The NASA SCI Files™
The Case of the
Disappearing Dirt

Segment 3

As the tree house detectives continue their quest to solve the mystery of the disappearing beach, Tony offers to help by going to Mountain View Elementary School in Anchorage, Alaska to learn more about how mountains are formed. After learning about mountain building, the other detectives decide that they now need to know more about the processes that tear down mountains. Tony is off again, but this time he visits Dr. Crossen at Exit Glacier near Anchorage, where he learns more about weathering. Once the detectives understand weathering, they set off to learn how the agents of erosion might help them move weathered sediment to their beach. Back at the beach, they continue to practice for the upcoming volleyball tournament while Tony enjoys the salmon fishing derby and learns how to ride a dog sled.

Objectives

The students will

- understand how mountains are formed.
- demonstrate how glaciers changed the surface of the Earth through the processes of erosion and deposition.
- determine how rocks change through weathering.
- collect and graph data.
- simulate how raindrops affect rocks.
- demonstrate how wind can transport sand.

Vocabulary

dome mountains – mountains that are formed when hot, molten material rises from the Earth's mantle into the crust but does not reach the surface and pushes overlying sedimentary rock layers upward to form a dome shape

fault-block mountains – mountains that are formed when the Earth's crust is stretched and pulled apart, causing rifts to form and great blocks of crust to tilt, while other blocks sink between the tilted blocks

folded mountains – mountains that are formed when two plates of the Earth's crust collide, making the crust bend and squeeze the plates together, causing the layers of rock to fold

glacier – a large body of ice moving slowly down a slope or valley or spreading outward on a land surface

lava – melted rock (magma) that comes to the surface of the Earth through volcanoes or fissures and cools and hardens

magma – molten rock inside the Earth

striations – the scratches, scrapes, and gouges left by glaciers on underlying bedrock

volcanic mountain – a hill or mountain composed entirely or in part of the materials thrown out of a volcano

Video Component

Implementation Strategy

The NASA SCI Files™ is designed to enhance and enrich existing curriculum. Two to three days of class time are suggested for each segment to fully use video, resources, activities, and web site.

Before Viewing

1. Prior to viewing Segment 3 of *The Case of the Disappearing Dirt*, discuss the previous segment to review the problem and find out what the tree house detectives have learned thus far. Download a copy of the Problem Board from the NASA SCI Files™ web site and have students use it to sort the information learned so far.
2. Review the list of questions and issues that the students created prior to viewing Segment 2 and determine which, if any, were answered in the video or in the students' own research.
3. Revise and correct any misconceptions that may have occurred during Segment 2. Use tools located on the Web, as was previously mentioned in Segment 1.
4. Focus Questions—Print the questions from the web site ahead of time for students to copy into their science journals. Encourage students to take notes during the program to answer the questions. An icon will appear when the answer is near.
5. "What's Up?" Questions—Questions at the end of the segment help students predict what actions the tree house detectives should take next in the investigation process and how the information learned will affect the case. These questions can be printed from the web site ahead of time for students to copy into their science journals.

View Segment 3 of the Video

For optimal educational benefit, view *The Case of the Disappearing Dirt* in 15-minute segments and not in its entirety. If you are viewing a taped copy of the program, you may want to stop the video when the Focus Question icon appears to allow students time to answer the question.

After Viewing

1. Have students reflect on the "What's Up?" questions asked at the end of the segment.
2. Discuss the Focus Questions.
3. Have students work in small groups or as a class to discuss and list what new information they have learned about the rock cycle, weathering, and erosion. Organize the information, place it on the Problem Board, and determine whether any of the students' questions from Segment 2 were answered.
4. Decide what additional information is needed for the tree house detectives to continue to determine what has happened to the sand on their beach. Have students conduct independent research or provide students with information as needed. Visit the NASA SCI Files™ web site for an additional list of resources for both students and educators.
5. Choose activities from the educator guide and web site to reinforce concepts discussed in the segment. Pinpoint areas in your curriculum that may need to be reinforced and use activities to aid student understanding in those areas.
6. If time did not permit you to begin the web activity at the conclusion of Segments 1 or 2, refer to number 6 under "After Viewing" on page 16 and begin the problem-based learning (PBL) activity on the NASA SCI Files™ web site. If the web activity was begun, monitor students as they research within their selected roles, review criteria as needed, and encourage the use of the following portions of the online, PBL activity:

   Research Rack—books, internet sites, and research tools

   Problem-Solving Tools—tools and strategies to help guide the problem-solving process

   Dr. D's Lab—interactive activities and simulations

   Media Zone—interviews with experts from this segment

   Expert's Corner—listing of Ask-an-Expert sites and biographies of experts featured in the broadcast
7. Have students write in their journals what they have learned from this segment and from their own experimentation and research. If needed, give students specific questions to reflect upon as suggested on the PBL Facilitator Prompting Questions instructional tool found in the "Educators" area of the web site.
8. Continue to assess the students' learning, as appropriate, by using their journal writings, problem logs, scientific investigation logs, and other tools that can be found on the web site. Visit the Research Rack in the tree house, the online PBL investigation main menu section, "Problem-Solving Tools," and the "Tools" section of the "Educators" area for more assessment ideas and tools.

Careers

mountaineer
glacial expert
geologist
soil engineer
topographer
cartographer

Resources

Books

Berger, Melvin: *Are Mountains Getting Taller?* Scholastic, Inc, 2003, ISBN: 0439266734.

Bramwell, Martyn: *Mountains.* Watts Franklin, 1994, ISBN: 0531143031.

Brown, Tricia: *Children of the Midnight Sun*. Alaska Northwest Books, 1998, ISBN: 0882405004.

Cole, Melissa: *Mountain*. Gale Group, 2003, ISBN: 1567118062.

Corral, Kimberly: *My Denali*. Alaska Northwest Books, 1995, ISBN: 0882404679.

Fowler, Allan: *They Could Still Be Mountains*. Scholastic Library, 1997, ISBN: 0516261592.

Gallant, Roy: *Glaciers*. Scholastic Library, 1999, ISBN: 0531159566.

Klein, James: *Gold Rush!: The Young Prospector's Guide to Striking It Rich.* Ten Speed Press, 1998, ISBN: 1883672643.

Lobel, Arnold: *Ming Lo Moves the Mountain*. Morrow, William, & Co., 1993, ISBN: 0688109950.

Marsh, Carole: *Alaska Math: How It All Adds Up in Our State*. Gallopade International, 1996, ISBN: 0793364914.

Peters, Lisa Westberg: *Sun, the Wind, and the Rain*. Henry Holt & Company, 1990, ISBN: 0805014810.

Simon, Seymour: *Icebergs and Glaciers*. Morrow, William, & Co., 1999, ISBN: 0688167055.

Wallace, Marianne: *America's Mountains*. Fulcrum Publishing, 1999, ISBN: 1555913830.

Zoehfeld, Kathleen Weidner: *How Mountains Are Made.* Harper Collins Children's Books, 1995, ISBN: 0064451283

Web Sites

Animation: Moving Mountains
See how mountains are made in this simple animation.
http://earthsci.terc.edu/navigation/visualization.cfm

The National Snow & Ice Data Center: Glaciers
Find out general information about glaciers and take a quick tour of the life of a glacier on this web site.
http://nsidc.org/glaciers/

The National Park Service: Glaciers
Investigate the glaciers of North America on this web site sponsored by the National Park Service.
www.nps.gov/olym/edglac.htm

NASA: Glacier Galleries: Mighty Glaciers
View some awesome pictures of glaciers and explore glacier history and maps depicting their locations.
http://sdcd.gsfc.nasa.gov/GLACIER.BAY/pictures.glaciers.html

The Illinois State Museum: The Retreat of Glaciers
Visit this web site for maps and animations that show the extent of glaciers through time.
http://www.museum.state.il.us/exhibits/larson/glaciers.html

Travel Alaska: Virtual Tours
Take a virtual tour of Alaska and learn about the history, culture, and geography of this amazing place.
http://www.travelalaska.com/tours/indextours1.html

South Dakota Department of Education: Glacier Lesson Plans
Explore classroom activities designed to teach students about glaciers.
http://www.state.sd.us/deca/DDN4Learning/ThemeUnits/Glaciers/lessonplans.htm

Wildernet: Mountains of the World
Explore the mountains of the world. Find the elevation of over 1700 mountain peaks. See photos and read journals of people who have climbed these peaks.
http://www.peakware.com/encyclopedia/

Alaska Native Heritage Center
Learn about the Native people of Alaska. Explore their cultural heritage. Watch events at the Center with a web cam.
http://www.alaskanative.net/

Bureau of Land Management: A Golden Opportunity for Science
Folklore, legends, and science related to one of the most sought after minerals—gold.
http://www.blm.gov/education/going_4_the_gold/gold_poster.html

Science for Ohio: Dig This! Erosion Investigations
Investigate rocks and look at issues related to weathering and erosion on this site for students and teachers.
http://casnov1.cas.muohio.edu/scienceforohio/Erosion/index.html

Activities and Worksheets

In the Guide

On the Web

To Orbit or Not To Orbit, That Is the Question
Use this activity to demonstrate how rivers and streams erode and deposit sediment.

A Mountain Building We Will Go!

Problem

To understand how three basic types of mountains are formed

Teacher Note

Prior to conducting this activity, review with the students plate tectonics and plate boundaries. Activities for review can be found in the teacher guide for *The Case of the Shaky Quake*, pages 21, 24, 33, 34, and 48. The teacher guide can be downloaded from the homepage of the NASA SCI Files™ web site by clicking on the fence post that says "Guides." *http://scifiles.larc.nasa.gov*

Background

Mountains are classified by how they were formed. There are three basic classifications: volcanic mountains, fault-block mountains, and folded mountains. Plate tectonics, or the movement of the Earth's crustal plates, plays an important role in how the mountains are formed. The demonstrations below will help explain the formation of each type.

Materials

- 30 cm waxed paper
- frosting
- 4 graham crackers
- 2 zippered storage bags
- 355 mL of pudding (1.5 cups)
- 2 slices white bread
- 1 slice wheat bread
- peanut butter
- grape jelly
- strawberry jam
- plastic knife
- science journal
- 2 small cakes *(optional)*

Procedure

1. Spread a small amount of frosting on the waxed paper.
2. Place two graham crackers very close to each other on top of the frosting.
3. Create a divergent plate boundary by slowly pulling the graham crackers apart.
4. Observe and record your observations in your science journals. As magma wells up through the crack in the crust, volcanic mountains can form along these divergent plate boundaries. The Mid-Atlantic Ridge is a divergent plate boundary and Iceland is a volcanic island formed along that ridge.
5. Create a convergent plate boundary by placing the graham crackers side by side and slowly pushing them together. Observe and record. What would happen if real plates collided? Folded mountains are created in this way by converging plates. This process happens over millions of years, and the Appalachian Mountains are an example of folded mountains.
6. **Optional**: To better demonstrate folded mountains by using food, use two small cakes (such as Twinkies®) and push them together, creating a convergent plate boundary. (Two small, thin bricks of clay can also be used.) Observe and record.
7. Create a second type of convergent plate boundary by pulling the graham crackers apart and pushing them together again, but this time make one slide under the other.
8. Observe and record. Note: When one plate is denser than the other, it will subduct under the lighter plate. As it subducts deep in the Earth, it begins to melt from the intense heat and pressure. As the rock melts, the magma can work its way through cracks and crevices until it reaches the surface, forming a volcanic mountain. Mount Saint Helens is an example of a volcanic mountain.
9. To demonstrate how volcanic mountains are formed from subducting plates:
   a. Place 118 mL (1/2 cup) of pudding into a zippered plastic bag and seal, leaving a small opening in the middle unsealed.
   b. Place the sealed bag on a flat surface with the zipper on top in the center.
   c. Place a graham cracker on each side of the bag and gently push the crackers toward one another, making one go under the other. Observe and record. Note: Sometimes a pocket of magma becomes trapped as it pushes against the crust, but it does not break through onto the surface of the Earth. This uprising of crust is called a volcanic dome mountain.
   d. Continue to push against the bag until it pops open. (This process can be messy!) Observe the "magma" as it erupts from the bag. Record your observations.

A Mountain Building We Will Go! (concluded)

10. To create fault-block mountains:
    a. Spread peanut butter on a piece of white bread.
    b. Add a layer of grape jelly.
    c. Place a piece of wheat bread on top of the jelly.
    d. Spread peanut butter on top of the wheat bread.
    e. Add a layer of strawberry jam.
    f. Place a piece of white bread on top of the jam.
    g. Cut the sandwich into three pieces.
    h. Place about 237 mL (1 cup) of pudding into the zippered plastic bag and seal.
    i. Place the sandwich on top of the bag.
    j. Gently apply pressure to the sides of the bag to push the pudding toward the center.
    k. Observe and record. Note: The Earth's crust bends on the fluid-like mantle until the pressure is too great and the crust splits. This area is known as a fault. As the pressure continues to push against the rocks, the middle section may move higher than the area on its sides, forming a mountain, or the sections on the side may move up, leaving the middle section lower and forming fault-block mountains. The Sierra Nevada Mountains in Utah are examples of fault-block mountains.

Conclusion

1. Explain the three most common ways mountains are built.
2. Describe the role that plate tectonics plays in the process.
3. Are all mountains the same? Why or why not?

Extension

1. Use a world almanac or web site *http://www.peakware.com/encyclopedia/ranges/* to investigate the elevations of several major mountain chains. Graph the elevations of several of the major mountains such as Mt. Everest, Mt. McKinley, or Mt. Mitchell.
2. Compare and contrast the Appalachian Mountains to the various mountains in Alaska. Create a Venn diagram to show how they are the same and how they are different. Be sure to include the relative ages of each.
3. Read a book about mountains and give a report to the class.
4. Draw or paint a picture of a mountain and create a story or poem explaining how it was formed, when, and what life is like today on the mountain. Share your mountain with the class.
5. Research the Hawaiian Islands and learn how they were formed over a "hot spot" in the Earth's crust.

Go, Go Glaciers

Problem

To understand how glaciers changed the Earth's surface by the processes of erosion and deposition

Materials

several small, sharp stones *(pebble size road gravel works well)*
coarse sand
small plastic tub
unglazed brick or tile
water
freezer
warm gloves
tray or shallow pan

Background

A glacier is a moving body of ice. Glaciers form during climatic episodes when more snow accumulates in the winter than melts in the summer. Over a period of years, the packed snow gradually changes to solid ice. Gravity causes a glacier to move down a mountainside. On level land, the weight of the ice causes the glacier to move or spread out from its thickest part. Ice at the bottom of the glacier melts where it rubs across the ground, "greasing" the glaciers' movement. Rocks and soil are frozen in the base of the glacier and are dragged along. These materials act like sandpaper to smooth the landscape over which the glacier passes. During cold episodes, the glaciers advance. During warm periods, the glaciers recede (or melt). (Glaciers do not move backwards—receding simply means melting.) When glaciers melt, they leave behind whatever they were carrying. These materials are called

- **till**—may consist of a mixture of rock debris and soils. Till is simply soil, pebbles, and rocks mixed at random and unsorted by particle size.
- **outwash**—sediments laid down in layers and sorted by size that are left behind from the rivers of water that flow from the melting glacier.
- **loess**—fine particles of the outwash blown across the landscape in glacial dust storms that settle across the landscape to form a blanket of silt-sized particles. Loess is the parent material of most of the young rich soils of the United States plains.
- **moraines**—long, thin deposits that mark the sides and front of a glacier. Scientists search for moraines to find the boundaries of glaciers that melted long ago.
- **kettles**—depressions left from melted ice sheets. Many of these kettles filled with water and became lakes.

Procedure

1. Place a handful of sand and the pebbles in the bottom of the plastic tub.
2. Fill the tub with water until it is about half full.
3. Allow the sand to settle to the bottom. See diagram 1.
4. Place the tub in the freezer and leave it until the contents are frozen solid.
5. Put on gloves and remove the ice block from the tub.
6. This ice block represents a glacier.
7. Put the glacier, dirty side down, on top of the brick or tile.

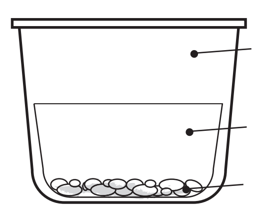
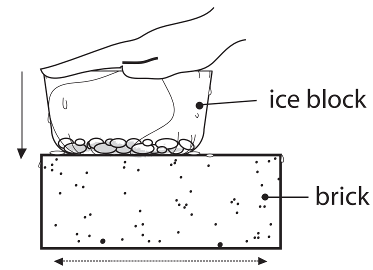


Diagram 1

Go, Go Glaciers (concluded)

8. While pressing hard, slide the glacier across the brick in the same direction several times. See diagram 2.
9. Remove the glacier and observe the brick.
10. In your science journal, record your observations.
11. Repeat steps 7 and 8 several times.
12. Look at the bottom of the glacier and carefully observe any changes in the sediment that is trapped in the bottom of the glacier.
13. Record your observations in your science journal.
14. Place the glacier in a shallow pan and put it where it will not be disturbed.
15. Let the glacier melt.
16. Observe what happened to the sediment the ice was carrying.
17. Illustrate your observations in your science journal.



Move ice block back and forth on brick.

Diagram 2

Conclusion

1. What happened to the surface of the brick after the glacier passed over it? Why?
2. What changes did you see in the glacial sediment after it had passed across the brick several times?
3. What conclusions can you make as to what happens to the bedrock under a glacier?
4. What did you observe after your glacier melted? Why did it happen?
5. What could you learn about the glacier from studying this moraine?

Split, Splat, I'm Taking a Bath

Purpose

To simulate how raindrops affect rocks

Materials

30 mL flour
eyedropper
one sheet black construction paper
water
metric ruler

Background

As raindrops fall from high in the sky and hit the ground, the water slowly begins to break apart tiny pieces of rock, thus weakening the overall structure. Large amounts of rain may cause rock slides, in which large chunks of rock are carried down a hillside. Water is the most powerful agent of erosion. It can move large amounts of sediment in a short time.

Procedure

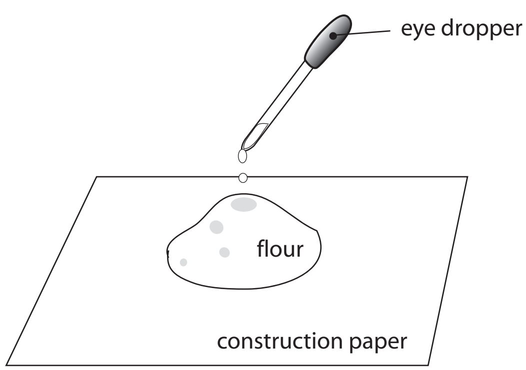
1. Place the flour in a pile in the center of a sheet of black construction paper.
2. Fill an eyedropper with water.
3. Hold the eyedropper about 30 cm above the paper.
4. Release a few drops of water, one at a time.
5. Observe the pattern made by the flecks of flour that are scattered as the water drops splatter onto the flour.
6. Record your observations in your science journal. Illustrate.
7. Experiment by holding the eyedropper at different heights.
8. Observe and record your findings for each height.

Conclusion

1. What happens to the flour when the water drops hit it?
2. Describe how this activity is like rain falling on the surface of the Earth?
3. What other forces cause the movement of sediment and rock fragments?

Extensions

1. Put sand or flour in a rectangular baking pan, making a small hill in the center. Slowly pour water over the hill. Record what happens to the hill. Where does the sand or flour end up?
2. Research any recent major flood or landslide in your area. Explain what and how it happened? Draw a picture of the land before and after the flood or landslide.



Honey, I Shrank the Rocks

Purpose

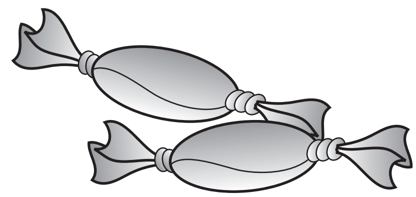
To determine how rocks change through weathering and to collect and graph data

Materials

three identical small, hard candies
graph paper
pens or pencils of three colors
stopwatch

Background

Weathering is a process that changes rocks or breaks rocks into smaller and smaller pieces. There are two types of weathering: mechanical weathering and chemical weathering. Mechanical weathering breaks rocks apart without changing the minerals that make up the rocks. Water is the most common mechanical weathering agent, but weathering can also be caused by air, sun, water, or living things. Factors that affect the rate of weathering include particle size and water speed.



Procedure

1. Pick three identical hard candies to represent "rocks."
2. Observe your rocks and record your observations in your science journal.
3. Find the mass of each rock and record it in the Rock Chart below. Be sure to keep the rocks separated so that you know which one has what mass.
4. To simulate a stream of water weathering rock, put one of the rocks (candies) in your mouth.
5. Start the stopwatch.
6. Hold the rock gently in one place in your mouth. You may suck on the rock (candy) but no biting!
7. When the candy is dissolved, stop the timer and record in the Rock Chart the amount of time it took for the rock (candy) to dissolve.
8. Put a second rock (candy) in your mouth.
9. Start the stopwatch.
10. This time tumble the rock (candy) with your tongue against your teeth. Your teeth represent your rock tumbling against other rocks in the stream.
11. When the rock (candy) is weathered completely away, stop the stopwatch and record the time.
12. Put the third rock (candy) in your mouth.
13. Start the stopwatch.
14. Bite the candy once and begin to tumble it against your teeth (the other rocks in the stream).
15. When the rock (candy) is completely weathered, record the time.
16. Using the data you collected, create a bar graph by using a different color pencil or crayon to represent each rock (candy). Be sure to include a key.
17. Collect data from students and find the average weathering time for each of the three tests.
18. Using the average times, create a class bar graph.
19. Analyze the data and draw conclusions.

Honey, I Shrank the Rocks (concluded)

Rock Chart

Rock (Candy)	Mass	Time Dissolve
Rock 1-slow dissolution		
Rock 2-mild tumbling		
Rock 3-hard tumbling		

Graph

Conclusion

1. Which rock weathered first? Why?
2. What factor or factors are responsible for the different rates of weathering?
3. What would happen if you increased the size of the rocks (candy)?
4. How did your test data compare to the class average?
5. What can you say about the relationship between the amount of motion and the rate of weathering?

Extension

1. Brainstorm for other factors that could affect weathering rates, such as the minerals that make up the rocks and their hardness. Design and conduct experiments that would test the effect of these variables on weathering. For example, use different kinds of candy.
2. Take a field trip around the school grounds or neighborhood to observe examples of weathering. Take pictures of the sites you find and create a picture book about weathering.

Blowing in the Wind

Purpose

To demonstrate how sand can be transported by wind

Materials

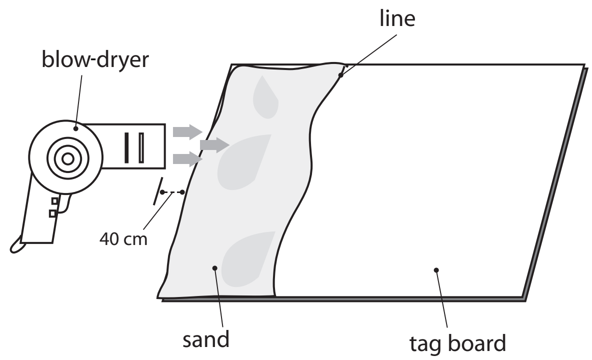
m^2 of heavy tag board
500 mL of sand
250 mL of potting soil
100 mL of baby powder
blow-dryer (hair)
large, plastic bowl

Background

Wind is also an agent of erosion. It transports soil and pieces of rock from one location and deposits them in another. The effects of wind erosion are very dramatic, especially in the dry areas of the world. When the wind blows over dry, bare soil, it causes terrible dust storms. In the 1930s, dust storms were common over the drought stricken mid-western United States. Soil from Kansas, Oklahoma, and Colorado was carried as far away as New England. The amount of soil and sand carried by the wind depends on the size of the pieces and the wind speed. Light winds can lift only fine dust. Strong winds are needed to lift and move rocks and pebbles. Given enough time, windblown sand grains can act like a sandblaster, pitting and destroying rock. As wind blows large amounts of sand from place to place, it forms sand hills (sand dunes). Because the wind is constantly changing, it can move dunes. Sand dunes along the shoreline of Lake Michigan, for example, move as much as five to seven meters a year. Although we cannot stop wind erosion, we can take steps to slow it. One way is by planting vegetation to help hold the soil in place and protect it from the wind. Sometimes fences are also built to help stop the movement of sand.

Procedure

1. Mix the potting soil, sand, and baby powder in a bowl.
2. Dump the sand mixture onto the sheet of tag board.
3. Use the mixture to make several small hills or dunes along one edge of the tag board sheet.
4. Draw a line to mark the edge of the sand hills.
5. Point the blow-dryer toward the sand hills, holding it about 40 cm from the tag board sheet.
6. Turn the blow-dryer on low for 30 seconds. See diagram 1.
7. Observe the sand dunes. Record your observations.
8. Draw a second line on the tag board to show the new placement of the dunes.
9. Examine the sand that has been transported.
10. Record your observations in your science journal.
11. Repeat steps 5 and 6 using the blow-dryer's medium speed.
12. Re-examine the sand dunes and record your observations.
13. Draw a third line on the tag board sheet to show the new location of the dunes.
14. Repeat steps 5 and 6 using the blow-dryer's high speed.
15. Observe and record your observations.
16. Draw a final line where the sand is now located.
17. Carefully look at the sand that has moved.
18. Record your observations.
19. Using a metric ruler, measure the distance the sand moved each time. Enter the data into the data chart on page 62.
20. Create a graph depicting your results.



Blowing in the Wind (concluded)

Data Chart

Wind Speed	Distance Dune Moved	Comments
Low speed		
Medium speed		
High speed		

Conclusion

1. What did you notice about the movement of the sand mixture as the wind speed increased?
2. When you examined the shape of the new sand dunes, what conclusions did you make about the effect of wind on sand?

Extension

1. Investigate other ways that people attempt to stop erosion. Set up an experiment using some of these techniques, such as wind fences. Record the differences the various techniques had on the movement of the sand. Evaluate the effectiveness of each technique used.
2. Interview someone from your local farm bureau or the US Department of Resource Conservation. Find out what effect erosion has in your area. Learn what is being done to prevent serious erosion problems.
3. Research areas other than farming where erosion is a problem. Find out what is being done to prevent it and give a report on your findings.

Answer Key

A Mountain Building We Will Go!

1. Answers will vary but should include that folded mountains are formed when two plates of the Earth's crust collide and make the crust bend and fold. Fault-block mountains are formed when the Earth's crust is stretched and pulled apart, causing rifts to form and great blocks of crust to tilt, while other blocks sink between the titled blocks. Dome mountains are formed when hot, molten material rises from the Earth's mantle into the crust but does not reach the surface and pushes overlying sedimentary rock layers upward.
2. See answer above.
3. Mountains are the same in that they are all made of rock and have formed above the Earth's crust. However, they are also all different because they have formed in different ways and are made of different materials. They are also of varying sizes and shapes and in different stages of development.

Go, Go Glaciers

1. The surface of the brick was deeply scratched because the sediment was trapped in the bottom of the glacier and the pressure applied was harder than the surface of the brick, thus creating grooves and scratches.
2. The sediment at the bottom began to change color (turning the color of the brick) as it picked up the sediment that was being eroded (scratched away) from the brick.
3. The bedrock below a glacier that is beginning to break up will get long, deep scratches and scrapes in the surface.
4. A ridge of sediment. The water flowed away from the glacier and left behind a ridge of the sediment that had been trapped in the ice.
5. You could learn the boundaries of the glacier, telling where it had been and where it had stopped.

Split, Splat, I'm Taking a Bath

1. The flour particles are scattered away from the point where the water drop hits.
2. When rain falls on soil, the fine silt and soil particles are disturbed by the water drops. Large amounts of water can cause rock slides or can carry away sediment, depositing it far from its original location.
3. Wind, gravity, and ice may also affect the movement of sediment. Sediment caught up in a stream or river is dependent on the amount of water in the stream and the speed of the water in the flow.

Honey, I Shrank the Rocks

1. The rock that was broken and tumbled (third test) should weather fastest because it has smaller pieces at the beginning of the process and the tumbling motion allows the pieces to hit against each other, aiding the weathering process caused by the water.
2. The particle size and water speed affect the weathering process.
3. The larger the rock, the longer it takes to weather.
4. Answers will vary.
5. Answers will vary but might include that the faster the tumbling motion, the faster the weathering rate, or the smaller the rock size, the faster the weathering rate. Students should understand that there are many factors that affect the rate of weathering, such as mineral size, rock composition, rock type, location (climate), and so on.

Blowing in the Wind

1. On the low speeds, only the finest silt was transported by the wind. As the wind speeds increased, more and larger particles were moved by the wind.
2. The side of the dune that faces the blowing wind is long and gently sloping. The sheltered side of the dune has a shorter and steeper slope.