Sediments & Soil

Grade: 2

Subject Areas: Earth Sciences

Skills: communicating, exploring, modeling, observing, predicting, writing

Duration: 1hour

Connections: history, physics, plant science, soils

Vocabulary

coarse
erosion
fine
forces
layers
sediments
sieve
soil
strata
weathering

Objective:

Students will observe the nature of sorted sediments and will investigate the various parts of soil.

Materials

- 1/2 cup of dried beans, rice and coffee grounds
- a see-through container of water
- buckets of sediments
- jars with lids
- plastic funnels (large enough for sand to pass though)
- clear cups of silt, sand, and gravel
- tall clear soda bottles (250+mL)
- sieves (optional)
- small shovel or trowels (if collecting on campus)
- paper or science journals
- soil samples (from a garden)
- magnifying glasses or microscopes
- tweezers
- plastic tubs or petri dishes
- "non-living" and "living" labels (see attachment)
- white paper

Standards

Strands: Excellence in Environmental Education Guidelines

Strand 1 —Questioning and Analysis Skills: A) Learners are able to develop questions that help them learn about the environment and do simple investigations. **B) Designing Investigations:** Learners are able to design simple investigations. **F) Working with models and simulations:** Learners understand that relationships, patterns, and processes can be presented by models.

Strand 2.1 —Knowledge of Environmental Processes and Systems A) Processes that shape the Earth: Learners are able to identify changes and differences in the physical environment. **B) Changes in matter:** Learners are able to identify basic characteristics of and changes in matter.

Strand 2.2 — The Living Environment: C) Systems and connections: Learners understand basic ways in which organisms are related to their environment and to other organisms.

California State Educational Standards:

Earth Sciences 3b: Students know smaller rocks come from the breakage and weathering of larger rocks.

3c: Students know that soil is made partly from weathered rock and partly from organic materials and that soils differ in their color, texture, capacity to retain water, and ability to support the growth of many kinds of plants.

3e: Students know rock, water, plants, and soil provide many resources, including food, fuel, building materials, that humans use.

Investigation and Experimentation 4f: Use magnifiers or microscopes to observe and draw descriptions of small objects or small features of objects.

Background

Everchanging

Not long ago, people believed the Earth was static and unchanging. No one could imagine something as hard as rock could wear down over time. People could not conceive of the idea that mountains could wear down to little more than rubble. Today, a trained observer can see the erosional forces that are wearing away the landscape.

There are many forces that can break down rock including blowing sand, grinding glaciers, earthquakes, running water, rolling waves and penetrating chemicals. The process that breaks down rock is called **weathering** and the transportation of weathered material is called **erosion**. There are two types of weathering, mechanical and chemical. Mechanical weathering does not alter the chemical composition of the rock whereas chemical weathering does. For instance, during physical weathering, as in the case of abrasion, the rock is worn down and gets smaller and smaller. The only thing that changes is the size of the sediments. During chemical weathering, various chemicals like carbon dioxide change the minerals that the rock is made of usually making the bonds weaker. Rust is an example of this. Mechanical and chemical weathering usually happen together.

Breaking Down

Sediments are small particles produced from the wearing down of larger particles. Sediments are sorted by size from fine sediments like clay to coarse sediments like gravel. Most sediment that is deposited in slow moving water eventually forms layers called **strata**. Strata develop in places like lakes or along the sea floor because these are the places to which sediments are eventually carried. Rivers and streams move most of sediments, but other forces such as wind, glaciers, and ocean currents can transport sediments long distances. How much sediment a stream can carry depends on its velocity and the area of its cross section.

Excess sediment from improper forestry management practices, land slides, roads and other factors is a local concern in the King Range National Conservation Area (NCA) and the surrounding area. Siltation , occurs when tiny, silt-sized particles settle out on the stream bottom. Siltation can smother the stream bed and reduce oxygen availability. Oxygen availability is important to the animals that live in stream habitats especially ones like aquatic insects that live amongst the rocks. Excess silt is particularly

Local Connection

The Devastating Flood of 1964

In 1964, Humboldt County made nationwide news when it became sealed off from the rest of the world. A few days before Christmas, all rivers in northern California counties were well beyond their banks in a historic flood caused by a deluge of rain. In Humboldt County, major bridges, railways and roads were washed out where supplies had to be flown in. Many places were hit hard. People lost their homes and their lives.

The storm could not have come at a worse time. Forest slopes were denuded after post WWII logging efforts. Clear cutting practices were in full swing. Effects from this flood and the previous flood of 1955 are still prevalent today. Some towns were wiped out completely like the town of Bull Creek. Many river channels were raised 1-4 meters by sediment loads and prime salmon habitat was decimated.

Places in Bull Creek are 40 feet higher than original levels because of massive sediment deposition. With loads of coarse sediment it is difficult to get riparian growth to take root. High river levels can be observed today by markers along Highway 101 and large redwood trees by having residual mud still caked onto their trunks. It will take centuries for natural processes to heal the damage done by our poor logging practices of the time coupled with the devastating flood of 1964.

devastating to fish eggs which are laid in gravel beds called redds. Along the Mattole River, great efforts have been undertaken to prevent excess sediments from building up there to protect salmon habitat.

Building Rocks

The coast ranges are relatively young mountains and much of the bedrock is prone to landslides. Clogged culverts and downed trees can quickly alter drainage channels. During a down pour it is easy to see sediments being carried away in ditches and other drainages. In general, sediments are sorted by physical means. Gravity is a force that is pulling sediments downwards. Larger sediments will often be on the bottom of a sediment deposit or alluvium, and lighter sediments on top. Light weight sediments like clay and silt can be suspended in water for long periods of time before being deposited. Sedimentary rock is formed by the compaction and cementation of accumulated sediments. Sedimentary rocks can be made of any bits and pieces of material including shells, sand, mud and gravel. Many sedimentary rocks are classified by particle size. In one of the following activities, students will place various sized sediments in water to see how sediments naturally sort themselves to form **layers** or a strata.

Sediments are an important component of **soils**. Soils are partly classified by the size of sediments within it. There are sandy soils and clay soils. Sediments are the non-living components of soils. Soils are also made up of living things such as fungus, decayed plant and animal products, and bacteria. In addition, the activities of burrowing animals like worms, moles, ground squirrels and millipedes also have an effect on the health of a soil. For soil to be healthy and support a wide variety of plants, it needs to have spaces for air and water otherwise, the roots of plants would suffocate from lack of air or become dehydrated from lack of water.

Soil takes thousands of years to develop depending on many factors. Bedrock is worn down and mixed by a variety of means such as plant roots, animal burrows, worms and decomposition. In addition to supporting plant life, soils are important in storing water because they can act like a sponge. Sediments and soils are very important components of an ecosystem.

Activity 1: Sorting Sediments

Preparation

Collect different sized sediment from a local stream bed or from a sand and gravel company along with examples of semi-soft sedimentary rocks like shale or mudstone. Have students sort the different sizes of sediment using sieves or do this ahead of time. Ideally you want to have approximately a ½ gallon bucket of each - silt, sand, and gravel (fine, medium and coarse grained sediments).

Materials

- 1/2 cup of dried beans, rice and coffee grounds
- a see-through container of water
- buckets of sediments
- jars with lids
- plastic funnels (large enough for sand to pass though)
- clear cups of silt, sand, and gravel
- tall clear soda bottles (250+mL)
- sieves (optional)
- small shovel or trowels (if collecting on campus)
- paper or science journals
- Pictures showing the following:
- eroded landscapes
- natural rock strata
- gravel beds along streams
- examples of erosion (landslides, slumps, etc.)
- cross section showing deposition (in a lake or ocean

Procedure

1. Gather the students around and begin discussing what they know about mountains, rivers and sediments. Show examples of mountains. Ask the students to tell you what the pictures are of. Say something like: "Believe it or not, if you could board a time machine and go forward in time, you would be able to see real mountains made of rock break down just like mud or chocolate. The process of breaking down rock is called weathering because things like the weather wear down mountains. " What kind of forces do you think could break down a mountain? (accept their responses)

- *What are mountains made of?*
- *Are mountains strong?*
- *Can mountains wear down?*
- *What if you had a mountain made of mud?*
- *What if a mountain was made of chocolate—how could you wear it down without touching it?*

Explain that there are 3 main things that break down mountains. 1) exposure to air 2) exposure to water 3) exposure to chemicals. Air and water apply forces to the rock that eventually break it down. Chemicals act a little differently than forces. Ask the students to come up with forces that we see in nature (wind, flowing water, gravity, rain, waves, etc.). Write these down on the board.

2. Show the pictures of weathered landscapes. Ask the students if they have ever seen signs of erosion (The local area is prone to landslides). Tell them big pieces of rock break down into littler pieces of rock. These are called sediments. Hold up a bucket full of river sediment and explain to them that these sediments were collected from a river, but came from the mountains.

3. Show them pictures of erosion, rivers, streams, etc. Hold up a bucket full of river sediment. When scientists study sediments they separate them by their size. Using sieves, separate the sediments up into coarse, medium and fine. Ideally you will have three sizes. Next, hold up a jar of mixed silt and water. Ask the students what causes the water to be brownish in color. You may want to add a sample of each sized sediment to water in three different jars. This way students can observe how each size behaves in water. Pass these samples to any older students to shake and observe.

Activity 1: Sorting Sediments (cont.)

Preparation

Have the plastic soda bottles 2/3 full of water at various stations around the room. Next to each station, have the funnels and cups of sorted sediments handy.

Procedure

1. For our first demonstration instead of using rocks we are going to use common ingredients beans, rice, and coffee. Explain that these three foods are of three different sizes. Ask: which of these is coarse? Medium? Fine? Model observing sediments in water using the household products. Have them predict what will happen if you put these products in water. Place the rice in the clear bottle or cylinder. Next add the beans. Lastly, add just a pinch of coffee. Do not stir. Ask the students what they think happened and why. (They should understand that the heavier particles form layers and finer particles are suspended).

2. Next, have them predict what will happen if you shake the mixture up. Cover the top, shake it and let it sit for a minute as everyone observes Note: it may be difficult to see through the dirty water just like during a heavy winter rain in a river. Have the students explain what they think happened (weight and gravity sort the sizes). Ask: What type of environment might shake sediments up? (answer: moving water, waves, and wind). Next, show them the examples of three different sized sediments. Hold up cups of silt, sand, and gravel. Ask the same question: Which of these is coarse, medium, fine? Explain, that when mountains are worn down, particles that are small enough are carried away by water and wind. Next ask, "do you think sediments are sorted or mixed when they are following down a stream?"

3. Worksheet practice: Explain to the students that they are to identify the various sediments by size coarse, medium and fine and label them gravel, sand, and silt. Pass out the worksheet (see attachment). Assist where necessary. (If you have a mixed level class, you might have the older kids sort sediments using sieves while the younger students fill in the worksheet).

4. The students will now observe what happens to river sediment of sorted sizes: silt, sand, and gravel. Have them spoon each of them into a plastic bottle and observe what happens. Using a funnel for silt and sand will work best. (The students can always make funnels out of stiff paper). Next, have them put the cap on the bottle and shake it. Have the students record what they observe on a piece of paper or in a science journal (see attached). Have the students observe and record every 10-20 minutes what they observe in their bottles. After their first recording, proceed to Activity 2—Introducing soils.

Activity 2: Introducing Soils

Preparation

Set up stations for a soil investigation. Using petri dishes or shallow containers, divide the soil sample up into the appropriate amount so that groups of 2-4 students can investigate one sample together. Have a pair of tweezers a magnifying glass and a piece of white paper for each student. At each station have the labeled pieces of paper taped down for sorting purposes. This can be done in partners (option: students can do this outside in the school garden or another nearby location).

Procedure

1. Ask questions that will get them thinking about soil. After Activity 1 first written observation, gather the students around an appropriate location that exhibits a soil sample.

2. Next, educate them about soil. Explain that part of soil is non-living and is made of sediments. Another part of soil is living. This living matter is broken down by decay. Ask further questions. What types of sediments are there? (ideally they will tie this lesson in with the previous one). Model what they are about to do. Dump the dry soil on white paper. They will separate non-living things from living things using tweezers. Do this at least once in front of them so they get the idea. Have the students investigate soils on their own. Remind them that if they find a living animal, they are to not hurt it. You may want a container for larger animals. After 5-10 minutes of exploration, have them go back and observe their sediments in water. Students should record their second observation. Clean up the soil and have the students wash their hands. Encourage the teacher to have students continue to write observations.

Materials

- **soil samples (from a garden)**
- **magnifying glasses or microscopes**
- **tweezers (one for each student)**
- **plastic tubs or petri dishes**
- **"non-living" and "living" labels (see attachment)**
- **white paper**

- *Who has worked in a garden before?*
- *Hold up a soil sample and ask them to explain what they think it is.*
- *What kinds of things make up soil?*
- *What types of animals live in the soil?*
- *What importance does soil have for humans?*
- *What is planted in soil?*
- *What do plants need to grow?*

Extensions

- Connect sediments that they find in rivers to the health of fish and other animals.
- Use soil science to introduce the process of decomposition and its importance.
- Using a stream table or roller pan, design a lesson showing the rate of erosion based on the steepness of a slope and/or the amount of water flowing down it.
- Begin a compost pile
- Investigate signs and examples of weathering and erosion on campus
- Investigate the flow of water near the campus—where do drains lead?

References

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Living	**Non-living**
Living	**Non-living**
Living	**Non-living**

Name: _____ **Date:** _____

1. First Observation

2. Second Observation

Name: _____ **Date:** _____

Coarse	Medium	Fine