"SANDS" OF TIME
EXERCISE IN STRATIGRAPHY
ADAPTABLE TO GRADES K-12

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MATERIALS

small (1-3 ounce) clear plastic vials with tightly fitting caps (clear film canisters work great if you can collect enough for one per student)

plastic teaspoons

salt (enough to fill all vials)

brightly colored chalk (sidewalk chalk works well)

1 paper plate per student (flexible paper ones are best for dumping salt out)

paper, pencils

small ruler with metric units

OVERVIEW

This activity can stand alone as a demonstration for lower primary grades of "What Came First " incorporating art, science, and math skills, while illustrating the use of mineral products (salt, chalk). For upper elementary through high school classes it can accompany a study unit on rocks and earth science to illustrate the "Law of Superposition" (oldest sediments/rocks are on the bottom, youngest on top) and to illustrate how sedimentary layers are deposited. This activity can be done in small groups, each using and sharing five or six different colors of chalk and a carton of salt, but each student should have his or her own finished "rock column" in a vial to take home.

PROCEDURE

Hand out a plate, spoon, vial, pencil, and paper to students as you introduce the activity to them; describe how they will "deposit" layers of different colored "sediments" in a container (show them a finished one as an example). For students who can tell time, or who are learning to do so, instruct them to write down on their paper the time they deposit each colored layer of their sediment column. Show them how to color a SMALL amount of salt (measure out only 1-2 teaspoons) at a time by rubbing a stick of chalk around in the salt on their paper plate; do this before you hand out the salt and chalk, or they may dump too much out at once. Hand out salt cartons and chalk to student groups and instruct them to make as many different colored layers of "sediment" in their container as they want, carefully pouring each layer of salt into the vial without mixing it with previous layers. Layers need not be uniformly flat - they may be wider on one side, with hills, etc.; students may use their imagination, but each layer should remain relatively undisturbed and unmixed with other layers once deposited.

Students should record on paper the time they deposit each layer (show them how to make a chart of "time" and "color of layer"). If necessary, help students with the time recording as they proceed.

If students are too young to tell time, just have them number and color-code the layers on paper in the order they deposited them (1-red, 2-yellow, 3-blue, etc.) (Record-keeping, no matter how simple, is important to learning scientific procedures).
Have students continue depositing layers until the vials are completely full. Once full, have students carefully put the caps on without disrupting the contents. If vials have been filled completely, the cap will hold contents in place without mixing of layers.
The resulting "3-D sand paintings" are attractive art projects to take home, but first initiate a discussion of relative "age" of the sand layers. Ask students what color layer is the oldest in their particular creation? Which is the youngest layer? (or what time was each layer deposited?). For younger students, which came first? Which came last? Which was second, third, etc.?) Have them label on their charts the oldest and youngest layers.

For upper level rock study unit:

- Relate the "Sands of Time" exercise to layered rocks or sediments they might see in the field (show pictures, or if possible, search for nearby examples in the school yard - or dig a small trench in gravel) ask where they might see such layers (*in a road cut, in a stream bank, in a gravel pit*). Assign a sedimentary rock type to each color and have students write a "geologic history" of the sediments in their bottle (e.g yellow=sandstone=beach or desert, blue=limestone=shallow ocean environment, purple=shale=calm water or lake , etc. starting from the bottom up)
- Ask which rocks or sediments are probably the oldest? (*those on the bottom*).
- Ask when this might not be true (*when the rocks have been disturbed, or turned upside down).* This can be illustrated by turning the vials upside down). Ask how likely, and under what circumstances might rocks or sediment layers in nature be disturbed or inverted? (Students may come up with many creative answers to this, but they should include earthquakes, landslides, caving along riverbanks, man-caused events).
- Discuss sedimentation rates in nature; ask students for the amount of time required to deposit each sedimentary layer in their particular column given a rate of, for example, a hundred years per millimeter. Have students come up with situations in nature that would cause large amounts of sediment to be deposited at once (mudslides, floods) or conditions of very slow sedimentation (in clear still water as at Lake Tahoe).
- Both the salt and chalk used in this exercise are mineral products: salt (halite) forms by evaporation in dry lakebeds, and chalk is a soft limestone formed on a shallow ocean floor from the shells of microorganisms.

This exercise incorporates science, art, language skills, simple measurement and estimation, time-telling, record-keeping, prediction, and modeling. It also shows how simple models can be used to approximate and help explain natural phenomena.

Note: Clear plastic vials can usually be purchased in lots of 100 for less than $10 from mining supply companies, laboratory suppliers, or chemical supply companies. Similar containers may be obtained from pharmacies or laboratories.

Nevada Science Content Standards addressed by this activity:

Grade 3 and 4

- ✓ Physical Science: **Content Standard 2.0: Structure and Properties of Matter.** Standard 2.3.1 - Physical Properties

- ✓ Earth and Space Sciences: **Content Standard 10.0: Earth Structures and Composition.** Standard 10.3.1 and 10.4.1 - Rocks and Minerals.

- ✓ Environmental Sciences: **Content Standard 17.0: Conservation.** Standards 17.3.2 and 17.4.2.

- ✓ The Nature and History of Science: **Content Standard 18.0: Scientific, Historical, and Technological Perspectives.** Standard 18.3.1 - The Nature of Science, Standard 18.3.2 and 18.4.2 - Attributes of Scientific Research, Standard 18.3.4 and 18.4.4 - Science as a Collaborative Process, and Standard 18.3.5 and 18.4.5 - Technology. : **Content Standard 20.0:** Systems, Models, Risk, and Predictions**.** Standard 20.3.1 –Models and Standard 20.3.2, Models and predictions.

- ✓ Investigations. **Content Standard 22.0: Communication Skills.** Standard 22.3.1 - Writing and Following Instructions, Standard 22.3.2 - Working with Graphical Models, Standard 22.3.3 - Working with Others. **Content Standard 23.0: Scientific Applications of Mathematics.** Standard 23.3.5 - Evaluating Measurements. **Content Standard 24.0: Laboratory Skills and Safety.** Standard 24.3.1 - Working Safely, Standard 24.3.3 - Using Experimental Apparatus.

Grade 5

- ✓ Earth and Space Sciences: **Content Standard 10.0: Earth Structures and Composition.** Standard 10.5.1 - Rocks and Minerals.

- ✓ Environmental Sciences: **Content Standard 16.0: Natural Resources.** Standard 16.5.1 - Renewable and Nonrenewable Resources.

- ✓ The Nature and History of Science: **Content Standard 18.0: Scientific, Historical, and Technological Perspectives.** Standard 18.5.2 - Attributes of Scientific Research, Standard 18.5.4 - Science as a Collaborative Process, and Standard 18.5.6 - The Dynamic Character of Scientific Knowledge.

Scientific Inquiry: Processes and Skills: **Content Standard 21.0: Scientific Values and Attitudes.** Standard 21.5.1 - Scientific Investigations. **Content Standard 22.0: Communication Skills.** Standard 22.5.2 - Working with Graphical Models, Standard 22.5.3 - Working with Others. **Content Standard 23.0: Scientific Applications of Mathematics.** Standard 23.5.3 - Estimating. **Content Standard 24.0: Laboratory Skills and Safety.** Standard 24.5.1 - Working Safely, Standard 24.5.3 - Using Experimental Apparatus, Standard 24.5.4 - Recording Data