EVERY STONE HAS A STORY

CFE 3244V
OPEN-captioned
NATIONAL GEOGRAPHIC SOCIETY
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Grade Levels: 4-10
20 minutes
DESCRIPTION
Different landforms exhibit the three different kinds of rocks: sedimentary, pressed into layers beneath water; igneous, formed from volcanic action; and metamorphic, changed under heat and pressure. Rocks are made of minerals. Demonstrates the basic tests for rocks and discusses crystals. Learn not only what rocks are made of, but what we make of rocks.

INSTRUCTIONAL GOALS
- To describe the three classes of rocks: sedimentary, igneous, and metamorphic.
- To demonstrate the basic tests for minerals.
- To identify the parts of an atom.
- To demonstrate identification of minerals through use of the flame test.
- To list the six basic systems of crystals.

BEFORE SHOWING
1. Read the CAPTION SCRIPT to determine unfamiliar vocabulary and language concepts.
2. Make a time line to show how old the earth is. Explain that rocks provide valuable information about the earth in previous times.
3. Discuss the usefulness of biographies in explaining people's life stories.
   a. Explain that this video is like a biography of rocks.
   b. Show a picture of a diamond and try to determine its life story.
4. Introduce the term geology.

DURING SHOWING
1. View the video more than once, with one showing uninterrupted.
2. Pause at the scene showing the word Changeling. Explain its meaning.
3. Pause at the beginning of the section on minerals. Clarify the difference between rocks and minerals.

**AFTER SHOWING**

1. Obtain satellite pictures from textbooks showing landscape forms composed of different rocks. Discuss how the rock formations evolved.
2. Set up a chart on the computer.
   a. Label the columns as: *Name of rock, Class, Where found, Use, Illustration.*
   b. Obtain a list of various rocks and research to complete the chart.
3. Conduct a flame test of the following metals: barium, strontium, sodium, and copper. Discuss the flame test as a means of metal identification.
4. Conduct a lab experiment of the basic tests that help identify rocks and minerals. Record the findings on a computer-generated chart.
5. Research the manufacturing of fireworks.
6. Design a pie chart of the elements that make up the composition of the earth.
7. Obtain slides of thin sections of various rocks. Use a petrographic microscope to view them.
8. Write a life story of a given rock.
10. Research rock collecting. Include the following information:
    a. Types of tools
    b. Protective clothing
    c. Identification of specimens
    d. Methods of collecting specimens
    e. Methods of recording
    f. Methods of transporting specimens
    g. Storing the collection
11. Research marble and its use as a building material.
12. Report on rocks from the moon, from Mars, and from meteorites.
13. Friedrich Mohs devised a scale of mineral hardness that is still in use today. Use the Mohs Scale to determine hardness of various minerals.

14. Observe a rock collection in a store or museum.

15. Obtain fossil specimens or pictures of fossils. Determine in which kind of rocks fossils are found.

16. Design a poster illustrating careers in geology.

17. Obtain crystals or pictures of crystals. Classify them using the six basic systems.

18. Expand the list of common items and their mineral compositions from the end of the video.

**WEBSITE**

Explore the Internet to discover sites related to this topic. Check the CFV website for related information (http://www.cfv.org).
CAPTION SCRIPT

Following are the captions as they appear on the video. Teachers are encouraged to read the script prior to viewing the video for pertinent vocabulary, to discover language patterns within the captions, or to determine content for introduction or review. Enlarged copies may be given to students as a language exercise.

(male narrator)
These are
the spectacular rock formations
of the Colorado National Monument.
[tap, tap, tap, tap]
[tap, tap, tap]
My name is Rolf Johnson,
and whenever I get a chance
to do field work,
you'll find me out here,
collecting rocks.
What's so special
about rocks?
They're everywhere!
Anywhere on earth--
even on the ocean floor--
you'll find rocks.
They make up earth's crust.
There are
many kinds of rocks,
and each one has
a story to tell.
You observe rocks,
both in nature
and in the laboratory,
to determine which
of the three classes of rocks
you have.
What do you see?
Enormous, long streaks
of color,
as if someone had pressed
different layers of rock
on top of each other.
Each of those layers
has a story to tell.
This is sedimentary rock--
the first type of rock
we'll discuss.
One tale begins
with the rushing water
of a mighty river.
The time?
Many millions of years ago.
The water carries rocks
and other debris downstream,
sometimes
for hundreds of kilometers.
The river flows
into an ocean.
As the water slows,
it drops its cargo
of debris, sand, silt, and clay.
that we now call sediment.

It settles to the bottom of the sea and forms a thick layer.

Over thousands of years, more layers are deposited.

The upper layers of sediment squeeze the lower layers until they harden into rock.

Millions of years pass.

Slowly, the land rises, and the water drains away.

On this plateau, you might find a fossilized seashell from the ocean bottom, embedded in sedimentary rock—

an underwater souvenir from millions of years ago.

That's a typical story of sedimentary rock, which was pressed into layers beneath a body of water.

Here's a different kind of rock structure.

This is the core of a volcano.

Millions of years ago, it was part of a system of volcanoes.

Over time, most of the rock eroded.

All that's left is the hard volcanic core.

You have to wonder, what titanic force could be strong enough to melt solid rock?

Many meters beneath earth's crust, there are places where the temperature is so high that certain types of rock have melted.

Molten rock, called magma, rises up through the surface... then bursts forth in a volcanic eruption.

That molten rock-- now called lava-- pours out over the landscape.

Time passes.

Slowly, the lava hardens like candle wax.

Now it's called Igneous rock-- a result of the heat and pressure found beneath the earth's crust.

That's a typical story of igneous rock, which rose from beneath earth's crust.

We can learn about a third kind of rock by looking at these canyon walls.
Sometimes rocks change forms, like the metamorphosis of a butterfly. Many rocks here are 1.5 billion years old. They were sedimentary and igneous rocks. Millions of years ago, they were buried by volcanic ash and other sediment. As this ash piled, the temperature and pressure increased. Under these extreme conditions, chemical and physical changes occurred to the rocks—changes we call metamorphism. The contorted lines on this cliff wall are evidence of the extreme pressures these rocks have endured. Here, igneous rocks metamorphosed into gneiss and schist—two of the most common igneous-based metamorphic rocks. Unlike igneous rocks, these changes occurred while the rock was solid. Gneisses are formed by high temperatures and pressures—the result of deep burial. The minerals that existed at surface conditions are changed into minerals that could withstand the new environment. Schists are formed almost the same way. But schist contains more flat, sheetlike crystals. Something similar can happen to limestone. Under pressure, it becomes marble, which can be quarried out of the earth. Once this was limestone. Now it’s marble—a metamorphic rock. Cut into sheets or blocks, marble makes a handsome building material. It can take a high polish, which brings out beautiful patterns. Each streak and swirl in the marble is a souvenir of change—or metamorphosis—where one type of rock has been transformed into another. Once you’ve learned about the major classes of rocks—igneous, sedimentary, and metamorphic—you’re ready to learn
about minerals—what rocks are made of.
Minerals have many stories to tell. There are over 2,000 different kinds of minerals within the rocks of Planet Earth. And they take many, many different forms.
To learn about these minerals, to hear their stories, you must observe them very carefully, using all your senses.
There are basic tests that help us identify rocks and minerals.
First of all, what does it look like? Is it shiny, like this pyrite? Or is it dull, like this limonite? Serpentine is silky. Mica is pearly. And calcite is glassy. This is the luster test.
Next, how hard is it? Some minerals are soft, like this piece of gypsum. It can be scratched just by using your fingernail. Others, like this piece of feldspar, are hard enough to scratch a penny. And some are hard enough to scratch glass, like quartz.
How heavy is it? What is its specific gravity? This volcanic stone is very light for its size, while this ore mineral, galena, is very heavy. A streak test is a simple test that often helps to identify minerals. Most colored minerals leave a streak when rubbed on an unglazed porcelain tile. Using the color of a mineral streak for identification may be more accurate than using the color of the mineral itself. Many metallic ores, like this hematite, leave a streak that's colored differently from the rock. Some minerals don't look or feel unusual, but they have an odor.
If you break open a sulfide mineral, it smells like rotten eggs. Sometimes you can learn something by the way a mineral breaks.

Most rocks crumble into rough and uneven shapes. But this is obsidian. By applying pressure, obsidian will break into flakes that have a pattern like a shell. This telltale pattern helps identify this rock as obsidian. Now compare mica with calcite. They cleave differently. They both break into pieces with smooth surfaces, but the number and angles of the surfaces are very different. The way they break can tell you what mineral it is and how its atoms are arranged. Then there’s the acid test. Acid reacts strongly with things that have the opposite or a base pH.

Acid makes this carbonate fizz and bubble. These are a few tests that help you learn the stories that minerals have to tell. Now that you’ve learned about the minerals that make up rocks, you’re ready for a deeper level: the atoms that make up the minerals. Atoms are the basic building blocks of nature. They consist of protons and neutrons, together in a central area called a nucleus. Around the nucleus is a changing, strangely shaped area that contains electrons. You can detect atoms with simple equipment. All you need are some chemical samples... and a flame. Why a flame?

It can make the atoms in a mineral show their colors. Copper burns with a green flame. Lithium...
Barium has a yellow-green flame.

Strontium is orange.

And sodium burns with a bright yellow flame.

You can see the same phenomenon in the brilliant colors of fireworks.

You've seen a few ways that we can observe and identify rocks, minerals, and atoms.

Let's move to a subject that's as fascinating as it is beautiful—crystals.

A crystal's form reflects the structure of the very molecules of the mineral.

The study of how they are formed reveals mathematical relationships as amazing as the crystals themselves.

There are six basic systems of crystals:

- cubic...
- hexagonal...
- tetragonal...
- orthorhombic...
- monoclinic...
- and triclinic.

These few basic forms of crystals combine into many different and unusual forms.

Atoms, minerals, rocks.

What makes this subject so interesting is not just what rocks are made out of, but what we make out of them.

Because every stone tells a story, you can often hear those stories by paying attention to everyday things.

Consider the diamonds in this brooch. Diamonds are brilliant gemstones.

But they start out under the earth's surface. A lot of tonnage must be moved just to find one of them. Rare as they are, the carbon atoms they are made of are actually quite common.

Once in a great while, carbon atoms come together under heat and pressure
to form the diamonds' unique pattern.

The atomic pattern in a diamond is so structurally sound that it's three times harder than the next hardest material on earth.

There's another story about rocks right here, within the framework of this new shopping center.

It all started with igneous rock rich in the element iron.

But this rock didn't rise from beneath the earth.

It remained under the surface, cooling and solidifying into iron ore.

It was dug from the earth by miners.

The iron ore was collected into freight cars and transported to giant furnaces, where the ore was refined into steel.

Enormous machines formed the steel into long, sturdy beams.

Then the beams were assembled by construction workers.

In this way, rocks from the earth were transformed into the skeleton of a skyscraper.

We have time for just one more story.

Much of what we know about dinosaurs we've learned by observing and studying rocks and minerals.

It starts many millions of years ago.

From sickness or a battle or simply from old age, the dinosaur dies.

Its bones settle into the mud.

Very slowly, over millions of years, dissolved minerals interact with the bones, displacing the living material that once was there, one atom at a time.

The result, made of rock, is a fossil--an exact impression of these long-lost bones.

From those rocks now rises the long-forgotten figure of a prehistoric creature.

There are plenty more stories.

Just keep your eyes open.

You'll see rocks and minerals everywhere--
in skateboards...
sidewalks...
and cars...
even in something as simple as toothpaste.

We wouldn't have toothpaste without the minerals...
Many of the things that we make or use or touch or even eat are made from rocks and minerals.

All you have to do is observe them—
with your eyes and all your senses.

Collect rocks for yourself.

Read books about rocks.
Visit rock collections in stores and in museums.
See how many rocks you can find.
how many stories you can hear—
stories about Planet Earth,
about the materials that it's made of,
and how they've changed over millions of years.

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