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Water Erosion: A Powerful Motion

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Water Erosion: A Powerful Motion

By Renee Heiss

There are lots of things that can move mountains--faith according to many religions, love according to Celine Dion, and hope according to the ant that also wanted to move a rubber tree. However, there are several natural ways to move mountains--earthquakes, volcanoes, and the subject of this article--water **erosion**.

(See picture, "Water **Erosion**: Effects.")

Water Erosion: Effects

You may think that when rain falls on a mountain, it pours off the sides, then fills the streams and rivers. While this is true, every bit of rain and snow that drains from a mountain takes with it some of the loose rocks and soil. Eventually, millions of years later, the highest mountains will be reduced to the well-known molehills.

Water **erosion** also occurs on flat areas. Farms, unpaved roads, and even your own backyard can be eroded by water. Floods erode the land surrounding a river. Heavy rains have caused some of the most devastating forms of **erosion** called mudslides. Glaciers, as frozen water, erode the land more slowly, but move the bits of rock farther. Water **erosion** carved the Grand Canyon and is constantly changing our coastline. It is a powerful force.

To Move Mountains

Look at any rock. It may seem smooth and impenetrable, but look more closely, perhaps with a magnifying glass. No rock is ever entirely solid. It is made up of tiny pockets of air that were trapped when the rock was formed. When rain falls on a mountain, it does two things. It runs down the mountain and it gets trapped in those rocky air pockets. If the weather turns cold, then the rainwater freezes in the rocks.

Unlike most other substances that contract when they freeze, water expands when it freezes. This characteristic of water is what causes the larger pieces of rock to break up into smaller pieces. If the water has gotten deep into the rock, then freezes, it will expand. With nowhere to go, the water will push against the sides of the rock until it cracks. Where there was once one large rock, there are now several smaller rocks. The process repeats itself until the rock pieces get smaller and smaller.

Eventually, the rainwater carries the smaller rock pieces along as it pours down the mountain. These smaller rocks, now the size of pebbles, form the base of the streams at the bottom of the mountain. The height of the mountain decreases as the depth of the pebbles in the stream below

increases. All this happens because little drops of water fall on a huge mountain. However, this process takes millions of years to significantly change the geography around a mountain.

Sometimes softer rock is surrounded by more solid rock. Water **erosion** will wear away at the softer rock first, carving interesting features into the mountain. Camel Rock in Santa Fe, New Mexico is one example of this phenomenon. The softer rock eroded away below the camel's head, which is formed from a harder rock. Shiprock peak is another example. It is also in New Mexico. This formation was actually created forty million years ago when a volcano erupted. The lava core became solid rock, but the looser rock outside washed away. All that remains is the inside of an ancient volcano.

Rainwater has become more acidic over the years. What causes acid rain? When fossil fuels, such as oil and coal, are burned in cars and power plants, they release exhaust. There is sulfur in the exhaust that combines with elements in the air to make sulfuric acid. This sulfuric acid comes back down to earth when it rains.

Acid rain erodes man-made structures as well as natural formations. In Europe, the buildings are older than they are in the United States. There, acid rain is destroying the buildings and monuments at an alarming rate. The great Sphinx and pyramids in Egypt have been affected by acid rain **erosion** for many years. Since they were made from limestone, they are slowly becoming smaller as a result of acid rain.

Our Changing Geography

In the late 1800s, the city planners for Longport, New Jersey mapped out the streets from First Avenue to Thirty-sixth Avenue. Longport is located on the same barrier island as Atlantic City. Today, the southern end of Longport begins with Eleventh Avenue. What happened to First through Tenth Avenues? During the early part of the twentieth century, the ocean currents began to erode and thin the end of the island. Then, waves from a spring storm broke through, connecting the bay with the ocean. This left a small island separated from the larger island. Eventually, that small island surrendered to the force of the waves and disappeared entirely. Who knows how many more streets the force of the ocean will claim in the next hundred years!

When you study geography, you learn about the oceans, rivers and lands. However, your ancient ancestors would have seen a different map because **erosion** is constantly changing the geography. Your descendants will also see a different map as water **erosion** continues to re-arrange the land.

All over the world, beachfront resort communities deal with the **erosion** of the sandy shores. As each wave breaks on the shore, the sand is pulled back from the shoreline and into the vast ocean. This causes a higher sea level and the shoreline marches farther inland. It is a never-ending cycle. To prevent further **erosion**, residents use three ways to protect the beaches:

1. Some build seawalls. They dump rocks on the beach to form a protective barrier between the ocean and the sand. The Dutch have been using this concept for hundreds of years. Their dikes have kept Holland from disappearing into the North Atlantic Ocean.

2. Other residents reinforce the dunes. They plant dune grass that holds the sand firmly in its roots. Grasses are also planted in other areas that may be affected by water **erosion**, such as hillsides and riverbanks.

3. When all else fails, the residents bring sand from elsewhere and build up the beach. Sand is trucked from inland areas. Another way to bring sand onto the beach is to pump it back up from the ocean bed. To do this, a boat sits offshore and runs a hose down to the bottom of the ocean. A pump sends the sand up to the shore. This method is very expensive.

Flood plain **erosion** is similar to ocean **erosion**. From the action of the constantly moving river or stream, the soil at the edges is pulled along with the water and deposited downstream. Over many years, this creates a different path for the river to follow. When homes are built along the river, **erosion** presents a real danger that the homes will be swept downstream, too. So engineers design dams and containment walls to help protect the homes, especially if there is a flood.

Waterfalls also change the geography of the land every day. As they fall from a higher level to a lower level, they bring bits of sand and pebbles with them. Year after year, this movement of water and earth changes the land.

Consider Niagara Falls. The rocks under the falls are considered soft rocks. They are shale and limestone, so they break apart easily. Sometimes large chunks of rock fall from the top of the falls to the bottom. Geologists predict that eventually, Niagara Falls will completely disappear, leaving rapids gushing over a rocky river.

Erosion by water is a strong force. Today, engineers are working on developing floating breakwaters that will stop the wave motion from pulling sand away from the shoreline. Special polygon-shaped devices connect and float just offshore. They absorb the wave's energy before it arrives at the beach. Other designs are being used on inland lakes for a similar purpose. We can't change the force of nature, but we can find ways to reroute the energy so it is not so harmful to our geography.

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Exactly what is **erosion**?

The dictionary says **erosion** is the wearing away of soil, sand, or rock by the action of water, wind, and other forces of nature.

Are there other words that I should know?

Try these:

Barrier Island--long, narrow landforms that were formed by sand and other loose sediments deposited by waves, currents, and winds.

Gullies--large rills. They happen when rills are left to grow bigger.

Rills--the most common form of **erosion**. It happens when soil is carried by rainwater over land with poor drainage. Rills are usually found between rows of crops.

Sediments--particles of soil deposited by water, usually from rivers and streams.

Sheet **erosion**--the uniform removal of soil in thin layers from sloping land. This occurs when rain removes the top layer of soil as a large sheet, rather than as small particles.

Activity!

An Experiment!

Soil and rocks are constantly shifting, changing our geography. Try the following activity to see how weather contributes to **erosion**.

What You Need:

• 3 yardsticks

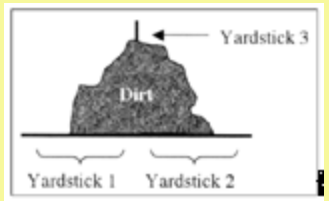
• Shovel
• Bucket
• Mound of sand or dirt
• Chart on this page (See picture, "**Erosion** Chart.")

Erosion Chart

Procedure:

1. Lay two yardsticks end-to-end.

2. Shovel a mound of dirt or sand onto the yardsticks. Leave at least 10" of the yardsticks showing at either end.



Erosion Activity

3. Place the third yardstick in the center of the mound. Make sure it goes all the way to the bottom of the mound. Also, make sure some of the yardstick can be seen at the top. (See picture, "**Erosion** Activity.")

4. Record where your mound is on all three yardsticks.

5. Each day for two weeks, record the weather and any movement of your mound.

What did you discover? Did the mound slowly erode when there was no rain and erode more quickly after a storm? Did the wind have any effect on your mound? What conclusions can you make about **erosion** and weather effects?

Here Are Some Other Experiments You Can Try:

1. Put a 5" (or larger) stone on the top of your mound and watch its progress.

2. Plant grass seed on one side of your mound. Note any difference between the two sides. You should see less **erosion** on the planted side after the grass has begun to grow.

3. Create layers in your mountain--dirt, sand, pebbles, etc. Note any differences in how quickly the layers erode.

Conclusions:

Find out More About the Powerful Force of Water

Read These.

Downs, Sandra. *Shaping The Earth: **Erosion***. 21st Century Books, 2000. 64 p. Find out how **erosion** has shaped the world as we know it today.

Hecht, Jeff. *Shifting Shores: Rising Seas, Retreating Coastlines*. Simon and Schuster Children's, 1990. 160 p. This is an easily understood book about how the oceans and lakes erode their coastlines.

Hooper, Meredith. *The Drop in My Drink: The Story of Water on Our Planet*. Illustrated by Chris Coady. Viking, 1998. 32 p. Find out about water cycles and how they affect the environment.

Olien, Rebecca. ***Erosion***. Bridgestone Books, 2001. 24 p. This is one of the series, (Bridgestone Science Library Exploring the Earth).

Prager, Ellen. *Sand*. Illustrated by Nancy Woodman. National Geographic Society, 2000. 32 p. See how water and ice can move sand as seen through the eyes of a sandpiper.

Rowe, Julian. *Water*. Franklin Watts, 1997. 32 p. **Erosion** has an effect on the economic success of some people.

Rutten, Joshua. ***Erosion****: Earth's Conditions Series*. Child's World, 1998. 32 p. This book contains questions and their answers regarding the causes and effects of **erosion**.

Rybolt, Thomas R. and Robert C. Mebane. *Environmental Experiments About Land*. Enslow Publishers, 1993. 96 p. Try some possible science fair experiments about **erosion**.

Spickert, Diane Nelson. *Earthsteps: A Rock's Journey Through Time*. Illustrated by Marianne D. Wallace. Fulcrum Publishers, 2000. 32 p. Follow the journey of a 250-million-year-old rock as it transforms from a mountaintop to a grain of sand.

Winner, Cherie. ***Erosion***. Lerner Publishing Group, 1999. 48 p. Learn how glaciers and other water forces affect the earth's surface.

Search the Internet.

Beach Erosion Protection
http://www.whisprwave.com/Homeland-Defense-Links.htm
See pictures of floating breakwaters in use on the coast.

Disappearing Beaches
http://whyfiles.org/091beach/
View causes of disappearing beaches in places like Cape Hatteras.

Erosion
http://www.mountainnature.com/Geology/**Erosion**.htm
See how mountains erode.

Erosion
http://www.bright.net/~double/erode.htm
Follow a class project that demonstrates weathering and **erosion**.

Erosion and Weathering
http://members.aol.com/bowermanb/**erosion**.html
Games, quizzes, and puzzles about **erosion**.

Erosion Control with Turfgrass
http://www.turfgrasses.com/info/**erosion**.html
See a picture of what happened when a farm was left to the forces of **erosion**.

Hazard Slides--Erosional Landforms
http://www.ngdc.noaa.gov/seg/hazard/slideset/24/24_slides.html
Examine pictures of land formed from water **erosion**.

An Introduction to Water Erosion Control
http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex2074?opendocument
How can farmers control for water **erosion**?

Observe River Erosion Creating Waterfalls and Chasms.
http://www.classzone.com/books/earth_science/terc/content/visualizations/es1305/es1305page0l.cfm?chapter_no=visualization

Water Erosion Prevention
http://129.128.55.165/rr/SoilPosters/water.cfm
Click on the picture to see how water **erosion** can be prevented.

Watch a Movie.

The Beaches Are Moving: A Personal View of the Barrier Islands. University of North Carolina Center for Public Television/Environmental Media, 1990. 60 min.

Coastal Biomes: Where the Land Meets the Sea. Rainbow Educational Media, 2001. 24 min.

Running Water. Annenberg/CPB Collection, 1992. (2 programs) 60 min.

Running Water: How It Erodes. TMW Media Group, 2000. 41 min.

The Story of a Woodland Stream. MBG Videos, 1991. 15 min.

*Weathering and **Erosion***. 100% Educational Videos, 2002. 21 min.