

## MiSP WEATHERING AND EROSION UNIT

**Introduction:** Weathering and erosion is a significant topic in both intermediate level and Regents level earth science instruction. Teaching and learning involves:

- Definition of weathering, chemical vs. physical weathering
- Weathering produces sediment which is part of soil
- Definition of erosion
- Gravity's role in erosion - directly or through agents
- Agents of erosion
- Changes in materials, surface features, and landscapes as a result of erosion

This MiSP unit includes one activity on erosion (mass wasting) and one activity on weathering (stream erosion). Teachers may choose to do these activities as culminating events in their classes' study of weathering and erosion.

Resources:

Glacier Simulations:

<http://phet.colorado.edu/en/simulation/glaciers>

[http://www.classzone.com/books/earth\\_science/terc/content/visualizations/es1501/es1501page01.cfm?chapter\\_no=visualization](http://www.classzone.com/books/earth_science/terc/content/visualizations/es1501/es1501page01.cfm?chapter_no=visualization)

[http://serc.carleton.edu/NAGTWorkshops/geomorph/visualizations/glacier\\_physics.html](http://serc.carleton.edu/NAGTWorkshops/geomorph/visualizations/glacier_physics.html)

**ILST Core Curriculum - Major Understandings:**

Standard 4 Physical Setting 2.1g, 2.1h, 2.1i

**Physical Setting/Earth Science Core Curriculum - Major Understandings:**

Standard 4 Physical Setting 2.1p, 2.1s, 2.1t, 2.1u

**Objectives:**

After completing this unit students will be able to

- Define and describe weathering, chemical and physical
- Define and describe erosion
- Define and describe mass wasting
- Relate the length of time a material flows through mass wasting to its velocity and explain that the change in velocity is due to changes in thickness.
- Observe and explain the changes that occur after initial and subsequent erosion of rock particles.
- Relate unit rate of change (slope) to the speed of mass wasting and the speed of erosion (L2)
- Determine the formula for lines on the mass wasting and erosion graph and use the formula to calculate values (L3)

## Day 1 - Introductory Lesson -

Review or complete instruction about mass wasting, glacier movement and weathering by water so that students will understand the context of the two MiSP activities.

If students are going to make the gak - glacial ooze - in the lab, that work should be done on Day 1.

### QUESTION OF THE DAY

Glaciers have been in the news because it has been reported that they are shrinking or "receding" due to global warming. It has always been true that glaciers tend to creep forward in the winter and seem to move backwards in the summer. But, gravity is what causes glaciers to move or slide downhill. So, how can glaciers seem to move backward or "recede?"

## Day Two - Glacial Creeping - Mass Wasting - Glacial Ooze - Worksheet #1

One of the challenges of this lab is relating the use of a model to learn about phenomena: mass wasting and/or glacial movement. Discussion before and after the lab experience should review the usefulness of using models to explain and study phenomena and that models are not "perfect" representations of what is being studied.

This lab requires the teacher or students to make "Gak" to be used as the glacial ooze in the experiment. Students can make the glacial ooze but it should be made in advance of the lab day. Glacial ooze can be reused. Teachers should prepare the 4% borax solution in advance.

### Recipe for Gak:

The GAK (glacial ooze) used for this lab is a polymer formed from sodium borate and Elmer's glue.

To make the 4% borax solution:

or 1-tablespoon (15 ml) laundry borax into one cup of water-stir until dissolved  
40 grams  $\text{Na}_2\text{B}_4\text{O}_7$  (sodium borate) and 960 ml of water stir until dissolved

1. Add 50 ml. of Elmer's glue directly into a 250 ml beaker (no need for graduated cylinder)
2. Using a graduated cylinder, add 50 ml of  $\text{H}_2\text{O}$  to the glue and stir well to combine
3. Add 2 drops of food color and stir well to produce an even pastel color.
4. Add 30 ml of borax solution (4%) to glue/  $\text{H}_2\text{O}$  mixture and stir well to combine
5. Knead in your hands or in a plastic bag
6. Return glacial ooze to the beaker and let it take on the shape of the container.

7. Wash your hands - borax can be an eye irritant

Teacher Tips:

If more than two drops of food coloring is used the color may darken to the point where it will stain the students' hands- hard to wash off. Food coloring is not a requirement of the lab. Glacial ooze will work fine if it is white.

Students will want to play with glacial ooze. If you schedule the lab for a double period, making the ooze, playing with the ooze ( stretching it, tearing it, watching it drip out of one's fist) and clean up, including washing hands, will take one period. The lab can be done in one period.

If you do give glacial ooze to students, it is suggested that they sign an adoption agreement. See sample below (Cut and paste it to a document or make your own):

*Glacial Ooze Adoption Agreement*

*I understand that I am responsible for the containment of my glacial ooze.  
I understand that the glacial ooze contains borax which is an eye irritant and is toxic (so it must not be eaten)!  
I agree to behave in a responsible manner and accept all responsibility regarding my actions and the fate of the glacial ooze.*

*Print Name* \_\_\_\_\_

*Date* \_\_\_\_\_

*Signature* \_\_\_\_\_

**QUESTION OF THE DAY:**

List three (3) or more examples of weathering that you see in your everyday life.

**Day 3 and 4 - WEATHERING BY A STREAM - Worksheet #2**

As in the previous activity, a challenge is to help students understand that this is a model and the model has limitations. There is also the opportunity to connect weathering and erosion - Where does the lost mass of rock go?

**LAB TEACHER TIPS**

1. Pre-soaked shale broken into pieces about this size work very well.
2. It is absolutely essential that the shale is soaked in water for a day or the weight will increase after shaking due to water absorption.



## Teacher Guide - MiSP - Weathering - Erosion

3. It is also essential that the abraded chips be dried thoroughly between each 3 minute shaking episode.
4. It is possible to complete this lab in a single period if questions and graphing are either assigned for homework or done in class the next day.
5. Some of the lab questions are not evident from lab observations and require background knowledge that the instructor or readings can provide.
6. A cheap source of screening is nylon screen found at hardware suppliers cut into squares that are a bit larger than the opening of the jar used for shaking.
7. The jars used for shaking must be wide enough to allow pieces of shale the size of the ones shown above to pass through them.

### Day 5 Weathering - Erosion Assessment - Day 5

Administer assessment (Weathering Erosion Worksheet #3).