

More than Mud; Exploring lake sediments in your own backyard

Lesson 4

Sediment Core Analysis



Title: Playing with Mud –in depth sediment core analysis.

In this lesson students will examine the sediments to learn what they can tell about the environment.

Completion Time:

- About 1-2 periods (Allow additional period for palynology extension)

Grade Level:

- Middle School and up

Overview:

After initial core description of color and larger visible features, in this lesson students will examine sediment texture and make sediment smear slides. Examining sediment texture (grain size) and microscopic features may provide clues to the environment in the lake or pond when these sediments were deposited.

Objectives:

The primary goal and objective is for students to discover that lake and pond sediment will record environmental clues to the depositional environment. In other words, the sediments are recording climate information.

Materials:

Split cores
Grain size sample standards (minimum sand, silt and clay) wet and dry samples
Microscopes
Microscope slides
Water droppers
Tooth pics
Lamp (heat source for drying smear slides)

Lesson Preparation:

Prepare sample containers for grain size analysis standards. At minimum there should be six sample containers. Students need to be able to “train their fingers” to be able to recognize the textural differences between sand, silt and clay. (Both wet and dry) If desired and if the class will take more time in this analysis, samples of coarse, medium and fine sands or multiple clays may be used. Additionally sample containers of mixtures may also be used (eg. sandy-clay)

Procedure:

Divide student into partners/working groups some may work on grain size analysis while others begin making smear slides.

Grain size analysis

Finger-training; using prepared and labeled samples have students feel different sediment types and record observations in journal/notebook. After students achieve an understanding of the "feel" of different textural characteristics of sediment, have them analyze the texture of the sediment in their core sample. Depending on the type of sediment collected, this analysis may be done along standard measured intervals or at visible changes in sediment lithology. Student observations should be recorded on the sediment core description sheet or excel file.

Smear slides

On clean microscope slide, using a toothpick, take a small crumb of sediment from core sample and smear it around in the center of the slide with a drop or two of clean water. Spread the sediment out as thin as possible. Place slide under a lamp or near a heat source to dry the water. Optical cement and cover slips may be added if desired. Examine sediment smear slides under microscope. Look for differences in sediment, diatoms and other micro fossils.

Discussion

Begin to introduce students to the concept (this may occur with very little prompting) that these characteristics of the sediment record environmental conditions. The discussion may hinge on exactly what is found in the samples so it may be beneficial to have core samples from varying locations.

Example leading questions:

Q: What may cause a change in grain size?

A: Higher or lower energy depositional environment

Q: What may cause more or less organic matter in the sediment?

A: seasonal variation

Note: It is common to find one or two distinct leaf layers in the sediment from previous autumn leaf drop.

Resources:

How to make a smear slide

<http://www.youtube.com/watch?v=yURphJ9P3hk>

DFG Science TV episode about diatoms

<http://dfg-science-tv.de/en/projects/polar-archive/2010-01-25>

Assessment:

Student core description sheets, excel core description files, or lab notebooks may be checked for completeness, understanding and careful documentation.

Students working on opposing halves from the same core sample may compare/contrast results.

Palynology Extension:

(This ideally will be completed in the spring)

While it would be interesting and desirable for students to extract pollen from sediment samples, the process by which palynologists extract pollen from sediments is extraordinarily dangerous. Concentrated acids and other corrosive chemicals are essential for these extractions. (H₂O₂, HCl, and HF are standard)

1. The day before this activity, assign students to bring in a pollen sample. This may be pollen from a tree, grass or any flower.
2. Have students view pollen samples with microscope. Depending on the time, students may prepare microscope slides. OR Cut a small strip (2 cm) from a 3X5 index card. Make a hole in the center of the card strip using a hole punch. Place a small piece of scotch tape over the hole, gently touch the sticky side of the tape to a pollen sample and place on the microscope stage sticky side up.
3. Identify different pollen sources
4. View generalized pollen sample from lake or puddle (or any horizontal surface that collects pollen.) Try to identify different plant pollen types in the generalized sample.
5. View included images (or, photograph similar samples from your local area)
6. Discuss what will happen to the pollen after a rain storm (Pollen becomes incorporated with sediment in lakes and other bodies of water)
7. Discuss how this activity would be different in different areas of the country. (Different biomes in different geographic regions)

Example questions:

- How would you expect the pollen to be different 500 km North or South of your present location?
- If the climate warmed significantly, how would the pollen change?
- During an Ice age, how may the pollen be different?

8. Discuss how pollen in lake sediments can be used as proxy data for understanding climate.

Credits:

Tim Martin

Earth Science Teacher

Greensboro Day School

5401 Lawndale Drive

Greensboro NC, 27455

tmartin@greensboroday.org

www.adventureearthscience.org TMartscience YouTube

Standards:

The list below includes some of the NGSS standards likely to apply to lessons from these activities

Middle school

- | | |
|-------------------|---|
| MS-ESS1-4. | Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used |
| MS-ESS2-1. | Develop a model to describe the cycling of Earth's materials |
| MS-ESS2-3. | Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales |
| MS-ESS2-4. | Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past |

High School

- HS-ESS2-2.** Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems
- HS-ESS3-5.** Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.