LESSON PLAN #2: Creating the Driftless: A Study in Glacial Movement

Overview:

Glaciers are moving mountains of ice. They move like slow rivers and actually flow. Gravity and the sheer weight of the ice mass are the causes of glacial motion. Ice is softer than rock so is easily deformed by the pressure of its own weight. Movement at the underside of a glacier is slower than movement along the top. Glaciers retreat and advance, depending on snow accumulation, evaporation, or ice melt.

Glaciers transport materials as they move. They also sculpt and carve the land beneath them. A glacier's weight combined with gradual movement, reshapes the land over hundreds to thousands of years. The ice erodes the land surface and carries broken rock and soil debris far from their original places, resulting in some interesting glacial landforms.

Due to the nature of land formations, some areas in northwest Illinois along with southwest Wisconsin, southeast Minnesota, and northeast Iowa were missed by the four glaciers that at different times covered the rest of these states. This area not covered by glaciers and the resulting glacial drift is called "The Driftless Area." This Driftless Area is rich with historic and geological information free from glacial impact.

Duration: 30 minutes

Subject Areas: Earth Science, Physical Science, Geography

Standards Addressed:
4-PS3-1
4-PS3-4
5-ESS3-1
MS-ESS3-1
MS-ESS2-5
MS-ESS2-3
MS-ESS1-C
MS-PS2-4

Objectives:

- Gain an understanding of how glaciers move
- Understand the types of landforms created from glacial movement and glacial scraping
- Define what is meant by The Driftless Area

Teacher Background:

Glaciers are made up of fallen snow that, over many years, compresses into large, thickened ice masses. Glaciers form when snow remains in one location long enough to transform into ice. What makes glaciers unique is their ability to move. Due to share mass, glaciers flow like very slow rivers. Some glaciers are as small as football fields, while others while others grow to be over a hundred kilometers long. Glaciers made up most of the landforms that we have in Illinois including glacial lakes, kettle lakes, till, and moraines.

Till is material deposited as glaciers retreat, leaving behind mounds of gravel, small rocks, sand and mud. It is made from the rock and soil ground up beneath the glacier as it moves. Glacial till can form excellent soil for farmland. Material a glacier picks up or pushes as it moves forms moraines along the surface and sides of the glacier. As a glacier retreats, the ice melts away from underneath the moraines, leaving long, narrow ridges that mark its path. Glaciers don't always leave moraines, because sometimes the melt water carries the material away.

Streams flowing from glaciers often carry some of the rock and soil debris out with them. These streams deposit the debris as they flow. Consequently, after many years, small steep-sided mounds of soil and gravel begin to form adjacent to the glacier. These mounds are called kames.

Kettle lakes form when a piece of glacier ice breaks off and becomes buried by glacial till or moraine deposits. Over time the ice melts, leaving a small depression in the land, filled with water. Kettle lakes are usually very small and are more like ponds than lakes. Glaciers leave behind anything they pick up along the way, and sometimes this includes huge rocks. Called erratic boulders, these rocks might seem a little out of place, which is true, because glaciers have literally moved them far away from their source before melting away.

Glossary:

Moraine: a ridge, mound, or mass of unstratified glacial drift like boulders, gravel, sand, and clay
Kame: a short ridge, hill, or mound of stratified drift deposited by glacial meltwater
Glacial till: unstratified glacial drift consisting of clay, sand, gravel, and boulders
Kettle lake: a steep-sided hollow without surface drainage especially in a deposit of glacial drift

Activity: Glacier Simulation

Supplies Needed:

Access to freezer
Plastic cup
Angular gravel
Tap water
Plastic wrap
Tape
Paper plate
Smooth piece of wood

Activity Steps:

1. Review with your students what they have learned about glaciers. They should be able to define glacier and explain why glaciers move over landforms.

2. Ask students how they think scientists can tell if glaciers have moved over the land in a particular area. Explain that rocks and gravel freeze into the ice and are dragged over the land by the bottom surface of a glacier. How would the land over which a glacier has moved be affected? What evidence of glaciation do glaciers leave behind?

3. Tell your students that they will participate in an activity that will simulate the way landforms are affected by glaciation.

4. Divide the class into groups. Have each group create its own miniature glacier as follows:

    - Have students half-fill a paper cup with angular gravel.
    - Cover the gravel with about an inch of water.
    - Securely tape plastic wrap over the top of the cup.
    - Flip the cup onto a paper plate.
    - Leave the inverted cup in a freezer overnight.

5. When the "glaciers" are frozen solid, have students peel off the paper and scrape them, gravel end down, over a smooth piece of wood. To simulate the action of a glacier, students should scrape in only one direction, since glaciers move only one way.

6. Ask students to observe the patterns the gravel has made on the wood. How would they compare these to the patterns made on landforms by a real glacier? (If possible, provide photographs of actual glacial scraping.)

7. Have each student sketch their patterns and write a short paragraph explaining what they can infer about the way real glaciers affect the landforms over which they move.

Discussion Questions:

- Discuss with the class how patterns of glaciation provide clues to the climate in a particular area over time. For example, if evidence of glacial scraping is found in an area that is too warm for glaciers to exist, what can we infer about how the climate in that area has changed over a long period of time?
- Discuss how we can tell that the area we live in is considered Dritless. What evidence do we have to support that conclusion?
- Discuss the physical differences between the Driftless Area and land that has been covered by glaciers.

Lesson plan inspired by: http://209.7.198.36/geologyonline/lessons/6.1/lesson.pdf