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TESI05
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Title: Glacial Striation Investigation

Subject: Geoscience

Grade: 10-12

Michigan Content Standards:

Constructing New Scientific and Personal Knowledge CS1:B2,3
Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts CS1: B1

Objectives:
Students will:

- Operate a GPS unit to investigate the direction of glacier movement
- Describe the motion of glacier movement by interpreting a graph
- Explain how scientists use glacier striations to determine glacier movement

Background information:
Prior to this lesson students will have knowledge of the different features that glaciers leave behind after they have covered and moved over an area. Students should also be familiar with how to operate GPS equipment. This investigation uses UTM coordinates, so students should also be familiar UTM.

Key vocabulary: Striations, UTM (Universal Transverse Mercator), moraines, till, erratics, kettle lakes, Ice Age Theory

Materials and set-up:
Some set-up is required prior to students coming to class.

- Chalk: using chalk you can mark the school parking lot so that it resembles glacial striations (You may create as many marks as you would like.)

Or

- Foam: using large foam from a craft store carve out striations so that the foam resembles a rock with striations
- GPS equipment: enough GPS units so that there are no more than 4 people per group
- Handheld compass: to determine the angle of the striation
- Graph paper: to graph glacial striations
- Protractors: to graph the angle of striations

Introduction:
Ask students: "How do we know which direction the glaciers moved if nobody was here to witness it?"

"Why do we care what direction the glaciers moved?

- It may tell us where trace minerals originated from.

Example: Trace amounts of copper have been found in the soil of a farming area. Geologists confirm that there is no copper found beneath the soil. Where did this copper come from? ---Glaciers may have carried it and deposited it here.

Investigation:
*Students will work in small groups to accomplish the given task.
*Each person in the group will be assigned a task.

a. Navigator - using the compass to find the direction of the glacier movement
b. Navigator - using the GPS, find the coordinates of the striations
c. Explorer – help group find where the striations are located
d. Recorder – record all coordinates and directions of striations

1. To begin, have all groups record the UTM coordinates of the starting point. The starting point may be anything you assign, such as a flag pole. Make sure that all GPS readings are approximately the same for this one location.
2. Students should record the coordinates and angle of at least 5 different striations. Each striation should be no closer than 5 meters from each other. (You may have them do more, depending on time.)
3. Have students plot the coordinates. (You may want to set the scale for them.)
4. Using a protractor, have students dissect the point with a line that represents the angle of the striation. (North being 0º, East 90º, etc.)
5. Students will then answer the investigation questions.

Closure:
Ask the students the following questions:

1. Why weren't all the striations in the same direction?
2. Why did the striations need to be more than 5 meters apart from each other?
3. What do these striations tell us about the movement of the glacier?

Assessment:
Students will answer the follow-up questions after they have completed the investigation.

Enrichment:
You can also set up erratics and moraines in the parking lot. Have students also record these coordinates and graph.

Name:_____Date:_____Hr:___

Investigation: Glacier Striations
"Who wants to be a glaciologist?"

Objective: Students will use Global Positioning System (GPS) data and compasses to graph glacier striations and determine the direction of glacier movement.

Materials: GPS unit, compass, graph paper, protractor

Procedures:

1. Determine group member roles
    a. Navigator #1 - using the compass to find the direction of the glacier movement
    b. Navigator #2 - using the GPS, find the coordinates of the striation
    c. Explorer – help group find the where the striations are located
    d. Recorder – record all coordinates and directions of striations
        - You may switch roles so that everyone gets a chance doing something different
2. Find the UTM coordinates of the _____, this will be our starting point. Record this on the data table.
3. Procede to find at least 5 glacial striations. Make sure that the striations you record are at least 5 meters apart. Record coordinates and compass direction for each striation in the data table.
4. Each member in the group is responsible for graphing these coordinates.
5. Plot these coordinates using UTM. Northings will be the Y axis and Eastings the X axis.
6. Draw a line that dissects the point with a protractor. The angle of this line should be the angle you recorded with your compass. North is 0º, East 90º, South 180º, and West 270º.
7. Answer follow-up questions.

Data Table:

Location	Northings	Eastings	Compass Direction
Starting Point			**XXXXXXXXXX**
#1			
#2			
#3			
#4			
#5			

Follow-up Questions:

1. In what general direction did the glacier appear to move when it was advancing? Retreating? How did you determine this?

2.Why weren't all the striations in the same direction?

3.Where would end moraines have been found and in what direction?

4.Where would drumlins have been found and in what direction?

5.How do glaciologists know which direction a glacier moved over an area?