12 *What Are Rocks?*

Page 9 *Igneous Rocks*

- Have students read the introduction. Then invite students to share any information they have about rocks in general or about particular kinds of rocks. Explain that rocks are formed in different ways. This section of the book will describe the three main types of rock.

- Have students read the text about igneous rocks and look at the photographs and captions. Then assess their understanding of how igneous rocks are formed. Ask, *How does igneous rock form?* (Melted rock called magma cools and forms igneous rock.) *What causes different kinds of igneous rocks to have different size crystals?* (Magma that cools under Earth's surface cools slowly and forms large crystals. Magma that reaches Earth's surface as lava cools more rapidly and forms small crystals. Lava that cools very quickly may not give crystals time to form.)

- If necessary, provide help with the pronunciation of *igneous* (IG-nee-us) and *obsidian* (ob-SID-ee-uhn).

Pages 10, 11 *Sedimentary Rocks*

- Have students read the first four paragraphs on page 10, look at the photographs, and read the captions. Assess understanding by asking students to paraphrase the main idea of each paragraph. (Sedimentary rocks are formed from layers of sediments, which are tiny bits of materials. Deposition is the placing or laying down of sediments by wind, water, ice, or gravity. Small sediments stick together and form solid rock in a process called compaction. Larger sediments are cemented together by

minerals such as quartz and calcite in a process called cementation.)

- Have students read the text about clastic rocks and compare and contrast the three types of clastic sedimentary rocks mentioned: sandstone, siltstone, and shale. (Sandstone and siltstone are both made of pieces of quartz, calcite, feldspar, or other minerals. Sandstone is made of sand-sized pieces and has a rough texture. Siltstone is made of smaller pieces and has a gritty texture. Shale is made of tiny pieces of clay and silt and has a smooth texture.)

  Oil shale is a source of oil that is found throughout the world. A ton of oil shale can yield up to 34 gallons of petroleum.

- Have students read the text on organic rocks and look at the photograph and caption about coquina. Ask, *What are organic rocks?* (Rocks that are formed from things that were once alive, such as shells of ocean animals.) *What kinds of rocks are formed in this way?* (coquina, chalk)

- Ask students what they learned about coal from the last paragraph in the column. (Coal is an organic rock. It forms from decayed plant matter. It is a fossil fuel.) Ask, *Why is "fossil fuel" a good name for coal?* (Coal is burned as fuel to provide warmth and energy. It is a fossil because it is formed from the remains of once-living things.) *Why are fossil fuels called nonrenewable resources?* (Once they are used up, they cannot be replaced.) *What are some other nonrenewable resources?* (oil, petroleum, natural gas)

  (You may wish to introduce the concept of *renewable resources*—resources that are replaced as they are used. Renewable resources include the sun, wind, tides, and geothermal energy.)

- Have students read the text on chemical rocks and look at the photograph and caption about stalactites. Ask, *How are chemical rocks formed?* (Sometimes, minerals are dissolved in water. When the water dries up or evaporates, the minerals are left behind. These mineral deposits form chemical rocks.) *What kinds of rocks are formed in this way?* (limestone, halite)

- If necessary, provide help with the pronunciation of *sedimentary* (sed-ih-MEN-tuh-ree), *deposition* (dep-uh-ZISH-uhn), *cementation* (see-men-TAY-shuhn), *coquina* (ko-KEE-nuh), and *calcium carbonate* (KAL-see-um KAR-buh-nate).

Page 12 *Metamorphic Rocks*

- Before students read, write the word *metamorphic* on the board and ask students whether they know what this word means. If necessary, tell them that *metamorphic* is an adjective that means "relating to a change of physical form, structure, or substance." Ask, *What do you think a metamorphic rock is?* (a rock that has changed from one form into another)

- Have students read the first paragraph. Ask, *What two forces cause rocks to change?* (great heat and pressure) *From what substances do metamorphic rocks form?* (igneous rocks, sedimentary rocks, and other metamorphic rocks)

- Then have students finish reading the page and look at the photographs and captions. Ask, *What is slate formed from?* (the sedimentary rock shale) *What is slate used for?* (floor and roof tiles) *What is marble formed from?* (limestone) *What uses does marble have?* (buildings, sculptures, monuments)

  In the past, slate was most commonly used for chalkboards (called blackboards) and for children's slates.

- If necessary, provide help with the pronunciation of *metamorphic* (met-uh-MOR-fik) and *gneiss* (nice).

Page 13 *What Is the Rock Cycle?*

- Have students read the text about the rock cycle. Ask, *What is the rock cycle?* (the process by which rocks are constantly being formed, worn down, and formed again) *What process breaks rocks down?* (weathering) *What causes weathering?* (Water, wind, temperature changes, and plants break large rocks down into smaller rocks and sediments.)

- Then have students look at the diagram. Explain: *The words* cycle *and* circle *are related. Just as you can run your finger around and around a circle, a cycle repeats itself in the same order.* Ask, *How do the arrows help show that the rock cycle keeps repeating?* (They go around in a circle.) Guide students to describe the different stages in the rock cycle represented in the diagram.

People in Science (page 14)

Florence Bascom, Geologist

- Ask whether students know what a geologist is. If necessary, explain that a geologist is a scientist who studies Earth and Earth's history as shown in its layers of rock. Then have students read page 14 to find out about a pioneering woman geologist who achieved many firsts in her field.

- Encourage students to discuss what personal qualities Florence Bascom must have possessed that caused her to enter college at a time when few women did so and to pursue a career in geology—at that time an exclusively male field. Ask, *What do you think enabled her to succeed in achieving her goal?* (Students may mention intelligence, persistence, desire to learn, love of her chosen field, and her parents' support, among others.)

- Inform students that Dr. Bascom's mother was an active suffragist who worked to obtain for women the right to vote. Her father was a supporter of the women's suffrage movement and of coeducation. Ask, *How do you think this background contributed to Dr. Bascom's desire for an education and a career?* (Accept reasonable responses, such as that it gave her a desire for equality with men and the determination to use her intelligence and abilities to their fullest.)

- If necessary, provide help with the pronunciation of *geologist* (jee-OL-uh-jist).

  Students may be interested to know that one of the astronauts who walked on the moon, Harrison Schmitt, is a geologist. He collected moon rocks on the last *Apollo* mission to the moon in 1972.

Further Facts

- Florence Bascom was actually the second woman to earn a Ph.D. in geology. She received her degree in 1893. Mary Holmes was awarded a Ph.D. in geology in 1888.

- In college, Bascom had limited access to the library and gymnasium and was not allowed to take courses already filled with male students, who were given preference in registering for classes.

- Dr. Bascom was the first woman hired by the U.S. Geological Survey.

- Dr. Bascom founded the geology department of Bryn Mawr College in Pennsylvania; the department gained a national reputation under her leadership.

Did You Know? (page 15)

About Fossils

- Before students read, ask them whether they have ever seen fossils at a natural history museum, science store, or other place. Invite them to share what they know about fossils. If necessary, tell students that fossils are the preserved remains of living things from the ancient past. Point out that if students have ever seen a dinosaur skeleton or tracks, they have seen fossils.

- Then have students read page 15 to find out about fossils, look at the photographs, and read the captions. Ask, *What are the two main categories of fossils?* (trace fossils and body fossils) *What is the difference between these two types of fossil?* (Trace fossils are signs that an animal left behind, such as tracks or tooth marks. Body fossils are fossils made by the body of an animal or plant.) *What are the names of three kinds of body fossil?* (petrified fossils, mold fossils, cast fossils) *What is the difference between a mold fossil and a cast fossil?* (A mold fossil is a hollow space left behind in rock when the organism's body dissolves. A cast fossil is formed in a mold fossil when sediment seeps in, fills up the hollow space, and hardens.) Invite students to share their own experiences with making molds and casts.

- Engage students in a discussion of what scientists can learn from fossils. You may wish to share the information that scientists who study fossils are called *paleontologists,* from the Greek word *palaio,* meaning "ancient."

- If necessary, provide help with the pronunciation of *trilobite* (TRY-luh-bite).

Further Facts

- Eggs can be fossilized. In 1995 scientists discovered a fossil of a dinosaur named *Oviraptor* lying protectively over a nest of fossil eggs. The find changed scientists' views about dinosaurs as parents.

- Soft-tissue fossils are rare, since soft tissues such as internal organs usually decay quickly. In 2000, a fossil hunter found a fossilized dinosaur heart—a first! Even more remarkable, the heart had four chambers like hearts of warm-blooded animals, not the usual three chambers of cold-blooded reptiles.

AFTER READING

Summarize

Complete the KWL chart you began with students before reading by asking them to share the answers to their questions. Call on volunteers to retell each text section. Then have students use the information in the KWL chart to write brief summary statements.

Discuss with students how using the KWL strategy helped them understand and appreciate the book. Encourage them to share any other reading strategies that helped them understand what they read. Direct attention to the fourth column in the chart and ask, *What questions do you still have about rocks and minerals? What would you like to explore further?* Record students' responses. Then ask, *Where do you think you might be able to find this information?* (Students might mention an encyclopedia, science books, and the Internet.) Encourage students to conduct further research.

Review/Assess

Use the questions that follow as the basis for a discussion of the book or for a written or oral assessment.

1. What is the difference between rocks and minerals? How are they alike? (Rocks are a mixture of different minerals and other materials. Minerals have a certain chemical makeup and physical structure. Both rocks and minerals come from the Earth.)

2. What are the five main ways of telling minerals apart? (The five main ways are the way a mineral breaks—by cleavage or fracture—color, streak, luster, and hardness.) Which ways seem to be the most useful? Why? (Accept reasonable answers that students can explain. Students may mention streak and hardness. Streak is useful because a mineral's streak is always the same regardless of its color. Hardness is useful because different minerals have different degrees of hardness.)

3. What are the three main types of rocks? (igneous, sedimentary, and metamorphic) How are they formed? (Igneous rocks form from magma that changes into solid rock when it cools. Sedimentary rocks are formed from layers of tiny bits of matter called sediments. Metamorphic rocks are formed from other rocks by heat and pressure.)

4. Describe the rock cycle. (Weathering is constantly breaking down rocks into smaller rocks and sediments. At the same time, new rocks are being formed by heat and presuure and by melting and cooling.)

Writing Links/Critical Thinking

Present the following as writing assignments.

1. This book presents five properties of minerals that can be used to help identify them. Explain why it is necessary to use more than one of these properties to positively identify a mineral. (Students' answers should make the following points: Different minerals may break in the same way, so the way the mineral breaks is not sufficient to identify it. The same mineral may be found in different colors, so color is not always useful. A mineral's streak is always the same, but different minerals can leave the same color streak. Luster and hardness give clues, but different minerals can have the same luster or hardness. Therefore, a combination of several properties is necessary to positively identify a mineral.)

2. Florence Bascom spent her adult life studying rocks and minerals and educating other women geologists. What makes the study of rocks and minerals important? Explain the benefits for our everyday life of information gained by geologists. (Accept reasonable responses.)

Science Journals: You may wish to have students keep the writing activities related to the Delta Science Reader in their science journals.

References and Resources

For trade book suggestions and Internet sites, see the References and Resources section of this teacher's guide.