



Big River Journey Classroom Activity: Geology

Create Sedimentary Strata

Objective: The student will utilize two types of sediment and water to create sedimentary layers as found in sedimentary rocks along the Mississippi River.

Concept: Moving water carries and sorts sediment, changes landforms, and creates strata.

Grade level/ time req't: 4-6; 20 minutes initial activity, plus at least one day to observe

Materials:

sand

dried powdered clay (available from art or pottery supply stores, e.g. "Continental Clay")
water

pint-sized jar (clear plastic or glass) with lid (students may bring in own jars in advance)

measuring cups (to measure 1/4 C. and 1 C.)

Introduction: Show students a picture of the Grand Canyon. Ask students for ideas about how the layers (strata) might have been created. Tell them that similar layers can be seen along the Mississippi River between Minneapolis and St. Paul. This experiment can provide clues to how the strata were formed. Tell students that they are geologists.

Procedure:

- 1) Each student (or group) should place in their jar: 1/4 cup sand and 1/4 cup dry clay powder. Use dust mask. Close lid and shake jar to mix sand and clay so that no layers are evident. (Students may want to mark their jar at this point to identify it as theirs.)
- 2) Add 1 cup water. Close lid and shake jar again to mix contents.
- 3) Set aside, and *do not disturb* jar.
- 4) Observe contents after 1 min., 15 min., 30 min., 1 hour, 1 day. Record observations.
- 5) Discuss results and draw conclusions. (Why did the sand and clay form layers? Which layer is on top? Why?)

Conclusions and follow-up: Given the results of the experiment, how do you think the strata of sedimentary rocks along the Mississippi River might have been formed? Are layers on the top formed before or after those under them?

Background for teacher: The ground in the Twin Cities is composed mainly of sedimentary rock layers (strata). These strata are exposed in many places along the Mississippi River.

Sediment is particles of soil such as sand, silt, or clay that can be suspended (carried) in water; sedimentary *strata* are layers of sediment compressed over time.

Moving water can carry and sort sediment. How much sediment it can carry depends on the amount of movement (energy) in the water. When water movement slows, larger, heavier particles of suspended sediment (e.g. sand) will settle out first; when the movement slows more or stops, finer sediments (such as clay particles) will also settle.

Sedimentary strata visible along the

Mississippi

River resulted from the rising and falling of tropical seas that covered Minnesota during the Ordovician period, from 500 million to 435 million years ago. These sedimentary deposits were hardened into rocks as a result of time and pressure. Sandstone deposits are evidence of sand beaches; shale (composed of fine clay particles) formed during a period of deeper, calmer seas. Geologists read sedimentary strata much as biologists read tree rings. The most recent strata are normally on top.

The geology of the Mississippi River set the stage for the Twin Cities by causing large riverboats to have to stop in St. Paul, and by creating waterpower opportunities at St. Anthony Falls.



River Geology Vocabulary

Basic Vocabulary:

geology - the study of the origin and history of the earth; the study of rocks

fossil - any trace or remnant of a life form from a past geological age, embedded in rocks

strata - layers of rock

erosion - breakdown or weathering of rocks, sediment or soil by wind, water, etc.

Ice Age - common name for time period during which glaciers were abundant

glacier - a large mass of slowly moving ice

Intermediate Vocabulary:

geological era - a basic division of geological time, composed of one or more periods

geological period - a portion of a geological era

geological epoch - a portion of a geological period

sedimentary - a classification of rocks created by deposits of sediment (particles of silt, sand, clay, etc.)

sandstone - a sedimentary rock composed chiefly of sandlike grains of quartz

shale - a fine-grained, layered sedimentary rock formed from clay, silt or mud; often gray

limestone - a sedimentary rock composed of calcium carbonate, often from shell fragments

Advanced Vocabulary:

Paleozoic era - a geological time from 570 million to 225 million years ago during which early forms of life appeared

Ordovician period - part of the Paleozoic era from 500 million to 430 million years ago, characterized by small sea-dwelling organisms (found in Mississippi River valley fossils)

Pleistocene epoch - ice age time period, 2 million to 10,000 years ago. (The Upper Mississippi River took its present route at the end of this time period.)

River Geology Extensions

Pre-trip activity ideas:

- **Science/math.** Create a timeline of geological eras and periods, and make corresponding descriptions of plant and animal life associated with each.
- **Art/science.** Find pictures of various eras and periods. Create your own picture of a specific geological period. Use the class's pictures to illustrate a geological timeline.
- **Science.** Classify rocks as belonging to one of three broad categories – igneous, sedimentary, or metamorphic – and learn the meaning of each. Identify examples of each type.
- **Writing.** Compose a story correctly using at least half of your vocabulary words.
- **Reading.** Read “Minnesota’s Rocky Roots” (for young naturalists) about Minnesota geology in [The Minnesota Volunteer](#), Sept.-Oct., 1995. Teacher guide and article: www.dnr.state.mn.us/young_naturalists/rockyroots/index.html
- **Career exploration.** Find out what a geologist does. Imagine that you are a geologist, and write about your work.

Post-trip activity ideas:

- **Art.** Draw and color the river gorge showing a rock outcrop. Make a display showing what you’ve learned about Mississippi River geology. Make a drawing of fossils seen. Or, use fossil patterns to create a larger abstract design.
- **Writing.** Write a poem or short story about your life as a brachiopod in the Ordovician sea that once covered Minnesota, or as a time traveler atop an ice age glacier melting to start the Mississippi River. Describe your surroundings.
- **Social studies.** Find out how people have utilized the geology of the river and river valley. What uses have been found for limestone, shale and sandstone in building, agriculture, gardening, food production and medicine?
[Teacher note: these rocks are used as building materials and can be seen in buildings of St. Paul (though local sandstone is too soft for use in building.) Shale deposits have been used for brick-making; lime from limestone is used to make cement, to lower the pH of soils, and as an antacid; caves have been carved out of sandstone for growing mushrooms, sand from sandstone has been used for making glass. Gravel from river islands is widely used in construction.]
- **Science field study.** Explore for fossils in the Lilydale “brickyards” or other site along the Mississippi River.
- **Science.** Find out more about fossils. What kind of life is associated with each of the fossils you found?
- **Speaking.** Teach others what you have learned about the geology of the river.