

# 32 Modeling Erosion



In the previous activities you investigated erosion and deposition caused by rivers, streams, and rain. But erosion can take place anywhere that water, ice, or the wind carries pieces of rock or soil from one place to another. The shores of oceans, seas, and lakes are other sites where erosion and deposition play a role in shaping the land. In this activity you will model the role of ocean waves at Seaside Cliff and examine their effect on the rate of erosion.



**How do ocean waves affect the shape of the land?**

1987



2002



*These photographs show the same cliff in California in 1987 and 2002. Notice how much of the cliff has eroded away from the columns that support the houses.*

## MATERIALS



*For each group of four students*

- 1 plastic box
- 1 plastic retaining wall
- 1 wavemaker (2 pieces)
- 1 river model catch basin
- 1 30-mL graduated cup
- 1 spoon
- supply of moist earth material
- supply of water
- 2 mesh sleeves of small rocks
- 2 rectangular blocks, long
- 2 rectangular blocks, short

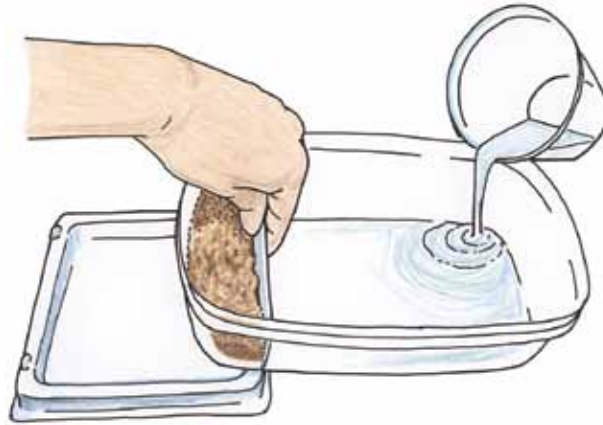
## PROCEDURE

### Part A: Modeling Cliff Erosion



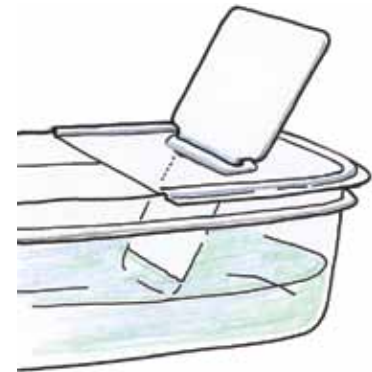
1. Place the plastic retaining wall in the plastic box at the line marked on the box. Hold the wall vertically in the box.
2. Use the 30-mL graduated cup to fill the smaller portion of the box with 150 mL of moist earth material. Level the top of the material with the spoon.
3. Place the sand-filled end of the box on the catch basin from the river model. This will create a gentle slope.

4. While holding the retaining wall in place, gently pour water into the edge of the box opposite the earth material until it just touches the bottom of the cliff.



5. Complete the cliff model by carefully removing the retaining wall. Do this by slowly lifting the wall straight up out of the box.

6. Place the slotted part of the wavemaker on the side opposite the model cliff. Insert the other piece of the wavemaker into the slot, as shown at right.



7. At the rate of 1 wave per 3 seconds, move the wavemaker back and forth along the bottom of the box 5 times. Record your observations in your science notebook.

8. Make 5 more waves and record your observations in your science notebook.

Make 2 more sets of 5 waves and record your observations.

9. Observe the bottom of the container and record any additional observations in your science notebook.

10. Place the retaining wall back in the plastic box and use it to push the earth material back into the end of the box. Carefully drain out any remaining water in the box.

### Part B: Preventing Cliff Erosion

11. Rebuild the cliff as in Steps 1–2. If the earth material is too wet to form the cliff, mix a little dry earth material into it until it is the right consistency.

12. Place two long rectangular blocks up against the base of the cliff. These blocks represent a retaining wall.

13. Repeat Steps 4–9.
14. With your class, compare the results of the investigation with and without the retaining wall.

### Part C: Modeling and Slowing Down Beach Erosion

15. Make a model of a beach by flattening the sand out where you built the cliff. Use the spoon to make an even slope to the water.






16. Based on what you learned in Part A, design and build a structure to reduce erosion on the model beach. Work with the materials provided. The best design will involve as little material as possible to protect the beach. The structure you design should not prevent people from playing on the beach or swimming.

As you develop your design, make sure to:

- decide on a standardized way of testing your design, recording what happens, and explaining your design to others.
- predict what will happen when you make the waves.
- obtain your teacher’s approval of your design, and conduct your investigation.
- construct diagrams that show the beach before and after you use the wave maker. Include any measurements you take.
- discuss ways in which the model might be improved, based on the evidence from your investigation.
- redesign the structure(s), and conduct the investigation again.

17. Present your final design to the class.
18. With the class, discuss the limitations of your design.

## ANALYSIS

-  1. What did the waves do to the cliff model? Explain in terms of erosion and deposition.
-  2. What was the effect of the retaining rocks on the model cliff?
3.
  - a. What kind of landform was created at the bottom of the model cliff?
  - b. What earth process was involved?
4. Granite on a mountaintop is likely to erode differently than granite found on a sea cliff. Why do you think this is true?
-  5. Review your results and your response to Analysis Question 5 in Activity 31. This activity has provided you with more evidence about the erosion of cliffs. Where would you expect to see more erosion, at Green Hill or at Seaside Cliff? Be sure to explain your evidence.
6. What did all the designs for reducing erosion on a shoreline have in common? Explain how they reduce erosion at a cliff and a beach.
7. What are some of the advantages and disadvantages of building a structure to protect a cliff or beach?

## EXTENSION

Design and conduct an investigation of the model cliff that compares the erosion in an area that has high and powerful waves to the erosion in a calmer area with less powerful waves.

