Jeanne Suttie ` Summer 2005
TESI 05 – Lesson Plan

Title: Glacial Geocaching

Grade level: 8th grade

Subject: Regents Earth Science

Time frame: 2 or 3 periods. Each period 40 minutes long.

NYS Standards:

STANDARD 1 - Analysis, Inquiry and Design
- Mathematical Analysis
- Scientific Inquiry

STANDARD 2 - Information Systems

STANDARD 6 - Interconnectedness: Common Themes
- Systems Thinking
- Models

STANDARD 7 - Interdisciplinary Problem Solving
- Connections
- Strategies

STANDARD 4 - Science
- Key Idea 2 Performance Indicator 2.1
  - Major Understanding 2.1p, 2.1q, 2.1r, 2.1s, 2.1t, 2.1u
- Key Idea 3
  - Major Understanding 3.1a, 3.1b, 3.1c

For more detail explanation go to www.nysed.gov

Objectives:
Students will:
- Measure strike and dip of given land features.
- Explain the differences between two different types of land features.
- Identify rock and mineral samples.
- Calculate density of four samples.
- Analyze the information collected to prove a discrepancy in information.

Prior knowledge: identification of rocks and minerals, soil horizons, glacier erosional and depositional landforms, latitude, longitude, GPS, UTM (Universal Transverse Mercator) coordinates, density

Materials:

Each group: GPS, compass, string, level, clipboard, pencil, hand lens, field bag, rock/soil/mineral sample bag, measuring tape, Earth Science Reference Table

Field station: hand lens, sieves, digital scales, W*ite-out*, permanent marker, graduated cylinder, eyedropper, water in pitcher, copper sample

Mock glacial striae – take foam board carve out striae, spray paint, and glue fake moss onto it. Stake the glacial striae models in the area that students will be using in the directions of known glacial movement.

Panning activity – wading pull, sediment, water, pans, copper, stopwatch

Procedure:

Setup

1. Divide class into 5 groups with approximately 5 students per group.
2. Have students come up with a group name.
3. Each student should be given a particular role, such as: group leader, equipment manager, data collector, identification coordinator, and safety officer.
4. There will be 5 geocaching courses set up. This is to prevent students from collaborating with other groups and having too many students at one particular cache site.
5. Each group will be given an initial UTM coordinate. This will take them to the first geocache site where, once they locate the cache will have to perform a specific task.
6. Each cache will be "hidden" in a container like a film canister. The task will be on a rolled up piece of colored paper. Students are to place each cache task on the clipboard provided.
7. Placed in each container will be a trinket, for example, eraser, marble, stickers, etc.
8. All math calculations are required to have the three-step method, formula, substitution and answer plus unit to the nearest tenth.

Activity

Geocache Sites

Note: format of these sites is similar to www.geocaching.com

Site 1 UTM 18T E ######
N #######

Site 2 UTM 18T E ######
N #######

Difficulty: ☆ ☆ Terrain: ☆ ☆

(Ratings are out of 5 stars. 1 is easiest, 5 is hardest.)

In-field task:

- Find the compass orientation of the glacial features. Identify these glacial features ($*_1$).

Data observations:

Answer ($*_1$): Gur tynpvny srngher vf pnyyrq fgevnr.

```
    Decryption Key
A|B|C|D|E|F|G|H|I|J|K|L|M
-------------------------
N|O|P|Q|R|S|T|U|V|W|X|Y|Z
(letter above equals
below, and vice versa)
```

Teacher note: The glacial features are striae.

Site 2 UTM 18T E ######
N #######
Site 3 UTM 18T E ######
N #######

Difficulty: ☆ ☆ ☆ Terrain: ☆ ☆
(Ratings are out of 5 stars. 1 is easiest, 5 is hardest.)

In-field task:

- Measure the strike and dip of this landform.
- Using the auger obtain a sample of this landform. Remove the humus (grass, leaves, sticks, etc.). Place the remainder of the sample in the Ziploc bag provided. Label the bag sample 1.

Field station task:

- Identify three different rocks or minerals from sample 1, using ESRT. Label the rocks or minerals when done. Place the rest of the sample in the bin provided, for the next step, and keep the three rocks or minerals in the bag labeled sample 1.
- Take total mass of the sample 1 using digital scale and appropriate measuring technique.
- Place the entire sample into the top sieve. Shake the sieves carefully.
- Identify each sediment size obtained using ESRT.
- Find mass of each sediment size and its percentage.
    - (Mass of certain sediment size/total mass) x 100 = %

Data/observations:

Teacher note: The landform is a glacial moraine made up of unsorted sediment ranging from clay to pebble size sediment.

Site 3 UTM 18T E ######
N #######
Site 4 UTM 18T E ######
N #######

Difficulty: ☆ ☆ Terrain: ☆ ☆
(Ratings are out of 5 stars. 1 is easiest, 5 is hardest.)

In-field task:

- Measure the strike and dip of this landform.
- Obtain sample from site using auger. Remove the humus (don't keep) and place remainder of sample in bag labeled, sample 2.

Field station task:

- Take total mass of the sample 2 using digital scale and appropriate measuring technique.
- Place the entire sample into the top sieve. Shake the sieves carefully.
- Identify each sediment size obtained using ESRT.
- Find mass of each sediment size and its percentage.
    - (Mass of certain sediment size/total mass) x 100 = %

Data/observations:

Teacher note: The landform is a man made slope with a strike different from both the glacial striae and moraine. However the sediment is composed of sorted sand, indicative of outwash deposits in this area.

Site 4 UTM 18T E ######
N #######

Difficulty: ☆ ☆ ☆ Terrain: ☆
(Ratings are out of 5 stars. 1 is easiest, 5 is hardest.)

In-field task:

- Measure the glacial erratic using the tape measure provided. Remember to use centimeters.
- Using the ESRT identify the sediment size and rock ($*_2$).

Field station task:

- Remove the three rocks or minerals from bag labeled layer 1.
- Find the density of each of these samples.
- Find the density of the copper sample provided ($*_3$).
- Calculate the percent deviation for copper using your measurement and the one provided.

Data/observations:

Answer:

($*_2$) Gur obhygre vf n tarvff ebpx.

($*_3$) Gur grafvgl bs pbccre vf rvtug cbvag avar t cre pzphorq.

```
    Decryption Key
A|B|C|D|E|F|G|H|I|J|K|L|M
-------------------------
N|O|P|Q|R|S|T|U|V|W|X|Y|Z
(letter above equals
 below, and vice versa
```

Teacher note: The rock is gneiss and is a boulder. Gneissic rock is Long Island's bedrock. The density for copper is 8.9 cm^3.

Assessment

Using your knowledge of Earth Science and your data and observations from this lab, answer the following questions.

1. Direct ice contact and glacial meltwaters have aided in the formation of Long Island. The two landforms in this investigation have each been formed by one of these two

mechanisms. Identify the appropriate site to its agent of deposition. (Hint: sorted or unsorted sediment)

2. Compare the strike's of the landforms at Sites 2 and 3. How do they compare with the glacial striae's orientation? One of these landforms has been altered by humans. Which one and provide evidence to support the statement?

3. In a rare occurrence, three deposits of copper have been found on Long Island (not really true). How could you convince your teacher that copper is not normally found here? Provide at least three pieces of evidence.

4. Panning activity. Students use their knowledge obtained at Site 4 to pan for copper. This will be a timed activity. All groups participate. Lowest time with three pieces of copper wins.

Extension

Student located 2 additional pieces of glacial evidence and record UTM coordinates. Switch with a chosen group.