Connecting FOSS to Northern Arizona

References:
Russell, H. R. 1993. Ten-Minute Field Trips (second ed.). Washington, D.C.: J.G. Ferguson Publishing Company. Pg. 122 #1. [NAEERC: EE 038]

Materials needed:
Hand lenses (optional)

Time: 30 minutes

"Pebbles, Sand and Silt" Activity 1 page 13:

Extension 1: "Rock Outcroppings"

BACKGROUND INFORMATION:
Many of the rock outcrops that are present around Flagstaff are of a few different types. Basalt outcropping is fairly common, especially north of town. Kaibab Limestone outcropping is common along Lake Mary Road and in the communities of Kachina Village and Mountainaire.

TEACHER PREPARATION:
Go outside in the schoolyard and try to identify which types of outcrops are present. You might have to walk to an Environmental Study Area (ESA) or a park nearby to see good outcrops.

PLACE-BASED ACTIVITIES:
•**Science:**
1. "Rock Outcroppings"
How?: Have students observe rock outcrops and record characteristics of the rock like color, texture, composition, crystals and patterns. See if any students can sleuth out the type of minerals in the rocks. What do they think these outcroppings could have been used for or could be used for in the future?

Connecting FOSS to Northern Arizona

References:
Russell, H. R. 1993. Ten-Minute Field Trips (second ed.). Washington, D.C.: J.G. Ferguson Publishing Company. Pg. 122 #4. [NAEERC: EE 038]

Materials needed:
None

Time: 45 minutes

"Pebbles, Sand and Silt" Activity 1 page 13:

Extension 2: "Rock Picking"

TEACHER PREPARATION:
Walk around the school grounds to get an idea of what types of loose rocks a student might find outside in your area.

PLACE-BASED ACTIVITIES:
•**Science:** Go on a rock picking stroll
1. "Rock Picking"
How?: Have students wander around the school grounds collecting different types of rocks. They might find gravels that were brought in from somewhere else, local rocks, and rocks of the three different types: igneous, sedimentary, and metamorphic. Have the students group themselves into groups that found similar rocks. Can they identify them? How many different kinds of rocks did the class find?

Connecting FOSS to Northern Arizona

References:

Forces of Nature. Pamphlet. NAEERC

"Pebbles, Sand and Silt" Activity 2 page 1:

Extension 3: "Mount Elden"

PLACE-BASED ACTIVITIES:

Take a field trip to the Mount Elden Environmental Study Area (ESA). This trip can be led by you or by the Resource Center for Environmental Education (RCEE: 928-779-1745). If you choose to lead the trip yourself, an excellent resource is the "Forces of Nature" Teacher's Trail Guide for Mt. Elden ESA. This is available at the NAEERC (928-523-1651) or the RCEE. See the text in the guide for trail marker 4, "Natural Drainage." This booklet is a supplement to the Flagstaff Unified School District publication (1984), Curriculum for the Mt. Elden Environmental Study Area.

Connecting FOSS to Northern Arizona

"Pebbles, Sand and Silt" Activity 2 page 4:

Extension 4: "Archeology"

BACKGROUND INFORMATION:
The Elden Pueblo Project is a cooperative endeavor between the Coconino National Forest, NAU, the Arizona Natural History Association, and the Arizona Archeological Society to provide educational opportunities in archeology to the public at Elden Pueblo. Elden Pueblo is a 60-80 room pueblo of the prehistoric Sinagua culture. Elden Pueblo is open to the public and is located one mile north of the Flagstaff Mall on U.S. Highway 89. Programs provide hands-on mapping, excavation, laboratory and analytical experience, under professional supervision for school students and the general public. Program participants are made aware of archeological concepts, values, laws and practices through personal experience. Fee based.

PLACE-BASED ACTIVITIES:
●**Science/History:** Go on a field trip to the Elden Pueblo 1. "Archeology"
How?: This field trip would be great to do during this part of the kit because it connects to the next investigation (Using Rocks) and they can also see how archeologists use the same screening techniques that they will use to sort in these experiments.

Contact: Joelle Clark, (520) 523-8797 or joelle.clark@nau.edu

Connecting FOSS to Northern Arizona

References:

Russell, H. R. 1993. Ten-minute field trips (second edition). Washington, D. C.: J. G. Ferguson Publishing Company. Pg. 116. [NAEERC: EE 038]

Materials needed:

Aluminum pans
Soil
Rocks
Popsicle sticks
String
Tape
Cardboard
Tap water
Spray bottles

Time: 45 minutes

"Pebbles, Sand and Silt" Activity 2 page 4:

Extension 5: "Observing Waterways"

This activity was modified by Michelle Kearns, NAU.

BACKGROUND INFORMATION:
Teacher needs to know current weather forecasts. This activity could follow an exploration of weather.

TEACHER PREPARATION:
Teacher should construct a model illustrating run-off and flooding.

PLACE-BASED ACTIVITIES:
•**History/Science:** This activity combines the following disciplines of history and science by discussing the scientific processes that have affected past generations. For example, flooding of the Colorado river in the past and the hardships faced by towns that were flooded. How?: Teacher will have students construct miniature towns in aluminum foil pans with potting soil, clay, rocks and cardboard houses. They will then create different rain shower patterns to illustrate sprinkles, hard rain, and rain accompanied with wind. They will also have to build dams and levees to show different manmade structures that affect the ecosystem. They will observe the amount of topsoil that runs off into the town. The teacher should then discuss the history of such natural disasters and the effects that this kind of erosion has brought upon society.

Connecting FOSS to Northern Arizona

References:
Russell, H. R. 1993. Ten-minute field trips (second edition). Washington, D. C.: J. G. Ferguson Publishing Company. Pg. 116. [NAEERC: EE 038]

Materials needed:
Sandstone (Moenkopi or Coconino)
Limestone (Kaibab)
Various other local rocks (basalt, dacite)
Building materials like concrete
Leaves or foliage
Acid rain (or simulation made from lemon juice or vinegar + water)
Droppers

Time: 45 to 50 minutes

"Pebbles, Sand and Silt" Activity 2 page 10:

Extension 6: "Differential Weathering"

This activity was modified by Michelle Kearns, NAU.

BACKGROUND INFORMATION:
This activity would tie in well with both weather and geology. A little prior knowledge of weather patterns and rock formation would be helpful with this activity.

TEACHER PREPARATION:
Teacher needs to obtain samples of sandstone and different leaves and foliage from the community. Teacher must also prepare a solution of acid rain (vinegar & water or lemon juice & water) or collect rain in a bucket and test the pH to indicate the acidity of the rain that falls in the area. Acid rain should have a pH of somewhere between 3.5 to 4.5.

PLACE-BASED ACTIVITIES:
•**History/Science:** This activity combines the disciplines of history and science by discussing the scientific processes and effects of differential weathering upon weather changes in the environment and past building materials. It also explores why certain materials must be used in order to prevent differential weathering and possible disasters.
How?: Set different materials on and inclined plane. Use a dropper to drip acidic water (or acid rain) on the different materials (allow the water to run down the surface of the material). Allow students to observe the effects on the materials. Then have a discussion on what materials show the least amount of differential weathering.

Connecting FOSS to Northern Arizona

References:

VanCleave, Janice. 1991. Janice VanCleave's Earth Science for Every Kid. Pg. 38-43. [NAEERC EE029]

Materials needed:

Several different colors of modeling clay
Pencils
Drinking straws
Scissors

Time: at least 50 minutes

"Pebbles, Sand and Silt" Activity 2 page 11:

Extension 7: "Mimic Flagstaff Rock Layering"

This activity was modified by Seton Sobolewski, NAU.

Use the book now located in your kit!

BACKGROUND INFORMATION:
Sedimentary rocks are formed from loose particles that have been carried from one place to another and re-deposited. These rocks usually are deposited in a series of layers. Each layer can be distinguished by differences in color, texture, and composition. The oldest layer and lowest bed is deposited first and the youngest layer is on the top. The layers over time become compacted together to form solid rock structures.

TEACHER PREPARATION:
Observe near your school grounds to see if there is an exposed hillside that has been cut through because of a road passage or the creation of a building. If there is no exposed hill, take close-up pictures of areas around Flagstaff where rock layering can be observed or gather close-up pictures of rock layering in the Grand Canyon. Initiate a conversation in class about where rock layering can be found.

PLACE-BASED ACTIVITIES:
•**Science/Art:** Constructing simple models of stratification from pictures or real-life out of several different types of clay. Observe rock layering, create model of layering and take core sample.
1. "Mimic Flagstaff Rock Layering"
How?: Observe in person or on a picture a longitudinal section of rock layering. Draw the various layers and take notes on the color and if possible the textures of the different layers. Re-create the rock layers with layers of clay. Use a pencil tip to create a texture for each layer. Once the model is complete, drive the drinking straw through the layers and pull out a core sample.

Connecting FOSS to Northern Arizona

•**Arizona State Science Standards:**

6SC-F1: Describe the basic earth materials (rocks, soil, water and gases) and their physical properties

PO1: Identify physical properties of earth materials

PO2: Describe physical properties of earth materials

1AV-F3: Demonstrate knowledge and use of a variety of techniques, processes and/or media.

PO1: Create a two-dimensional artwork using a variety of techniques, processes and/or media.

PO2: Create a three-dimensional artwork using a variety of techniques, processes and/or media.

Connecting FOSS to Northern Arizona

References:
Milford, S. 1989. The Kid's Nature Book: 365 Indoor/Outdoor Activities and Experiences. Charlotte, VT: Williamson Publishing Co. Pg. 89. [NAEERC: EE 033].

Materials needed:
Variety of crumbly colorful rocks (red clays work well)
Binding medium (liquid starch, soap flakes, corn starch, corn syrup, or egg yolks may work…experiment!)
Paintbrushes

Time: 1 hour

"Pebbles, Sand and Silt" Activity 3 page 5:

Extension 8: "Rock Paint"

TEACHER PREPARATION:
Scout out places around town that have crumbly rocks (clays, loams, sandstone might even work!). Collect some different types and bring them in for the class to use.

PLACE-BASED ACTIVITIES:
●**Art/Geology:**
1. "Rock Paint"
How?: Kids can make rock rubbings and create and use paint made from crushed rock. Many types of local rock could be used. Once you have found your brightly colored, crumbly rocks, crush them into a fine powder. You can use some heavy canvas to wrap the rock in and smash it with a hammer, or you can use a mortar and pestle. Now you have your pigment. Add a binding medium (experiment around). Then you are ready to paint. Students can paint on other rocks or on paper.

Connecting FOSS to Northern Arizona

"Pebbles, Sand and Silt" Activity 3 page 6:

Extension 9: "Mud Mural"

TEACHER PREPARATION:
Find cheap sources of dirt, straw, water and clay. A local artist from the Artist's Gallery or NAU Ceramics might be willing to help!

PLACE-BASED ACTIVITIES:
●**Art:** Make a mural out of mud!
1. "Mud Mural"
How?: Have students help mix up the mud mixture, called "cob" made of clay, dirt, straw and water. You can mix it with your feet. This cob can be patted into shapes to create a bas relief mural on a wall or a large piece of wood. Once the mud has dried, it can be painted with mixtures of clay and water (called slips) to provide both protection and color (if you add pigments to the slips). See the article on the next page from the Oregonian newspaper.

Connecting FOSS to Northern Arizona

"Pebbles, Sand and Silt" Activity 3 page 7:

Supplement 1: "Tap Water from Sandstone & Limestone"

Coconino Sandstone is the stone that holds Flagstaff's aquifer. Some of the aquifer is also in Kaibab Limestone. Both are highly porous, and often can erode quickly. There is a lot readily available in Oak Creek Canyon and could be collected with permits. It is great for showing how rocks wear down, erode and are often made up of smaller pieces.

Have you heard of "hard" water? Hard water leaves deposits of minerals on silverware, in teapots, and in your hair. Flagstaff has VERY hard water. Hard water is caused by dissolved calcium, magnesium and silica, in the water that is picked up as the water moves through the ground. Because our water moves through so much sandstone and limestone, it picks up high concentrations of these minerals.

Connecting FOSS to Northern Arizona

References:

Russell, H. R. 1993. Ten-minute field trips (second edition). Washington, D. C.: J. G. Ferguson Publishing Company. Pg. 116. [NAEERC: EE 038]

Materials needed:
None

Time: 20 minutes

"Pebbles, Sand and Silt" Activity 3 page 10:

Extension 10: "Stones in Schools"

This activity was modified by Michelle Kearns, NAU.

BACKGROUND INFORMATION:
Students should have a basic understanding of rock formation and weathering.

TEACHER PREPARATION:
If natural rocks are not used in your school building, then find examples of local building materials in the nearby neighborhood.

PLACE-BASED ACTIVITIES:
•**Science/English:** This activity combines the disciplines of English and science by having the students do a short write up on what they have observed. Students will observe different building materials used in construction and conclude why they were chosen.
1. "Stones in Schools"
How?: Take students to walk around the building and observe which materials were used and why. The students should be able to conclude that the materials are ones that suffer the least from differential weathering. Have students do a short write-up on what they have observed.

Connecting FOSS to Northern Arizona

References:

Russell, H. R. 1993. Ten-minute field trips (second edition). Washington, D. C.: J. G. Ferguson Publishing Company. Pg. 116. [NAEERC: EE 038]

Arizona State Science Education Standards. Arizona Dept. of Ed. http://www.ade.state.az.us/standards/science/standard1.htm

Materials needed:
None

Time: 30 minutes to 1.5 hours

"Pebbles, Sand and Silt" Activity 4 page 4:

Extension 11: "The Power to Move: Examples of Erosion"

This activity was modified by Nathan Marler, NAU.

BACKGROUND INFORMATION: Water is an excellent force when it comes to the erosion and deposition of rock. One can witness this phenomenon in progress anywhere water contacts a surface and carries bits of it away. The size and shape of whatever is carried away will eventually determine the composition of what is later deposited, and the size and shape depend, in turn, upon the speed and turbulence of the water. Fast, smoothly moving water may transport more and larger particles than slow-moving water, but not as much as rapid and turbulent water, which can churn objects up, suspend them, and transport them away.

TEACHER PREPARATION: Look around school grounds to find some examples of erosion in progress. Good examples include areas where frequent water contact erodes the concrete, and even a missing sprinkler-head (a common occurrence) can provide a nice demonstration as it dissolves the ground around it and leaves a small delta of silt and rock behind. Also, if water tends to run-off repeatedly in certain areas, these could be used as well. Try to reserve some examples for the students to discover themselves.

PLACE-BASED ACTIVITIES:

•**Science:** Examination of "close-to-home" kinds of runoff and erosion can introduce students to these concepts without limiting them to grand, textbook examples of idealized erosion and deposition. Examine local instances (on the school grounds) of water runoff and subsequent erosion and deposition of rock and other dissolved substances.

1. "The Power to Move: Examples of Erosion":
How?: Examine school grounds for instances of water run-off and erosion.

Connecting FOSS to Northern Arizona

Materials needed:
Green FOSS "Landforms" trays (or other shallow plastic trays)
Multicolored and different-sized beads (about 1 cup of each)
Sink
Water

Time: 45 minutes to 1 hour

"The Power to Move: Examples of Erosion" cont'd:

Notice that manmade materials (e.g., concrete) can be eroded by water as effectively as soil and natural rock. Attempt to locate sources of water runoff and describe how this water created the observed erosion. Note any deposition of dissolved materials elsewhere and hypothesize what might happen if the dissolved materials accumulate and remain where they are over large spans of time.

•**Science:** Have students construct a model of how water moves particles. Have students show big and small particles can flow in water that is either fast-moving or slow. They should confer with each other and develop a written hypothesis of what they expect will happen
1. "Tray Transport"
How?: Place students in groups of about three to four and give them a green tray from the FOSS Landforms kit (or another shallow plastic tray). Have about four to five different sizes of beads available, from the very smallest, round ones to large and irregular varieties. Give each group a different kind of bead. Have students (carefully) run water over their trays with the trays themselves canted at a slight (perhaps ten-degree) angle for about a minute. Vary the speed of the water from very slow to rather fast. Observe what happens. Have students record their observations. As an extension activity, you can also mix some of each kind of bead into a hodgepodge (more representative of natural sedimentary rock composition) and perform the procedure above on this heterogeneous mix of beads. How do the beads in each case organize themselves? Does the water speed affect this?

•**Arizona State Science Standards:**
(Grades 1-3)
1SC-F2: Construct models (e.g., a volcano, a paper airplane, a solar system) that illustrate simple concepts and compare those models to what they represent.

Connecting FOSS to Northern Arizona

References:

Russell, H. R. 1993. Ten-minute field trips (second edition). Washington, D. C.: J. G. Ferguson Publishing Company. Pg. 116. [NAEERC: EE 038]

Arizona State Science Education Standards. Arizona Dept. of Ed. http://www.ade.state.az.us/standards/science/standard1.htm

Materials needed:
None

Time: 30 minutes to 1.5 hours

"Pebbles, Sand and Silt" Activity 4 page 4:

Extension 12: "Dramatic Deposits"

This activity was modified by Nathan Marler, NAU.

BACKGROUND INFORMATION: Substances that are deposited tend to vary in composition as different deposits are formed over time. This can be seen as strata in rocks (distinct and visible layers). Even when the substances that form the strata are identical in composition, the way the strata are laid down can still provide a distinct separation that is visible to the eye. Northern Arizona's geology provides stellar examples of sedimentary rock deposits that form appreciable strata, and in some places, this is visible close to the surface (if your school is so lucky as to have a nearby creek or small ravine). Many of the rocks that are scattered on the surface are also representative of this geology, as violent events have heaved up bits of rocks from strata that are normally not right at the surface. Use this to your advantage when looking at rock deposits and where they are formed.

TEACHER PREPARATION: Find a location on your school grounds where a cross-section of ground with rock layers is exposed, if possible. If this is not feasible, find an area where there is an assortment of rocks (natural rocks, not a location where cinders or decorative rocks have been placed). You may want to identify a few species of rock that are native to Northern Arizona, such as Coconino sandstone and Kaibab limestone (the latter is present in huge chunks along the main pedestrian walkway at Northern Arizona University).
For a good demonstration of strata deposition, wait until snow is on the ground and has been plowed.

PLACE-BASED ACTIVITIES:
•**Science:** Analyzing rock fragments gathered from school grounds can provide insight into the diverse composition of the ground beneath students' feet.

Connecting FOSS to Northern Arizona

Materials needed:
Drawing supplies
Paper
Colored pencils
Etc.

Time: 30 minutes to 1.5 hours

Materials needed:
None

Time: 45 minutes to 1.5 hours

"Dramatic Deposits" cont'd:

Analyze composition of local rock strata through representative rock fragments found on school grounds
1. "Dramatic Deposits"
How?: Have students gather unique rock fragments from a predetermined area. Then have them assess various attributes of the rocks, such as hardness and texture. Discuss how erosion can occur at different rates, and note that rocks of different hardness and texture can disintegrate unevenly.

•**Art/Writing:** Have students draw what can happen if different strata are deposited and then worn away unevenly.
1. "Delta Drawing"
How?: If one is available, find a small fan of mud that has been washed away and left in a delta shape on the school grounds. Dissect through the mud, and see if there are identifiable layers. Note the uniformity. Have students draw what they see, and then—using the information they gained from the local rocks—draw pictures of how the local rocks were deposited. Ask students to extend this information through the hardness and texture characteristics and draw what would happen if the "softer" rock eroded first, and then strata were deposited on top of the eroded area. An emphasis should be placed on the potentially convoluted deposition of strata (not necessarily always nice, straight lines, due to the different rock hardness and attributes).

•**Science:** For a more concrete example of strata, and if the season permits, look at areas of snow. Compare snow drifts to rock formations.
1. "Snow Strata":
How?: Have students examine an undisturbed area of snow and assess its texture and composition (e.g., big or small flakes? Compact or loose and powdery?). Then, proceed to an area where snow has been plowed or shoveled. Cut away a section and look at the layers. Have students find the topmost layer that compares directly with the undisturbed snow, and then have them compare it

Connecting FOSS to Northern Arizona

"Dramatic Deposits" cont'd:

to the underlying layer that was plowed or shoveled. Again, note texture and composition. Relate, in classroom discussion format, how snow can closely mimic the process of deposition of strata in geology. How is snow very different from rock?

•**Arizona State Science Standards:**

(Grades 1-3)
1SC-F3: Identify and record changes and patterns of changes in a familiar system (snow activity)

Connecting FOSS to Northern Arizona

References:
Russell, H. R. 1993. Ten-Minute Field Trips (second ed.). Washington, D.C.: J. G. Ferguson Publishing Company. Pg. 117 #7. [NAEERC: EE 038].

Materials needed:
Shovel

Time: 45 minutes

"Pebbles, Sand and Silt" Activity 4 page 4:

Extension 13: "Plants Eat Topsoil?!"

PLACE-BASED ACTIVITIES:
"The top layer of soil is generally rich in organic matter and is called topsoil. Lower layers are made of rock fragments and are known as subsoil. If there is an embankment at one side of your school grounds, make a clean cut on its side with a shovel. Look at the cross-section: How deep is the topsoil? What does it look like? What does the subsoil look like? How do the plant roots grow in the topsoil? Are there roots in the subsoil? What do plants get from each area? Can students check the relative moisture in each area? Visit your cross section during droughts, after a rain and during a windstorm" (Russell, 1993).

Connecting FOSS to Northern Arizona

References:
Russell, H. R. 1993. Ten-Minute Field Trips (second ed.). Washington, D.C.: J. G. Ferguson Publishing Company. Pg. 124 #15. [NAEERC: EE 038].

"Pebbles, Sand and Silt" Activity 4 page 4:

Supplement 2: "I Love Layers"

"To help understand the Earth's timetable and different time intervals, geologists use places where one layer of sedimentary rock was deposited on another. Sometimes the different layers are of different materials and are easy to recognize; however, they may be composed of the same materials. One way of recognizing different layers is by unconformities and disconformities. In an unconformity, the first sedimentary layers were folded, faulted, or twisted and pushed up in other patterns. Then a new layer of sediments was deposited on top of the contorted rocks. In disconformities, the top surface of the early rock layer was changed by exposure to disintegration and decomposition before another layer of sediment fell on top" (Russell, 1993).

Connecting FOSS to Northern Arizona

References:

VanCleave, Janice. 1991. Janice VanCleave's Earth Science for Every Kid. Pg. 102-103. [NAEERC: EE 029]

Materials needed:

Pencils
Paper cups
Drinking straws
Modeling clay
Cardboard (about one square foot)
30 square cm of dirt
1 gallon jug filled with water

Time: 1 to 2 hours

"Pebbles, Sand and Silt" Activity 4 page 9:

Extension 14: "Erosion with Speedy Water"

This activity was modified by Seton Sobolewski, NAU.

Use the book now located in your kit!

BACKGROUND INFORMATION:

As slope increases the water running off that slope has increased energy. This increase in energy results in an increace in the speed of the water. Moving water hits against dirt and soil and pushes it forward. The faster the water moves, the more energy it has, and thus the more dirt it pushes forward. Several examples of this can be seen all over Flagstaff particularly during the rainy season or after the snow starts melting.

TEACHER PREPARATION:

Think of some places where running streams can be observed (Lake Mary during run-off, Oak Creek, Rio de Flag, Walnut Canyon, Grand Canyon, Shultz Creek) and think about taking your class there to observe erosion in action. Discuss in class where you can see running water and subsequent erosion.

PLACE-BASED ACTIVITIES:

•**Science:** The speed of running water affects erosion. Observe how increasing the inclination or slope of running water increases erosion and give examples around Flagstaff where this can be seen.

1. "Speedy Water"

How?: Take a class trip where several different types of running water can be seen. Make observations of what is seen (look for patterns). Back at the school have students create a running water area. Construct a water disperser by inserting a drinking straw into the base of a paper cup and sealing around the hole with modeling clay to prevent leaking. Set the piece of cardboard on an incline of about two inches. Place the running water cup at the top of the incline and cover the cardboard below the cup with dirt.

Connecting FOSS to Northern Arizona

"Erosion with Speedy Water" cont'd:

Have students discuss hypotheses about what might happen to the dirt. Pour water into the cup and allow the runoff to work its way through the dirt on the cardboard. Record any observations. Repeat with an increased incline of 6 inches. Have students update their hypotheses. Relate this runoff simulation with the observed areas in Flagstaff.

Connecting FOSS to Northern Arizona

References:
Crisswell, Susie Gwen. 1994. Nature Through Science and Art.

Materials needed:
Sand
Clay
Potting soil
3 two-liter soda bottles
graduated cylinder

Time: 45 minutes

Materials needed:
Newspaper
¼-inch mesh sieve
Coffee cans
Hammer
Window screen
Cloth-lined bowls
Shovels

Time: This is a pretty lengthy process!!!

"Pebbles, Sand and Silt" Activity 4 page 14:

Extension 15: "Soil Scrutiny"

This activity was modified by Kim Pomeroy, NAU.

TEACHER PREPARATION:
Discuss the make-up of the Earth's soils. Explain how soils are created and how soils influence plant growth. Collect some 2-liter soda bottles and cut the bottoms off. To conduct this activity you will need to locate a natural clay bed in the Flagstaff area and obtain permission to collect there. Check with the USGS (520) 213-0786 to find a clay bed and obtain permission or call NAU Ceramics department for information regarding clay and where to locate it, (520) 523-3731.

PLACE-BASED ACTIVITIES:
•**Science:** Discuss the different properties of different soils.
1. "Soil Scrutiny"
How?: To demonstrate different soil types' reactions to water, take three 2-liter soda bottles with the bottoms cut off and place them upside down in a large graduated cylinder so that the bottle acts as a funnel and the cylinder acts as the container. Place clay in one bottle, sand in the second bottle and potting soil in the third bottle. Ask the students to predict what will happen when you pour water into the three bottles. Will the clay, sand or potting soil filter the fastest? After you take a vote, conduct the experiment. You will find that the clay is the slowest to drain and the potting soil is the fastest. Discuss why the three types drain or hold water.

•**Art:** Make clay pots in a fashion that is similar to the way Native Americans of the Colorado Plateau make pottery using clay found in nature.
How?: Collect a clay sample that is as free as possible from impurities like sand, pebbles, roots, garbage and so on. Collect enough clay to fill your coffee cans. Once you have collected the clay, have the children help you with the following steps:

Connecting FOSS to Northern Arizona

"Soil Scrutiny" cont'd:

1. Lay the clay out on some newspaper in the sun so that it can dry out.
2. Once the clay is dry and in clumps, use a hammer to break the clumps and pulverize the clay into a fine powder (you might want some dust masks for yourself and the students using the hammer).
3. Sift the powder through a sieve and then remove any particles like pebbles still in the clay.
4. Pour the sifted powder into the coffee cans. Fill each can about 2/3 full with the powdered clay. Then slowly pour in water, saturating the clay and filling the can to the top with water.
5. With your hands, mix the water into the clay until evenly distributed.
6. Let the clay soak for two hours or until it reaches a consistency similar to thick cream.
7. Pour the mixture through a piece of window screen into another coffee can.
8. Allow the mixture to stand for about 12 hours or until the clay has settled to the bottom of the can. Remove the clear water from the top without disturbing the liquid clay (called slip) on the bottom of the can.
9. Pour the slip into a cloth lined bowl. The slip will harden and separate from the cloth. You can store the clay in covered cans (it will dry out fast in Flagstaff!)
10. When you are ready to use the clay, it needs to be wedged first by kneading, beating and slicing it repeatedly to remove all of the air bubbles.
11. Have fun creating a pinch or coil pot with the clay!

•**Science:** Discuss the texture of clay. Explain why it is so fine and smooth. Discuss the effects different soil types have on agriculture and vegetation.

•**Arizona State Science Standards:**

6SC-F1: Describe the basic earth materials (rocks, soils, water and gases) and their physical properties

PO 1. Identify physical properties of earth materials

Connecting FOSS to Northern Arizona

"Soil Scrutiny" cont'd:

PO 2. Describe physical properties of earth materials

6SC-F5: Identify major features of natural processes and forces that shape the earth's surface, including weathering and volcanic activity

PO 1. Identify natural forces (e.g., water, ice, wind) that shape the earth's surface

PO 2. Identify natural processes (e.g., weathering, erosion, global warming) that gradually shape the earth's surface

PO 3. Identify natural processes (e.g., earthquake, floods, volcanic eruptions) that rapidly shape the earth's surface

6SC-F6: Describe natural events and how humans are affected by them

PO 1. Identify natural events that affect humans

PO 2. Explain how natural events impact human life