

## **Archaeology and Erosion Lesson Plan**

### **Grade Level(s):**

5, 6, 7

### **Subject(s):**

- \* Social Studies/ World History
- \* Mathematics
- \* Physical Science

### **Duration:**

2 forty-five minute classroom periods

### **Description:**

Students will use real archaeological data to create a scale model of Tikal Temple 1, a Mayan pyramid, using sugar cubes. Students will then set up and conduct a scientific experiment using their sugar cube models to simulate the process of erosion and its effects on archaeological sites.

### **California State Standards**

This lesson plan is compliant with the following California State Standards:

#### **Grade Five**

Mathematics Content Standards.  
Measurement and Geometry

1.0 Students understand and compute the volumes and areas of simple objects:

#### **Grade Six**

Science Content Standards.  
Focus on Earth Science: Shaping Earth's Surface

2. Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment. As a basis for understanding this concept:

1. Students know water running downhill is the dominant process in shaping the landscape, including California's landscape.

2. Students know rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural and recurring patterns.

3. Students know beaches are dynamic systems in which the sand is supplied by rivers and moved along the coast by the action of waves.

4. Students know earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.

#### **Grade Six**

Mathematics Content Standards  
Algebra and Functions

2.0 Students analyze and use tables, graphs, and rules to solve problems involving rates and proportions:

## **Grade Seven**

Mathematics Content Standards.

Measurement and Geometry

1.2 Construct and read drawings and models made to scale.

Social Studies Content Standards

7.7 Compare and contrast the geographic, political, economic, religious, and social structures of the Meso-American and Andean civilizations.

## **Materials**

Graphing Paper

Pencils

Pens

Rulers

Sugar Cubes (2 lbs per group of 4-6 students)

Glue

Cardboard

Aluminum Foil

Spray bottle

Hair drier

Lamp

CyArk Tikal Maps (one for every student)

Digital Camera (optional)

## **Procedure**

### **Day 1**

Time: 45 minutes

1. Introduce students to Tikal as an example of a Mayan site. Tikal is located in modern day Guatemala and is one of the largest Mayan sites, with six stepped pyramids rising from the jungle. Media from the CyArk website (<http://www.archive.cyark.org>) is available for free to educators and students and can be used to create a slideshow introduction to the site. The CyArk website has background on the city of Tikal and images, videos, and 3-D models of the city. Each media item also contains a detailed description and information relating to that media pieces.

A Power Point introduction to the site of Tikal created by CyArk can be downloaded at SlideShare and is free to be used in classrooms.

<http://www.slideshare.net/namedina/tikalthe-ancient-city-of-the-maya>

2. Go to the CyArk website and view the 3-D models of Tikal Temple 1. Explain to students that they will be re-building this pyramid as their assignment.

3. Review scale, ratios, and proportion with students if necessary.

4. Have students form groups of 4-6 and distribute copies of the Tikal Temple 1 Map. Alternatively, you can make your own Tikal Temple 1 map using the CyArk 3-D viewer by creating slices and measuring the temple. Explain to students that they will be creating a scale model of a Mayan pyramid using real archaeological data and sugar cubes to construct a physical scale model. Using the Temple 1 Map measurements, students will apply ratios and proportions to create a scale model of the Tikal's Temple 1.

5. Ask students to design a scale model of the temple. When constructing the temple, 1 sugar cube will represent 3 meters. Using the laser scan cross section image of Temple 1, students will calculate dimensions based off the actual measurements and then design a model plan by breaking the pyramid into basic shapes. Have students round to the nearest whole number for the construction of their models.

Once students have completed calculations for the models, ask students compare their calculations with another group. Have students discuss their methods of determining the various dimensions of the model. Are there any recognizable patterns? What can these patterns tell us about the ancient Maya and their construction techniques?

Student should notice that each pyramid tier in a ratio is exactly one less sugar cube in length than the tier below it. This shows the Maya's considerable skill and precision in engineering and architecture.

6. Provide each group with a 2 lb box of sugar cubes and bottle of glue. Each group will be construct their own scale model using the Tikal Temple 1 Map. To reduce the number of sugar cubes used, it is recommended that students only construct a 4 tier pyramid, consisting of the 4 top most tiers and the pyramid's temple and roof comb. If students are using a 1:3 scale, a 2 lb box of sugar cubes will provide more than enough sugar cubes for a group to construct the 4 tier pyramid. For the purposes of constructing the pyramid, students will assume that the pyramid is a square pyramid. Students should wrap a piece of cardboard in a sheet of aluminum foil and then construct their pyramid on top of the foil, using glue to hold the sugar cubes together.

Once students have completed their scale model, have each group label their pyramid with their group name and carefully set the pyramids in safe place.

## **Day 2**

Time 45 minutes

1. Introduce students to the concept of erosion and weathering. Ask the students to think of examples of erosion that they have witnessed or evidence of erosion that they have seen.

2. Explain to students that erosion can affect both natural and man-made objects, including archaeological sites. Archaeological sites can be damaged by the process

of erosion, which can include water, wind, and heat. Tikal's temples are constructed of stone, and can be eroded. Tell students that they will be conducting a scientific experiment to determine the effects of erosion on archaeological sites.

3. Have students follow the procedure in next section. This procedure is also included in the student sheets for this activity.
4. During their experiment, students should record their changes in their notebook. If available, have students use a digital camera to assist in recording their experiment results.
5. Once the students have completed their experiment, have each group briefly describe to the class their procedure and results.
6. After the experiment, students should analyze their results and write a conclusion. Each student should turn in a copy of their experiment, including their hypothesis, materials, procedure, recorded results and conclusion. Students should answer the following questions: How did erosion affect their sugar cube pyramid? How do you think erosion affects archaeological sites?

## **Erosion Experiment**

### **Procedure:**

1. Each group will be assigned to test one aspect of erosion: water, wind, and sunlight.

### **Water Group**

#### **Day 1**

1. Record any observations on the sugar cube pyramid. If possible, take a picture of the pyramid using a digital camera. When taking a picture, create a label with your group name, date, class period and "Day 1 -0 sprays of water"
2. Fill a spray bottle with water and set the spray bottle to mist. Spray the pyramid evenly with water. Spray the pyramid with a total of 20 sprays.
3. Record any observations in your notebook or on the worksheet. If using a digital camera, take a picture of the pyramid and label it with your group name, date, class period and "Day 1 -20 sprays of water"
4. Carefully move the pyramid to a safe location where it can remain undisturbed until the next class session.

#### **Day 2**

1. Repeat Steps 2-4 of Day 1

#### **Day 3.**

1. Repeat steps 2-4 of Day 1.

## **Wind Group**

### **Day 1**

1. Record any observations of the sugar cube pyramid, If possible If possible, take a picture of the pyramid using a digital camera. When taking a picture, create a label with your group name, date, class period and "Day 1 -no wind applied"
2. Using a blow drier, blow dry the pyramid evenly for 10 minutes. If using a blow drier with multiple settings, select the "cool" setting.
3. Record any observations in your notebook or on the worksheet. If using a digital camera, take a picture of the pyramid and label it with your group name, date, class period and "Day 1 -10 minutes of wind"
4. Carefully move the pyramid to a safe location where it can remain undisturbed until the next class session.

### **Day 2**

1. Repeat Steps 2-4 of Day 1

### **Day 3.**

1. Repeat steps 2-4 of Day 1.

## **Sunlight Group**

### **Day 1**

1. Record any observations of the sugar cube pyramid, If possible If possible, take a picture of the pyramid using a digital camera. When taking a picture, create a label with your group name, date, class period and "Day 1 -no sunlight applied"
2. Using a lamp, shine the light on the pyramid for 10 minutes.
3. Record any observations in your notebook or on the worksheet. If using a digital camera, take a picture of the pyramid and label it with your group name, date, class period and "Day 1 -10 minutes of sunlight"
4. Carefully move the pyramid to a safe location where it can remain undisturbed until the next class session.

### **Day 2**

1. Repeat Steps 2-4 of Day 1

### **Day 3.**

1. Repeat steps 2-4 of Day 1.

## **Extension Activities**

Have students view Temple II at the CyArk website. The eighth-century Tikal king Jasaw Chan K`awiil commissioned Temples I and II during his reign. Temple II is dedicated to his wife, Lady Twelve Macaw (died 704 A.D.), and she is interred within it. Though its roofcomb is now eroded, Temple II has also been known as the Temple of the Masks on account of its upper frieze once having been adorned with gigantic stone and stucco masks. Roof combs were used as grand billboards for the display of religious and political imagery.

Have students examine Temple II. How is it different than Temple I? How is it the same? How many levels does the temple have? Does it have similar motifs to Temple I? How tall is it compared to Temple I? Measure it in the CyArk 3-D viewer.

