A Waterfall on the Move

Part 1: Mississippi River Bluff Strata

Objective: Students will learn the names and characteristics of three sedimentary rocks found along the Mississippi River in the Twin Cities. Students will understand the role these rocks played, in combination with a Glacial era Mississippi River, in the development of the Twin Cities.

Grade Level: Grades 4-6

Time required: 30-45 minutes

Materials: At least one set of sandstone, shale and limestone rock samples, the worksheets titled "A Waterfall on the Move: Part 1 Mississippi River Bluff Strata," *River of History*, chapter 1, available as a pdf at: http://www.nps.gov/miss/historyculture/collections.htm, *First Came the River* (pgs 3-5), and the Army Corps of Engineers publication, *Engineering the Falls,* (http://www.mvp.usace.army.mil/docs/history/engineering.pdf).

Standards:
History and Social Studies:
Geography- D. Interconnections- The student will describe how humans influence the environment and in turn are influenced by it. 1. Students will recognize changes over time in nearby landscapes resulting from human occupation.

Science: A. Earth and Space Science- The student will explore the structures and functions of Earth systems. 1. The student will recognize the natural processes that cause rocks to break down into smaller pieces and eventually into soil.
2. The student will investigate the formation, composition and properties of soil.
3. The student will describe how waves, wind, water and ice shape and reshape the Earth's surface.

Procedure: First read through the following information. Make a copy of the student activity for each student, each group of students or for use on an overhead. Answers are provided in the Teacher Guide. Follow steps 1-6 in the Student activity.

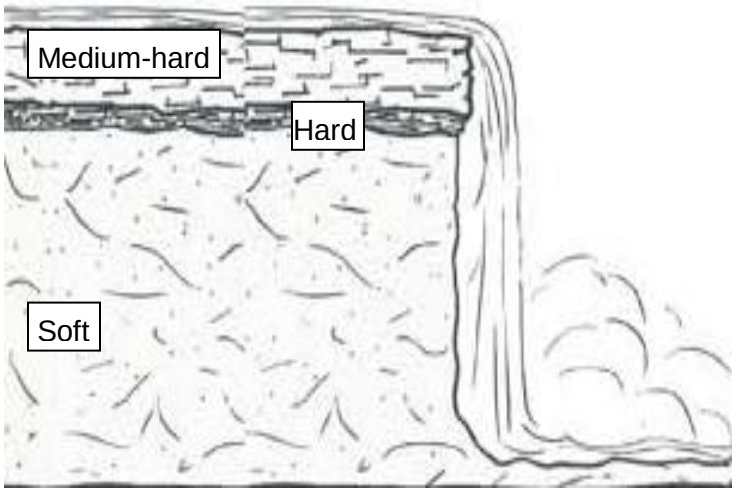
A Waterfall on the Move
Part 1: Mississippi River Bluff Strata

Imagine a waterfall a mile wide and 200 feet in height. The waterfall would be as tall as a 20 story building and so wide that it would take a half-hour to walk from one side to the other! Almost 12,000 years ago, a waterfall of that size was in downtown St. Paul.

What happened to the waterfall?
The answer to that question is found in the rock layers (strata) of the Mississippi River bluffs between Minneapolis and St. Paul. Geologists tell us that over 450 million years ago ancient seas deposited layers of sediment that eventually formed three types of sedimentary rock; sandstone, shale and limestone. As the glaciers began melting 11,700 years ago, the meltwater made its way to the Twin Cities in a river called Glacial River Warren. Near downtown St. Paul the river fell over a cliff made up of the three sedimentary rock layers. This 200 foot high, mile wide waterfall, called River Warren Falls, eventually moved 10 miles upstream to become St. Anthony Falls.

How did the waterfall move?
1. Examine the classroom set of rocks- compare the hardness and color of each rock. Do any rocks have fossils? Could water wear away any of the rocks?

2. Draw a line to connect the name of each rock with where it is found in the river bluffs. Hint! Use the rock hardness and color to match the rock to the descriptions below.



Limestone
A sedimentary rock composed of calcium carbonate deposited by the remains of marine animals. Often contains fossils. Usually yellowish or light grey in color.

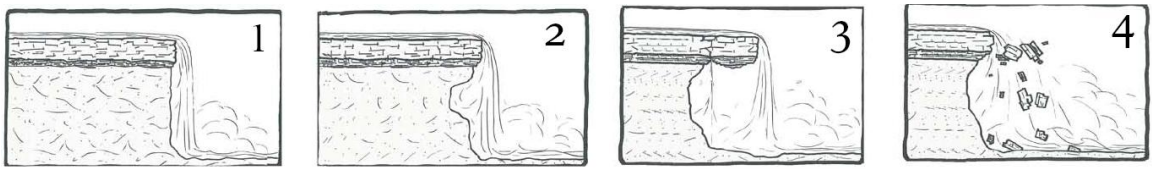
Sandstone
A sedimentary rock composed of sand-like grains of quartz, often yellow but sometimes white, tan or red.

Shale
A sedimentary rock composed of mud, clay, or silt often containing fossils. Usually medium grey in color.

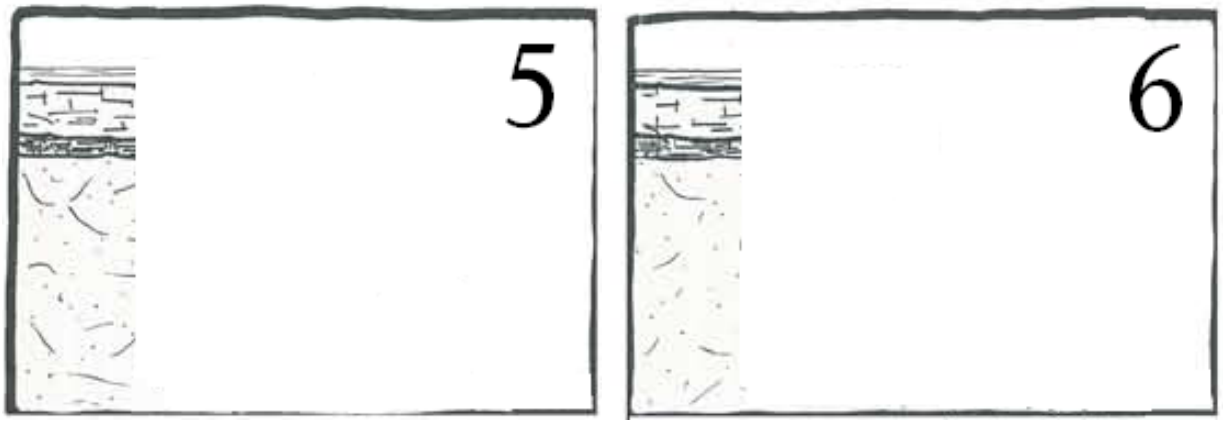
3. Think about this- notice the softest rock is on the bottom. Did you think water could wear away the softest rock?
(Go to next page)

A Waterfall on the Move
Part 1: Mississippi River Bluff Strata

4. Look at pictures 1 – 4 to see what happened as the waterfall eroded the soft rock on the bottom layer.



Draw what you think will happen next in pictures 5 and 6. Part of the rock layers are drawn in for you.



5. What role did the waterfall play in the history of Minneapolis and St. Paul?
With your class discuss the following:

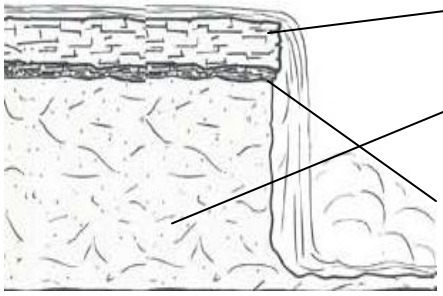
- What happened to the rocks after they broke off?
- For a boat traveling on the river in the 1850s, would it be easier to land at St. Paul or Minneapolis? Why?
- How did Minneapolis businesses near the river use St. Anthony Falls to their advantage beginning in the 1850s?

6. Write a short paragraph describing why there are the "Twin Cities" of Minneapolis and St. Paul.

A Waterfall on the Move
Part 1: Mississippi River Bluff Strata

1. **Time Travel** with your students! Have the class close their eyes while they listen to a description of River Warren Falls and the environment and animals that may have been around the Falls. The booklet, *First Came the River,* has a description of the environment on page 5.

2. Students should **examine** the three different sedimentary rocks found along the river bluffs. Notice the color of each rock, whether it is hard or soft (for a rock), and if there are fossils. After examining rocks, student will draw a line to connect the rock name and description with where it is found in the river bluffs.



Limestone
A sedimentary rock composed of calcium carbonate deposited by the remains of marine animals. Often contains fossils. Usually yellowish or light grey in color.

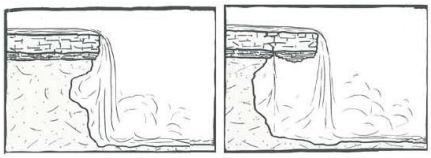
Sandstone
A sedimentary rock composed of sand-like grains of quartz, often yellow but sometimes white, tan or red.

Shale
A sedimentary rock composed of mud, clay, or silt often containing fossils. Usually medium grey in color.

3. **Discuss** as a class the process of the recession of St. Anthony Falls. The recession process and riverfront geology is described in *River of History*, chapter 1, available as a pdf file at: http://www.nps.gov/miss/historyculture/collections.htm
Additional recession information can be found in *First Came the River* (pgs 3-5) and the Army Corps of Engineers publication, *Engineering the Falls,* (http://www.mvp.usace.army.mil/docs/history/engineering.pdf).

4. **Students should draw what they think pictures 5 and 6 might look like.**

Picture 5 might look like one of these drawings:



Picture 6 should look like this:

5. **Discuss** with the class the role the waterfall played in the history of Minneapolis and St. Paul.

6. Students will **write** a paragraph describing why there are two cities close to each other; the Twin Cities of Minneapolis and St. Paul.