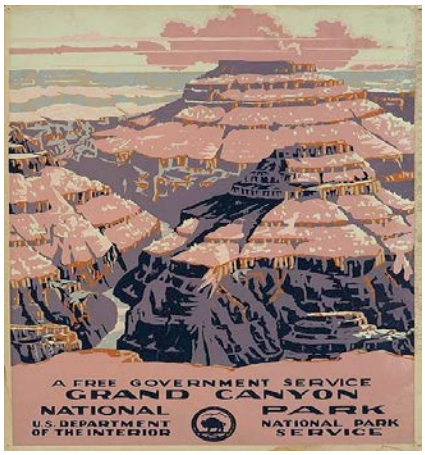
Water: A Give and Take



In the year 2000, miners working with the Industrias Peñoles mining company in Mexico made a startling discovery, deep within the earth. Peñoles had been working the Naica Mine for many, many years by then. Its deposits of silver, zinc and especially lead were extremely plentiful and valuable. The company wanted to find new mineral-rich areas around the mine and sent its staff to explore.

A group of them were attempting to drill through some rock when they ventured into a cavern the company had drained of water in 1975, but had never fully explored. What they found there, 1000 feet below the surface of the earth, has consumed scientists of many varieties ever since.

The horseshoe-shaped cave was full of gigantic crystals. Those give the cave its current name: The Cave of Crystals. They shot from floor to ceiling in thick, gleaming shafts, passing each other at crazy angles. It was like being inside a magician's box after he has stabbed it with a dozen swords. A recent photograph shows four men in orange suits picking their way across the giant formations. One man stands on a large crystal growing horizontally several feet off of the ground. He bends down to grab the hand of a man standing below, who has his arms stretched high over his head and still does not reach the crystal. The crystal formations make the cavern's floor look as if it were covered in ice, and the ceiling's mix of rock and crystal makes it look like diamonds tossed into a chocolate cake.

These crystals grew—and grew so large—because of some very special interactions between water and heat. The Cave of Crystals sits on top of a large deposit of magma, or super-heated liquid rock. Until it was drained in the 1970s, it was also full of water, rich with the kinds of minerals needed to form crystals. This water was kept at the same very high temperature (roughly 129 degrees Fahrenheit, scientists estimate) for hundreds of thousands of years by

the magma. It was like a pot of rice, tightly covered and simmering away for much longer than human beings have been alive on earth. Scientists recently discovered that the cave's crystals grow at one of the slowest rates ever recorded, adding only something like the width of a hair every 100 years. The largest crystals there, at over 36 feet tall, 13 feet wide, and weighing 55 tons, are estimated to have taken as long as one million years to form.

The crystals were formed underwater, and scientists are trying to explore the cave as fully as possible. This is more difficult than you might imagine. Since being drained of water, the cave's temperature has risen. It now sits at a constant 150 degrees Fahrenheit. The humidity hovers around 99 percent. These are punishing conditions and limit the amount of time researchers can work there. A team led by an Italian scientist named Paolo Forti designed a special suit for people to wear while working in the cave. It contains 44 pounds of ice, which cool the water that circulates around the wearer's body in tubes to keep him or her cool. Even with this technology, people can only stay in the cave around 30 minutes before the heat becomes overwhelming, and they have to leave.

These crystals are just one particularly dramatic example of the ways that water shapes the world around it. From valleys and mountains to fields, lakes and swamps, features of your everyday landscape shaped by the action of water are everywhere.

The Cave of Crystals is an example of water creating something beautiful in the world. More often, water takes away from the landscapes that surround it. Powerful rivers run through a flat plain and leach away the dirt and rock around themselves, slowly carving deep niches in the earth that become canyons. This process is known as erosion. Erosion is simply when soil is transported on the earth's surface from one location to another by a natural cause.

This is easy to imagine. Picture a sandcastle on a beach. This sand castle is particularly beautiful, the work of a whole long, hot summer afternoon. It has three towers, with a great wall running all around. Small square houses sit in an open area in the center. From the tallest tower flies a Popsicle-wrapper flag from a small twig flagpole. Its builder sits back, proudly admiring her work. But it is late, and the tide is coming in, bringing the water closer. Finally, the castle is hit with a giant wave. As it pulls out, the builder sees there is nothing left but the nubs of the towers and a small broken twig. Where has the sand gone? Not very far, really. It's churning around the water that will wash back and forth across the beach all day. It's spread around the beach next to the castle. However, to our eyes, it has vanished. This is also the way with erosion. Parts of the earth seem to vanish but have really just been moved around.

One of the most famous examples of this process is the Grand Canyon. Located in Arizona, in the United States, it's widely acknowledged to be one of the natural wonders of the world. This is not surprising. Running for over 227 miles, it is 18 miles wide and a mile deep at its various points. The canyon is a startling and breathtaking reminder of the age of the earth and the inevitability of natural processes. The canyon shows a record of history by exposing layers upon layers of rock, dirt and organic matter. The top is the newest layer. If you were to tie a rope to the top and gradually lower yourself to the bottom, upon reaching the bottom you would have seen over two billion years of the earth's history play out in front of you, in neat segments like a layer cake.

This immense and beautiful thing was created by water. The Colorado River, scientists believe, has run in the same spot for at least 17 million years. Over that time, it has been ripping apart the land it runs across, slowly wearing a hole in the ground. This action has been helped by the fact that the part of the earth's surface where is it is located—the Colorado Plateau—has been slowly pushed up for much of that time. The result is one of the deepest cuts in the earth.

Another much more common example of water changing the landscape is sinkholes. Sinkholes are formed when underground water wears away the dirt and rock that surrounds it. Eventually, the hole underneath the ground is so big, and the earth above it so thin, the surface collapses into the hole, taking with it anything unlucky enough to be on the surface at the time. Sinkholes occur naturally and have been around a very long time. Today, though, many sinkholes are caused by the action of human beings.

In fact, today, human beings are one of the things helping to speed up erosion of the earth. Scientists believe that by pumping water from underground, moving sand dunes and other naturally-occurring anti-erosion measures, humans have allowed erosion of the earth to speed up by as much as 40 times. This means that beaches around the world are disappearing, more sinkholes are opening up, and farmland is rapidly becoming desert.

There are, of course, many things people can do to respect the earth and help slow erosion. These largely boil down to respecting natural processes: replanting trees and other vegetation, planting crops in such a way that the soil is naturally replenished between harvests, and more. This way of thinking is catching on. It was recently announced that geologists would re-flood the Cave of Crystals with water to help preserve its unique crystal towers. This should ensure their survival for another million years.

Name: _____ Date: _____

1. What is the Cave of Crystals?

A a river that has been flowing along the same path for 17 million years
B a hole underneath the ground whose surface will eventually collapse
C an underground space full of large crystals in Mexico
D a mining company in Mexico seeking new mineral-rich areas

2. The creation of sinkholes is an effect mentioned in this passage. What is the cause?

A water
B heat
C crystal
D sand

3. Water shapes the world around it in a variety of ways.

What evidence from the passage supports this statement?

A There are many things people can do to take care of the earth and help slow erosion.
B Heat played a role in the formation and growth of the crystals in the Cave of Crystals.
C Water can move soil from one place to another and carve canyons into the earth.
D Industrias Peñoles drained water out of a cavern in 1975 but did not fully explore the cavern at the time.

4. What do the Cave of Crystals and the Grand Canyon have in common?

A Both were caused by erosion.
B Both were formed by water.
C Both were formed in fewer than 100 years.
D Both are likely to disappear within the next 100 years.

5. What is this passage mostly about?

A the effects of water on the land around it
B what people can do to slow down erosion
C the history and importance of the Colorado River
D the Industrias Peñoles mining company

6. Read the following sentences: "Sinkholes are **formed** when underground water wears away the dirt and rock that surrounds it. Eventually, the hole underneath the ground is so big, and the earth above it so thin, the surface collapses into the hole, taking with it anything unlucky enough to be on the surface at the time."

What does the word **formed** mean above?

A used for food
B heated up
C made or created
D harmed or injured

7. Choose the answer that best completes the sentence below.

Water helps form canyons, sinkholes, fields, and swamps; _____, water helps form much of the land around it.

A but
B third
C as an illustration
D in summary

8. What is erosion?

_____

_____

_____

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9. What has happened as a result of humans speeding up the process of erosion?

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10. The passage discusses several effects water has on the land around it. Which of the effects mentioned has the biggest impact on people? Support your answer with evidence from the passage.

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Teacher Guide & Answers

Passage Reading Level: Lexile 1050

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- **D** sand

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What evidence from the passage supports this statement?

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- **B** Heat played a role in the formation and growth of the crystals in the Cave of Crystals.
- **C** **Water can move soil from one place to another and carve canyons into the earth.**
- **D** Industrias Peñoles drained water out of a cavern in 1975 but did not fully explore the cavern at the time.

4. What do the Cave of Crystals and the Grand Canyon have in common?

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8. What is erosion?

Suggested answer: Answers may vary but should all reflect the passage's definition of erosion as the transportation of soil from one location to another on the earth's surface by a natural cause.

9. What has happened as a result of humans speeding up the process of erosion?

Suggested answer: Students should provide at least one of the following responses: beaches are disappearing, more sinkholes are opening up, and/or farmland is rapidly becoming desert.

10. The passage discusses several effects water has on the land around it. Which of the effects mentioned has the biggest impact on people? Support your answer with evidence from the passage.

Suggested answer: Answers may vary, as long as they are supported by the passage. For example, students may respond that, of the various effects of water mentioned in the passage, erosion has the biggest impact on people. Whereas the gradual formation of crystals and canyons do not have much effect on human life, the disappearance of beaches (places people visit and live) as well as the drying up of farmland have a direct negative impact on many people.