

Teacher Guide

Archaeology and the Rock Cycle



Grade Level: 4th – 8th Grade

Time Requirement: 60 – 90 minutes

Introduction

In Part 1 of this activity, students will model sediment deposition by reading a story that transports them through time. They will create layers of sediment and deposit some of the objects used by people living in the area as well. In Part 2, students will become amateur archaeologists. They will excavate an archaeological site, catalogue artifacts they find, and make inferences about the people who left them behind.

Required Materials

- 32-oz. Plastic Containers (12)
- Mica Powder (5 Jars)
- Paper Artifacts
- Deposition Story Flipbooks
- 6-in Rulers (12)
- Flour
- Vegetable Oil
- Paper Artifact Tags
- Wooden Trowels (30)
- Tweezers (12)
- Brushes (12)

Science Standards

- 4.10(B) model and describe slow changes to Earth's surface caused by weathering, erosion, and deposition from water, wind, and ice.
- 5.10(B) model and describe the processes that led to the formation of sedimentary rocks
- 6.10(C) describe how metamorphic, igneous, and sedimentary rocks form and change through geologic processes in the rock cycle
- 7.10(A) describe the evidence that supports that Earth has changed over time, including fossil evidence, plate tectonics, and superposition

Objectives

- Demonstrate how sediment deposition can occur and lead to sedimentary rock formation.
- Identify relative ages of strata and archaeological artifacts using the Law of Superposition.
- Infer how people lived in past eras based on the artifacts they excavate.

Art Extension: Story Illustrations

After creating their strata in Part 1, students can illustrate a single Deposition Event or make a comic panel of the whole Deposition Story. Alternatively, after excavating, students can create an illustration based on the artifacts in a single stratum or a comic panel representing the whole excavation site and each layer.

Historical Context

Archaeology is the study of the human past through material remains. We call those remains the archaeological record. Archaeologists examine objects humans of the past left behind, such as tools and pottery. Those objects are known as **artifacts**. Through the examination of artifacts and their context, archaeologists are able to identify patterns that can aid in the interpretation of the site. For example, pottery can have distinct designs or forms that are specific to a certain time period, which can, in return, provide a time range for a site.

Artifacts are not isolated. They are surrounded by context. **Context** refers to the exact location, what other artifacts, if any, are associated, and what kind of sediment the artifact is found in. Archaeologists use two key scientific concepts in understanding artifacts and context: the law of association and the law of superposition. The **law of association** tells us that artifacts found in the same stratigraphic layer were deposited at the same time. The **law of superposition** states that stratigraphic layers closer to the surface are younger than layers below. Both of these concepts are vital in understanding chronology. For example, imagine there are 4 layers of sediment. At the bottom is a dark brown clay, on top of that is a gray sandy clay, then there is a light brown sand, and the top layer is grayish-brown loam. Within the brown clay, there are stone tools, and within the light brown sand, there are painted potsherds and stone tools. Using the law of association, we know that the painted potsherds and stone tools are from the same time period. Using the law of superposition, we know the stone tools from the dark brown clay are from a different time period and are the oldest artifacts.

At the Alamo, archaeologists use artifacts and context to identify the various time periods and activities that occurred throughout the 300-year history of the site. **Excavations** have identified depositional layers that directly correspond with the mission life of the Alamo, the Battle of 1836, and the occupation of the U.S. Military. Creating a chronology using stratigraphy first requires an examination of the soil deposition and identifying the distinct layers. Once the layers are identified, archaeologists then look at the artifacts within those layers. In addition to creating a chronology, those layers can assist in determining what type of activities were occurring at the time. In the Battle layer there are musket balls and gunflints, but there are also the byproducts (such as sprue and lithic debitage) of manufacturing those items! This tells us that people were making musket balls and gunflints in certain areas of the site.

Background

The **rock cycle** describes how the three rock types, **igneous**, **metamorphic**, and **sedimentary** rocks, are formed, broken down, and changed from one type to another. There is no direct pathway through the rock cycle that all rocks must take, and since it is a continuous process, there is no specific starting or endpoint.

To simplify things, follow the story of one rock. It enters the rock cycle when molten rock makes its way to Earth's surface through a volcano. When the lava cools, it becomes an **igneous rock**. Over time, the igneous rock is broken down into smaller pieces by wind and water to form **sediment**. The sediment is transported, deposited, and later buried. The sediment then cements together to create a **sedimentary rock**. The sedimentary rock is buried deeply under other rocks, exposing it to high pressure and temperature. The minerals in the sedimentary rock can change shape and size and even sometimes partially melt, transforming into a **metamorphic rock**. Countless other scenarios describe how rock can move through the rock cycle. One small part includes weathering, erosion, and deposition.

Weathering is the breaking down of rock into smaller pieces, or **sediment**. Every rock type can be weathered, no matter if it's igneous, metamorphic, or sedimentary. **Erosion** is the transport of the weathered sediment away from its source to a different location. There are many causes of weathering and erosion, including wind, water, and ice. For example, the waves on a beach can weather a stone cliff by breaking the rock into smaller pieces and erode it by carrying the sediment away.

After being carried, sediment can settle in a process called **deposition**. An example of this can be seen when a river, carrying sediment in the water, meets the sea. As the river slows, the sediment is deposited as it settles at the bottom of the delta. Another example is when the wind in a desert transports sand grains which accumulate to form dunes. When sediment is deposited, it does so in layers forming **strata**. According to the **law of superposition**, as newer sediment is introduced, it lays on top of the older layer, or **stratum**.

Procedures

Teacher Notes

Sediment: To create the “sediment” students will use for creating their strata, follow the steps below. The amounts mentioned make enough for about 25 students.

1. Mix about 10 cups of flour with about 1 teaspoon of mica powder.
2. Mix vegetable oil with the flour and mica powder until it is the consistency of wet sand, about 1 cup to 1.5 cups.
 - a. If the mixture cannot hold any shape when packed together, you may need to add more oil. If it completely retains its shape when molded and squeezed, you have likely added too much oil and can mix in more flour.
 - b. If you’d like a more vibrant color, you can mix in more mica powder.
3. Repeat steps one and two with at least three other colors.

Deposition Story Flipbooks: For Part 1, each student group will get one of the three Deposition Stories. Cut out each Event Card and staple them together.

Student Procedures

Part 1

1. Get all the necessary materials for your group.
2. Read the Introduction of your Deposition Story.
3. Read through each Event and deposit sediment and artifacts as directed.
 - a. *Note that not all layers will have artifacts!*
4. Once you have completed your Deposition Story, you should have four distinct layers of sediment, each a different color.

Part 2

1. Before beginning your excavation, sketch and color a diagram of the strata in your container.
2. With your trowel, carefully scrape sediment and place it in a cup, on a plate, or a paper towel.
 - a. *Note that you are not digging but scraping a very thin layer at a time.*
3. When you find an artifact, use your tweezers to pick it up and place it to the side.
4. Use your brush to dust any sediment from the artifact.
5. Label the layer from your sketch with the artifacts found in it.
6. Using your ruler, measure how deep the artifact was buried from the top of the container. Note the depth on your sketch.
7. Continue excavating and remove a whole layer (color) before moving into the next.
8. Once you have excavated the entire site, complete an Artifact Tag for each artifact you found.

Safety and Disposal

It is recommended that students wear gloves, goggles, and aprons during this activity. The plastic containers, tweezers, wooden trowels, and brushes can be cleaned and reused, and the remaining “sediment” can be thrown away.

Contributors

Tiffany Lindley, PhD, RPA
Morgan Oldham

Brianna Echavarria
Rosemary Kriegel

Caryn Condello
Carla Perrio