

Session 6.

Restless Landscapes

If most mountains are formed in the same way, why do they look so different? In this session, we learn about the forces sculpting Earth's ever-changing landscape. One particular landform—Cape Cod, a peninsula off Massachusetts—is the setting for our investigation.

The Video

This video opens with a geologic puzzle. Cape Cod is an unusual landform, as it has no bedrock, and is made almost entirely of sand. How did this peninsula form and what secrets can it reveal about the processes that sculpt the surface of the Earth? We join our geologist host Britt Argow on Cape Cod to learn about how the Cape formed, and how understanding this will assist us in answering our mountain question.

As we think about this question, we consider two mountain ranges that look very different: the Appalachian Mountains in North America and the Himalayas in Eurasia. We join Dr. Sherilyn Williams Stroud in the Appalachian Mountains of western Massachusetts in her search for evidence in the rocks and clues in the landscape.

During the program, interviews with children uncover their thinking about where the sand on the beach comes from, the differences between 'old' and 'new' mountains, and the erosive power of water. We also visit science specialist Barbara Waters and fifth graders at the Quashnet Elementary School on Cape Cod, in Mashpee, Massachusetts. As she facilitates an exploration of groundwater, we observe the students constructing models depicting what is under the surface on Cape Cod and learn about the journey a raindrop takes as it flows into and through the ground.

Learning Goals

During this session, you will build understandings to help you:

- Describe how sand is formed
- Relate the action of water and ice to the evolution of landforms
- Model how water occurs underground

On-Site Activities

Getting Ready (60 minutes)

Activity One—Problem Set and Reading Discussion (20 minutes)

1. In small groups, review the questions from the problem set for Session 5.
2. Choose a partner. Review and discuss each other's concept maps for mountains.
3. Next, think about what you know about landforms. Discuss how or where this topic might connect to your map.
4. Session 5's homework asked you to read the article "Children's Understanding of Earth Systems Phenomena in Taiwan" and be prepared to discuss the ideas expressed by the author that you think are most useful in teaching about mountains. As a group, discuss these ideas.

Activity Two—Mountain Mystery (5 minutes)

To prepare for today's session, you were asked to consider the following question: If most mountains around the world form in the same way, why do they look different? Share your ideas with your group.

Activity Three—Wrapping Up Rock Specimens (20 minutes)

1. Another task to prepare for today's session was to bring your rocks, unanswered questions, and classification schemes from Session 2: Every Rock Tells a Story. After reassembling your group's rock specimens, examine them with a hand lens or magnifying glass, using your new knowledge of the three rock types. Then discuss their similarities and differences and try to regroup them based on rock type. Finally, revisit your classification schemes from Session 2 and compare the results to your groupings based on rock type. Has your thinking about the rock specimens changed? If so, how?
2. Revisit your unanswered rock questions. Share these questions with your group and together answer as many as you can. Write down your group's remaining unanswered questions and record them. You will be asked to do some research to construct answers to these questions as part of this session's homework assignment. If there are no remaining questions, generate several new questions.
3. With a partner, place your combined rock specimens into a plastic container. Close the container with its lid, and take turns shaking it. With each turn, shake the container 20 times with force. Take three turns each. Then, open the container and discuss what you see.
4. Discard any rock fragments from the container. Leaving the rocks inside the plastic container, fill the container with water until it is half full. Close the lid and take turns shaking the container of rocks as you did before. Open the container and discuss what you see.
5. Relating your experiences in this activity to processes that weather and erode rocks in a natural setting, discuss your ideas about what happened to the rocks with your partner.

Activity Four—Construction and Destruction (15 minutes)

1. In preparing for this session you were asked to think about different types of landforms, choose one type, and write a description of how it might have formed. Share your ideas within your group. Try to identify each of the landforms described as being formed by "construction" or "destruction." As a group, organize your landforms into one of those two categories.
2. Now create a two-column list that describes the forces themselves. In the first column, list constructive forces and in the second, list destructive forces.
3. Do constructive or destructive forces form mountains? How would you categorize the forces that form mountains? Are mountains connected to the formation of any other types of landforms? How?

On-Site Activities, cont'd.

Viewing the Program (60 minutes)

As you view the video, think about the following focus questions:

1. Where does the sand on the beach come from? What does this tell us about the Earth's ever-changing landscape?
2. In our featured classroom, Barbara Waters's students investigate a model for groundwater. As you watch them, think about how your ideas compare to their groundwater model.
3. During the interviews with children, Joe thinks that the Himalayas are older than the Appalachians. Listen for his reasons. Do you agree or disagree with Joe's ideas?

Going Further (60 minutes)

1. In your group, spend a few minutes discussing the video. Revisit your responses to the question: If most mountains around the world form in the same way, why do they look different?
 - How does your current thinking compare to your thinking before watching the video?
 - How do the two parts of the "rock shake" activity relate to the differences among mountains?
 - What can we learn about mountains from sand?
 - What does sand on the beach tell us about the ever-changing landscape of Earth's surface?
2. Catastrophic changes in landforms, such as those caused by earthquakes, occur rapidly. Water, in both liquid and solid form, changes landforms more slowly. In this session's video, Dr. Sherilyn Williams Stroud highlighted how liquid water can erode mountains. Glaciers can also cause erosion. What evidence of erosion does a glacier leave behind? Explore this question by making a model of a glacier with a partner.
 - Spread a layer of newspaper on your table and place a piece of wax paper on top.
 - Cover your wax paper sheet with a thin layer of sand.
 - What do you think will happen when you push an ice cube across the paper?
 - Take an ice cube and press down on it as you move it slowly all the way across the wax paper.
 - Dump the bulk of the sand off of the wax paper into a waste container.
 - *Gently* brush the remaining sand off of the wax paper.
 - What do you observe on the bottom of the ice cube?
 - What do you observe on the sheet of wax paper?
 - Which geological features do the following model parts represent: ice cube, sand, and scratches in the wax paper.
 - Why do you have to push down on the ice cube to simulate the actions of a glacier?
 - How does this activity relate to the formation of Cape Cod?
 - What evidence would you look for to determine whether a glacier was connected to the formation of a landform elsewhere?

On-Site Activities, cont'd.

Note: See the *Earth and Space Science* Web site to learn more about glaciers (A Closer Look: Glaciers) at www.learner.org/channel/courses/essential/earthspace/session6.

3. The video focused on the geology of Cape Cod and its relationship to groundwater. What do you know about the geology in your area, especially what exists underground? How do you think the occurrence of groundwater in your area compares to Cape Cod?
4. Revisit your group's lists about landforms built by forces that involve construction and destruction. Use any new understandings to add to or revise your work.

Between Sessions

Homework (* = required)

* Reading Assignment

Baxter, J. "Children's Understandings of Astronomy and Earth Sciences," in *Learning Science in the Schools: Research Reforming Practice*, ed. Duit and Glynn. Mahwah, NJ: Lawrence Erlbaum Associates, 1995.

As you read, identify several children's ideas that compare to your own or are prevalent among students that you have known. For each idea, write a question about the related content and try to answer it.

* Problem Set

(Suggested answers are listed in the Appendix.)

1. Describe several natural agents responsible for sculpting the Earth's surface, and give examples of how each affects the land.
2. Describe the different types of glaciers. In what ways are glaciers like streams? In what ways are they different?

* Ongoing Concept Mapping

Develop a concept map around the concept of "landforms." Reflect on the content of the video and the site investigation activities and identify major concepts that could be included in your map. Provide as many details and connections as you can for each concept. Be sure to incorporate what you have learned about how Cape Cod formed into your map.

Guided Journal Entry

In your journal, compare what you have learned in today's session about the geological processes operating on the surface of the Earth with what you have learned in previous sessions about the geological processes working within the Earth's interior. How do forces above and below the Earth's surface interact to shape, create, and destroy all kinds of landforms?

Between Sessions, cont'd.

Guided Channel-Talk Posting

Landforms are, quite literally, all around us. During the video, we visited several locations that were examples of landforms and investigated some of the forces that created them. What kinds of landforms are in your local area? What are some possible field trips you could plan that would give students first-hand experiences with the concepts presented in this session? Discuss your ideas in your Channel-Talk posting for this week and share any experiences you have had with your colleagues.

Suggestions for Textbook Reading

- Agents of erosion
- Geomorphology: the study of landforms
- Glaciers and glacial landforms
- The hydrologic cycle
- Processes of uplift, subsidence, and erosion
- Types of landforms
- Ice ages throughout Earth's history

* Preparing for the Next Session

For "Getting Ready"

Without consulting any outside resources, brainstorm and list what you know about the Moon. Then answer the following questions as best you can:

- Where did the Moon come from and how did it form?
- What can the Moon tell us about the Earth?

Materials Needed for Next Time

Facilitator:

- Large balloons (2 per pair)

All participants:

- Your answers to the questions listed in For "Getting Ready"

Graduate Credit Activities

Continue your work on the annotated bibliography and action research project.

Notes
