DFW Earth Day 2024

Lesson Plan Information

Name: Sedimentary Rock Formation
Grade: *First through eighth*
Topic: *Lean how sedimentary rocks are formed*
Time: *30-45 mins*

Introduction:

Rain delivers large amounts of water to a river, but did you know they also bring along lots of eroded soil and debris from the surrounding landscape? Sediment is material that is moved and deposited in a new location. Sediment can include tiny clay particles, pebbles, and sand. Fast-moving water can pick up, suspend, and move larger particles more easily than slow-moving waters. This is why rivers look more muddy-looking during storms – they are carrying a LOT more sediment than they carry during a low-flow period.

If you scoop up some muddy river water in a glass, you are viewing the suspended sediment in the water. If you leave your glass in a quiet spot for a while the sediment will start to settle to the bottom of the glass. The same thing happens in rivers in spots where the water is not moving so quickly. Much of the suspended sediment and pebbles fall to the bottom of the river, lake, or ocean. The sediment may build up on the bottom or it may get picked up and suspended again by swift-moving water, which moves it further downstream. If the sediment is buried deeply, it becomes compacted and cemented, forming sedimentary rock.

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Materials:

Kit will include:

- Plastic jars (10)
- Plastic cups (10)
- Pea gravel
- Gray sand
- Brown sand
- Paper funnels
- Scoops

Videos and additional Information can be found on the DFW Earth Day website

Additional materials needed:

- Water
- Ruler
- Scissors
- Marker pen
- Paper towels for clean up

Key Terms:

Soil: The unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants.

Clay: Fine-grained natural soil material containing clay minerals and granules smaller than silt.

Silt: Granular material of a size between sand and clay and composed mostly of broken grains of quartz.

Sand: Loose granular substance with particles larger than silt.

Pea gravel: Small stones, typically found near water, with a smooth surface due to weathering.

Erosion: Geological process in which earthen materials are worn away and transported by natural forces such as wind or water.

Stormwater: Water that drains off a land area from rainfall or snow and ice melt.

Waterbody: Any significant accumulation of water on the surface of the earth such as creeks, lakes, and rivers.

Sedimentation: Process of allowing particles suspended in water to settle out of the suspension under the effect of gravity.

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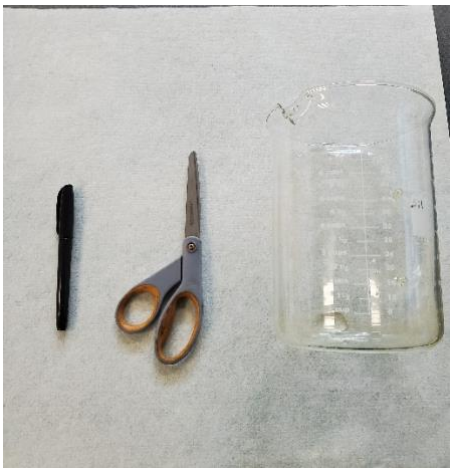
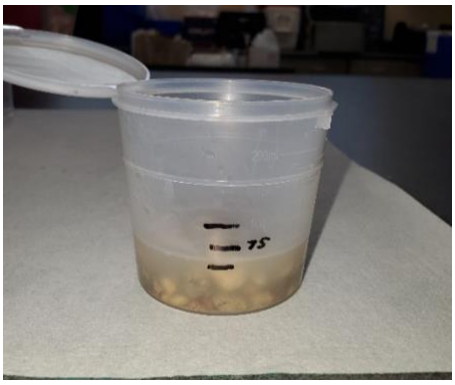
Procedure:

Sedimentation Experiment

1. Lay out the pebbles, gray sand, brown sand, jar, measuring cup, paper funnel, and metal scoop provided. Additional items not provided include water, ruler, marker, and scissors.

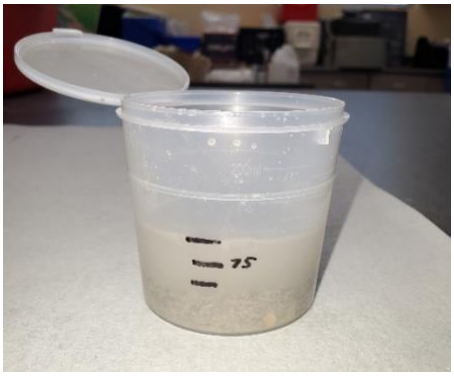


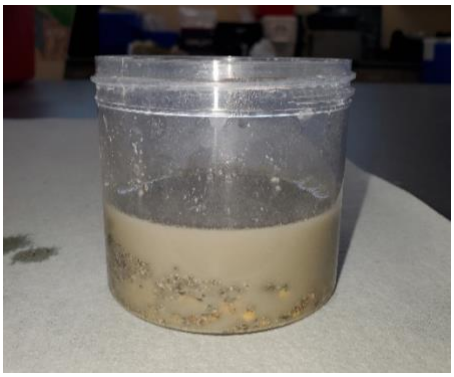
2. Fill the plastic cup with pea gravel to the 50 mL mark on the cup. Then fill the cup with water to the same 50 mL mark. Snap the lid closed, hold tightly, and shake the jar. Then pour the contents of the cup into the jar provided.



3. For the sand, we will use a little more water than with the pea gravel. Fill the plastic cup with the black sand to the 50 mL mark. Then fill the cup with water to the 100 mL mark. Snap the lid closed, hold tightly, and shake the cup. Then pour the contents of the cup quickly into the jar provided. You may need to shake out some of the sand from the bottom as some will settle quickly once you stop shaking. REPEAT the process for the brown sand.

Black Sand





Brown Sand

4. Have students write a paragraph or statement on what they predict will happen and why.
5. Let the jar stand undisturbed. Materials will settle into layers simulating how sediment is deposited in a river, lake, or ocean.

6. The pebbles and sand will settle out quickly, but the finer materials may take an hour or more to settle.
7. Explain to the students that these sedimentary layers usually form in river or lake beds and near running water. After a long period of time, multiple layers will build up on top of each other and they will eventually turn to rock.
8. Have students measure and graph the various sizes of the layers.
9. Students can choose the order they wish to pour into the jar. Try the two sands first and then the pebbles, or sand, pebbles, and then sand.
10. In the end, have the students shake up the entire jar of pebbles and sand together and see how the materials settle out all mixed together.
11. Finally, DO NOT pour the sand and gravel down the sink drain as this could cause a clog. It is safe to pour the materials outside.

Analyze Sedimentary Rocks

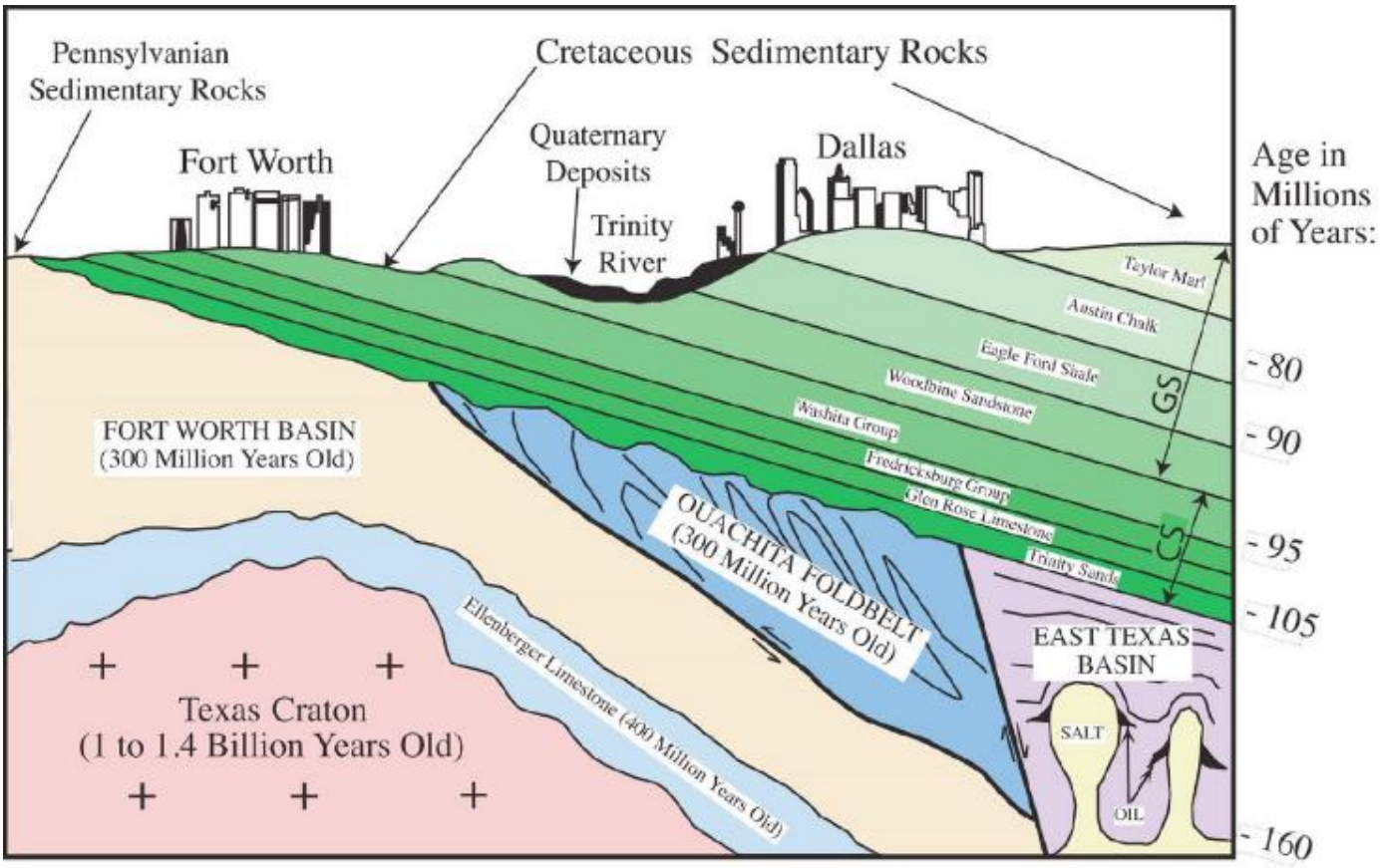
1. Lay out the magnifying glass and three rock samples provided (Eagle Ford Shale, Woodbine Sandstone, and the Austin Chalk).
2. The Austin Chalk is so fine grained that you cannot see any grains, even with the magnifying glass.
3. The Eagle Ford Shale is compacted mud and clay and can be easily split into fragile slabs. See if you can see any layers in the shale. The shale is mostly fine grained, but you may be able to see larger grains of material if you look closely.
4. The grains of sand in the Woodbine Sandstone can be easily seen with the naked eye and the magnifying glass. You may also be able to see the different layers and colors of brown that form the sandstone.

Conclusion:

Material Size Determines Settling Time

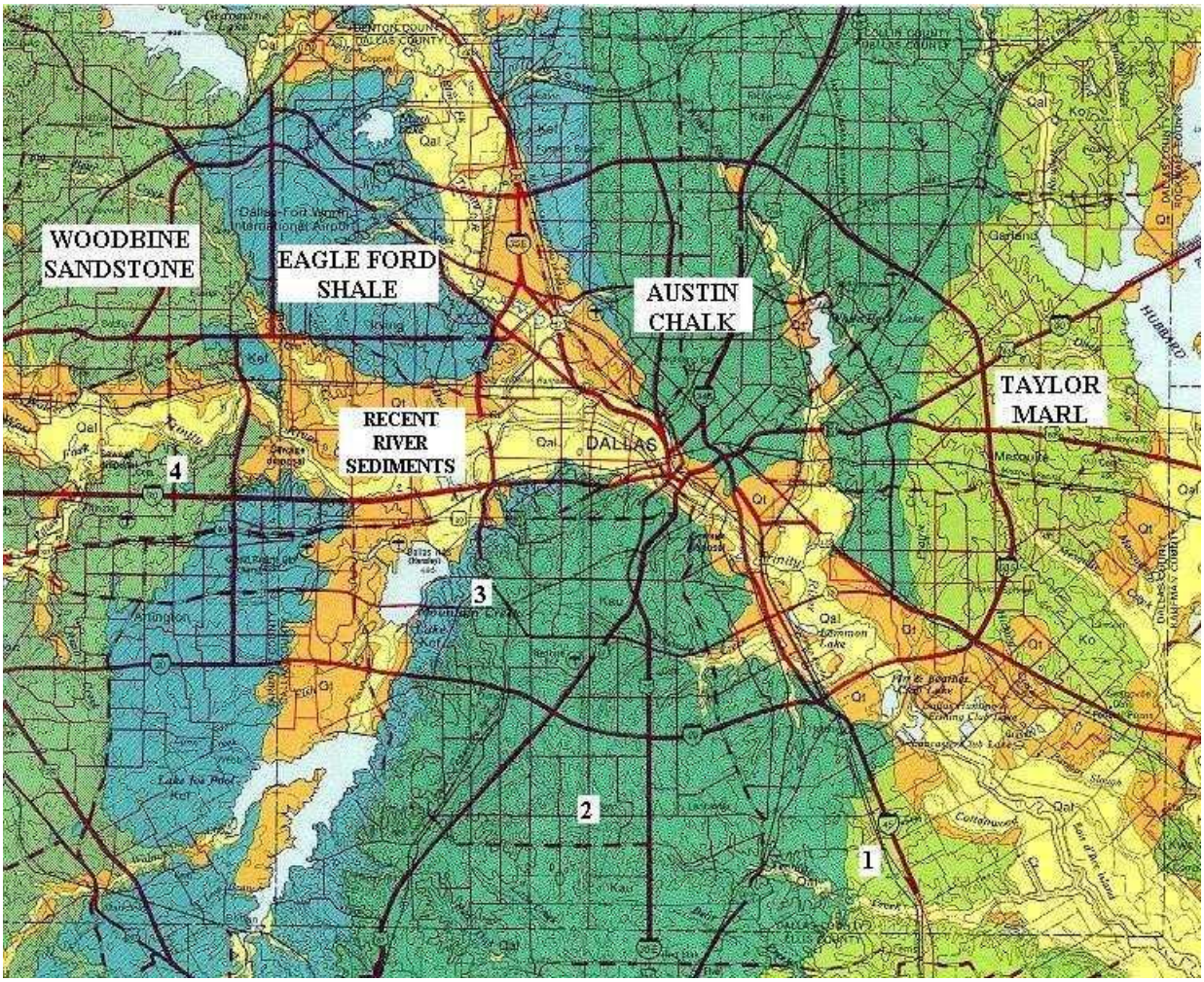
Sedimentary rocks are formed from the deposits of various sizes of materials, including pebbles, sand, and clays. Over millions of years, these materials will form rocks in layers as demonstrated in the jar. Different types of materials also have different settling rates due to the particle sizes and shape of each. You can see it takes longer for the very small particle like silt to settle out versus the sand and pebbles.

Figure 1 – Geologic Cross Section of the DFW Area



This map shows a cross section of the geologic formation under the Dallas-Fort Worth metroplex. Notice the slight tilt in the formation. The older rocks are at the surface near Fort Worth and the younger rocks are near the surface closer to Dallas. Dr. Nathan Brown with the University of Texas at Arlington discussed this in more detail in the associated video.

Figure 2 – Geologic Map of the DFW Area



This map shows the birds eye view of the geologic formation under the DFW metroplex. The areas are shown where you might be able to find a sample of the three of the rocks included in your kit. The river sediment areas correspond to the current location of the Trinity River and its tributaries.

Links and Videos on North Texas Geology:

https://athenaeumreview.org/wp-content/uploads/2019/05/Stern-83-93.pdf

https://www.smu.edu/-/media/Site/Dedman/Academics/InstitutesCenters/ISEM/Images/Ocean-Dallas/oceandallas.pdf

The story behind the rocks of Dallas-Fort Worth:
https://www.youtube.com/watch?v=axtGS7KSAzo

The Mesozoic Sedimentary Rocks of Dallas County:
https://www.youtube.com/watch?v=k-9eQszojqA&t=6s

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