LESSON 5

More about Wet Soils

Overview and Objectives

In the last two lessons, students discovered that each soil component has unique properties when dry and when wet. Now they smear wet samples on paper and observe that each one leaves a characteristic streak. They also find out that the clay balls they made a few days ago have hardened. By crushing them or adding water, students make them revert to their prior powdery or sticky state. Through these activities, students learn that water content affects a soil's consistency—a concept they will revisit in later lessons when they water seeds in soil. The reading selection connects the samples of sand and clay to their actual uses.

- Students conduct a smear test on sand, clay, and humus.
- Students record and discuss the results of the smear test.
- Students observe and discuss changes in the clay balls made in the last lesson.
- Students crush and moisten the dried clay balls and discuss the changes.
- Students read about everyday uses for sand and clay.

Background

Today your students perform what soil scientists call the "streak" test. If moist soil leaves a smear on paper, it contains clay or humus, as sand leaves no smear. A smear's color and texture provide more clues about the soil. A sticky orangish or brownish smear indicates the presence of clay, while a blackish, more watery smear is associated with humus.

Clay's streak is the most dramatic. Clay consists of flat, platelike particles that separate much as playing cards slide against each other in an entire deck. It is the sliding and separation of clay's tiny wet plates that creates a smear across the page.

Often a clay is a blend of minerals such as kaolinite, vermiculite, or smectite. An orange or reddish clay usually contains iron oxide. Just 1 or 2 percent iron oxide will turn a whitish clay orange, much the way a drop or two of red food coloring will turn white icing pink. The clay your students use in this lesson smears orange on paper because it contains iron oxide. If your students were to smear a whitish, grayish, or brownish clay, the streak left on the record sheet would roughly match the color of the clay. Whatever the color, the smear would remain sticky.

In the previous lesson, students tried to roll their wet samples into a ball. Then they set aside any successful balls to dry. Chances are good that all of those balls were clay. Today students discover that over the past few days the clay balls have grown hard and smooth. There seems to be no more water in them—and yet the

clay has not reverted back to its original powdery state. It has become dry, but a different kind of dry than when students began this experiment. When water is added again, the clay balls revert to their prior mushy state. What's more, if students press down firmly on the dry ball, it crumbles, completing the cycle. The clay is once again dry, dusty powder.

Seeing that clay's texture and appearance can change back and forth helps students understand the behavior of soil outdoors. A field can grow parched, its soil dry and cracked, during long months of drought. Yet all it takes is rain to moisten the soil again. And if hot, dry weather returns, the soil—like the students' clay balls—will dry out once again. By wetting the dry clay balls, students also begin to grasp the vital role of water in keeping soil moist. They will explore this concept in greater depth in later lessons as they plant seeds in different samples and water them to foster plant growth.

The reading selection at the end of this lesson explores some uses humans have found for sand and clay. Sand is used in everything from the manufacture of glass to the molds in which steel is cast to build skyscrapers; we use clay in products as varied as sewer pipes and roofing tiles. The reading selection increases children's appreciation of the many ways in which we rely on different soil components in our daily lives.

Materials

For each student

- 1 copy of **Record Sheet 5-A: Make a Smear**
- Science journal

For every two students

- 4 plastic cups, 30 ml (1 oz)
- 1 plastic dropper
- 1 cardboard tray

For the class

- 1 small container of sand
- 1 small container of clay
- 1 small container of humus
- 3 plastic spoons
- 1 marker (a different color than in Lesson 4)
- Dried balls of clay (and humus, if any) from Lesson 4
- "What We Know about . . ." charts from Lesson 3
- Newspaper
- Sponges
- Small bucket of water

Preparation

1. Place 45 cups in the distribution center next to the containers of sand, clay, and humus. Prop a spoon in each container. Every pair of students needs a spoonful of each sample in its own cup.
2. Fill the last 15 cups about halfway with water. Set these cups—one cup per pair of students—in the distribution center, along with the droppers and trays.

   Have the dried balls of clay (and humus, if any) ready to distribute.

4. Familiarize yourself with the reading selection "Have You Seen Sand or Clay Today?" on pgs. 65–67 of this guide.

   Note: "Have You Seen Sand or Clay Today?" is included in the Student Notebook. If you are not using the notebook, make copies of this reading selection for your entire class.

Procedure

1. Ask students what happened in the last lesson when they added water to sand, clay, and humus.
2. Direct their attention to **Record Sheet 5-A: Make a Smear.** Ask them to think about how they could smear sand, clay, or humus on paper. After they discuss this, incorporate their ideas as you outline the following procedure (see Figure 5-1):
   - Use your dropper to add a few drops of water to each of your samples.
   - Take a bit of the sample on your fingertip.
   - Smear it in the box for that sample on your record sheet.

   Note: Remind students to wipe their fingers after each smear to prevent the samples from mixing.

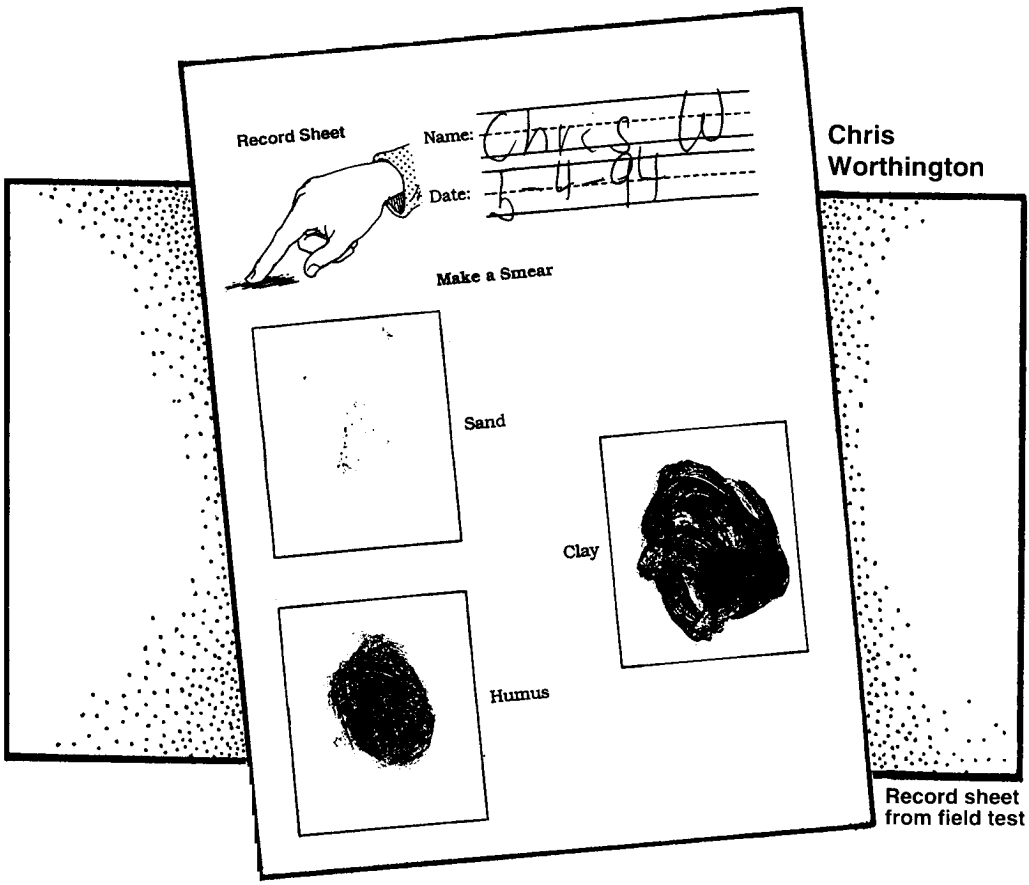
Figure 5-1

Smearing the three samples

3. Group students in pairs and invite them to collect their materials from the distribution center. Have them carry the water separately.
4. Let students smear their samples. Then ask them to share their results. Figure 5-2 shows a typical set of smears.

Figure 5-2

The completed smears



5. Now ask what students think has happened to the little balls of clay they made last time. Distribute a dried clay ball to each student. After they touch it, ask students if it has changed since the last class. What has changed? Does it look or feel different? What do they think happened? Let them discuss their observations.

6. Invite half of the students to press on the ball firmly with a thumb or a heavy object. Ask them what has happened. What does the ball look like now? What does it feel like? (Like the clay they started with—a dry, dusty powder.) Let them discuss their findings with the class.

7. Now invite the rest of the class to add water to the remaining clay balls, a bit at a time. Ask what is happening as they add water. Is the dried clay ball changing? How? What does it feel like? Does it look like the other wet clay in their plastic cups? Let them share their observations with the class.

8. After students clean their hands, they should return the plastic cups, droppers, and trays to the distribution center. Then complete your regular cleanup routine.

Final Activities

1. Invite students to describe their smearing results. Some questions you might ask:
   - What did you find out when you smeared wet sand, clay, and humus?
   - What does each smear look like?
   - How are your smears different from each other?

   Add their responses to the appropriate "What We Know about . . ." chart.
2. Now ask them to compare results for the dried clay balls. Focus the discussion with questions like these:
   - What happened when you pressed on your dried clay ball?
   - What happened when you added water to it?
   - What do you think might happen if you let the wet clay just sit there for a few days like we did before?

   List their responses under "What We Know about Clay."
3. Read "Have You Seen Sand or Clay Today?" (pgs. 65–67) with your class.
4. Get students to think and talk about the reading selection by asking questions like these:
   - What did you learn about sand or clay from this story?
   - Look around our classroom. What do you see that is made from sand or clay?
   - Why do you think an artist uses wet clay instead of wet sand to make a plate or a statue?
5. Let students describe today's activities with words or pictures in their science journals (see Figure 5-3).

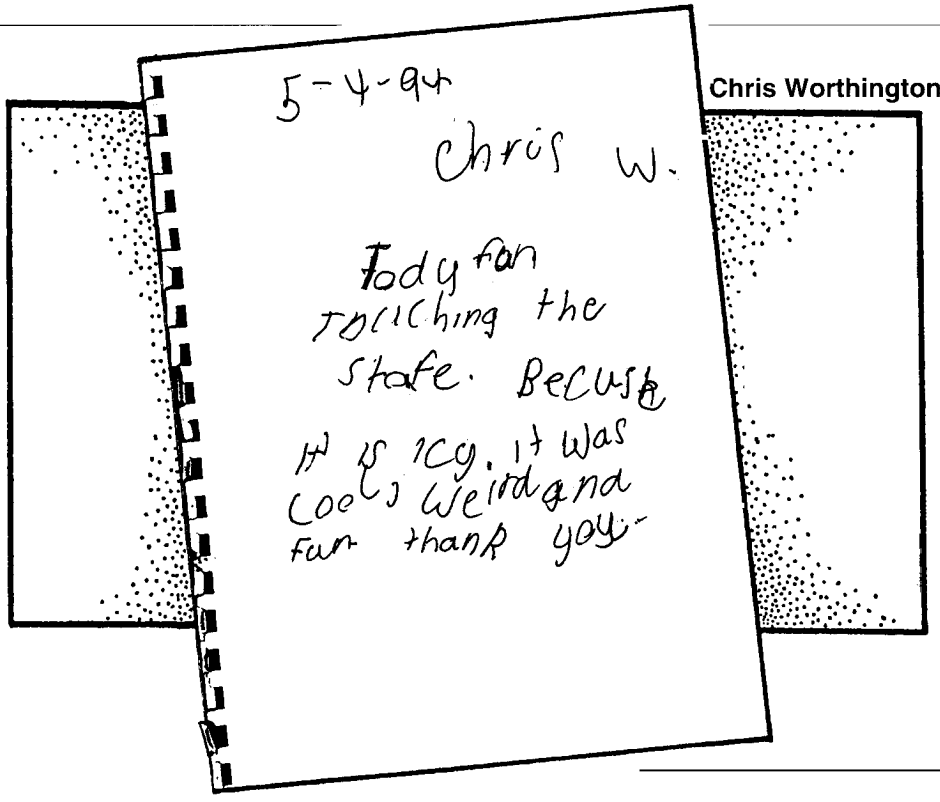


Figure 5-3

Science journal entry

Extensions

SCIENCE

1 Create three stations—one for each soil component—where students can continue to investigate dry and wet samples.

ART

2. Let students build clay objects using slabs or coils. If you have access to a kiln, let them explore the differences between moist, fresh clay and the sturdier texture clay acquires after it is fired. Perhaps you can find a local potter willing to supervise a primitive firing of student-made objects on the schoolgrounds. As a further extension, let students bake clay in the sun and compare it with kiln-fired clay.

ART SOCIAL STUDIES

3. Visit a museum to study old pottery objects. Ask students how these objects are alike or different. For example, do objects from various parts of the world have the same decorations? Do all the vases have an identical shape? Can students find examples of different-colored clays such as white, brown, or red?

ART SOCIAL STUDIES

4. Invite an archaeologist or anthropologist to discuss how and why we dig up ancient pieces of clay and what we learn from them.

ART SOCIAL STUDIES

5. Study mud-built houses in the southwest United States.

Reading Selection

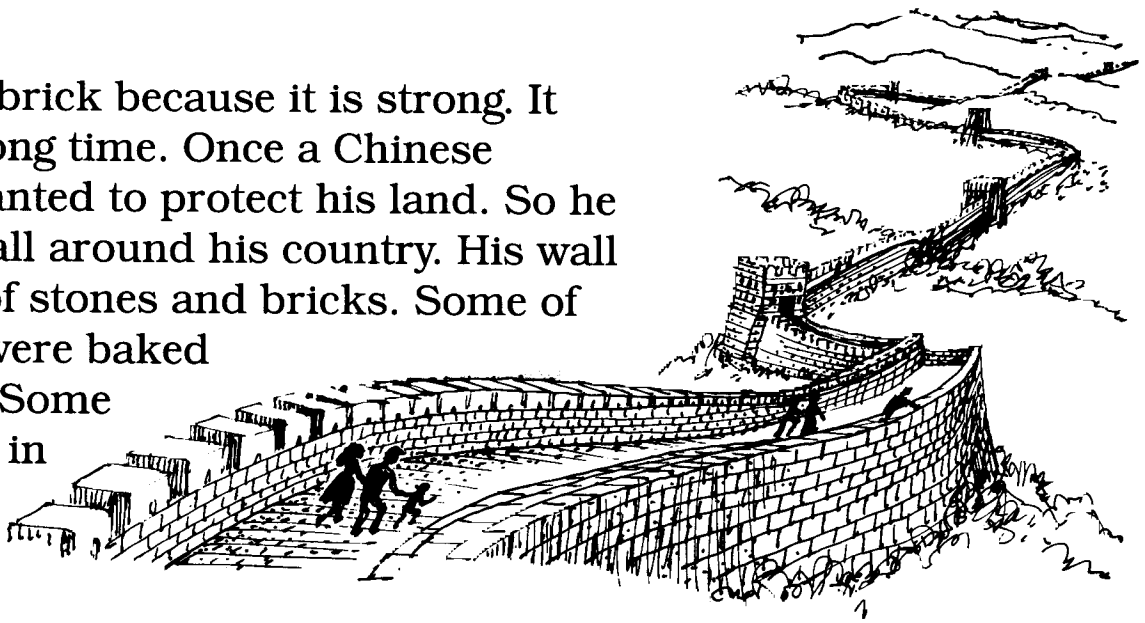
Have You Seen Sand or Clay Today?

Have you ever played with sand? Have you made shapes with clay? Human beings have always been curious about soil. A long time ago, people thought about soil and got an idea. Maybe they could turn soil into something pretty or strong. So they experimented. They found many ways to use sand and clay.

Have you ever seen a brick house? That house is made of clay. Bricks are made by shaping wet clay. In the United States, most bricks are baked in a special oven. As the bricks are baking, the clay gets very hard.

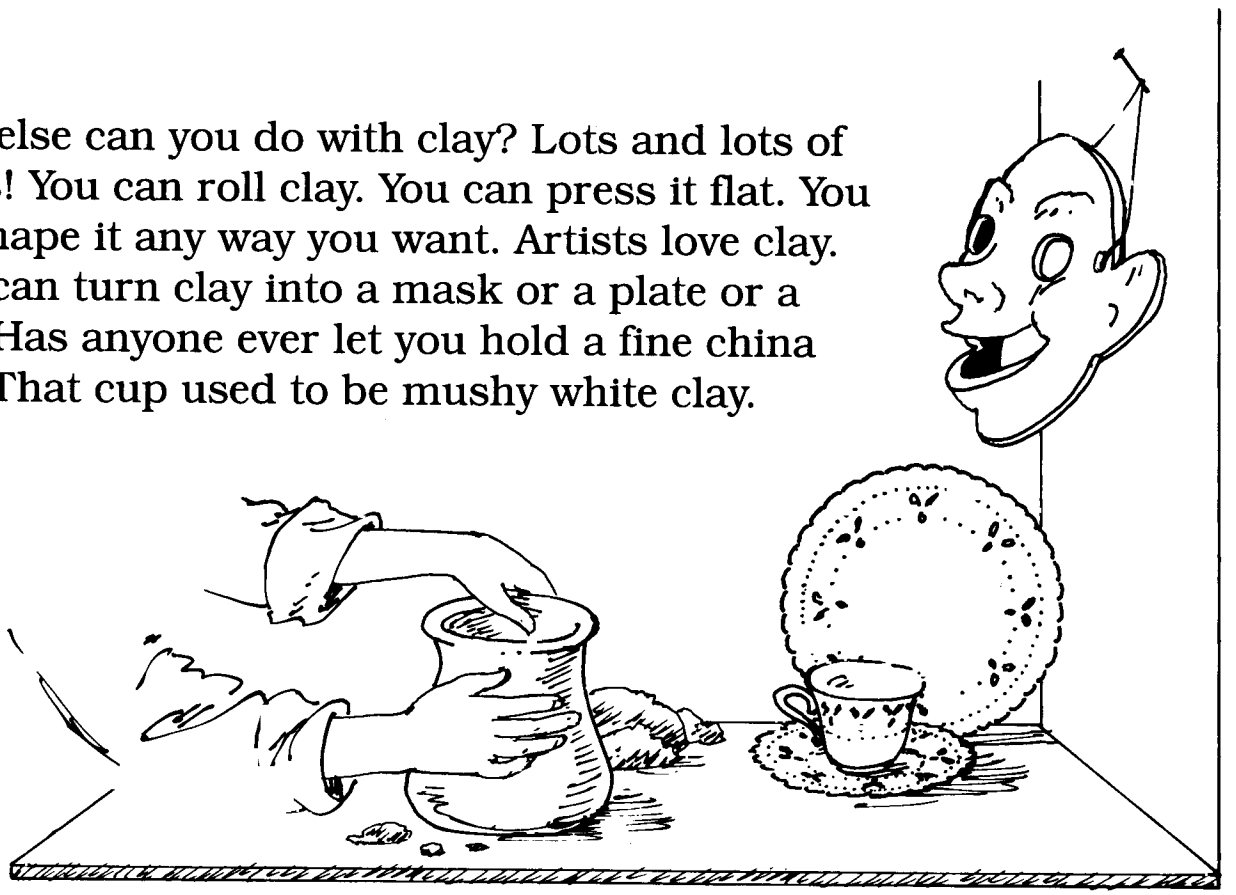
Some American Indians make a different kind of brick. It is called **adobe.** Indians have used adobe for a very long time. To make adobe, the Indians mix clay with straw. Then they let the adobe bricks dry in the sun. The heat from the sun bakes the adobe and makes it very hard.

People like brick because it is strong. It can last a long time. Once a Chinese emperor wanted to protect his land. So he put a big wall around his country. His wall was made of stones and bricks. Some of his bricks were baked in an oven. Some were baked in the sun.

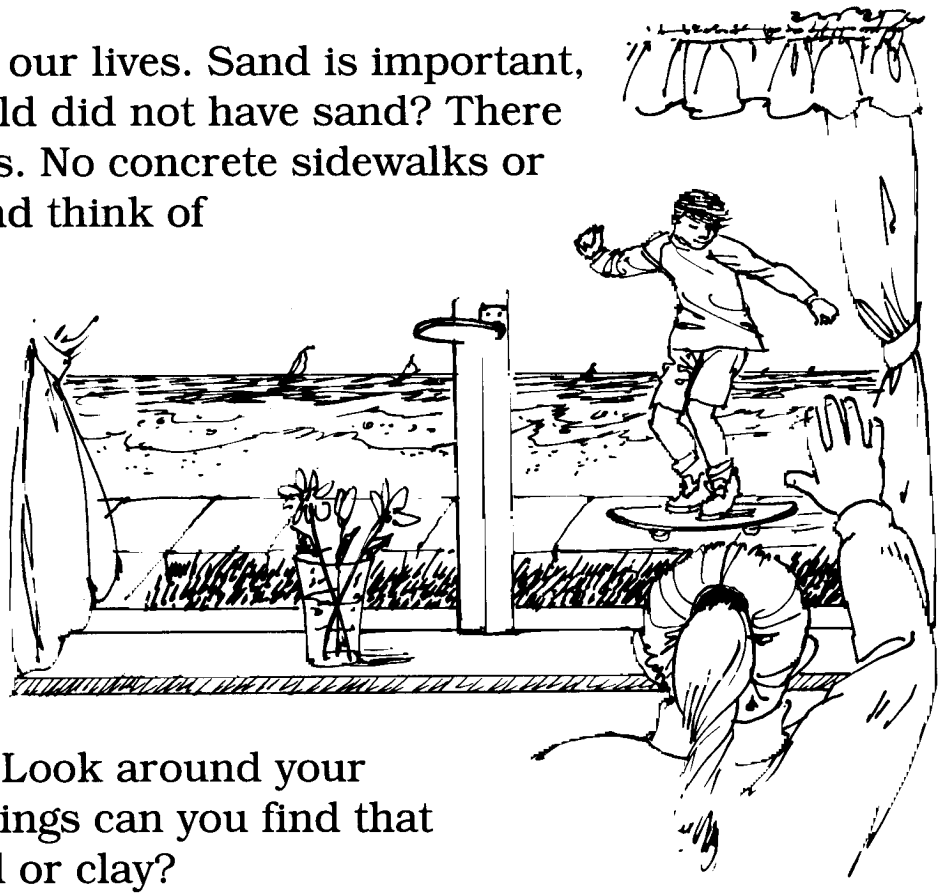


His wall was built more than two thousand years ago. It lasted for hundreds of years. When the bricks started to break, people in China made new bricks. The wall is still there today. We call it the Great Wall of China.

What else can you do with clay? Lots and lots of things! You can roll clay. You can press it flat. You can shape it any way you want. Artists love clay. They can turn clay into a mask or a plate or a vase. Has anyone ever let you hold a fine china cup? That cup used to be mushy white clay.



Clay is important in our lives. Sand is important, too. What if our world did not have sand? There would be no beaches. No concrete sidewalks or concrete bridges. And think of a world with no windows. We would have to say goodbye to glass because glass is made from sand!

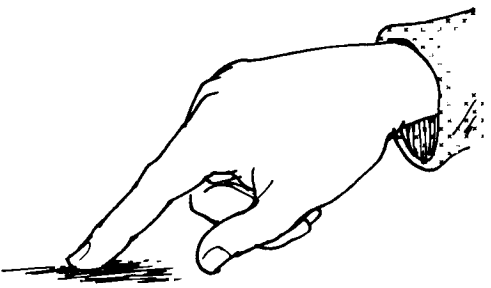


Have you seen sand or clay today? Look around your room. How many things can you find that are made from sand or clay?

Record Sheet 5–A

Name: _____

Date: _____



Make a Smear

Sand

Clay

Humus