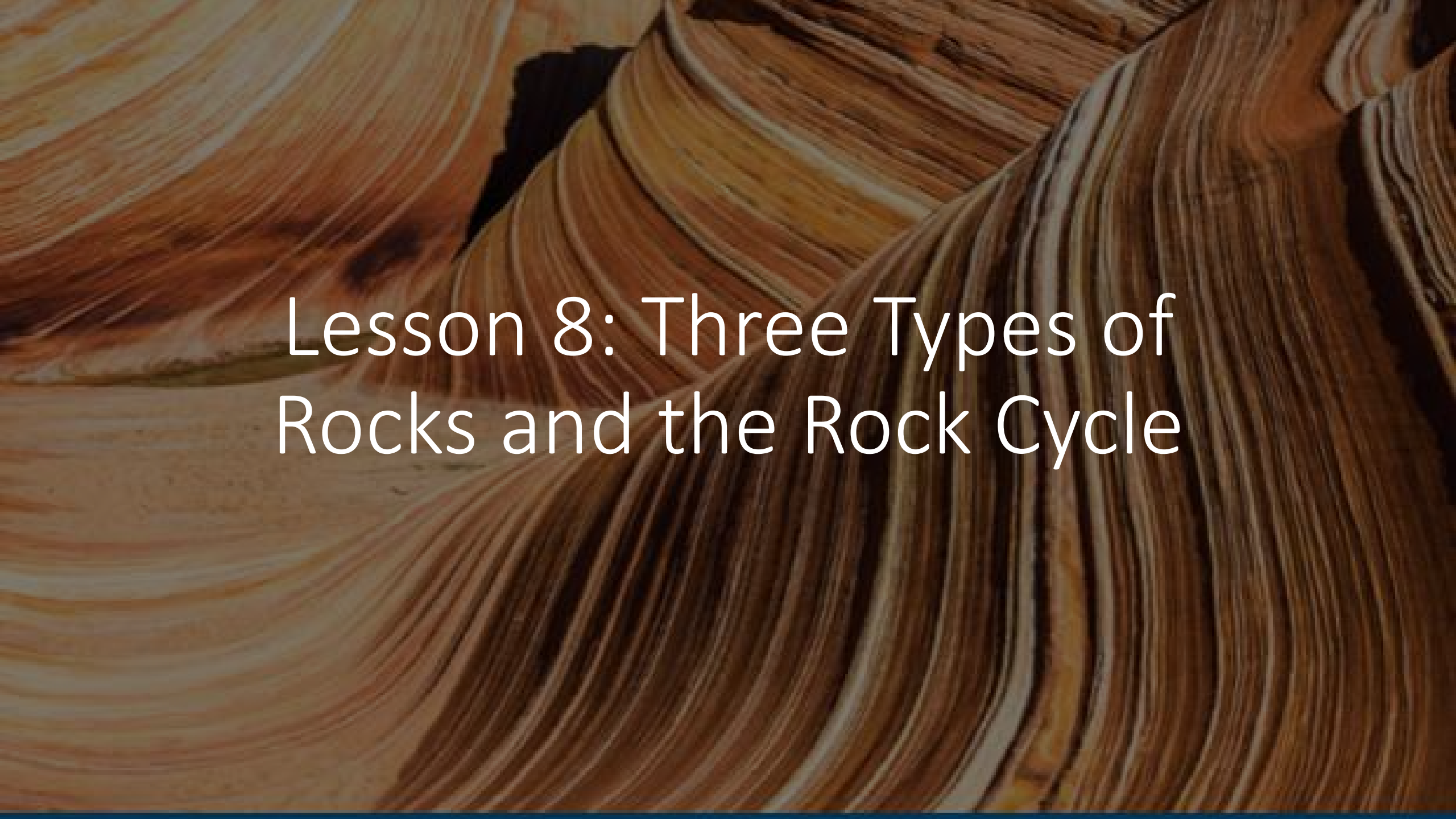


Lesson 8: Three Types of Rocks and the Rock Cycle

Vocabulary – 8.1

mineral, *n.* a solid, nonliving substance found in the earth that makes up rocks (**minerals**) (53)

Texture

Solidify

Obsidian

Granite

Durable

Compact

Dissolved

Word(s) from the Chapter	Pronunciation	Page
gneiss	/nis/	58
Agnes Nyanhongo	/ag*nes/ /nie*an*hong*goe/	59
Zimbabwe	/zim*bob*wae/	59

Chapter 6: Earth's Building Blocks

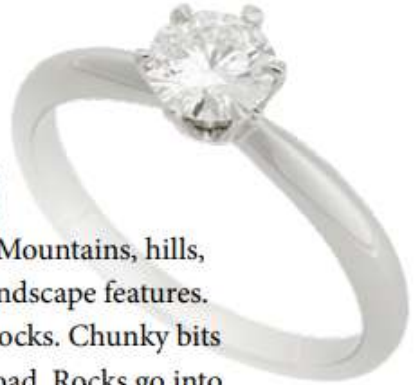
THE BIG QUESTION

How can changes in rocks over time be explained by the rock cycle?

Chapter 6

Earth's Building Blocks

THE BIG QUESTION
How can changes in rocks over time be explained by the rock cycle?



You don't have to look hard to find rocks. They are all around you—and under you, too! Earth's crust is made almost entirely of rocks. Mountains, hills, and cliffs are huge masses of rock that form landscape features. Pebbles in a streambed are smooth, rounded rocks. Chunky bits of broken rock form the gravel on a country road. Rocks go into making sidewalks and streets. Slabs of rock cover the outside of many buildings. Indoors, pieces of rock often make up floors, walls, stairs, and countertops. Museums are good places to see rocks that artists have carved into sculptures. The polished stones in some types of jewelry are rocks that people wear.

Rocks are all around. Some are carved into sculptures, others are used for jewelry.

All the varieties of rocks can be organized into three classes.

Rocks and Building Blocks

Just what are rocks, exactly? Rocks are naturally occurring materials made of solid, nonliving substances called **minerals**. Think of minerals as the building blocks of rocks. Some rocks are formed from just one mineral. Most rocks, however, are combinations of two or more minerals. Minerals appear as different-sized pieces, or grains, in rocks. Some rocks have very tiny mineral grains, giving the rocks a smooth, even **texture**. Other rocks have larger mineral grains and a rougher texture.

Imagine hiking up a mountain and picking up rocks along the way. When you reach the top, you'll probably have quite a collection. Your rocks may have different colors and textures. Some may have stripes or layers. Some might be hard and others crumbly. Some have tiny grains whereas others have large grains that glitter when they catch the light. All this variety might seem confusing. Yet geologists organize all rocks into just three classes, or basic types: igneous, sedimentary, and metamorphic.

Born from Magma: Igneous Rock

Let's start with **igneous rocks**, the most abundant class of rocks on the earth. Igneous rocks form when magma cools and **solidifies**. When you think of igneous rocks, think of volcanoes.

There are two basic types of igneous rock. One type forms from magma that erupts onto Earth's surface as lava. The lava cools and hardens into rock. The faster it cools, the smaller the mineral grains will be in the resulting rock. **Obsidian** is an igneous rock formed from lava that cooled very quickly, so quickly, there wasn't time for the minerals to form grains. As a result, obsidian is as smooth and shiny as glass. In fact, it is often called volcanic glass. Basalt is an igneous rock formed from lava that took longer to cool. Basalt is typically a dark-colored rock. It has fairly small mineral grains that give it a fine-grained texture.

The second type of igneous rock forms from magma that solidifies below Earth's surface. Magma cools very slowly when it's deep beneath the surface. Slow cooling leads to igneous rocks with relatively large mineral grains. The slower the cooling, the larger the grains. **Granite** is a common igneous rock that forms from magma that cooled within Earth's crust. Granite usually contains mineral grains that are large enough to see with the naked eye.

Igneous rocks

The Art of Making Stone Tools

Many prehistoric cultures made tools out of rock. Scientists working in East Africa have found obsidian stone tools that are nearly two million years old. Obsidian was especially prized by ancient tool makers. Obsidian breaks into pieces with sharp edges that are good for cutting and piercing.

To make a very sharp cutting tool, ancient tool makers struck a block of obsidian with another, harder rock. This caused a long, thin blade of obsidian to flake off. Although the blade was fragile, it had incredibly sharp edges. In fact, the edges of obsidian blades are much sharper than metal scalpels used by surgeons today.

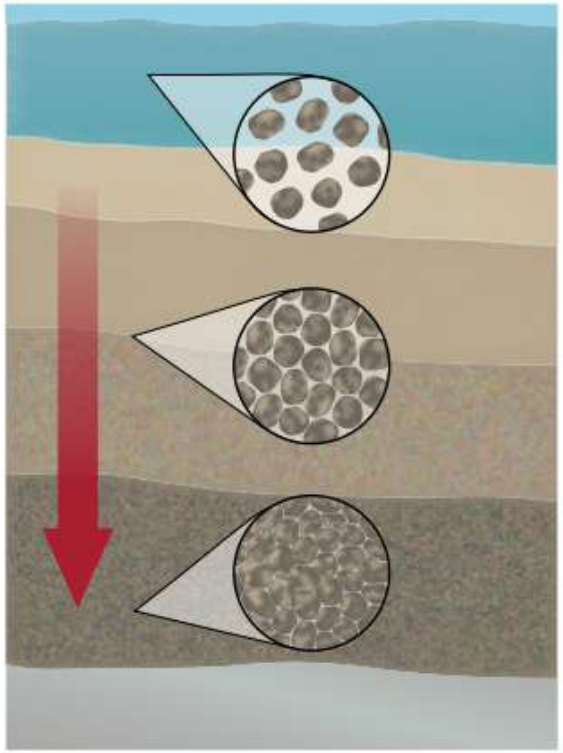
Spear tip

Making a spear tip or arrowhead was more time consuming. The tool makers started with a relatively flat piece of obsidian. They shaped it by striking off tiny flakes of rock, one after another, from the edges. They gradually shaped it into a sharp, **durable**—and often beautiful—pointed tool.

Arrowheads

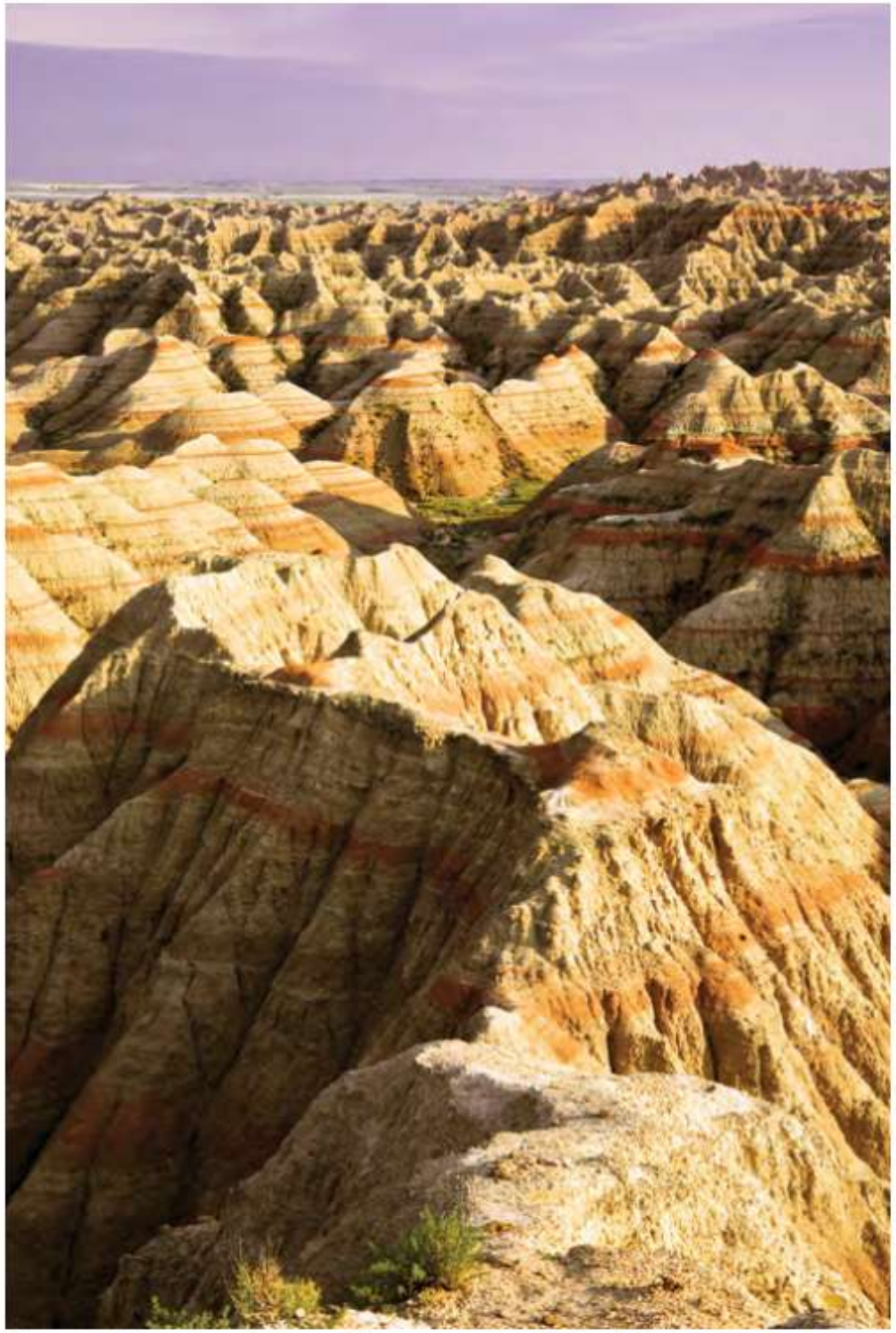
Layer after Layer: Sedimentary Rock

Sedimentary rock is the second major class of rocks. Sedimentary rocks are made of sediments. Sediments are tiny bits of rock and sand combined with fragments of once-living things. Sediments collect in low-lying areas both on land and in bodies of water. They form layers, one on top of another. Over long periods of time, the weight of overlying layers **compacts** the sediments in deeper layers, squeezing them closer together. Sediments also become cemented, or glued, together as **dissolved** minerals fill the spaces between the sediments. As the sediments dry, the dissolved minerals turn into solids, binding the sediments together. Over time, compacting and cementing processes transform sediments into sedimentary rock.



The weight of overlying layers compacts the sediments, squeezing them closer together.

Most sedimentary rocks are more easily broken than most igneous rocks. Hit a sedimentary rock with a hammer, and it will crumble or break apart. Some sedimentary rocks contain fossils. **Limestone** is a sedimentary rock often packed with the fossilized skeletons and shells of tiny ocean creatures. Some sedimentary rocks get their name from their sediments. Sandstone started as grains of sand, whereas mudstone formed from ancient mud.



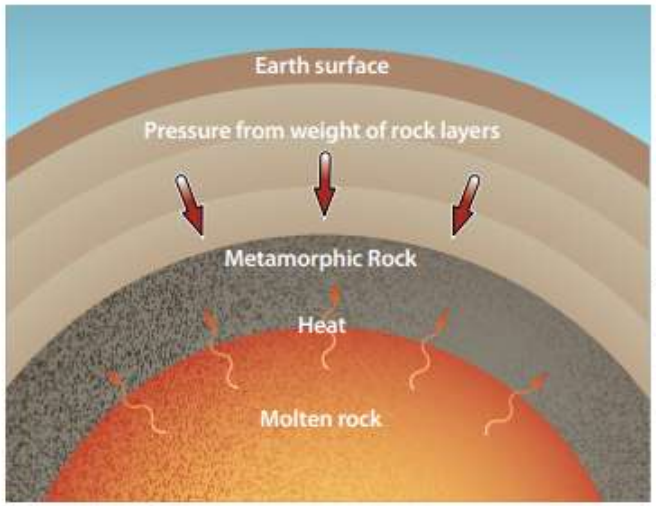
The eroded formations of these sedimentary rocks in Badlands National Park in South Dakota show their distinct layers. The oldest layers are at the bottom.

Changing Form: Metamorphic Rock

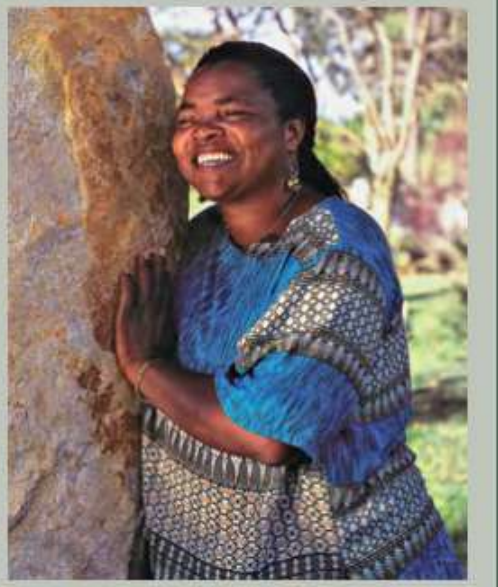
The third major class of rocks is **metamorphic rock**. Metamorphic rocks form when igneous or sedimentary rocks are exposed to extreme heat and pressure. They can even form from older metamorphic rocks. High temperatures and crushing pressure alter the minerals in the rocks. Mineral grains may be flattened or rearranged into layers, swirls, or stripes. They may also be changed into completely different minerals!

Remember granite, the igneous rock? When granite is subjected to intense heat and pressure, it becomes a metamorphic rock called gneiss. When the sedimentary rock limestone is squeezed and heated deep below ground, it becomes a metamorphic rock called marble.

Metamorphic rocks tend to form deep within Earth's crust. The pressure from countless tons of overlying rock is tremendous. Equally powerful is the heat rising from hot magma in the mantle beneath the crust. Metamorphic rocks often form where tectonic plates are slowly colliding. They can also form as magma travels up through cracks in Earth's crust and heats the rocks around the cracks. If the heat of the magma completely melts the rock again, then it becomes igneous rock. If the rock is heated just enough to be changed, however, it instead becomes metamorphic rock.



Agnes Nyanhongo's Stone Sculptures



Agnes Nyanhongo

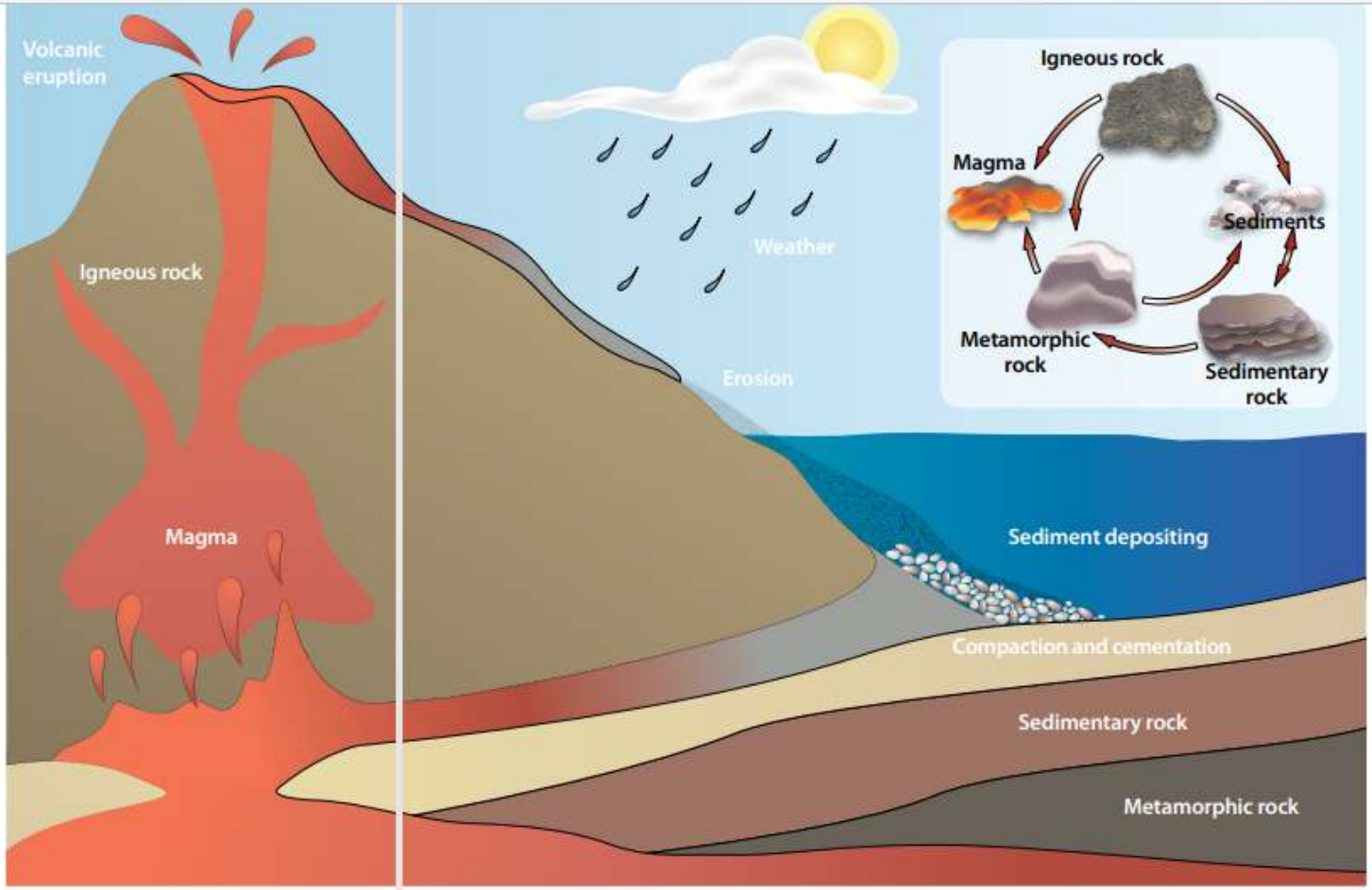
Zimbabwean sculptor Agnes Nyanhongo became interested in carving rock at an early age. Her father, Claud Nyanhongo, was a sculptor. She worked in his studio as a young girl and learned how to cut and polish rock. She is now one of Zimbabwe's most well-known artists. Agnes Nyanhongo carves many of her sculptures from a type of rock called serpentine. Serpentine is a metamorphic rock. The type of serpentine Agnes Nyanhongo uses for many of her sculptures is very dark in color. She usually polishes only some parts of her sculptures, leaving the rest simply raw stone.

Sculptures carved from serpentine

The Rock Cycle

Rocks you see in the world around you might seem like permanent fixtures. Given enough time, however, all rocks change. They are created, destroyed, and recreated in a continuous cycle. Geologists call this ongoing process the **rock cycle**.

The rock cycle has no starting or ending point. You can jump in anywhere to see how it works. Let's begin with magma erupting from a towering volcano. The magma (now lava) cools and hardens into igneous rock. Over the course of thousands of years, sun, wind, rain, and freezing temperatures cause the rock to **weather**, or break down into smaller pieces. The pieces continue to weather, slowly breaking down into sediments. Howling winds, flowing water, and gravity gradually move the sediments down the sides of the volcano and beyond. Movement of sediments from place to place is called **erosion**.



Imagine that the sediments end up in a lake, where they settle to the bottom. Over long periods of time, more layers of sediments are deposited on top of them. Compacting and cementing processes eventually turn the deeply buried sediments into sedimentary rock.

Now imagine that the sedimentary rock is near the edge of a tectonic plate. The plate collides with another plate—very slowly, of course. Tremendous heat and pressure generated by the collision gradually turn the sedimentary rock into metamorphic rock. As the plates continue colliding, their rocky edges crumple. The metamorphic rock is slowly pushed up higher onto Earth's surface. Think mountains! Exposed to air, rain, and snow, the rock begins to weather and erode.

Alternatively, one tectonic plate might be sliding beneath another. The metamorphic rock along the edge of the descending plate gets hotter and hotter as it nears the mantle. At some point it melts into magma—magma that someday might erupt from a volcano again.

Understanding how rocks change helps geologists understand how Earth has changed over time.

Activity Page 8.2

Earth's Building Blocks

Answer each question thoughtfully, citing the page number(s) where you found evidence for each question. Answer in complete sentences and restate the question in your answer whenever possible.

1. How might rocks differ from each other?

Page(s) _____

2. How does igneous rock form?

Page(s) _____

Activity Page 8.2

3. Which statement distinguishes between the two basic types of igneous rock?

   A. Two igneous rocks are granite and basalt.

   B. Different rocks have different size grains and different textures.

   C. One type forms on Earth's surface and the other forms below Earth's surface.

   D. The slower the rock cools and hardens, the larger its mineral grains will be.

   Page(s) _____

4. How does a sedimentary rock form?

   _____

   _____

   _____

   _____

   Page(s) _____

5. How does metamorphic rock form?

   _____

   _____

   _____

   _____

   Page(s) _____

Activity Page 8.2

6. What is the rock cycle?
   A. the continuous process of volcanoes erupting
   B. the continuous process of change in which rocks are created, destroyed, and recreated
   C. the continuous process of sedimentary rock changing to become igneous rock
   D. the continuous process of mineral grains making rocks smooth and shiny

   Page(s) _____

Complete the following items after you have finished reading the chapter. Match the following words with the correct definitions and examples. You may use some words more than once. Try to think of the answer to each item first from memory and then check back in the text to verify your answer before filling in the blank.

minerals	limestone	erosion
sedimentary rock	igneous rock	metamorphic rock

7. **Word**: _____
   Definition: any process or force that moves sediments to new locations

   Page(s) _____

8. **Word**: _____
   Definition: a rock that forms when magma cools and solidifies; the most abundant class of rocks

   Page(s) _____

9. **Word**: _____
   Definition: the building blocks of rocks that consist of solid, nonliving substances

   Page(s) _____

Activity Page 8.2

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   Page(s) _____

Activity Page 8.2

10. **Word**: _____
Definition: a type of sedimentary rock that often has many fossils and shells of tiny ocean creatures

Page(s) _____

11. **Word**: _____
Definition: a type of rock that forms when either igneous or sedimentary rock is changed due to extreme heat and pressure

Page(s) _____

12. **Word**: _____
Definition: a type of rock made of tiny bits of rock and sand mixed with small pieces of things that were once alive

Page(s) _____

13. **Word**: _____
Examples: basalt, granite, and obsidian are examples of this class of rock

Page(s) _____

14. **Word**: _____
Examples: serpentine, marble, and gneiss are examples of this class of rock

Page(s) _____

15. **Word**: _____
Examples: sandstone, limestone, and mudstone are examples of this class of rock

Page(s) _____

Lesson Wrap-Up

- How can changes in rocks over time be explained by the rock cycle?

Word Work: Class

- Yet geologists organize all rocks into just three classes, or basic types: igneous, sedimentary, and metamorphic.
- Definition
- You need a special license to drive vehicles in certain classes, such as a tractor trailer.
- Examples
- Part of speech
- Synonyms

Wiki Entry

*An online resource

*Provides information on many different topics or subjects

*Wiki is derived from a Hawaiian word meaning “quick” or “fast”

**What are some advantages of a wiki?

Wiki Entry

*Title and Headings – usually bolded

*Accurate information related to topic – usually in a list with numbers or bullets

*Final statement

*Reference – where you found your information

*Sentences are in logical order

*Paraphrased – in your own words

Wiki Entry Sample on "Volcano"

Volcano

Description

A volcano is a hill or mountain that forms over a crack in Earth's crust from which lava erupts.

Location

Volcanoes occur all over the world, particularly along tectonic plate boundaries and above hotspots.

Types of Volcanoes

There are three types of volcanoes:

- active
- dormant
- extinct

An active volcano has erupted in the past 10,000 years and is likely to erupt again. A dormant volcano is considered active but has not erupted for a very long time—several hundred years, for example. An extinct volcano has not erupted for at least 10,000 years. An extinct volcano no longer has a chamber full of magma beneath it, so it is not expected to erupt again.

Additional Information

Volcanoes can be creative forces. They can add new land to our planet and bring minerals from deep inside the earth to the surface. Volcanoes can also be dangerous and destructive. They can fill the air with poisonous gases and hot ash. They can also release rivers of lava that destroy everything in their path. Volcanoes can add things to Earth's surface but can also destroy things on Earth's surface.

References

The Changing Earth (2014)

Wiki Entry – Your Turn!

- Pick a volcano from “The Changing Earth” – either Tambora or Mauna Loa
    - Tambora Video
    - Mauna Loa Video
- Reread the page about your volcano
    - Tambora on page 33
    - Mauna Loa page 36
- Using your reader and a website, take notes on 8.3 about the volcano you picked
    - Remember to paraphrase!
    - Make sure to record your website as a reference!

Wiki Entry

Wiki Entry Rubric

	Exemplary	Strong	Developing	Beginning
Introduction	Initial section(s) provide accurate, general information related to location and type of volcano	Initial section(s) provide accurate information related to either location or type of volcano, but not both	Initial section(s) provide information loosely related to location and/or type of volcano	Initial section(s) lack information related to location and type of volcano
Body	Additional sections provide increasingly specific information about the volcano	Additional sections provide more information about the volcano	Additional sections provide some information about the volcano	Additional sections provide little to no information about the volcano
Conclusion	A final statement provides a thought-provoking summative or closing reflection about the volcano	A final statement provides a summative or closing reflection about the volcano	The summative or closing nature of the final statement is unclear	No final statement is provided
Structure of the Piece	All sentences in sections are presented logically	Most sentences in sections are presented logically	Some sentences in sections are presented logically	Connections between sentences in sections are confusing
	All information has been paraphrased	Most information has been paraphrased	Some information has been paraphrased	Little information has been paraphrased

Wiki Entry

Wiki Entry Editing Checklist

Wiki Entry Editing Checklist	After checking for each type of edit, place a check here.
Meaning	
All my sentences have a subject and predicate.	
I included all the words I wanted to write.	
I took out repeated words or information.	
I have checked how long my sentences are and split run-on sentences into two.	
I have used nouns and adjectives correctly.	
Format	
The volcano name is the title at the top.	
Each section of the entry has a heading.	
Indenting is not used.	
If lists are included, they are bulleted or numbered.	
There is a reference list at the end in the appropriate format.	
Capitals	
I began each sentence with a capital letter.	
I used capital letters for all proper nouns.	
I used capital letters for all words in titles or headings.	
Spelling	
I have checked the spelling for any words I was unsure of or my teacher marked.	
Punctuation	
I read my writing piece aloud to check for commas at pauses and periods, question marks, and exclamation points at the ends of my sentences.	
I used commas and quotation marks in places where they belong.	
The titles in my reference list are underlined or in italics.	

Wiki Entry
Activity Page 8.3

Take Notes on a Volcano

Take Notes on a Volcano	
Name of the Volcano	
Location of the Volcano	
Type of Volcano; Date of Last Eruption	
Description of Volcano or of Last Eruption	
Other Facts	

References for Volcano Wiki Entry		
Title	Date	Source (Book or Web Address)

Wiki Entry

*You can use the template on TEAMS or create your own Wiki using PowerPoint!

*Remember to make the headings **BOLDED**

*Use a *list* format for the section **Other Facts**

*Include your **References**

*Add a picture, but put the source in your references!