Name: _____ Date: _____

Ancient Pollen:
Unlocking the Secrets of the Past

Introduction

Lakes are excellent collectors of pollen (and other wind-blown material), catching and preserving a record of the surrounding environment. By studying lake sediment cores, scientists can reconstruct past environments and understand how they have changed over time. In this activity, you will collect and analyze a simulated lake sediment core to learn about past plant communities and environmental conditions.

Do Now:

The illustration below represents a lake core, with different bands of color representing different layers of sediment. Even though you haven't learned much about lake cores yet, try to answer the questions below.

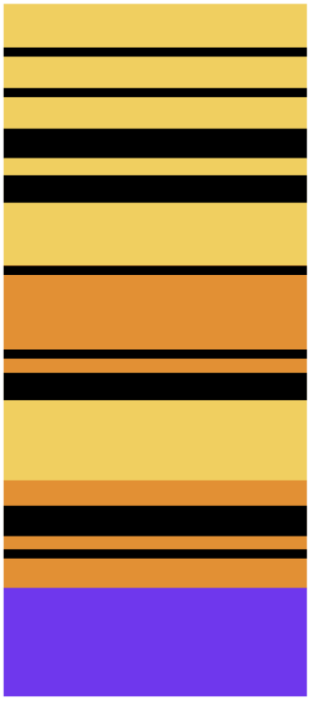
1. What do you notice about the sediment core?

2. How many layers do you see?

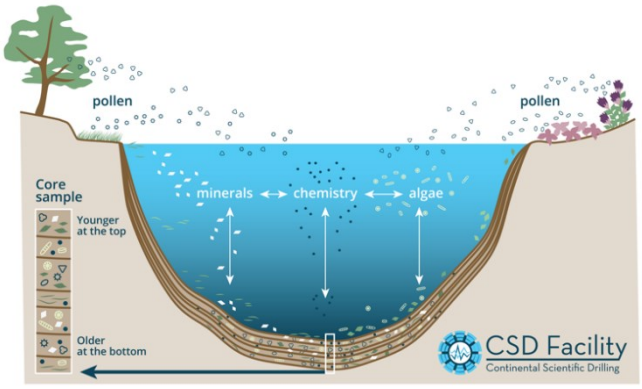
3. What do you think each layer represents?

Sediment Core

Top

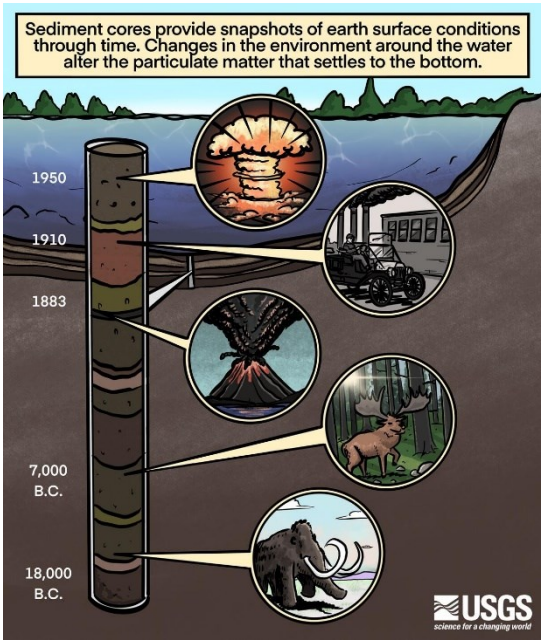


Bottom



Coring operation at Crater Lake, Colorado. September 2017. Source: Nicholas McKay, Northern Arizona University

Lake cores – how and why?



To collect a lake sediment core, a cylindrical tube is lowered into the bottom of a lake, where it is inserted into the lakebed. When a stopper caps the top of the tube, the sediment is trapped inside the tube and can be pulled out of the lake bottom. This is like what happens if you use your thumb to cover the top of a straw in a drink - you can lift the liquid out of the glass due to the suction.

There are many different questions about the Earth and its environments that can be answered by studying lake cores. Researchers can learn about when earthquakes occurred in the past, how large volcanic eruptions were, what the temperature and rainfall were like, and what kinds of plants and animals lived in and around the lake. In this activity, you will be collecting a lake sediment core sample to examine what kinds of plants lived around the lake at different times by studying pollen.

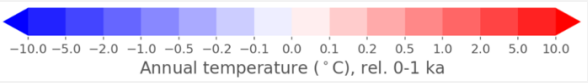
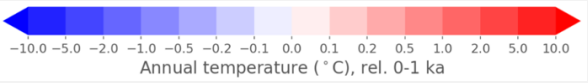
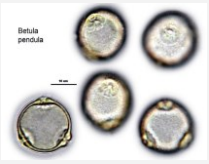
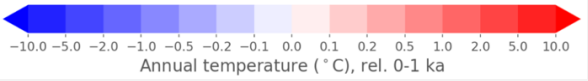
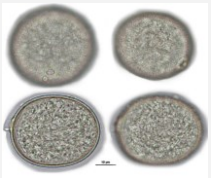
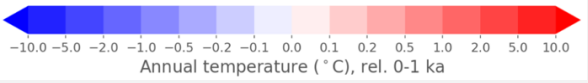
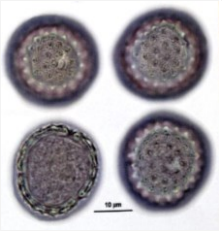
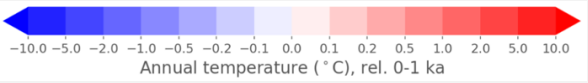
Before you collect your core sample, let's learn about pollen.

What is Pollen?

Have you ever noticed the yellow dust on the surface of a car that has been parked outside in the spring? Or perhaps you've heard of people suffering from pollen allergies? What is pollen anyway? Pollen is a powdery substance produced by flowering plants for reproduction. When viewed under a microscope, that powder consists of tiny grains of different shapes and sizes. Different plants create different pollen grains. A trained researcher can identify which plant produced which pollen. Specific pollen in lake sediments indicates the kinds of plant that were growing in an area at the time it was deposited in the lake.

Plants in the Environment

What can plants reveal about where they live? Are these places cold? Warm? Wet? Dry? Look at the pollen printouts and write down your responses. You can write your answers on the image below or make a chart with plant types on one side and environment on the other.

Plant Type	Pollen	Environment 4. Mark an “x” to select the environment where each plant is found
Pine Trees		
Oak Trees		
Birch Trees		
Grass		
Ragweed		

Part I: Collecting your Core Sample

Materials:

1. Lake Model: Tube of layered “sediments”
2. Large boba-tea-sized straw
3. White paper for extrusion of core sample
4. Colored pencils
5. Core description sheet
6. Pollen microscope printouts and radiocarbon dates
7. Magnifying glass or hand lens
8. Toothpicks for dissection/smearing
9. Metric ruler

Procedure:

Collect and Extrude a Core Sample

1. Insert the straw into the lake sediment model as far as possible while still holding the top.
2. Use your thumb to create suction and carefully pull up the core sample.
3. Extrude the core onto white paper by pinching the straw and pulling back.
4. Use toothpicks (or spatula) to carefully smear each layer for observation.

Initial Core Description

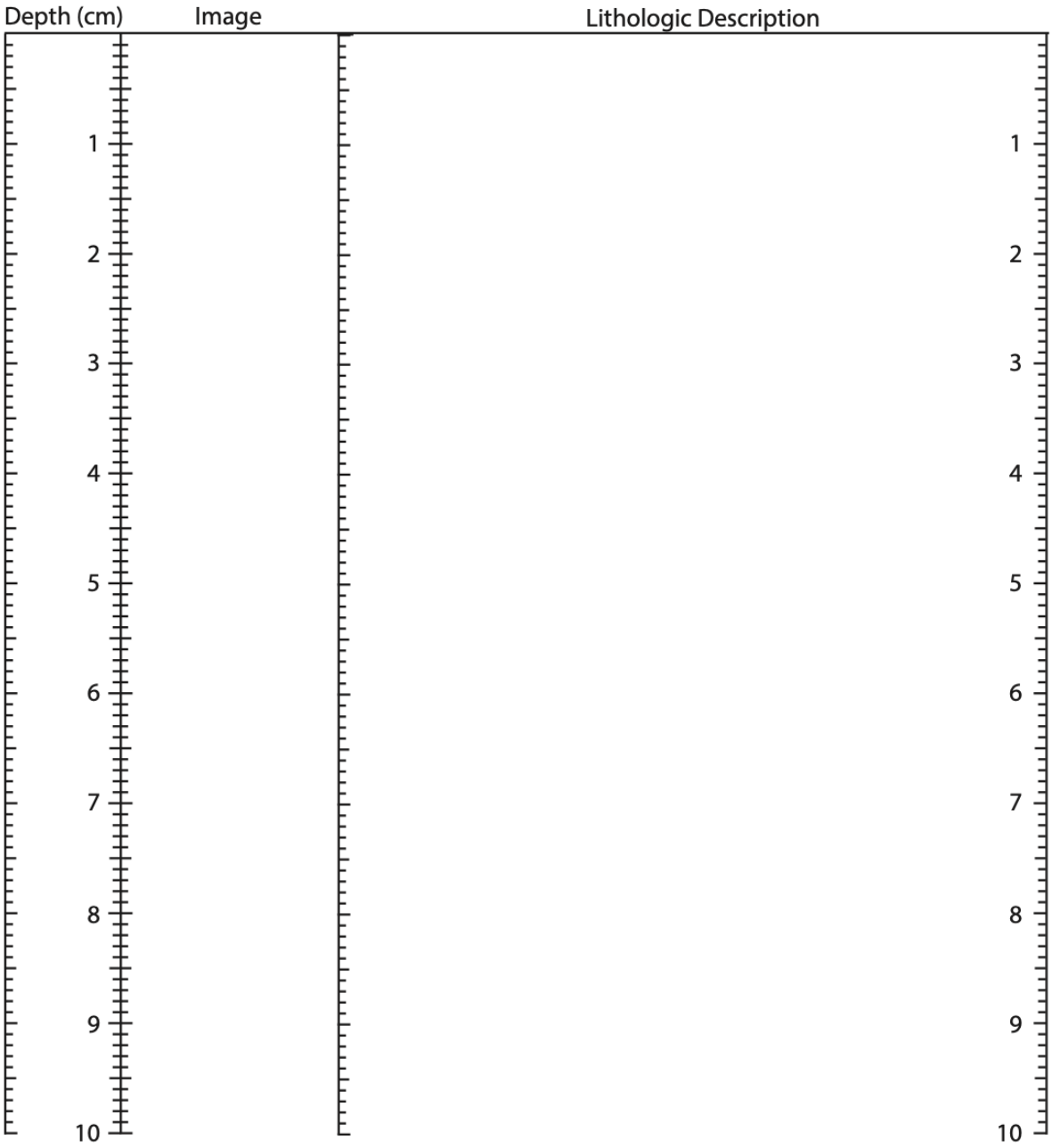
You can now identify the different pollen types in each layer. Using colored pencils and a ruler, fill out the **Initial Core Description** sheet, starting with the top of the core. Draw what you see in each layer, then write the name of the pollen type from each layer.

Part II: Core Description and Analysis

Initial Core Description

Lake:_____	Sediment Length (cm):_____

Use color pencils to differentiate layers



5. What part of your core is the oldest and which part is youngest? Explain your reasoning.

_____

_____

_____

6. Do you see layers? If so, why do you think they formed? (Consult the past materials to get ideas.)

_____

_____

_____

7. Describe any patterns you notice in the thickness of the layers. What might these patterns indicate about environmental conditions?

_____

_____

_____

8. Based on the pollen types you identified, how do you think the plant communities changed over time? What might this suggest about climate changes?

_____

_____

_____

9. Do you see any other materials (e.g., dust, ash, or small particles) in the core? What could these represent, and what might they tell us about past events?

_____

_____

_____

Part III: Comparative Analysis (Group Work)

10. Compare your core with those of your classmates. What similarities and differences do you notice?

_____

_____

_____

_____

_____

_____

11. Based on your observations and comparisons, what can you learn about Earth's history by studying lake sediment cores?

_____

_____

_____

Part IV: Connections to Traditional Knowledge

In several Indigenous cultures of the Southwest, there are stories of emergence from other worlds.

12. How does this activity connect to your culture’s worldview? You may include a drawing to respond to this question.

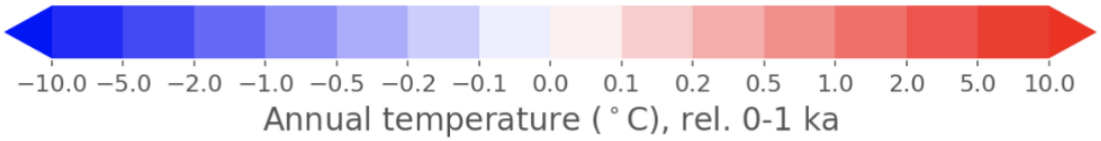
Part V: Cores into the Ancient Past - **Presto**

According to the Principle of Superposition, the lower layers are older than the ones above them. Scientists working in lakes have extracted cores to look into the ancient past. They know when it was warmer and colder than today.

Using your mobile device, visit the Presto visual application:
https://paleopresto.org/visualizer.html?dataset=daholocene
This is the Holocene Reconstruction visualizer, which goes back 12,000 years! In the beginning of the activity, you used seeds as proxies for pollen. Scientists also use pollen from lakes and models to reconstruct past climate. Pollen, which are sensitive to temperatures, make them useful to recreate the past.

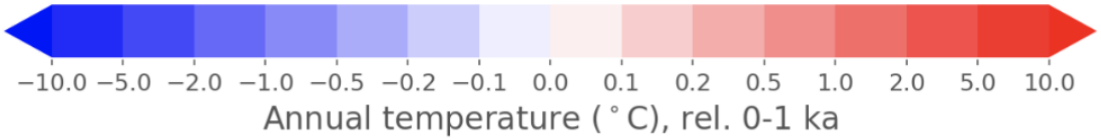
The age is set to 5 yr BP (years before the present) or 5 years before 1950. (Ignore the minus sign on the number.) The map is showing the year 1945. Cold is blue, while warm is red. For the questions below, mark the range of colors you see on the map.

13. Use the slider at the top to change the age to 11995 yr BP. What color does the map show?

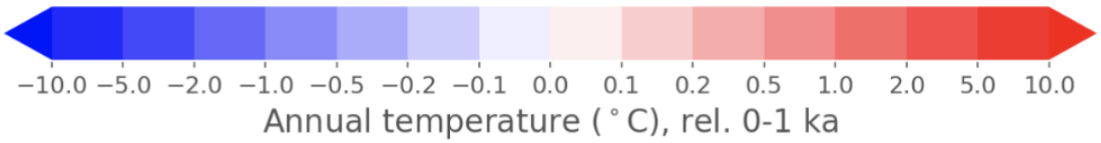


Around this time, the last of the giant animals, mastodons and mammoths, roamed Turtle Island (what is now known as North America).

14. Now toggle the switch to 8285 years BP. Does the Southwest show relatively warmer (red) or colder (blue) than the average of the last 1000 years?



15. Now go to 5 years BP, which is closer to present day. Does the Southwest show relatively warmer (red) or colder (blue) than the average of the last 1000 years?



Part V: Conclusion

16. Based on your analysis of the sediment core and the Holocene Reconstruction, what conclusions can you draw about how the environment in this area has changed over time? Consider changes in plant communities, climate, and any other evidence you observed.

17. How might studying lake sediment cores and maps help us understand and predict future climate changes?

18. What did you find most interesting or surprising about this activity?

This lesson was adapted from Lake Sediment Coring and Pollen Identification Activity provided by the Continental Scientific Drilling Facility, University of Minnesota. https://cse.umn.edu/csd