

**Author:** Chuck Lauritzen

**Title:** Lab Activity: Sediment Transport by Glacial Recession

**Subject:** Weathering and Erosion Unit of Earth and Space Science Course

**Grades:** 8-12

**Description:** Students will be divided into groups and each group will set up a simulated valley glacier as described in the lab activity handout. Each handout includes instructions and a scoring guide for the activity. After the glaciers are constructed the students will study terminology associated with glaciers. Students will need to make periodic inspections of their glaciers, so it will be necessary to schedule observation times for students throughout the day. The glaciers will finish melting overnight. Students will analyze the remains during the following class period and answer questions 1-7 on the lab handout. An extension for the activity is included on the handout and it could be used for advanced students or extra credit. A class discussion and summary would finish the activity.

**Length:** 2 class periods

**Objectives:** Students will develop an understanding that:

- 1.) Human activity affects natural earth processes.
- 2.) Earth's surface is shaped by erosion and deposition.
- 3.) Glaciers are one of nature's erosion agents that are affected by global climate changes.

**Materials, Procedure, and Assessment:** {included in handout}

Good Points:

- 1.) Everything in this activity is cheap! The most expensive item is a 10 ft. section of ABS tubing for \$14.00, but this will supply 10 troughs at \$1.40 each.
- 2.) The lab should work well and lends itself to many variations. For example, sediments can be frozen vertically in layers or frozen horizontally, types of sediment can be changed, and graphing and mapping can be incorporated.

Problems:

- 1.) A table saw or band saw is needed to cut the ABS tube in half lengthwise.
- 2.) The activity requires an extended period of time to complete, so it would be necessary to schedule observation times for students throughout the day.

**Scientific Explanation:**

Upon examination of the receding *valley glacier* students should observe that the *till* deposited by the *retreating glacier* is not distributed uniformly. The finest glacial sediment will be transported furthest by the *melt water stream* and

deposited on the *outwash plain*. In contrast, the coarse sediment from the *glacier load* will be left in place forming a *terminal moraine*, which marks the glacier's furthest advance. Additionally, students should understand that global warming is one factor affecting glaciers and that greenhouse gases linked to human activity are believed to be responsible for recent increases in global warming.

**Kansas Science Standards:**

**Standard 4, Benchmark 1, Indicator 1:** The student understands constructive and destructive processes dynamically reshape the surface of the Earth.

**Standard 6, Benchmark 4, Indicator 2:** The student understands there is a need to assess potential risk and danger from natural and human-induced hazards.

## Lab Activity: Sediment Transport by Glacial Recession

**Question:** As glaciers advance they scour the landscape, moving rock and soil forward in the direction of growth. Can receding glaciers also transport sediment?

**Hypothesis:** What is your prediction (answer in the space below)?

**Materials:**

- 1.) 2 ft. long sections of 3 in. diameter ABS pipe cut in half, lengthwise
- 2.) 6 in. long sections of wood for stacking to elevate ABS troughs
- 3.) plastic sheets to catch runoff water (buckets also, if done indoors)
- 4.) 12 oz. or 20 oz. plastic beverage bottles
- 5.) samples of silt, sand, and gravel
- 6.) protractors
- 7.) volumetric measuring devices (1/8 cup works well)
- 8.) freezer
- 9.) sieving screens and mass scales (optional – for activity extension)

**Procedure:** Mix equal volumes of silt, sand, and gravel in empty plastic beverage bottles. Shake the bottles well and fill them with water. Then freeze the bottled mixtures overnight. While the water is freezing set the ABS troughs (glacial valleys) on the wooden blocks to create different angles for comparison purposes. Use protractors or trigonometry to determine the trough angles. Place a plastic sheet at the bottom of each trough to catch the water run-off and transported sediment. If performed inside, place buckets after the plastic. When the bottles of water (glaciers) are frozen cut away the plastic bottles from the ice and place each glacier at the top of a glacial valley. Now start recording the desired data and make observations by checking every glacier at regular intervals.

**Questions:**

- 1.) What affects the rate of melting?
- 2.) What affects the volume of transported sediment? Explain.
- 3.) What affects the distance of transported sediment? Explain.
- 4.) Which type of sediment is transported the most by volume?
- 5.) Which type of sediment is transported the least by volume?
- 6.) Where would you find a melt water lake? Explain why.
- 7.) How would you locate an extinct glacier's farthest advance?

**Extension:** Sieve the sediments prior to mixing, weigh each type (silt, sand, gravel), and calculate the weight percentage of each. Record this data. After the glacier melts determine the weight percentage of each sediment type at set distances from the terminal moraine. Graph the weight percent of transported sediment type vs. the glacial trough angle to quantitatively determine how slope affects sediment transport.

**Assessment:**

## Scoring Guide

	<u>3</u>	<u>2</u>	<u>1</u>	<u>0</u>
<u>Hypothesis</u>	legitimate testable prediction	a prediction	irrelevant idea	blank
<u>Participation</u>	always working productively	usually working	following the herd	off task
<u>Questions</u>	correct answers good explanations	all answered some errors	many incomplete and incorrect	mostly blanks
<u>Extension</u>	accurate measures and calculations correct graphing	mostly correct calculations some graphing problems	incomplete many errors	no work no clue