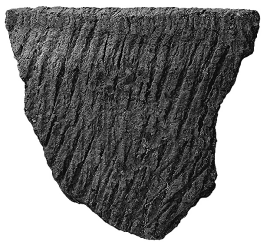
Lesson 2.7

EXPERIMENTAL ARCHAEOLOGY: MAKING CORDAGE



Pottery fragment from eastern North Carolina, decorated with impressions of cordage, ca. 100 BC–AD 800.

Subjects: science, social studies, mathematics, language arts, visual arts.
Skills: knowledge, comprehension, application, analysis, synthesis, evaluation.
Strategies: reading, discussion, computation, scientific inquiry, brainstorming, experiment, invention, writing.
Duration: one to two 45-minute class periods.
Class Size: any; groups of 4 to 5.

Objectives

In their study of experimental archaeology, students will make cordage and use an activity sheet to:

- experience a technique and skill that ancient Native Americans in North Carolina needed for everyday life;
- compute the amount of time and materials that might have been required to make cordage;
- construct a scientific inquiry to study the contents of an archaeological site.

Materials

For the teacher, one spool of hemp rope about a half inch in diameter; common dogbane (Indian Hemp), milkweed, or thin surface roots of pine; mulberry or poplar bark. If you cannot obtain native plant fibers, purchased string like cotton, raffia, or woolen yarn can be used. Transparency of the "Experimental Archaeology" activity sheet. For each student, a copy of "The Tuscarora Tied Their World Together" essay. For each student or team, a copy of the "Experimental Archaeology" activity sheet.

Vocabulary

Bast: fiber from the inner bark of trees.
Cordage: several strands of fiber twisted together; string or rope.
Experimental archaeology: a method of studying ancient artifacts that involves making and using replicas of those artifacts.
Fiber: a slender, threadlike strand.
Hemp: known as common dogbane, one of various plants that have a tough, strong fiber (called sisal) in the stem; the sisal is used to make rope.
Replication: the act or process of reproducing artifacts, structures, or use patterns.
Sinew: an animal tendon prepared for use as a cord or thread.
Technology: the technique or means for making or doing something, often associated with tool making.

Tuscarora: a North Carolina Indian tribe whose traditional territory extended from the western coastal plain to the eastern Piedmont. Their traditional language is Iroquoian. Most modern-day Tuscarora live in New York state. They migrated north after a war with European colonists and allied Indians in 1711–1713. They became the sixth member of the Iroquois Confederacy.

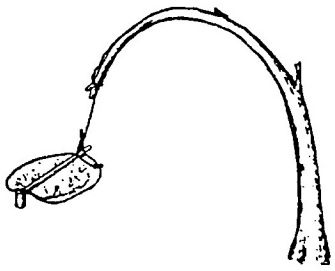
Background

Archaeologists can neither ask ancient peoples how they made their tools nor observe how they manufactured and used artifacts. Thus, archaeologists must find other ways to learn about past *technological* systems. Experimental *replication* of artifacts, buildings, and wear patterns is one method. Experiments provide possible interpretations and a basis for further study, but they do not directly prove how artifacts were used or made.

Experimental archaeologists replicate artifacts using techniques that may have been used by past people. These studies help archaeologists understand better the processes that produced the artifacts and buildings found in archaeological sites. They are particularly useful when ancient people left no written records or oral traditions of how things were made.

Replication studies include the reproduction of stone tools, basketry, ceramics, and cordage. By making these artifacts using (hypothesized) past techniques, archaeologists can address questions about how people once lived. Examples include: How long would it take to make a projectile point? Are some raw materials better for stone tool manufacture than others? What kind of clay is the best for pottery vessels and where can it be found? How long would it take to make a small snare or fishing net?

Experimental archaeologists also study how people used artifacts in the past. They do this by using them in ways that produce wear or damage patterns similar to those observed on artifacts. For example, archaeologists have used stone tools to butcher zoo elephants that have died in order to learn how Paleoindians may have butchered mammoths. They examine the wear patterns on stone tools as well as the cut marks on the bones of the butchered animal. The results of their studies are used to make inferences about how Paleoindians living 12,000 years ago may have performed similar tasks.



Animal snare.

In this lesson students will become experimental archaeologists and make *cordage* from native plant *fibers* or craft items. Cordage artifacts are seldom found in North Carolina sites because the region's wet, humid climate and acidic soils cause them to decay. However, cordage was an important part of earlier tribes' technology, and indirect evidence exists for how people used it. For example, some decorated clay pottery by stamping the surface with a small wooden paddle wrapped all over with a tightly spun cord. Others decorated pots by placing finely woven knotted nets over them and striking them with a paddle. Stone net sinkers suggest people used large and small fishing nets. Archaeologists infer cordage also tied together the support beams of houses. It undoubtedly was woven into animal snares, some kinds of bags and baskets, sandals and countless other crafted items. The importance of cordage to daily life is implied in a North Carolina tribal name. *Tuscarora* means "hemp gatherer," and Indian hemp (common dogbane) produces tough fibers used for making rope.

Besides using Indian *hemp*, local Native Americans made cordage from a variety of other materials. The vegetable fibers they used included stinging nettle, cattail, and milkweed. The

inner bark (*bast*) of mulberry, poplar, hickory, and red cedar trees was used, along with human hair, animal hair, and animal *sinew*. Also, the thin, flexible branches of willow trees, the surface roots of pines and vines like the trumpet vine were used to bind and tie things together. Even though these fibers were weaker or more brittle than spun cordage, they made a strong lashing when wrapped many times and then secured.

Archaeologists infer that finished cordage varied in size from 1 millimeter to several millimeters in diameter—that is, from fine twine to thick rope. The size and thickness may have been determined by the fibers selected and the intended purpose of the finished object. Experimental archaeologists produce cordage to learn how it was made, the characteristics of the finished pieces, and how much time was needed to make these important artifacts.

Setting the Stage

1. Distribute a piece of two-ply twine about 12 inches long to each student. Ask the students if they can determine how the twine was made.

2. The techniques that were used to make many ancient artifacts are not commonly used today. Thus, archaeologists are confronted with problems similar to what the students just experienced with the twine. To better understand how the artifacts were made and used, archaeologists must sometimes learn ancient manufacturing techniques. This often trial and error exercise is called *experimental archaeology*.

3. Share the Background information.

Procedure

1. The students read, "The Tuscarora Tied Their World Together." Briefly discuss the importance of natural resources to the Tuscarora and their ancestors.

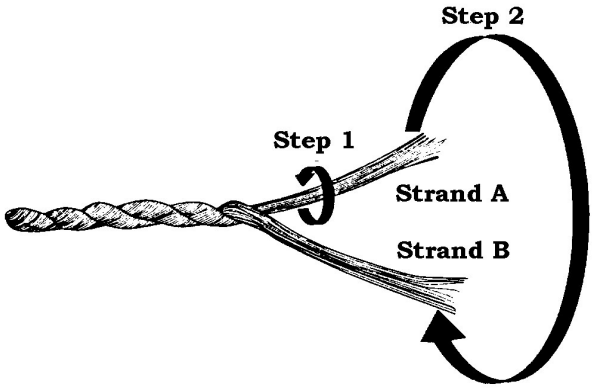
2. Demonstrate how to make cordage with the commercial hemp fibers (steps 4–8 below). Here are some additional tips on preparing the materials:

- To prepare the fibers, cut the purchased rope into 15-inch sections. Untwist the rope and pull the fibers straight. If using natural fibers, cut year-old (but no older) dead stalks of dogbane or milkweed. Gently pound the dried stalk. Tear it into strips; usually three work well. Beginning at the top, break the inner material by pressing the section between your fingers and strip the outer layer loose. Do this by working down the stalk, breaking and stripping about every inch. Gently roll the strip between your fingers or palms to remove the chaff.
- Obtain strips of mulberry or poplar bark from saplings by notching an incision near the base and pulling the tab up. (Primitive Skills educators who do this say the removal of small pieces will not kill the plants.) Soak the tree bark in water doused with dish detergent for at least a day. Then pull long fibers from the inner bark. If necessary, split the inner strips again into ribbons until they are thin and flexible. The splitting is best done by pulling and bending the thicker side toward you while holding the thinner side straight.
- Another way to obtain bast fibers is to use dead fall from poplar or mulberry. Cut the pieces in lengths and split. Soak the splits in a vat of water with dish detergent for at least a week. When the inner fibers can be stripped away easily, you've soaked enough. Beware, though. This is a smelly process. To retain the strips' flexibility, keep them in water until you are ready to use them. Use these natural fibers in the same way as the purchased rope.

3. Divide the class into groups of 4 to 5 students. Give each student about 15 inches of fibers. Assist each group in how to make cordage, asking students who readily learn the procedure to help other students.

4. To make cordage, first rub the hemp or natural fibers between both palms to remove debris. Separate two long strands of several fibers each from the 15-inch rope or plant section, starting from one end.

5. Hold one end of Strand A and one end of Strand B together, side by side, in your left hand between your forefinger and thumb. (This instruction is for right-handed people; do the opposite if you are left handed.) Pick up Strand A between your right forefinger and thumb, and twirl the strand *away* from your body (clockwise). This is shown as Step 1 in the illustration below.



6. Take the twisted Strand A and bring it *toward* your body, over and then under Strand B, as shown in Step 2 of the illustration.

7. Hold strands A and B between your left forefinger and thumb about where you crossed A over B. Repeat the twirling and crossing sequence: pick up Strand B, twirl it away from your body, and cross it over and under Strand A.

8. Continue these steps. The twirling in one direction and crossing in another direction forms an interlocking pattern like that of machine-made rope. If the cordage looks all twisted in the same direction, then the locking twist is not taking place, and usually the strands are being twirled in the wrong direction. (The process of making cordage is difficult to describe, and it sounds more complicated than it really is. Try it; it's surprisingly easy.)

9. Distribute copies of the "Experimental Archaeology" activity sheet to each student or team. Project the "Experimental Archaeology" activity sheet. As a class, work through the first problem. Students complete the remaining problems working individually or in teams.

Closure

1. Based on their experience with making cordage and the information in the reading, have students share their impressions of what daily life for Indian people living in North Carolina before Europeans arrived might have been like. In what ways might it have been similar to their own daily lives? In what ways different?

2. Tell students that archaeologists have excavated a dry cave site in the Mountains and more than 60 pieces of cordage were found in it. The cordage artifacts were classified and described as follows (write the information on the board):

Category 1
Material type: hemp (or dogbane)
Average thickness: 3 millimeters in diameter
Average length: 105 centimeters
Number of pieces: 38
Category 2
Material type: poplar bark (or mulberry bark)
Average thickness: 6 millimeters
Average length: 32 centimeters
Number of pieces: 22

Use scientific inquiry to study these two types of cordage.

- Research begins with a *question*. Ask the question: Why is the poplar bark cordage thicker than the hemp cordage? Brainstorm reasons such as: poplar bark is harder to work with, the hemp fibers are thinner.
- Select one *hypothesis*. For example, hemp fiber is stronger than poplar bark fiber, so it doesn't need to be as thick as poplar bark cordage to be as strong.
- *Test* this hypothesis by setting up an experiment to determine the relative strengths of cordage made from the two fibers. If you did not use the natural fibers to make cordage in the classroom, you can use different types of commercial string or yarn to design an experiment. For example, test the difference between cotton string and jute string.
- Unless the hemp cordage is poorly made it should be stronger than the poplar cordage. If the experiment determines that hemp is stronger than poplar, ask the following question: Why is there more hemp cordage than poplar cordage in the archaeological site? (Hemp may have been chosen because of its strength. Availability of the two fibers and the purpose of the artifacts may also have been determining factors.)

Evaluation

1. Evaluate students' efforts to make cordage.
2. Have students write a creative story or a report, make a chart, or construct a diorama about living on the western part of the Coastal Plain without modern technology. They need to include five things they would have to know how to do in order to live.
3. Evaluate the students' "Experimental Archaeology" activity sheets.

Extensions

1. Discuss how technology changes culture. For example, how would the acquisition through trade of metal tools, such as hoes, pans, and scissors have changed Indian cultures.
2. Demonstrate or display cordage in an Archaeology or Culture Fair.
3. Invent a modern use for cordage made from native plant fibers.

Links

Lesson 1.6: "Classification and Attributes."
Lesson 1.7: "Scientific Inquiry."

Sources

Boyce, Douglas W. 1978. "Iroquoian Tribes of the Virginia–North Carolina Coastal Plain." In

Handbook of North American Indians. Vol. 15, *Northeast*, edited by Bruce Trigger, pp. 282-289. Washington, D.C.: Smithsonian Institution.

Edholm, Steven, and Tarmara Wilder. 1991. "Cordage." *Bulletin of Primitive Technology* 1(2), pp. 19–22.

Lawson, John. 1967 [orig. 1709]. *A New Voyage to Carolina*, edited by Hugh Talmage Lefler. Chapel Hill: University of North Carolina Press.

Phelps, David Sutton. 1983. "Archaeology of the North Carolina Coast and Coastal Plain: Problems and Hypotheses." In *The Prehistory of North Carolina: An Archaeological Symposium*, edited by Mark A. Mathis and Jeffrey J. Crow, pp. 1–51. Raleigh: North Carolina Division of Archives and History.

Smith, Shelley J., Jeanne M. Moe, Kelly A. Letts, and Danielle M. Paterson. 1993. *Intrigue of the Past: A Teacher's Activity Guide for Fourth through Seventh Grades*. Washington, D.C.: Bureau of Land Management, U.S. Department of the Interior. [This lesson is adapted from "Experimental Archaeology: Making Cordage" on pp. 81–86, courtesy of the Bureau of Land Management.]

Ward, H. Trawick, and R. P. Stephen Davis, Jr. 1999. *Time Before History: The Archaeology of North Carolina*. Chapel Hill: University of North Carolina Press. [The image in this lesson's main heading is taken from Figure 6.5.]

"Experimental Archaeology" Activity Sheet Answers:

1. To answer the question for 10 meters of cordage, follow this general procedure:
   - Convert to centimeters: (100 centimeters per meter) (10 meters) = 1,000 centimeters.
   - Set up the ratio: (10 minutes) / (25 centimeters) = (x minutes) / (1,000 centimeters).
   - Solve for x: $25x = 10{,}000$; therefore x = (10,000 / 25) or 400 minutes.
   - Convert to hours and minutes: (400 minutes) / (60 minutes per hour) = 6.67 hours or 6 hours and 40 minutes.

Follow the same procedure to compute the time for 100 meters of cordage, or simply multiply the first solution by ten (since 100 meters is ten times more rope than 10 meters). The answer is 66.67 hours, or 66 hours and 40 minutes.

2. Use the same general procedure as in question 1, substituting 7 minutes for 10 minutes in the ratio. Alternatively, one may simply multiply the answers to question 1 by 0.7, as 7 minutes is 70% of 10 minutes, and thus the total times for making 10 and 100 meters would be reduced by the same factor. The correct answer for 10 meters of cordage is 4.67 hours or 4 hours and 40 minutes. The correct answer for 100 meters of cordage is 46.67 hours or 46 hours and 40 minutes.

3. The question may be answered by the following procedure:
   - Set up the ratio: (1 stalk) / (2 meters) = (x stalks) / (50 meters).
   - Solve for x: $2x = 50$; therefore x = 25 stalks.

4. As in the first problem, one can proceed by converting length to centimeters then using ratios to obtain the answer:
   - Convert to centimeters: (100 centimeters per meter) (2 meters) = 200 centimeters.
   - Set up the ratio: (10 minutes) / (25 centimeters) = (x minutes) / (200 centimeters).
   - Solve for x: $25x = 2{,}000$; therefore x = (2,000 / 25) or 80 minutes.
   - Convert to hours and minutes: (80 minutes) / (60 minutes per hour) = 1.33 hours or 1 hour and 20 minutes.

5. First compute the area (A) of the net by multiplying the length by the width. (Length and width must be expressed in the same units in order for the calculation to be valid.) Then measure the approximate length of cordage in each square meter of net, and multiply that amount by net's area in square meters. This calculation yields the total length of cordage in the net. From this number one can calculate the total time required to make the cordage, as in problem 1. Assuming that there are 3 meters of cordage in each square meter of net, and that it takes 10 minutes to make 25 centimeters of cordage, the calculation would proceed as follows:

- Convert width to meters: (120 centimeters) / (100 centimeters per meter) = 1.2 meters.
- Calculate the net's area: (42 meters) (1.2 meters) = 50.4 square meters.
- Calculate the total cordage length: (50.4 square meters) (3 meters per square meter) = 151.2 meters.
- Convert to centimeters: (100 centimeters per meter) (151.2 meters) = 15,120 centimeters.
- Set up the ratio: (10 minutes) / (25 centimeters) = (x minutes) / (15,120 centimeters).
- Solve for x: $25x = 151{,}200$; therefore x = (151,200 / 25) or 6,048 minutes.
- Convert to hours and minutes: (6,048 minutes) / (60 minutes per hour) = 100.8 hours or 100 hours and 48 minutes.

Alternatively, after computing the total length of cordage required in meters, one can set up a simple ratio using the answer to problem 1:

- Set up the ratio: (66.67 hours) / (100 meters) = (x hours) / (151.2 meters).
- Solve for x: $100x = 10{,}080$; therefore x = (10,080 / 100) or 100.8 hours.

Note that this answer represents a *minimum* figure for the total time spent in manufacturing the net, as it reflects only the time spent in making cordage and not the time spent in knotting the finished cordage into a net.

Experimental Archaeology

Name:

1. If it takes 10 minutes to make 25 centimeters of cordage, how long would it take to make 10 meters of cordage? 100 meters?

2. If you increased your speed from 10 minutes per 25 centimeters to 7 minutes per 25 centimeters, how long would it take to make 10 meters of cordage? 100 meters?

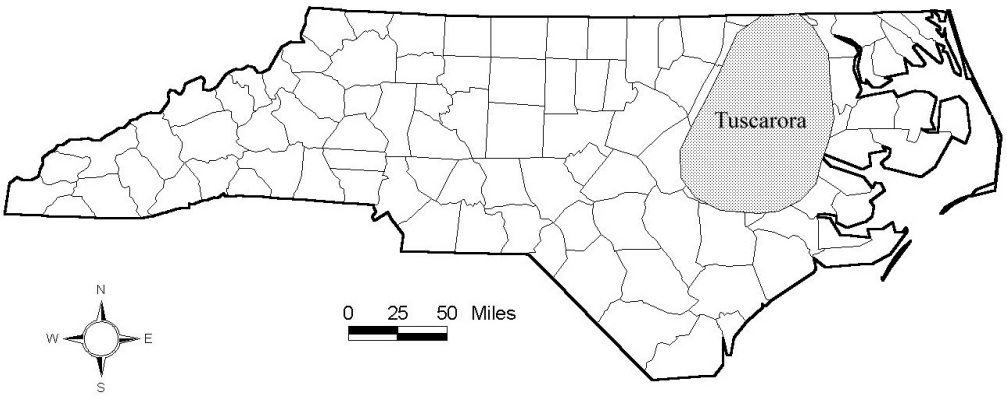
3. If it takes one dogbane stalk to make 2 meters of cordage, how many stalks would it take to make 50 meters?

4. It takes approximately 2 meters of cordage to make a snare to catch a small animal. How long would it take to make the cordage for the snare if you can make 25 centimeters in 10 minutes?

5. A cordage net measuring 42 meters by 120 centimeters was found an archaeological site. How long do you think it took to make the net? How would you find out? (Outline the process.)

The Tuscarora Tied Their World Together

The Tuscarora were once one of North Carolina's largest and most powerful tribes. Tuscarora legend says they used to occupy the country between the sea shore and the mountains. By the time Europeans arrived in the late 1500s, however, the Tuscarora lived in a smaller territory. It covered the western half of the Coastal Plain and the eastern edge of the Piedmont. Most Tuscarora villages were located on the terraces of the Roanoke, Neuse, Tar, and Pamlico Rivers. Their towns had names like *Haweta*, *Waqui*, *Chumanetts*, and *Kenta*. The contemporary towns of Raleigh, Smithfield, Goldsboro, Wilson, Rocky Mount, Tarboro, Greenville, and Kinston are in former Tuscarora lands.



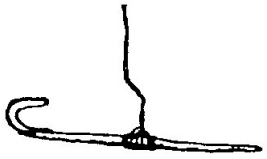
The approximate territory of the Tuscarora in the 1600s.

The Tuscarora are Iroquoian and speak an Iroquoian language. Their ancestors moved to Carolina sometime in the distant past. By the time Europeans arrived, several smaller tribes living on the Coastal Plain north and south of the Tuscarora were also Iroquoian. These were the Coree, Neusiok, Nottoway, and Meherrin. (The Cherokee are Iroquoian, as well.) Today, few Tuscarora live in North Carolina. Most modern-day Tuscarora live in New York state. Their ancestors left North Carolina and moved north after defeat in a war with colonists and allied Indians in 1711–1713. They went to live with the Iroquois and became the sixth nation in the Iroquoian Confederacy.

Before Europeans came, the Tuscarora lived much like most other North Carolina Indian tribes. They were agriculturalists who grew corn, squash, and several kinds of beans. Corn was their most important crop. It was parched and ground into meal, and people used it in soups and to make bread.

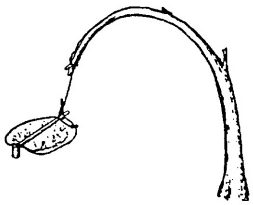
Even though they cultivated food, the Tuscarora relied heavily on wild foods. They fished and caught crayfish. They snared and hunted game animals, such as bear, beaver, racoon, rabbit, squirrel, and turkey. Deer was the most important source of meat. Hickory nuts, wild parsnips, wild turnips, Allegheny chinquapin nuts, and berries were among the wild plants the Tuscarora ate. Both men and women gathered food. Men hunted, and they also prepared the land for gardens.

The Tuscarora knew their environment well. To use what it offered, groups moved their entire villages twice each year. In the spring and summer, they stayed near the rivers. People farmed the



Fish hook.

soft, fertile soils and fished. In the fall, they moved away from the rivers to hunting quarters deeper in the Coastal Plains and stayed there all winter. Interestingly, the Tuscarora villages looked different in each place. Summer villages had houses set far apart. Fields were between them. The houses were round or oval. The walls were made from saplings that were pulled together at the top to form a roof. Fall and winter hunting villages had rectangular houses with ridge-like roofs. People built them close together, forming narrow streets. The house sides were covered with bark to keep cold and wet weather out.



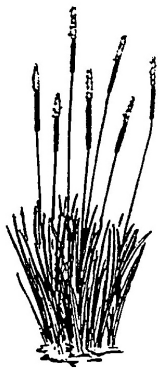
Animal snare.

As they went about daily life, the Tuscarora needed many kinds of things. Some were for pleasure and some for work or ritual. They made necklaces and earrings by shaping a kind of sea shell called Marginella. This shell was obtained by trading with coastal Algonkian Indians. Copper ornaments were popular among the Tuscarora, and they got copper by trading with people in the west. Some work-related tools the Tuscarora needed were bows and arrows made from wood. The arrow tips, knives, and scrapers were chipped from stone. They also made stone drills, milling stones, and hoes. Animal bone was used, too. People carved it into items like fish hooks and pins to hold garments together.

Hemp.

Clay pottery was very useful. The Tuscarora used different sizes and shapes of clay pots to cook and store food in. Archaeologists call the Tuscarora pots *Cashie ware* (pronounced ca-SHY). They are distinctive from those their neighbors, like the Algonkians, made. Some Tuscarora pots were decorated by placing a piece of loosely woven fabric on the surface of the wet clay. People then used a wooden paddle to lightly smack the fabric while turning the pot over in their hands. When the fabric was lifted off after paddling it, the pot's surface had the fabric's imprint on it. People also decorated pottery by cutting lines or using a hollow reed to punch holes near the vessel's rim.

Cordage was an especially important part of Tuscarora life. In the Tuscarora language, Tuscarora means "Hemp Gatherers." Indian hemp is a wild plant known today as common dogbane. Its dried stalks can be processed and made into strong cordage. The Tuscarora used other kinds of fibers besides Indian hemp. Each was suited to a specific purpose because of its special properties. Willow branches and surface pine roots were used for tying. Strong strings were made of sinew and human hair. Like Indian hemp, silk grass, rushes, and cattails made strong cordage. The Tuscarora needed to know where and when to find each kind of fiber, how to prepare the fibers, and how to make useful objects from them.



Cattail.

Lacking nails, bolts, wire, and screws, the Tuscarora tied their world together. They used cordage to tie wood into bundles to carry back to the village for fires. They lashed the poles of their houses together and tied them securely at the top. They tied small game onto their waist bands. They tied arrow tips to arrows and stone hoes to long sticks. Cords were used to make animal snares and fish nets. It was used to hang meat to dry from drying racks.