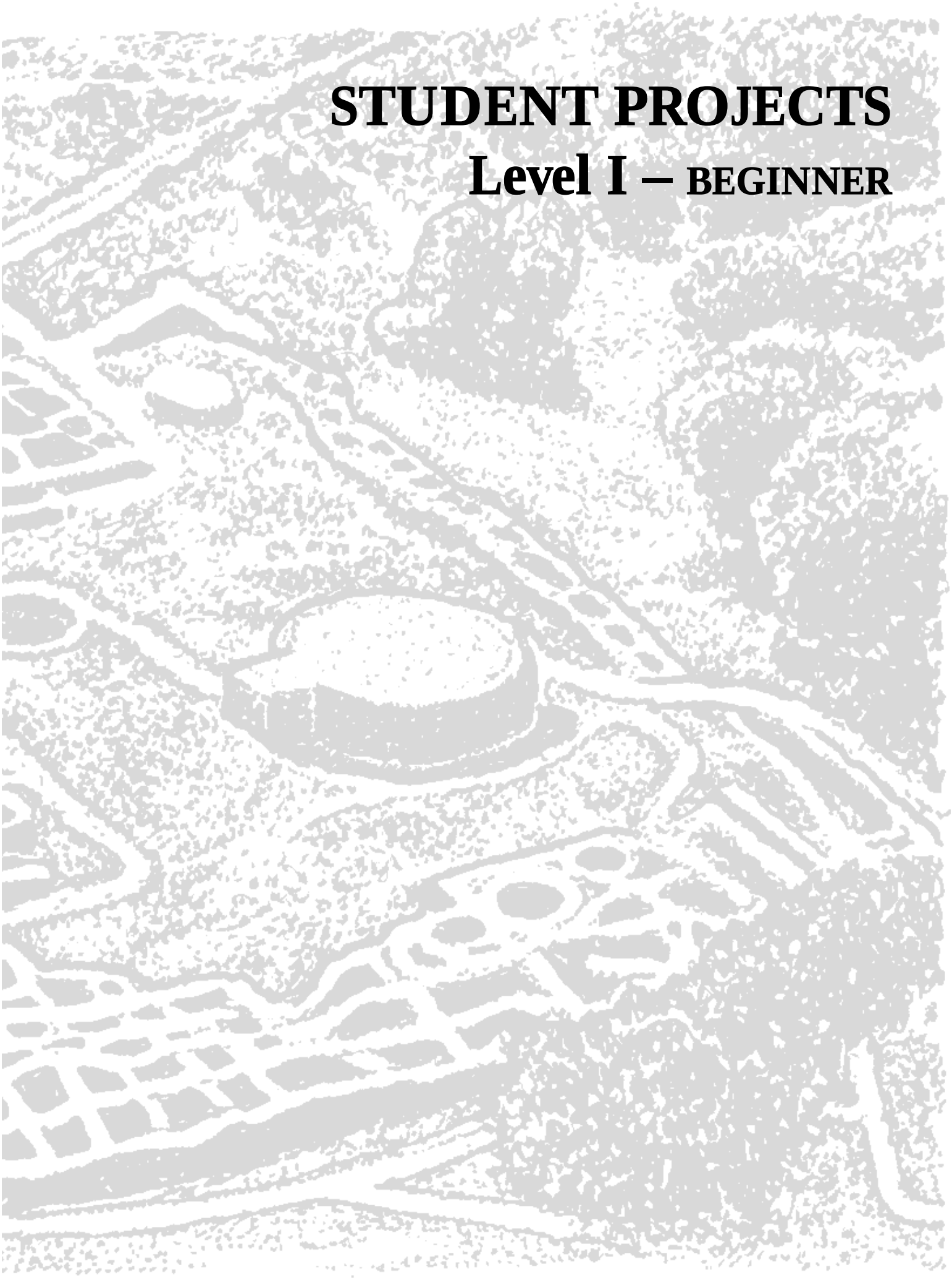
STUDENT PROJECTS

Level I – BEGINNER



Using Plants to Meet Basic Needs

Science, social studies, language arts

SKILLS.....Knowledge, comprehension, application, analysis, synthesis, evaluation
STRATEGIES.....Research skills, observation, writing, discussion
DURATION.....2 class periods
CLASS SIZE.....Any

OBJECTIVES
In their study of plant use at Aztec Ruins, students will:

1. Identify and list basic human needs.

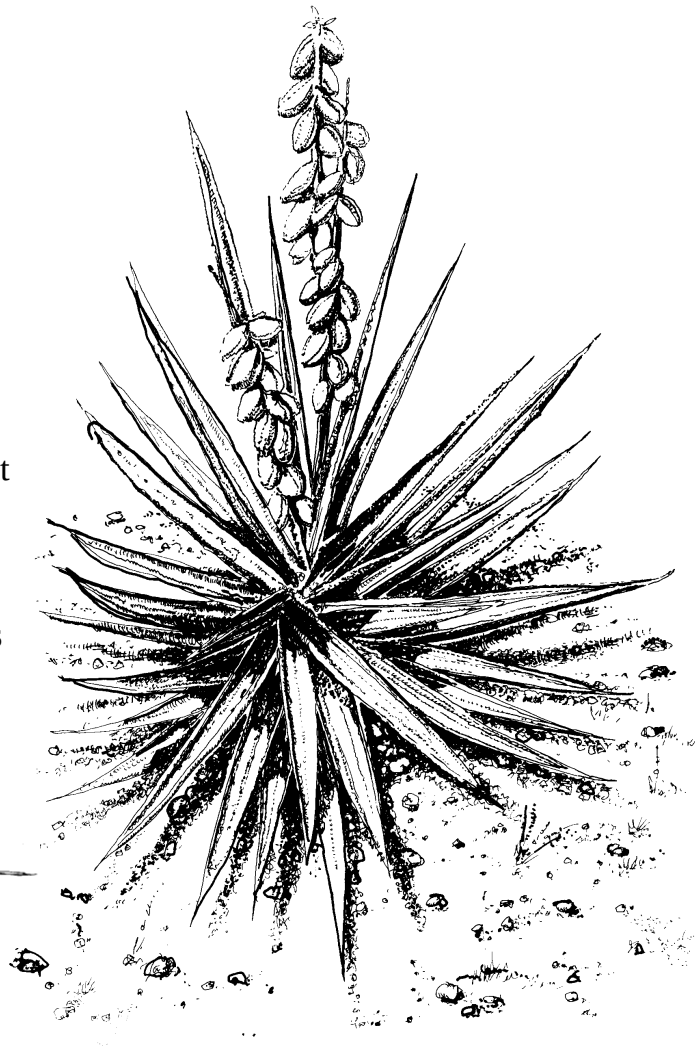
2. Describe how the people of Aztec used certain plants to fulfill basic needs.

3. Speculate why some plants were more valued than others.

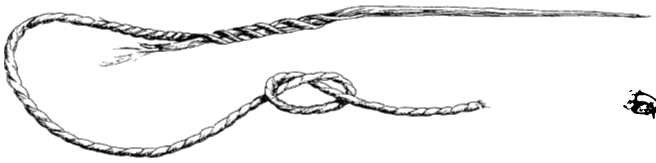
MATERIALS
- "Plants & Basic Needs" WORKSHEET
- References on native plants for research
- Trunk of replica artifacts from Aztec Ruins
- BACKGROUND information for each student (optional)

VOCABULARY
ethnobotany: the study of the use of plants by people.

This is the first of two lessons that explore how the Ancestral Pueblo people used plants. This lesson introduces students to the concept of plants helping to fulfill basic needs; the second concentrates on the identification, description, and uses of plants.



Needle and thread from yucca plant

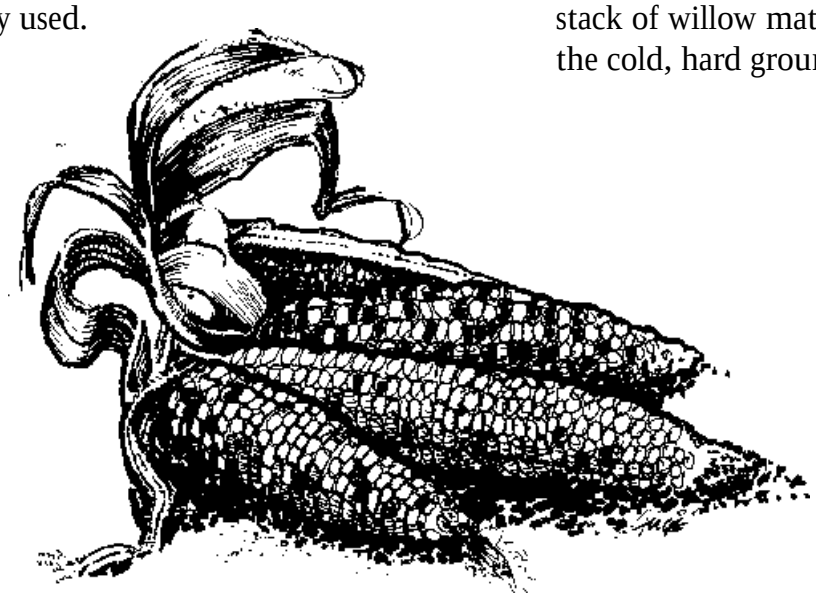


BACKGROUND

Everyone, past and present, has basic needs that must be met. These include food, shelter and protection from the elements, clothes, tools, explanation of the world, and medicine. The Ancestral Pueblo people skillfully used the wide variety of plants available to them to meet these needs.

The study of how people use plants is called *ethnobotany.* The people who specialize in this study are called *ethnobotanists.* By examining the locations and remains of plants and pollen among the artifacts from places like Aztec Ruins, ethnobotanists and archeologists have learned much about the use of plants in the past.

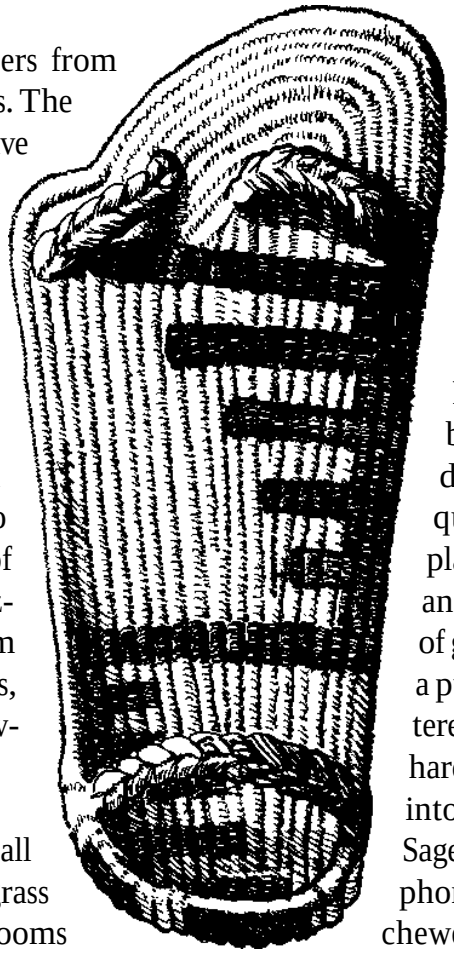
Most plant remains from the past perished quickly due to exposure to the elements. However, sometimes they were protected by a cliff overhang, a deep trash deposit, or a roofed room, which encouraged their preservation. Fortunately, at Aztec Ruins many plant remains survived because of the deep, dry trash deposits and protective roofs. Even though many vegetal items were found, they still represent only a small sample of what the people actually used.



The people at Aztec Ruins used a wide variety of plants in many ways to fulfill their basic needs. For example, to meet their need for food, they harvested the nuts of the piñon pine; gathered the berries of the three-leaf sumac and wolfberry; collected the young shoots of cattails and other herbs; and ate the seeds and fruits of other native plants such as Indian rice grass, yucca, prickly pear cactus, and globe mallow. Excavation in some rooms revealed deposits of corn stalks, tassels, husks, cobs and kernels; beans; and withered squash rinds. These plant remains indicated their dependence on corn, beans, and squash which they cultivated in irrigated garden plots.

Plants were invaluable for creating protection and shelter from the elements. Caches of building materials included sheaves of juniper splints, mounds of cottonwood bark and slabs, and peeled juniper and cottonwood ceiling poles. To construct their roofs, they used the trunks and branches of local juniper and cottonwood trees, and brought Douglas fir, ponderosa pine, and spruce from at least 20 miles away. They also burned the wood of some of these trees for warmth. One room yielded a stack of willow mats – a welcome relief from the cold, hard ground and room floors.

For clothing, they wove fibers from cotton into cloth for garments. The people at Aztec may not have grown cotton, but they traded for it from people who cultivated it elsewhere. They also extracted fibers from yucca leaves, and wove them with turkey feathers or strips of rabbit fur into warm blankets and shawls. Woven yucca fibers and leaves also made strong sandals. Some of the yucca sandals found at Aztec had holes in the heels from rigorous use by their wearers, and even showed signs of having been repaired.



Plants provided materials for all kinds of tools. Bundles of grass and strips of yucca found in rooms at Aztec indicate their importance for fashioning into useful items. The leaves and fibers of the narrow and broadleaf yucca plants were valuable for twisting into rope and cordage.

Yucca leaves and fibers were also used to make paintbrushes, awls (a pointed tool to punch holes), hairbrushes, baskets, snowshoes, and mats. Cattail leaves were also used in the same manner, although the fibrous yucca leaves were stronger and more widely used. Stems and branches of three-leaf sumac, juniper, rabbitbrush, and reed were useful for arrow shafts, bows, fire drills, cradleboards, basket frames, ladders, and knife handles, while oak branches and other hard woods made sturdy digging sticks. Coiled bunches of grass formed round pot rests. Certain plants such as rabbitbrush and Rocky Mountain beeplant were used as dyes and paints for cloth and pottery.

Without a drugstore, the Ancestral Pueblo people relied on plants for their medicinal needs. Bunches of herbs found in excavated rooms at Aztec Ruins hint at their importance for medicinal use. Researchers do not know how Ancestral Pueblo people used these plants because of a lack of surviving evidence, but their descendants frequently used – and still use – plants in the treatment of illness and healing. For example, the root of globe mallow was pounded into a pulp, mixed with water, and plastered over broken bones to make a hard cast. Rabbitbrush was brewed into a tea to cure stomach disorders. Sage leaves, rich with aromatic camphor oils, were brewed into teas, chewed, or applied as warm compresses to treat stomach disorders. Inhaling the steam from boiling sage leaves served as a decongestant and warm leaves were applied to the neck to help a sore throat.

Knowing plants and how to use them to meet basic needs was very important to the Ancestral Pueblo people who lived in the Aztec area, as well as to their descendants. Pueblo people today respect plants as an integral part of their world, recognizing their connection to them and honoring them as they gather them. Today, some plants, such as corn and bean sprouts, are necessary for, or are the focus of, certain rituals and ceremonies. The Ancestral Puebloans may also have used certain plants ritually and gathered them with the same care and respect practiced by their descendants.

PLANTS & BASIC NEEDS

Indicate how a particular plant was used for a selected need. Example: On the line for corn, beans, and squash, write "grew to eat" under the column marked "food." Research additional references about plant use to help you complete the worksheet.

	FOOD	SHELTER & PROTECTION	TOOLS	CLOTHING	MEDICINE
Corn, beans, squash	*Example: Grew to eat*				
Juniper					
Sage					
Broadleaf yucca					
Narrowleaf yucca					
Wolfberry					
Prickly pear cactus					
Piñon					
Rabbitbrush					
Three leaf sumac					
Cottonwood					
Globe mallow					

SETTING THE STAGE

Introduce the idea that all people, past and present, have basic needs. Brainstorm basic needs and list them on the board.

PROCEDURE

1. Distribute the "Plants & Basic Needs" WORKSHEET.

2. Share the BACKGROUND information about how the Ancestral Puebloans met many of the basic needs listed at the top of the worksheet through the use of plants. Give an example of how they used plants to meet a basic need. Example: They grew corn, beans, and squash to help satisfy the need for food.

3. From their present knowledge and examples you give them, students will complete as many boxes as they can on the worksheet to indicate how a particular plant was used to meet a particular need. Example: On the line for corn, beans, and squash, write "grew to eat" under the column marked "food."

4. Students examine the replica artifacts in the artifact trunk and read the written information with the artifacts for additional evidence of plant use that they can record on their worksheet. Distribute the BACKGROUND information to students to use as a reference, if desired.

5. Students research additional references about plant use to help them complete their worksheets.

CLOSURE

As a class, review and discuss the following questions:

In what ways did Ancestral Puebloans use plants to fulfill their basic needs?

Were any plants used to fulfill more than one basic need?

Do you think some plants were valued more highly than others? Why or why not?

EVALUATION

Students are evaluated on the accuracy and thoroughness of their worksheets and their participation in class discussions.

EXTENSIONS

1. Students research and evaluate how we use plants in our society today to fulfill our basic needs. Complete a chart similar to the “Plants & Basic Needs” chart completed for the prehistoric uses. Compare findings.

2. Determine additional uses of plants by other peoples, including historic Native Americans, Hispanic, and/or Anglo populations. Draw a picture of the plants researched.

3. Students experiment with making cordage, basketry, or weaving with plants.

4. Students explore, through research, the relationship that Ancestral Puebloans today have with plants, how they use plants in ceremonial ways, and how they gather and prepare them. Compare findings with observations about the relationship the students' families have with plants.

REFERENCES

Dunmire, William W., Tierney, Gail D., *Wild Plants and Native Peoples of the Four Corners*, Museum of New Mexico Press, Santa Fe, 1997.

Niethammer, Carolyn, *American Indian Food and Lore*, Collier Books, New York, 1974.

Identifying Plants

Science, social studies, language arts

SKILLS.....Knowledge, comprehension, application, analysis
STRATEGIES.....Observation, writing, mapping, communication, discussion, research skills
DURATION.....1 class period; 2-hour field trip to Aztec Ruins
CLASS SIZE.....Any

OBJECTIVES

In their study of plant use at Aztec Ruins, students will:

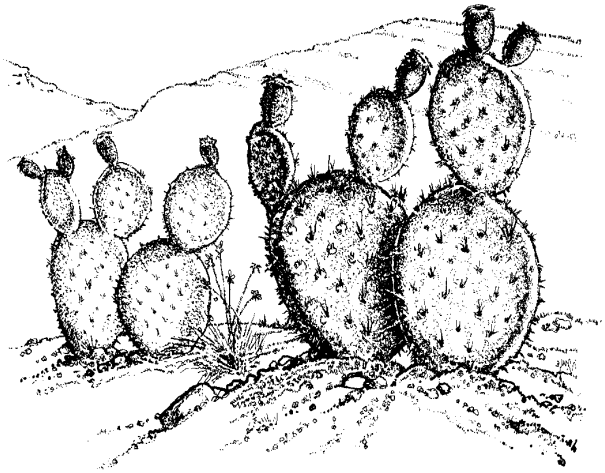
1. Locate, identify, and describe certain plants at Aztec Ruins.

2. Compare and contrast native and cultivated plants.

3. Research and describe how Ancestral Pueblo people prepared and used plants.

MATERIALS

- "Plants at Aztec Ruins" MAP and "Plants of Aztec" WORKSHEET for each student
- Completed "Plants & Basic Needs" HANDOUT from previous lesson
- "Plant Descriptions" HANDOUT and additional references, if desired



VOCABULARY

native plants: plants that naturally occur, or are native, to a given area; they have not been introduced from other areas by humans or animals.

cultivated plants: plants that are planted and cared for by people; the Ancestral Pueblo people cultivated corn, beans, squash, and in some areas, cotton.

digging stick: sturdy stick pointed at one end, used for digging holes for the planting of seeds.

juniper splints: thin layers of juniper placed above the latillas and below the dirt layer in a roof.

yucca: native plant with pointed, fibrous, stiff leaves, used in many ways by the Ancestral Puebloans.

This is the second of two lessons that explore how the Ancestral Pueblo people used plants. This lesson concentrates on the identification, description, and uses of plants. The first introduced students to the concept of plants helping to fulfill basic needs.

BACKGROUND

Ancestral Pueblo people relied on a variety of plants to fulfill their basic needs. But they not only had to know their uses, they also had to know their habitat and how to identify them, and determine the best time for collection.

Many of the plants used in roof construction, such as Douglas fir and spruce trees, did not grow in the immediate area. These trees grow in moister, higher elevations, over 25 miles away. Other plants grow only in certain habitats, such as along waterways, on mesa tops, or in rocky areas. Fortunately, the people did not have to travel far to find many of the plants they needed.

Today, several of the plants that the Ancestral Pueblo people used grow within the area that is now Aztec Ruins National Monument. Most are native plants – those that occur naturally in this area and have not been introduced by animals or humans. Some of the plants are occasionally planted and cared for by workers at the monument as a demonstration of plants cultivated by the Ancestral Pueblo people. These include corn, beans, squash, and cotton.

These cultivated crops were introduced to the Southwest from Mexico. Over hundreds of years they became increasingly important to the Ancestral Pueblo peoples as they relied more on farming for their food supply.

SETTING THE STAGE

Review the names of commonly used plants from the "Plants & Basic Needs" HANDOUT completed in the previous lesson. Share the background information regarding their occurrence at Aztec Ruins today.

PROCEDURE

1. Divide the students into teams of 3 to 5 students. Assign each group several plants listed on the "Plants & Basic Needs" HANDOUT to research while on the field trip.

2. Distribute "Plants at Aztec Ruins" MAP, "Plants of Aztec" WORKSHEET, and the "Plant Descriptions" HANDOUT to students. If available, use additional references that include color pictures of the plants.

3. Review proper behavior for the field trip: Stay on the surfaced trail through the West Ruin; do not remove any plants or plant parts.

4. Take a field trip to Aztec Ruins and complete the following assignments:

- Identify a specimen of each student's assigned plant. Use the "Plants at Aztec Ruins" MAP with locations of plants indicated to help students find their plants. Depending on the time of the year, some plants might be easy or difficult to identify. The group that researches corn, beans, and squash may not find live specimens (although sometimes they are growing in the plot in front of the visitor center), but may find pictures or samples in the exhibits or references in the trail guide.

- Look for additional specimens of their plants and plot their locations on the "Plants at Aztec Ruins" MAP. Use a suitable legend to denote their plant.

- Search for information about their plants and add it to their "Plants & Basic Needs" WORKSHEET.

- Complete the "Plants of Aztec" WORKSHEET. Describe characteristics of their assigned plants and describe what parts of the plant were used and how.

CLOSURE

While still on site, each group reports their findings to the class by addressing the following questions:

What are some of the distinguishing characteristics of their plants? (View the plant specimens with the entire class, if possible.)

How did the Ancestral Pueblo people prepare the plant to use it?

Share the BACKGROUND information on cultivated and native plants.

Were the plants they researched cultivated and/or native to the area?

Compare the findings of the different groups.

EVALUATION

Students are evaluated on the accuracy and thoroughness of their worksheets and their participation in class discussions.

EXTENSION

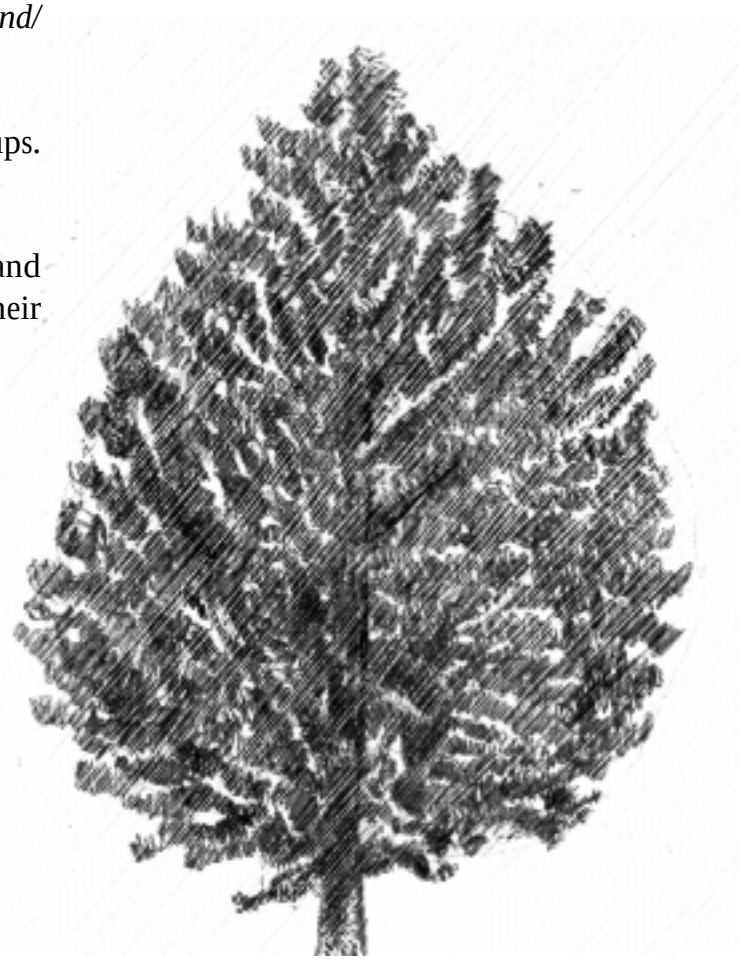
1. Identify and describe plants that the people who lived at Aztec Ruins used but that cannot be found locally or within the monument. Locate specimens in other places, such as the school yard, public lands, or around student homes.

REFERENCES

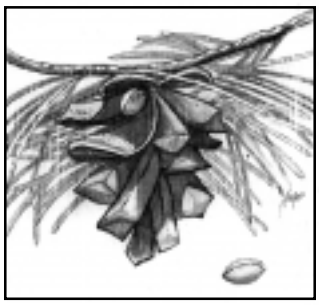
Dunmire, William W., Tierney, Gail D., *Wild Plants and Native Peoples of the Four Corners*, Museum of New Mexico Press, Santa Fe, 1997.

Flowers, Shrubs and Trees of the Southwest, Southwest Parks and Monuments Association, Tucson, 1995.

Niethammer, Carolyn, *American Indian Food and Lore*, Collier Books, New York, 1974.



Piñon



PLANT DESCRIPTIONS

Juniper
Growing up to 20 feet high, this tree has tiny, aromatic, scale-like leaves. The one seed berry is pale blue, globular, and grows to 1/4 inch in diameter.

Big sagebrush
This shrub grows from 2 to 5 feet tall. The smoky-colored bark hangs in shreds and has a distinctive turpentine smell, especially when wet. The 1-inch leaves have 3 teeth at the end. The flowers are tiny.

Broadleaf yucca
Sometimes called *banana yucca*, its long pointed leaves are up to 2 inches wide and thick from moisture stored inside. The leaves appear to sprout from the base of the plant and reach nearly 3 feet high. The creamy white flowers bear a heavy green fruit. Because it requires much energy to produce both the flower and the fruit, the yucca blooms only once every few years in the spring.

Narrowleaf yucca
This yucca is similar to the broadleaf yucca, but its pointed leaves are thin and strap-like, and not over 1 inch wide.

Wolfberry
The older branches of this bush are reddish brown, while the younger ones are pale yellow. Its mature leaves are leathery and pale green and grow in clusters. Long, sharp spines protrude from the branches. The creamy green flowers bloom from May to June, and are funnel-shaped and about 1 inch long. In July they produce an orange-red berry that resembles a very small tomato.

Prickly pear cactus
This sprawling cactus has flat, stout, spined stems arranged in pads. The type found at Aztec has pads that are flat on the ground, densely spined, and dry. The yellow flowers yield egg-shaped purple fruit called "tunas," which grow to 1-1/4 inches long when ripe.

Piñon
Also called the "two-leaf" or "Colorado" piñon, this tree grows up to 35 feet high. Its bark is grey to reddish brown with furrowed scaly ridges. The light green needles are usually found in bundles of 2. The yellowish-brown cones are egg shaped, about 1-1/2 to 2 inches long, and yield nuts in the fall.

Rabbitbrush
This shrub has erect, slender, flexible branches and grows up to 7 feet high. The branches are covered with dense, felt-like, matted hairs and many narrow leaves. The bright yellow flowers grow in dense clusters at the end of the stem, and bloom from the end of summer to mid-fall.

Three-leaf sumac
Mature shrubs can exceed 8 feet high. The three-part leaves turn a deep red in fall. The pale yellow flowers produce sticky, hairy, pea-sized red berries in the spring which taste sour and give this bush its other name, *lemonade bush*.

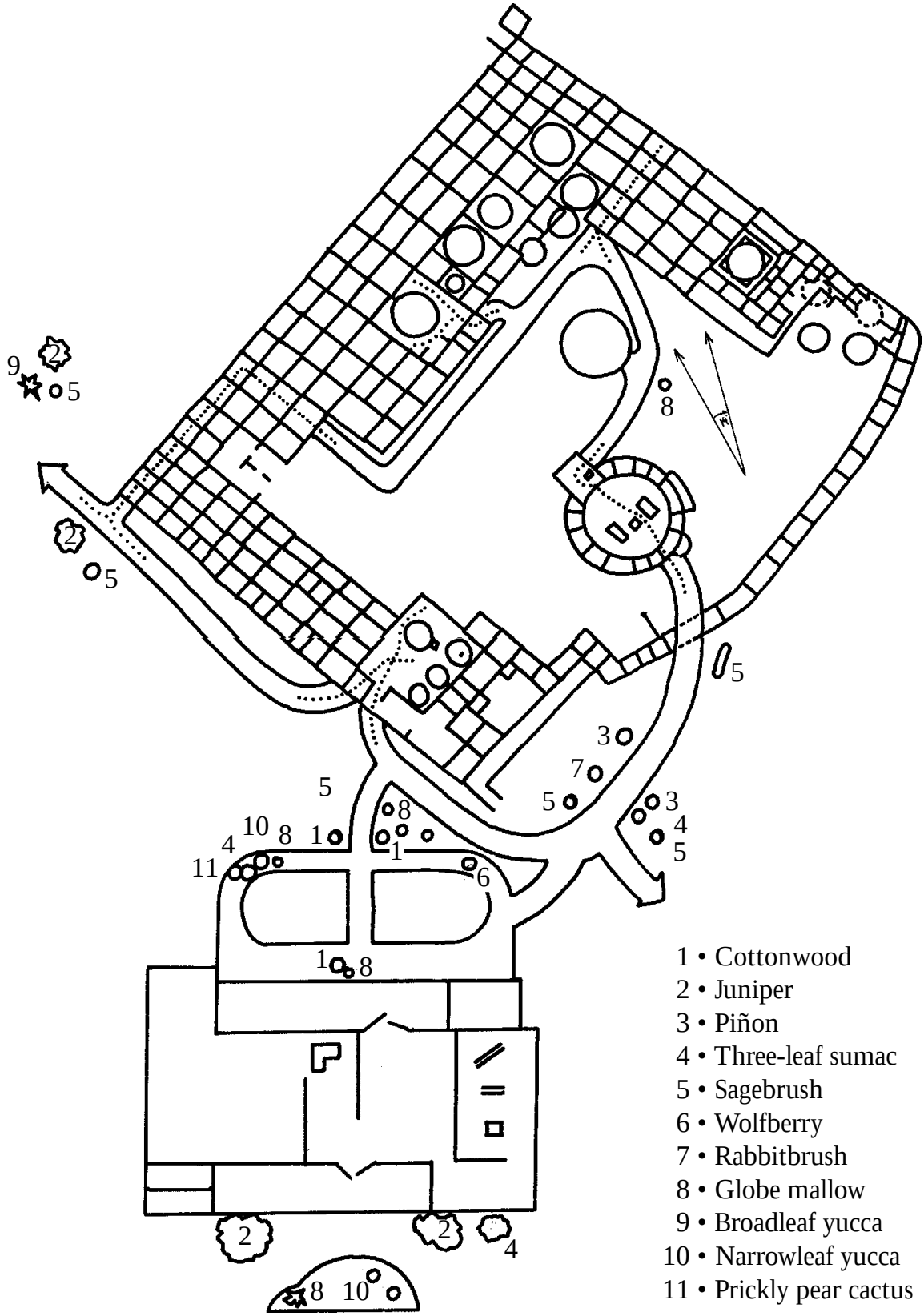
Fremont cottonwood
Growing up to 80 feet tall, this tree has deeply furrowed gray bark. The broad, triangular leaves with sawtooth edges are bright green in summer, gold in fall, and drop before the first snow. In spring and early summer it produces masses of soft, cotton-like fibers.

Globe mallow
Growing up to 20 inches high, this plant has green leaves about 2 inches long. The saucer-shaped orange flowers have 5 petals and are from 1 to 1-3/4 inches wide.

PLANTS OF AZTEC

PLANT NAME	DESCRIPTIVE CHARACTERISTICS	PARTS OF PLANT USED & HOW
(EXAMPLE) *Juniper*	1. *Scale-like leaves* 2. *Hard blue berries* 3. *Shaggy bark*	1. *Trunks and branches were cut and peeled and used for roof s of houses.* 2. *Berries were gathered and used in cooking.*

PLANTS AT AZTEC RUINS



1 • Cottonwood
2 • Juniper
3 • Piñon
4 • Three-leaf sumac
5 • Sagebrush
6 • Wolfberry
7 • Rabbitbrush
8 • Globe mallow
9 • Broadleaf yucca
10 • Narrowleaf yucca
11 • Prickly pear cactus

Resources Near & Far

Social studies, language arts

SKILLS.....Knowledge, comprehension, application, analysis, evaluation
STRATEGIES.....Reading, discussion, scientific inquiry, brainstorming, writing
DURATION.....2 class periods; optional field trip to Aztec Ruins
CLASS SIZE.....Any; students may work in pairs, then individually

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OBJECTIVES
After viewing the trunk of replica artifacts students will:

1. Examine replica artifacts and discuss their materials and uses.

2. Use observation and inference to determine how Ancestral Pueblo people obtained the natural resources for their artifacts.

3. Speculate about the value of natural resources to the Ancestral Pueblo people.

MATERIALS
- Trunk of replica artifacts from Aztec Ruins, along with written information about items
- "Resources Near & Far" WORKSHEET
- "Origins of Resources" MAP

VOCABULARY
awl: animal bone sharpened at one end, used to punch holes in hides and basketry.

cordage: rope or string made from plant fibers twisted together.

juniper splints: thin layers of juniper placed above the latillas and below the dirt layer in a roof.

latilla: cottonwood or aspen pole placed above the vigas and below the juniper splints in a roof.

maul: large hammer-like stone tool used to shape rocks for building.

obsidian: shiny, dark-colored volcanic glass that chips into very sharp edges, used for making sharp tools.

projectile points: objects chipped from stone and attached to the ends of arrows and spears.

replica: a copy of an object, made to look as much like the original as possible.

sherd: a piece of broken pottery.

viga: a log of spruce, Douglas fir, ponderosa pine, or juniper used as the primary support beam for a roof.

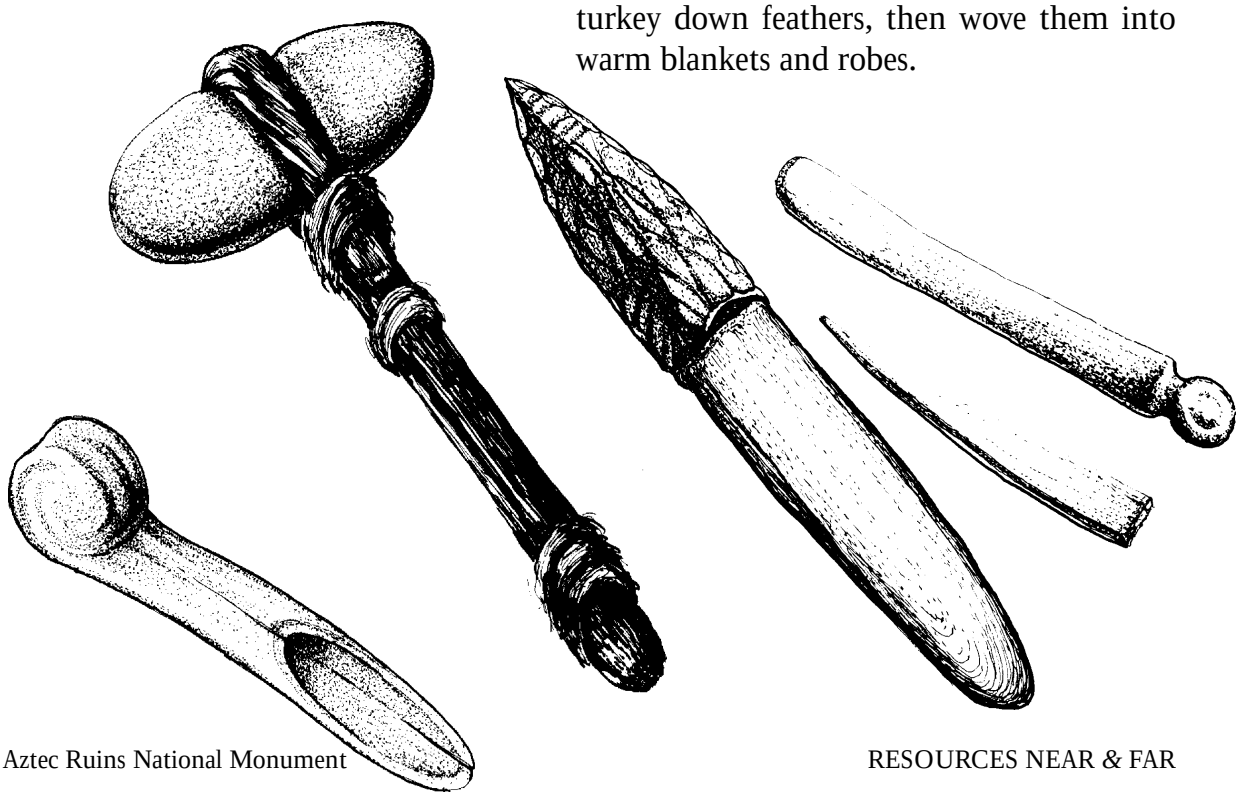
yucca: native plant with pointed, stiff, fibrous leaves, used in many ways by Ancestral Puebloans.

The people of Aztec Ruins used the raw materials and resources they found in their environment to make tools, process food, fabricate clothing, create art, and erect their structures. They collected some of these resources from nearby, but traveled or traded for others from more distant sources.

A variety of stones fulfilled many requirements for tools, construction materials, and jewelry. Locally-available cobbles and sandstone were converted into ground-stone tools such as hammer stones, mauls, axes, manos, and metates. The Ancestral Puebloans also used great quantities of these stones for constructing their buildings. Prehistoric mauls and hammers found at sandstone quarries some three to five miles from Aztec Ruins indicate the distance they traveled to obtain their building materials. Through travel or trade, they obtained other stones from more distant sources, such as obsidian from the Jemez Mountain area and turquoise from an area south of Santa Fe. These were prized in making jewelry: pendants, ear ornaments, beads, bracelets, and other body ornaments. Obsidian was also chipped into projectile points and very sharp cutting tools, such as knives, scrapers, and blades.

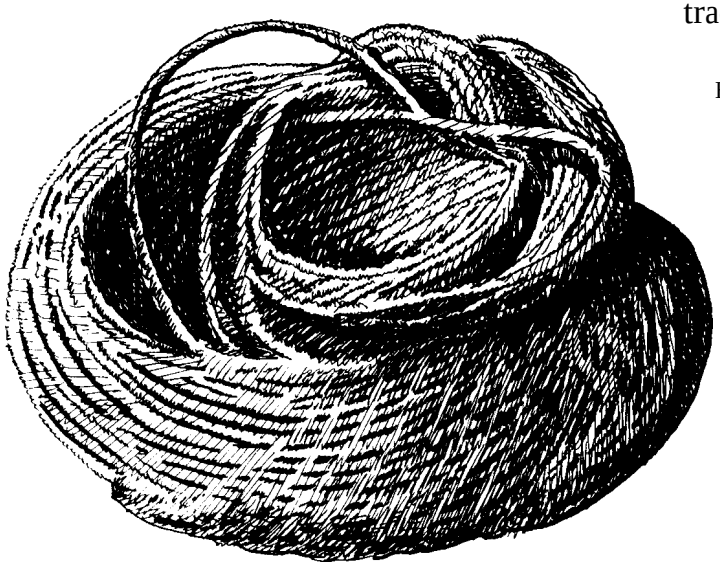
The bones of birds, turkey, rodents, deer, and bighorn sheep were fashioned into awls, scrapers, beads, whistles, and gaming pieces. The feathers and hides of these animals were used to make warm blankets, robes, and footwear. Most of these animals were found nearby.

Clay occurring naturally in certain areas was valuable in pottery making, while particular plants and minerals yielded pigments for painting them. Locally-grown wild and cultivated plants provided materials for making clothing, baskets, matting, and certain tools. They extracted the tough fibers from yucca plants to make cordage, and wove its leaves into mats, baskets, and sandals. They wrapped yucca cordage with strips of rabbit fur or attached turkey down feathers, then wove them into warm blankets and robes.



Different species of wood from local and distant sources provided firewood, roofing materials, and materials for bows, arrows, digging sticks, handles for axes, and spears. The large roof vigas were made from either fir, Douglas fir, spruce, or ponderosa pine, which all grow in higher elevations some 20 to 40 miles away. The smaller poles above the vigas, called *latillas*, were made from either cottonwood or aspen. Aspen trees also grow in higher and moister elevations, at least 40 miles to the north or west. Cottonwood trees grow nearby along the Animas River and in moist areas. Juniper trees also grow nearby, and were shaped into the short juniper splints placed above the latillas in the roofs.

The most distant origin of materials was most likely northern Mexico. From there, the Ancestral Pueblo people traded for the colorful feathers of the scarlet macaw – a kind of parrot that prefers the warmer climate to the south. One macaw feather was found at Aztec Ruins. Other materials and artifacts obtained afar sources include copper beads from northern Mexico (two were found at Aztec Ruins,) and shells from the Gulf of California that were used in jewelry.



While the people used and valued a broad range of materials, they may have valued resources for particular reasons. Some, such as macaw feathers and shells, required travel and trade to obtain, and thus assumed a special value. Other materials were valued for ritual use. Some resources were significant because of the items that could be made from them. For instance, obsidian, unlike most other stones, produces a very sharp edge for tools. Clay is necessary for pottery vessels – items that formed a prominent part of their everyday lives.

These people may have viewed and treated the resources in their world much as their descendents do today, honoring all things as alive, interconnected, and valued as components of the broader whole.

SETTING THE STAGE

Use the background information above and written information from the replica trunk to discuss the materials that the Ancestral Pueblo people used to survive (stone, animals, wood, plants, etc.). List these materials on the board. Discuss their sources. Show the "Origins of Resources" MAP that shows the origin of the various materials. How far did they travel or trade to obtain these materials?

EXAMPLES:

obsidian – Jemez Mountains

turquoise – south of Santa Fe

scarlet macaw feathers and **copper bells** – northern Mexico

some varieties of **wood** – 20 to 40 miles away

sandstone – quarries 3 to 5 miles away

yucca and other plants – nearby

PROCEDURE

1. Students examine the items in the trunk of replica artifacts. Discuss the uses of the items. Refer to the background information and written information with the trunk.

2. Students go on an optional field trip to Aztec Ruins, where they will complete the "Resources Near & Far" WORKSHEET. Otherwise, complete the procedures in the classroom.

3. Distribute "Resources Near & Far" WORKSHEET to each student. Working in pairs, students complete the columns for each artifact, listing its material, possible source, and inferring how it was obtained (trade, travel, collect locally, etc.). If students complete this while on a field trip to Aztec Ruins, they should obtain information from the exhibits, trail guide booklet, rangers, and observation of the site. If done in class, they can use information from the replica artifact trunk, the map, and the background information you give them.

4. Discuss answers from students' worksheets.

CLOSURE

Briefly share BACKGROUND information regarding reasons and ways the Ancestral Pueblo people might have valued various resources. Students use their research and knowledge of origin and use of materials to speculate and write a statement about which raw materials were valued most. Why? Share and discuss statements with the entire class.

EVALUATION

Evaluate student participation in discussion, completion of worksheet, and written statement on the value of resources.

EXTENSION

Students each write a two page story, putting themselves in the place of a young Aztec inhabitant. Use what they have learned about material sources to tell about searching and finding raw materials. How might you prepare for your search? Who might have taught you where and how to gather or hunt? Where did you find it? What time of year? What time of day? Describe the material and how you got it. What might happen to you during the search? Would you see any other animals? People? What did you do with the raw material after you found it? How did you prepare it? What did you finally do with it? Would you work for yourself only, or would you go with others to obtain or prepare the materials? Illustrate the story.

REFERENCES

Barnett, Franklin, *Dictionary of Prehistoric Indian Artifacts of the American Southwest*, Northland Printing Company, Flagstaff, 1991.

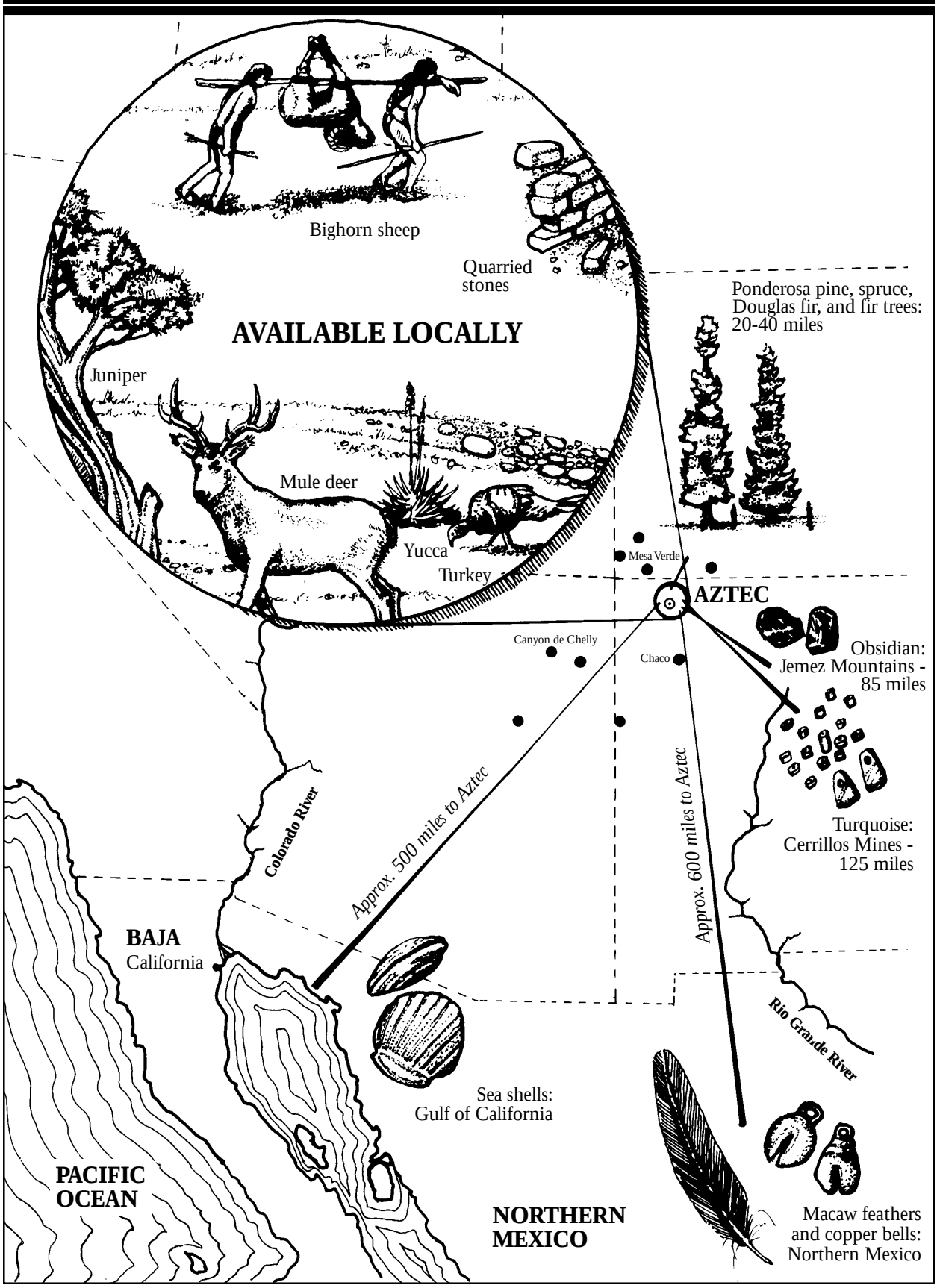
Lister, Robert H. and Florence C., *Aztec Ruins on the Animas Excavated, Preserved, and Interpreted,* Southwest Parks and Monuments Association, Tucson, 1987 Second Edition.

Aztec Ruins National Monument, Southwest Parks and Monuments Association, Tucson, 1992.

RESOURCES NEAR & FAR

ARTIFACT OR FEATURE	MATERIALS MADE FROM	ENVIRONMENT WHERE FOUND	HOW OBTAINED
Projectile points			
Hammers			
Awls			
Blanket			
Jewelry			
Baskets			
Cordage/rope			
Pottery			
Stone buildings			
Vigas			

ORIGINS OF RESOURCES



Corn

Math, social studies, science, language arts

SKILLS.....Knowledge, application, analysis, synthesis, evaluation
STRATEGIES.....Predicting, estimating, discussion, graphing, reconstructing
DURATION.....4 class periods, 3-hour field trip to Aztec Ruins
CLASS SIZE.....Any

OBJECTIVES

In their study of the prehistoric use and storage of corn, students will:

1. Observe, record, and discuss findings about the Ancestral Puebloan use of corn.

2. Create their own pottery for storing corn and estimate its volume.

3. Calculate the volume of corn contained in their vessels and make a graph of this value.

4. Estimate the amount of corn storage needed for Ancestral Pueblo people.

VOCABULARY

mano: small stone held in the hand used to grind corn and other substances by rubbing on a larger stone called a metate.

metate: large stone used to grind corn and other substances by rubbing with a smaller stone (mano).

corn or maize: a cultivated food important to ancestral pueblo people.

pottery: a container or object made from clay and fired for durability.

MATERIALS

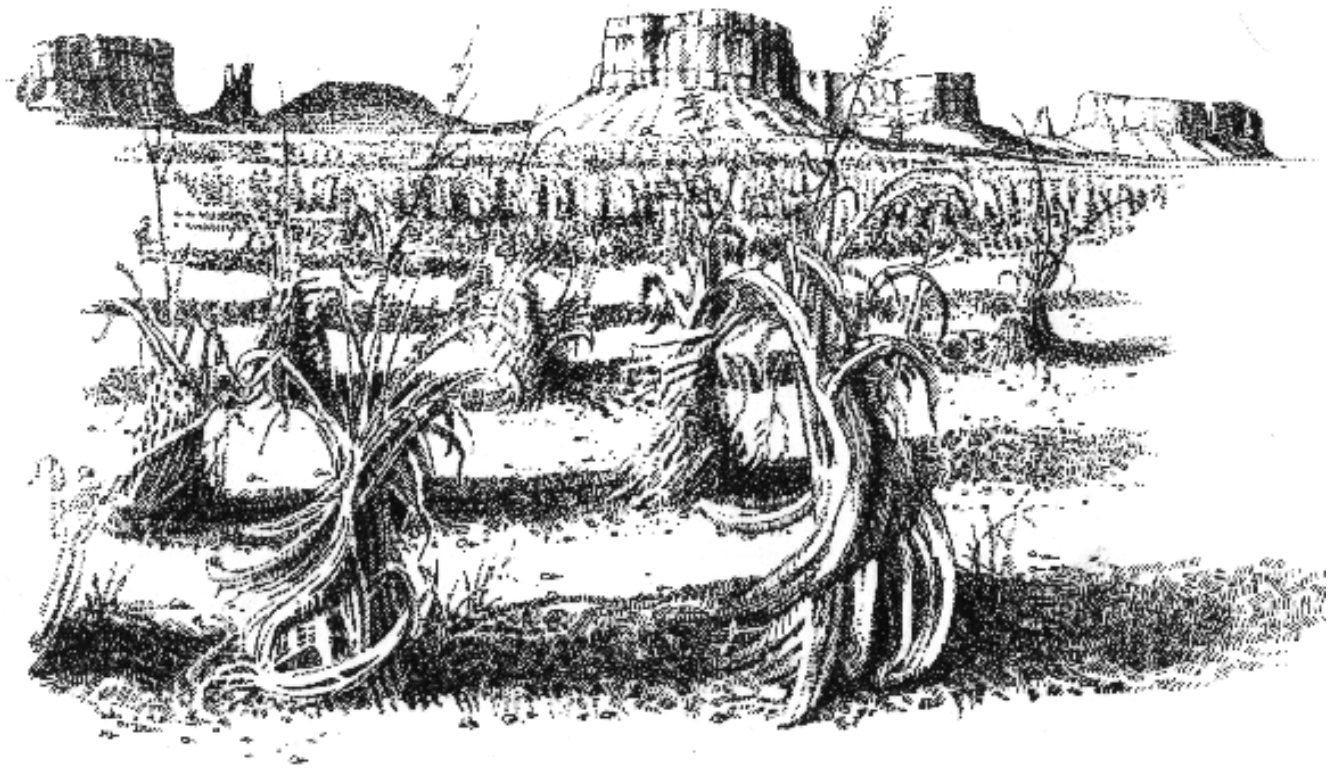
- Indian corn samples and corn poster (from Aztec Ruins trunk of replica artifacts)
- Pictures or samples of modern corn
- Pictures of prehistoric corn, mano and metate
- Dried popcorn kernels
- Popcorn popper
- Sacks to serve popped corn
- 2 large sheets of paper for graphs
- Rulers
- Golf-ball sized white air-dry clay for each student
- 2 small sticky notes (such as Post-it©) and one small thimble-size or medicine-dosage-size cup per student

BACKGROUND

Teachers could break this lesson into several, or omit some steps to reduce the amount of time needed. See the extensions at the end of this plan for ideas on how to do so.

The Ancestral Pueblo people probably felt about corn as their descendants do today. Corn is held in reverence and for many is considered the basis of life. Stories passed over many generations relate how the gift of corn was given to the Pueblo people, and suggest that it was the basis of ancient peoples' philosophy and religion. The Corn Dance, held during spring and summer at many pueblos, is a celebration to ensure rain, bountiful harvests, and abundant plants and animals. Corn and corn pollen play a role in nearly every life ceremony – for birth, puberty, marriage, and death, and in a variety of ceremonies conducted throughout the year. Pueblo people today use corn flour in porridge, bread, cakes, and drinks, prepare fresh corn in a variety of ways, and dry it for future use.

Ancestral Pueblo people of this region relied heavily on maize, or corn, for their survival. They devoted much effort to cultivating this plant in irrigated fields, where they also grew beans and squash. Besides eating it fresh, corn could be dried and stored to hedge against future crop failures. The dried kernels were ground into flour using stones called a *metate* and *mano*. The metate is a large stone on which the kernels were ground with the smaller stone, the mano, that was held in the hand. The cultivation and storage of corn allowed people to settle year-round in one place, rather than follow the availability of wild foods in different areas.



Pottery was invaluable for the long term storage of corn. Large vessels filled with dried corn kernels could be sealed and protected from rodents, insects, and moisture. They buried some beneath the floors of rooms, affording additional protection to their contents. Storing corn provided food for the people during poor growing seasons, and also maintained a supply of seed kernels for future years.

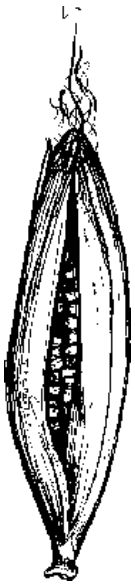
Aztec Ruins yielded much evidence indicating the importance of corn to the Ancestral Pueblo people who lived here. Remains found included stashes of corn stalks, tassels, husks, cobs, and kernels. One find included cobs, husks adhering, strung on wooden loops like keys on a ring. Presumably such rings of corn were hung to dry, allowing removal of one ear at a time. Other cobs were found with their husks tied together so they could be hung as a bunch to dry. One two story room had burned in early times – destroying the ceiling and allowing over 200 bushels of charred corn, some shelled but much still on the cob, to fall from the upper room.

The size of the corn grown at Aztec differs from today's corn. Most cobs were from three to seven inches long, with 12 to 14 rows of kernels on each cob. The kernels themselves were small, about the size of the kernels on miniature ears of decorative colored corn you see today.

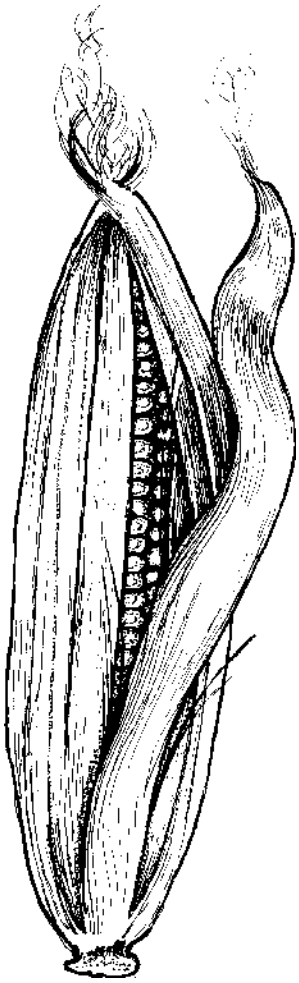
Corn is also important to us in modern times. We eat fresh, canned, and frozen corn, but also use corn products such as corn syrup, flour and meal, corn bread, tortillas, popcorn, and corn starch. Corn is important as food for cattle and other domestic animals.

5000 B.C.
Teosinte grass, the wild ancestor from which corn was cultivated

2500 B.C.



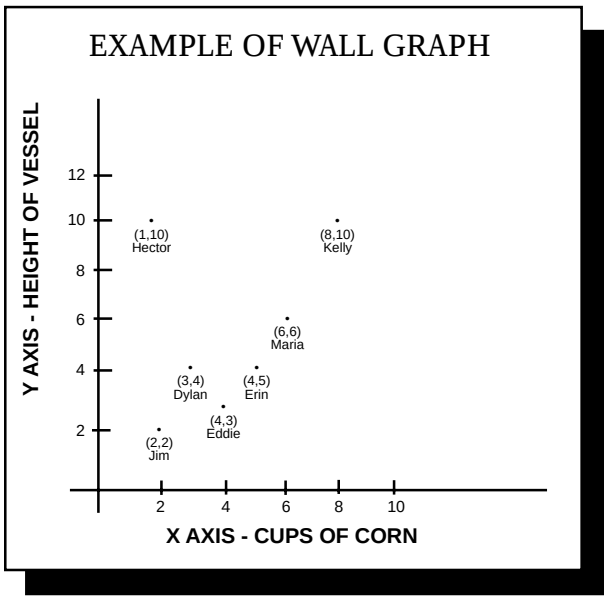
1200 A.D.



Modern hybrid corn, the result of 7,000 years of cultivation

Archeologists frequently answer questions and determine relationships of things by making estimates, or approximations, based on the information and variables at hand and his/her prior knowledge. For instance, an archeologist might estimate the size of a vessel based on observing and measuring the pottery fragments, called sherds, and his knowledge of other vessels. He then might estimate the number of cups of corn a storage vessel could contain based on its size. He could extend his estimates to answer questions such as: Based on the number of storage vessels found at a site, how many cups of corn could be stored over a winter? If one cup of corn could feed one person a day, how many people could have been supported for a year by storing corn in the vessels found at a site? Using good estimation skills is important to archeologists to decide on the plausibility of conclusions or answers about people of the past.

Archeologists can visually demonstrate these relationships by plotting them on a line or bar graph. The horizontal and vertical axes each represent a different value in the relationship.



The class will create two wall graphs, "Estimated Volumes" and "Actual Volumes," each with X and Y axes. Discuss the results, look for differences, and compare and contrast the graphs.

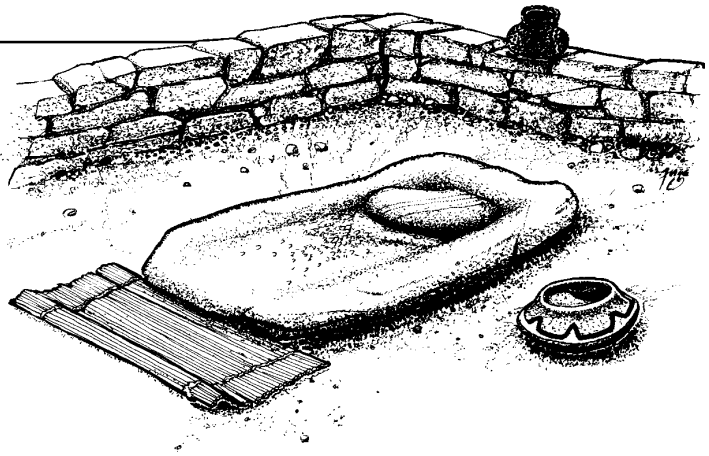
For instance, from the example about the size of the vessel and number of cups of corn, the vertical "Y" axis would represent the size of the vessel, and the horizontal "X" axis would represent the number of cups of corn.

SETTING THE STAGE

1. Display small dried ears of colored corn from the replica artifact trunk and modern ears of corn. Show pictures of prehistoric corn. Compare the sizes of both prehistoric and modern corn.

2. Discuss with the class the background information, emphasizing the importance and use of corn to Ancestral Pueblo peoples. Compare to modern uses.

3. Show the pictures of a mano and metate, and explain their uses.



Dried corn kernels were ground into flour using stones called a metate and mano.

PROCEDURE

1. Take a field trip to Aztec Ruins. Complete the following assignments:

    - Record information and thoughts in notebooks about corn – its cultivation, appearance, and use among the people of the Aztec Ruins area.

    - Research and record information about manos and metates and locate an example at Aztec Ruins.

    - Locate a large undecorated vessel on display in the museum that could have been used for the storage of corn.

2. Back in the classroom, give each student a ball of air-drying clay. Students make a small vessel with it.

3. Distribute 2 sticky notes to each student. Distribute rulers and small cups. Students label each sticky note with their name.

4. Students estimate the volume of corn kernels in terms of number of cups needed to fill their vessel. They write that number on their sticky note. Students measure the height of his/her vessel and record on the same sheet. Students should express the two values as ordered pairs, writing the X axis value first, followed by the Y axis value.

5. Distribute unpopped popcorn to each student. Students fill their vessel with the kernels.

6. Students calculate the actual number of cups of kernels in their vessel by emptying their vessel of corn into their small cup as many times as needed. They write that number followed by the height of the vessel on the second sticky note.

7. Create with the students two wall graphs, "Estimated Volumes" and "Actual Volumes," each with X and Y axes.

8. Students put their sticky notes on each wall graph at the appropriate points. Discuss the results, look for differences, and compare and contrast the graphs.

9. Students make the following calculations: Estimate the amount of corn needed for one person per day. How much would be needed for 100 people for one day? How much for 100 people for three months of winter storage? How many pottery vessels would be needed to store corn for this size population over a winter?

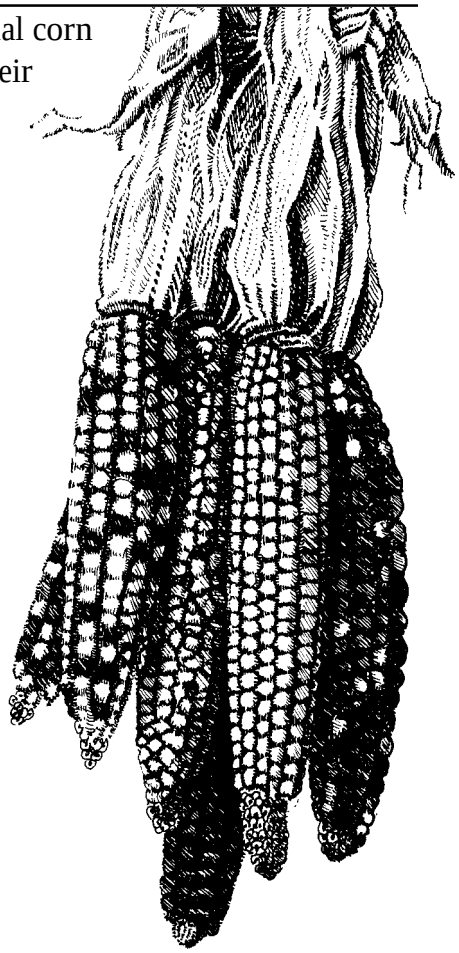
CLOSURE

Pop the corn that was not used and pass out in sacks. As the class eats the popcorn, review the lesson, including ideas about modern and ancient storage of corn and other foodstuffs. Drawing on the background information, speculate on the information that ceramic vessels can reveal about the storage capacity and corn needs of prehistoric people.

Display the pottery pieces and graphs in the room or in a public area of the school with a card of explanation.

EVALUATION

Evaluation is based on each student's participation in individual corn research on the field trip, contributions to class graphs, and their participation in class discussions.



EXTENSIONS

1. To shorten this lesson, break it down into several lessons taught individually, or in sequence. For example, one lesson could focus on the Ancestral Puebloan and modern uses of corn in objective one and include the field trip to Aztec Ruins. (SETTING THE STAGE and PROCEDURE 1.) Another lesson could focus on the math skills of estimation, volume, and graphing in objectives two and three. (PROCEDURES 2 through 8.) To shorten further, students do not create their own vessel from clay but instead bring a small vessel from home. A third lesson could focus on the Ancestral Puebloan storage and use of corn, estimating needs and calculating storage capacities of vessels. (SETTING THE STAGE, PROCEDURE 9.)

2. Students investigate and record decorative patterns on pottery while on the field trip. They incorporate these designs on their vessels.

3. Use a graduated glass measuring cup to measure the volume instead of the small paper cups.

4. Instead of placing sticky notes on the graph, students plot the values on the graph with their name marked next to it.

5. Weigh the corn instead of calculating the volume for the activities.

6. Graph the difference between the estimated volume of kernels and the actual volume of kernels. Express this difference as a ratio.

7. Express the size of the vessel by multiplying the height times the diameter at the widest point.

8. Cross curriculum integration can include:

- Literature – read *The Village of Blue Stone* by Stephen Trimble.

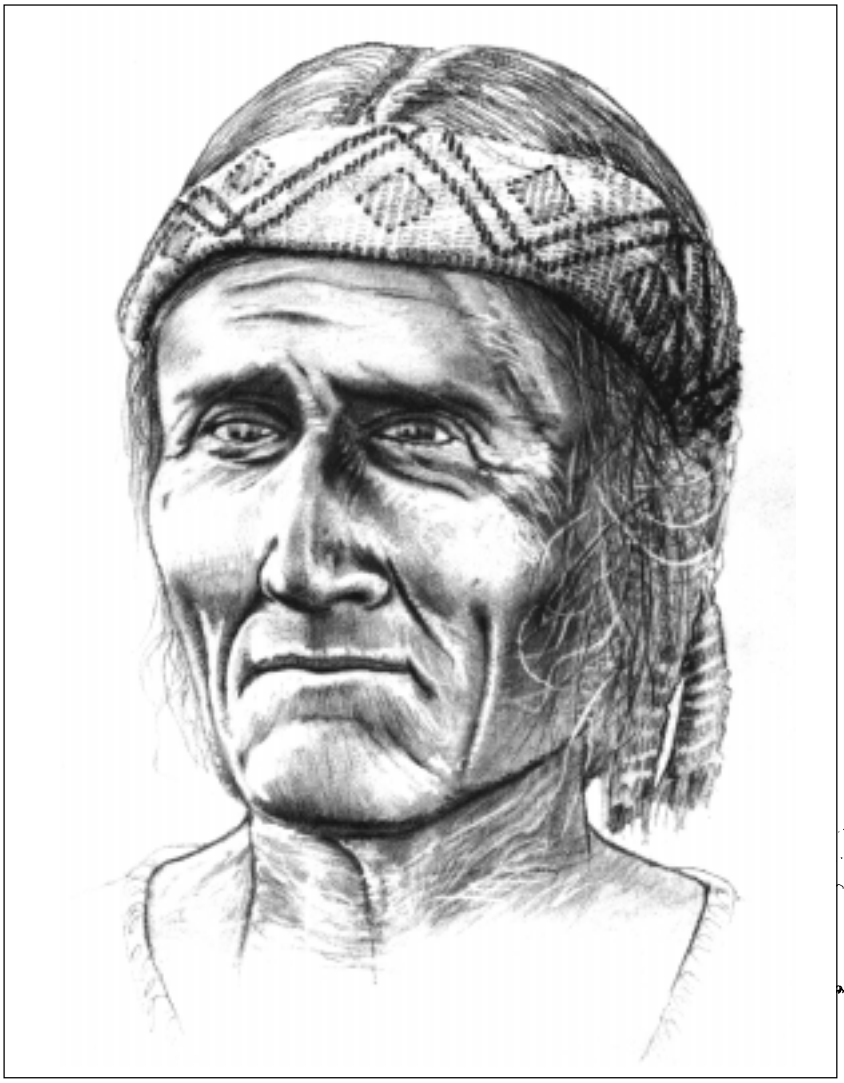
- Language – students research Ancestral Pueblo pottery patterns and present a report.

- Art – draw sketches of the pottery or pottery patterns displayed at the Aztec Ruins museum.

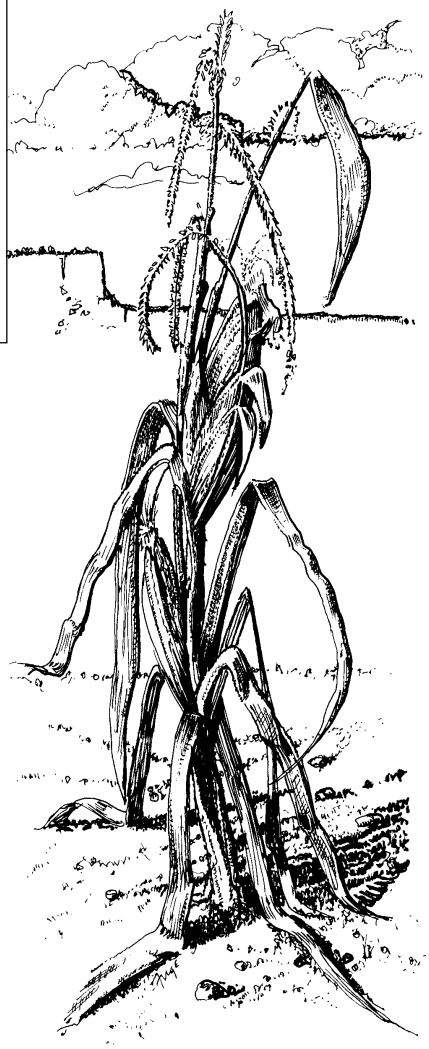
- Social studies – students conduct research on corn and make reports or posters concerning its ancient and modern uses; fill in a Venn diagram comparing these uses.

- Science – students prepare research papers or posters about a corn plant's life cycle.

from Vroman photo, circa 1900



from Vroman photo, circa 1900



Directions to the Past

Social studies, language arts, math, science

SKILLS.....Knowledge, comprehension, application, analysis, synthesis, evaluation
STRATEGIES.....Mapping, discussion, communication, compare and contrast, writing
DURATION.....2-hour field trip to Aztec Ruins
CLASS SIZE.....30 maximum in groups of 3 to 5 when using compasses; otherwise any

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OBJECTIVES

In their study of Aztec Ruins, students will use maps and/or compasses to:

1. Identify map locations and write map instructions for others.

2. Compare and evaluate effective means of communicating directions.

3. Speculate about prehistoric means of communicating directions.

MATERIALS

- "Area Map of Aztec" HANDOUT
- "West Ruin" MAP of for each student
- Compasses for older students; 5 compasses can be borrowed from Aztec Ruins

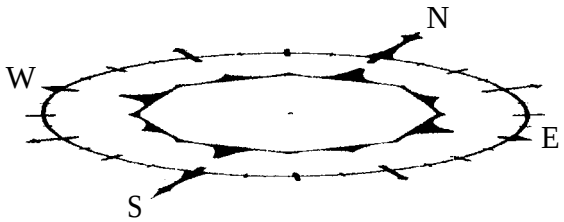
VOCABULARY

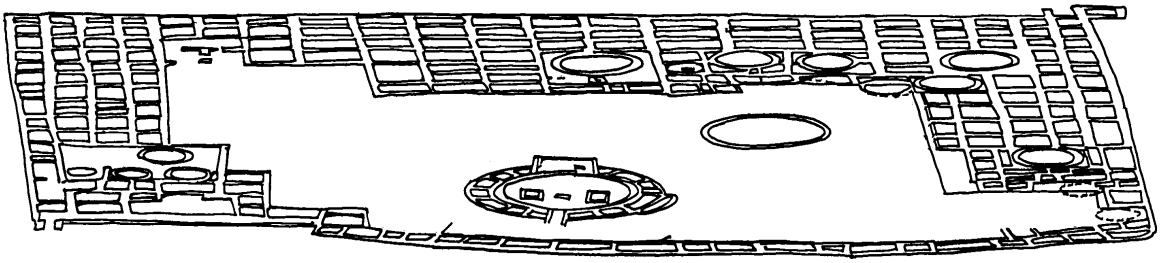
compass: an instrument for determining directions, consisting of a freely moving needle indicating magnetic north.

feature: something made by humans but not easily picked up or transported, such as a wall, firepit, concentration of artifacts, or doorway.

BACKGROUND

Ancestral Pueblo people participated in a widespread trade network extending east to the Rio Grande valley, south to Mexico, and west to the Gulf of California. Although the Aztec inhabitants most likely did not travel to those areas themselves, they did travel long distances to trade with others for materials from these distant places.





Wherever and however they traveled, they needed to communicate direction. They communicated knowledge of obstacles, the best routes, good hunting and gathering areas, water sources, rock quarries, sources for pottery clay, and locations of dwellings, shrines, and ceremonial places. Moreover, they probably communicated directions with others who did not always speak the same language. Without clear directions passed to them from others, traveling and trading for the Ancestral Puebloans would have been hazardous and limited.

Today, as in prehistoric times, we also need to communicate clear directions to others. We frequently use maps to communicate information about an area, how to locate certain places and travel to them. Archeologists use maps to locate and record information about archeological sites. It is relatively easy for us to communicate directions because we have written maps, compasses, well established and marked roads, and ways to easily measure distances.

Prehistoric inhabitants did not have compasses nor have archeologists found written "maps." However, they did use the locations of stars and the sun to establish directions, and they were familiar with location landmarks in their region, such as specific mountain peaks, tall hills, rivers, or rock formations.

In this region, Huerfano Peak south of Bloomfield can be seen for great distances. Knickerbocker Peaks northwest of Aztec are visible from Aztec Ruins and are also prominent land features in the area. Both were likely used as direction references. In prehistoric times, "shrines" of rocks were placed on each landmark, indicating their importance as ceremonial or spiritual locations or references.

Even with the help of maps, compasses, land features, and measures of distances, communicating clear directions to others can be a challenge. The person giving the directions may not be sensitive to the receiver's knowledge of the area, or may assume the receiver knows much more about an area and leave out important information. In addition, the direction giver may not recall directions properly in his/her own mind to be able to give accurate directions to someone else.

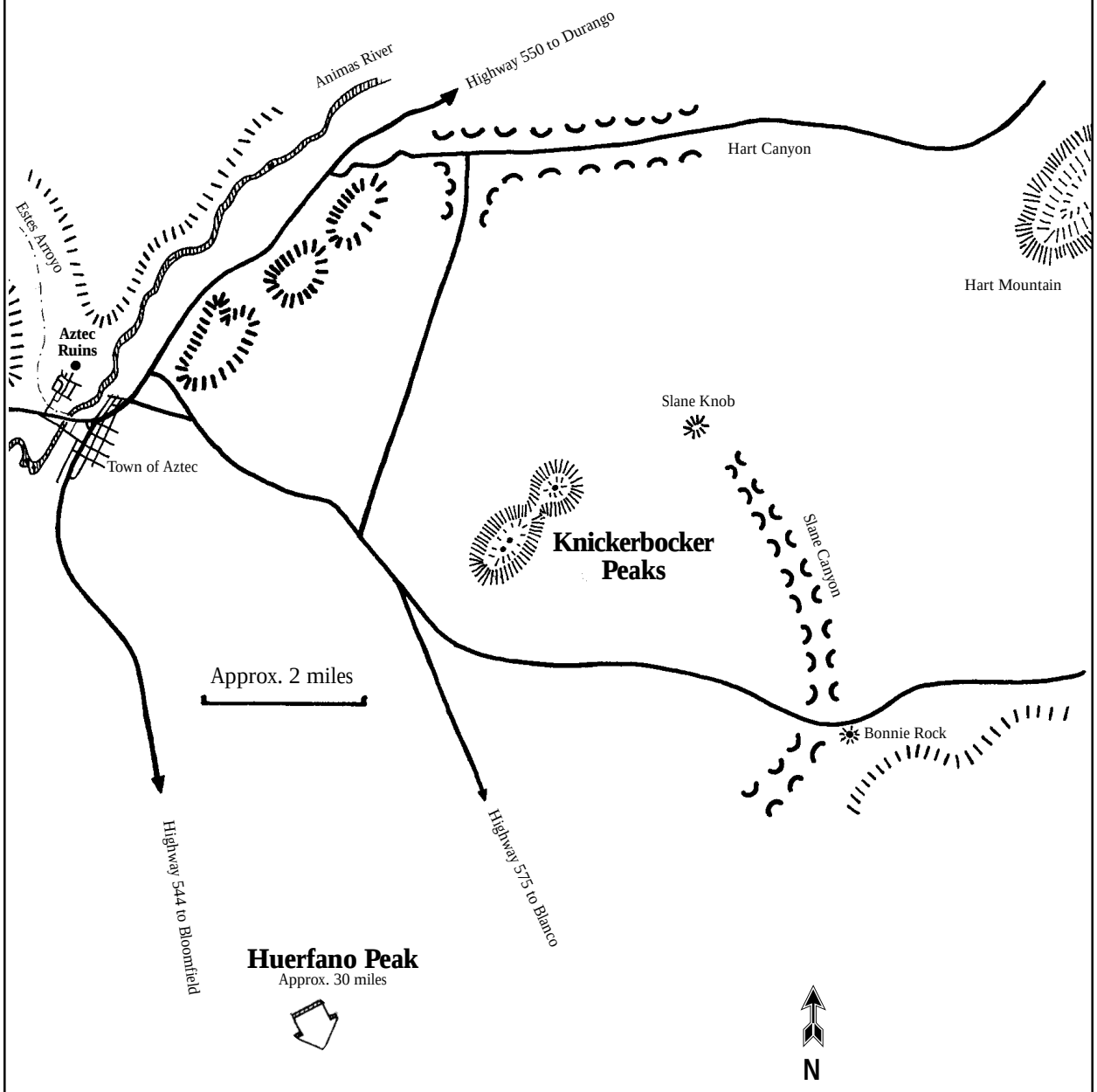
SETTING THE STAGE

1. Ask the students if they or their family have gotten lost when they followed someone else's directions. Why did they get lost? Were the directions incorrect or confusing? Did they follow the directions properly? Everyone interprets their surroundings and how to move about them differently, which sometimes leads to confusion.

2. Discuss background information about the need for Ancestral Pueblo people to give clear directions and how they accomplished this. What tools do we have today for communicating directions that prehistoric people did not have? Examples: written maps, compasses, easy methods to measure distances such as odometers on cars, units of measure such as feet and miles.

3. Using the “Area Map of Aztec” HANDOUT, have students locate Knickerbocker Peak and the direction of Huerfano Peak. Discuss their significance to earlier people. Discuss other prominent land features that might have been important to the Ancestral Pueblo people of this area. Examples: the La Plata Mountains and Animas River.

AREA MAP OF AZTEC



The radio towers located on Knickerbocker Peaks are used for communication. Ancestral Puebloans may have communicated by building signal fires on these same peaks.

PROCEDURE

1. If using compasses during the field trip, distribute to small groups of students while still at school and explain their use. Have students practice using the compass.

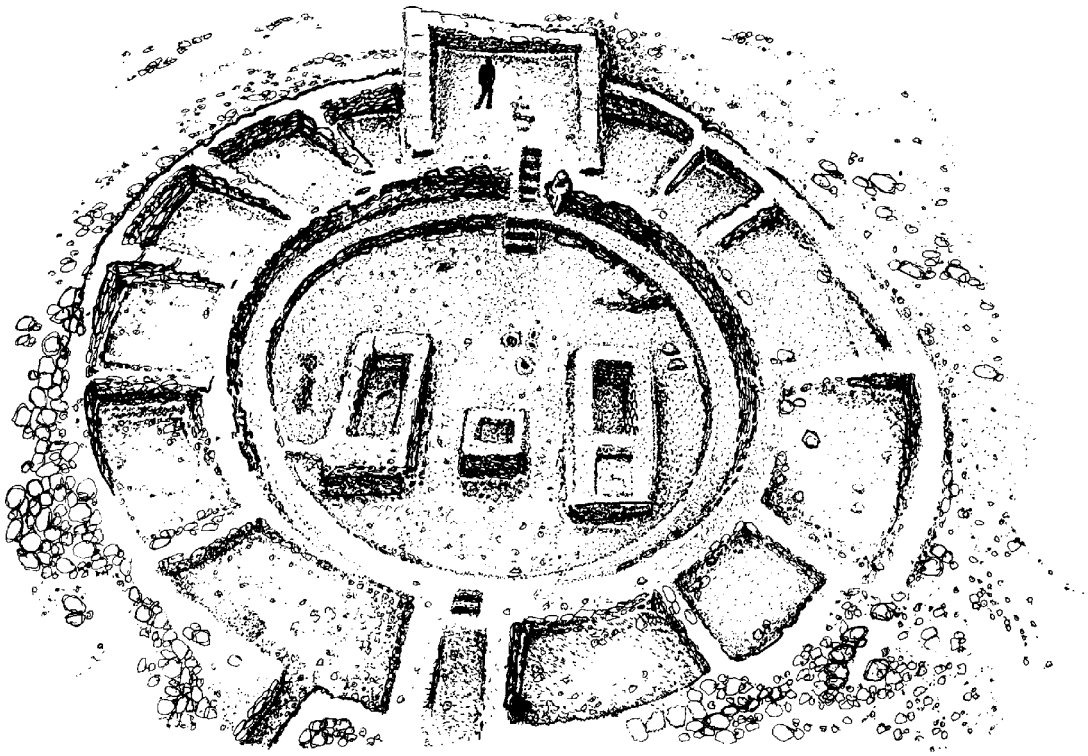
2. Take a field trip to Aztec Ruins and complete the following procedures. Distribute the "West Ruin" MAP to each student or small group.

3. Students select a particular spot or feature on the trail of the West Ruin that interests them (such as a particular doorway, niche, wall, stone, or room) and one that they would like to direct another student to find. Students mark this spot on their map.

4. Students write directions to their chosen spot by selecting a starting point (it could be the visitor center, picnic area, or parking lot) then writing directions – without relying on the numbered trail markers – to reach the selected spot. Students decide the kind of information someone else in their class needs to know in order to find their spot. Students may include directions incorporating the use of a compass. Remind students to stay on the paved trail.

5. Each student or group trades their written directions (not their maps) to their chosen spot with another student or group who then tries to locate it using the directions given. Once they have found the spot, they should mark it on their map using an appropriate symbol.

6. Students compare results on their maps.



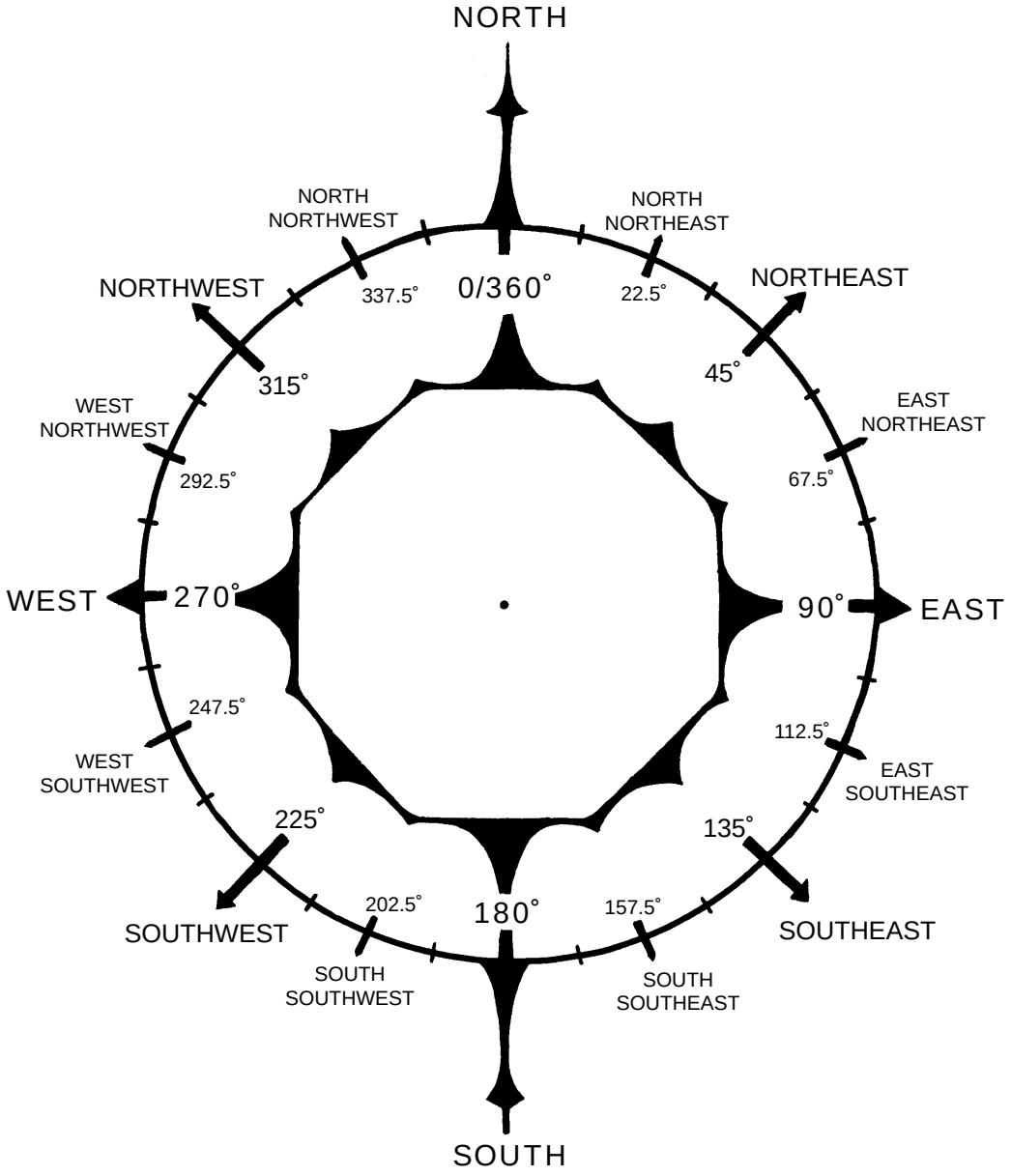
DIRECTIONS FOR USING COMPASS

1. Hold the compass level in the palm of your hand and directly in front of you so that the magnetic needle is free to rotate.

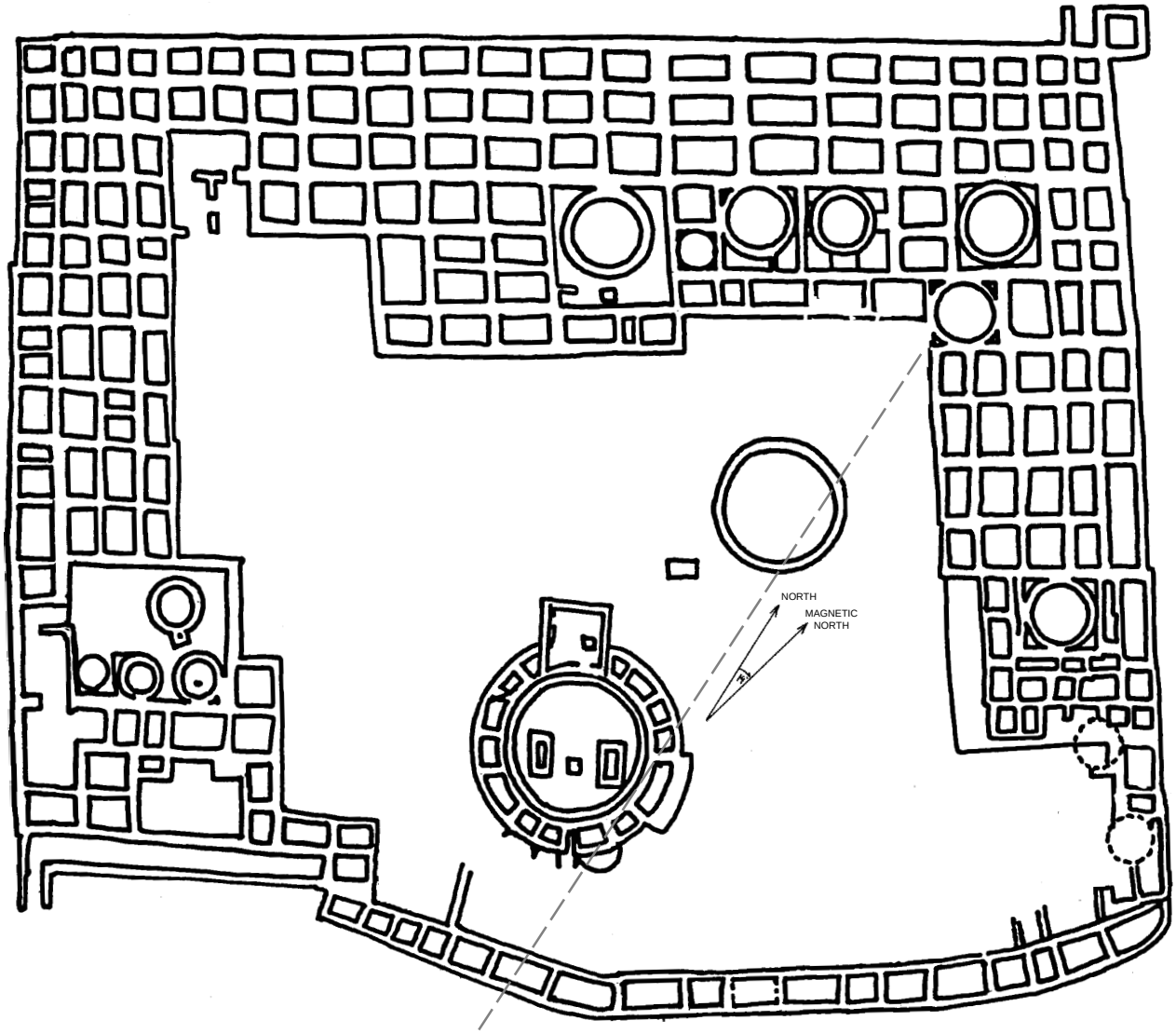
2. Turn the entire compass until the north (red) end of the magnetic needle points to N on the azimuth (degree) scale. The compass is now aligned with north. The azimuth scale now shows the directions from north 0 to 360 degrees.

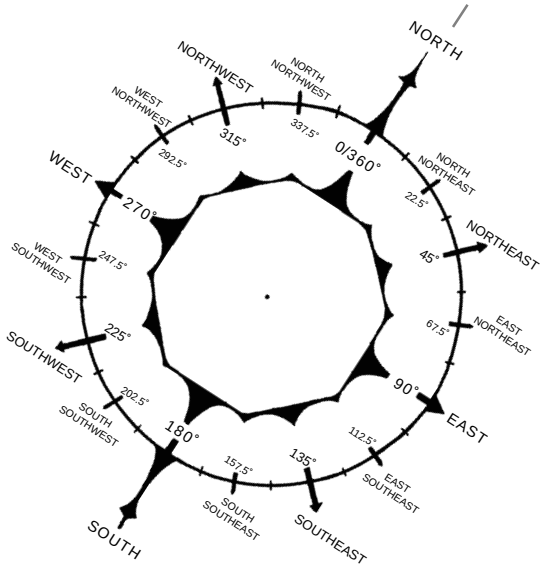
3. To determine the direction you are facing, look across the compass and read the azimuth scale on the side away from you (be sure the compass is still aligned to north.) Be aware that compass readings may be affected by the presence of metal – from a belt buckle, car, or other source.

4. This lesson is based on readings from magnetic north.



WEST RUIN – AZTEC RUINS





CLOSURE

Evaluate what it was like to write clear directions and what it was like to follow someone else's directions. Determine ways that students can make their directions clearer for others. Discuss ways that the prehistoric inhabitants could have made their directions clear to others.

EVALUATION

Evaluate students' map/compass reading skills, clarity of their writing, and participation in discussion.

EXTENSIONS

1. Each group reports to the rest of the class about the feature or spot they chose or found by following another group's directions. They can use information they learn from the trail guide, exhibits, or rangers.

2. While at Aztec Ruins, use a compass to determine north, south, east and west. Students indicate those directions on their map, then locate the direction of the sun and place its position on the map. To which direction is the West Ruin oriented? (It is oriented largely to the south.) How could this orientation benefit the people who used the building? (The sun's journey across the southern part of the sky warms more walls of the pueblo during the day, which release their heat into interior rooms at night. Its orientation may also reflect spiritual beliefs.)

3. Each student brings a different kind of map to class. Compare and contrast the different information revealed by each.

4. Have the students write a short story from the point of view of an Ancestral Puebloan boy or girl who is part of a group settling near the site which is now Aztec Ruins. Students address these questions:

   Why did your group decide to leave your former home?

   What directions were given to help you find your way from your old home to this place?

   How easy was it to follow those directions?

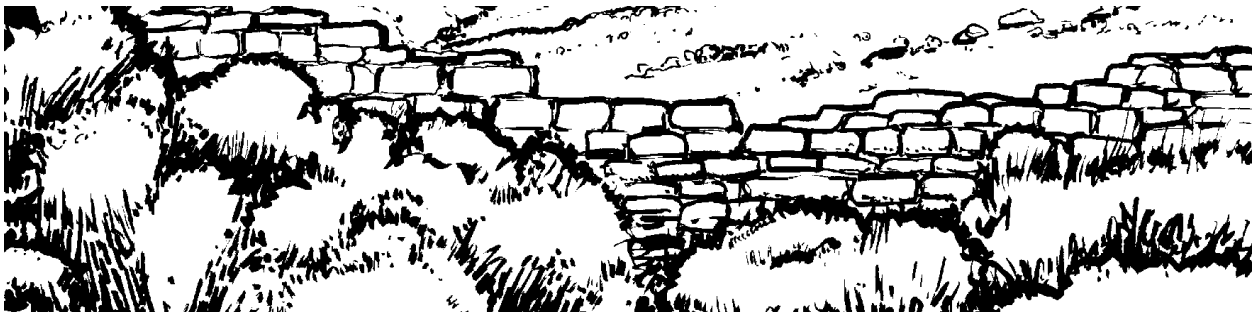
   Why did your group choose this location?

   Illustrate the stories and display at school or ask Aztec Ruins to display.

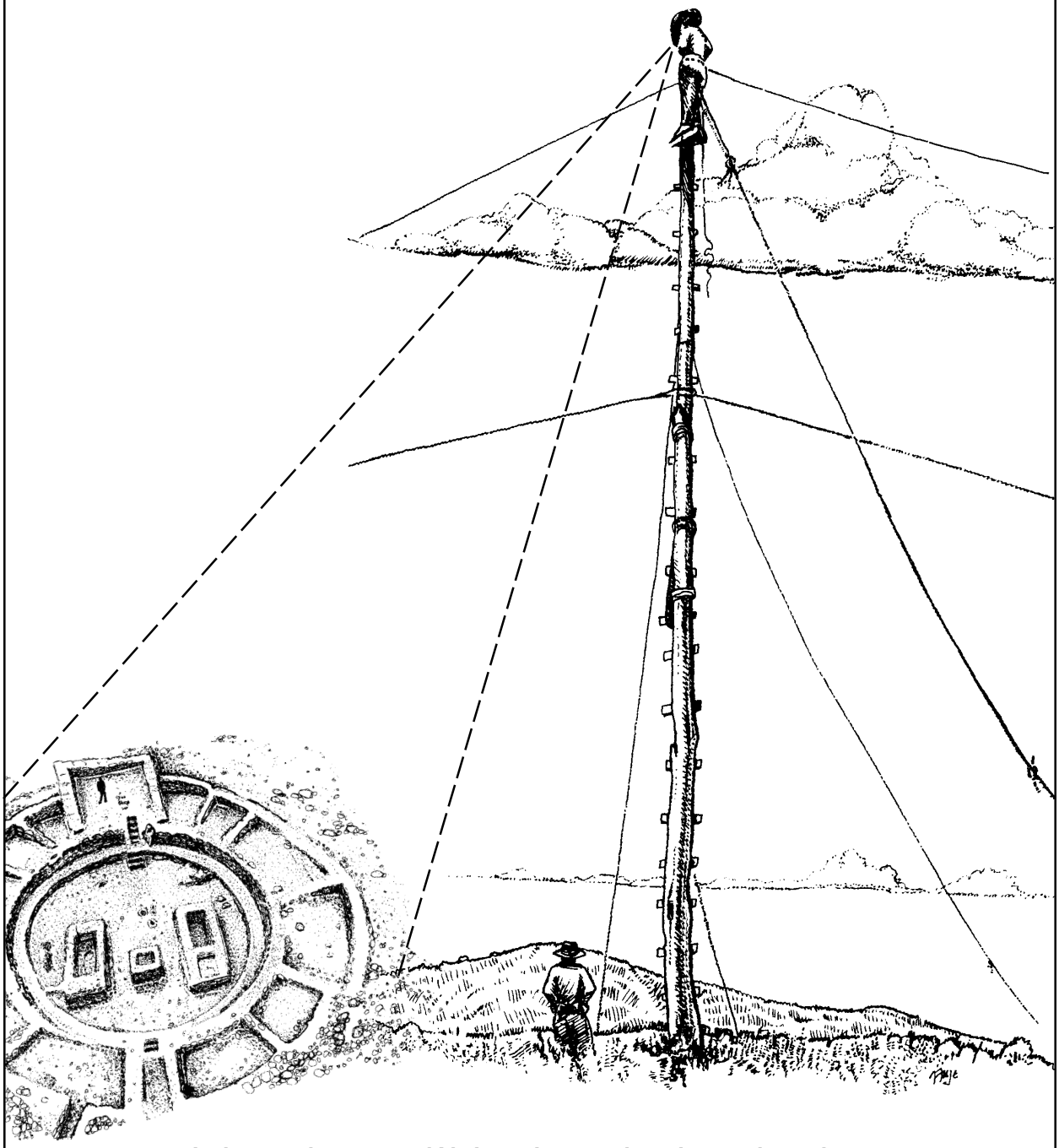
REFERENCES

A Trailguide to Aztec Ruins, Southwest Parks and Monuments Association, Tucson, 1994.

Aztec Ruins National Monument, Southwest Parks and Monuments Association, Tucson, 1992.



HOW'D THEY DO THAT?



Pioneer archeologist Earl Morris would lash together two telegraph-size poles, nail on cross pieces, pull them to a standing position with ropes, and go get the shot!

Graffiti

Social studies, language arts

SKILLS.....Knowledge, comprehension, application, analysis, evaluation
STRATEGIES.....Analogy, observation, discussion, decision making, research, values clarification, writing
DURATION.....1 class period; 2-hour field trip to Aztec Ruins
CLASS SIZE.....Any

OBJECTIVES

In their study of petroglyphs, pictographs, and graffiti at Aztec Ruins, students will:

1. Differentiate between graffiti, petroglyph, and pictograph.
2. Locate, observe, and record graffiti.
3. Analyze their findings.
4. Assess the impacts of graffiti in a letter to graffiti creators.

MATERIALS

- Transparency of designs at Aztec Ruins
- Stepstools and flashlights for each group

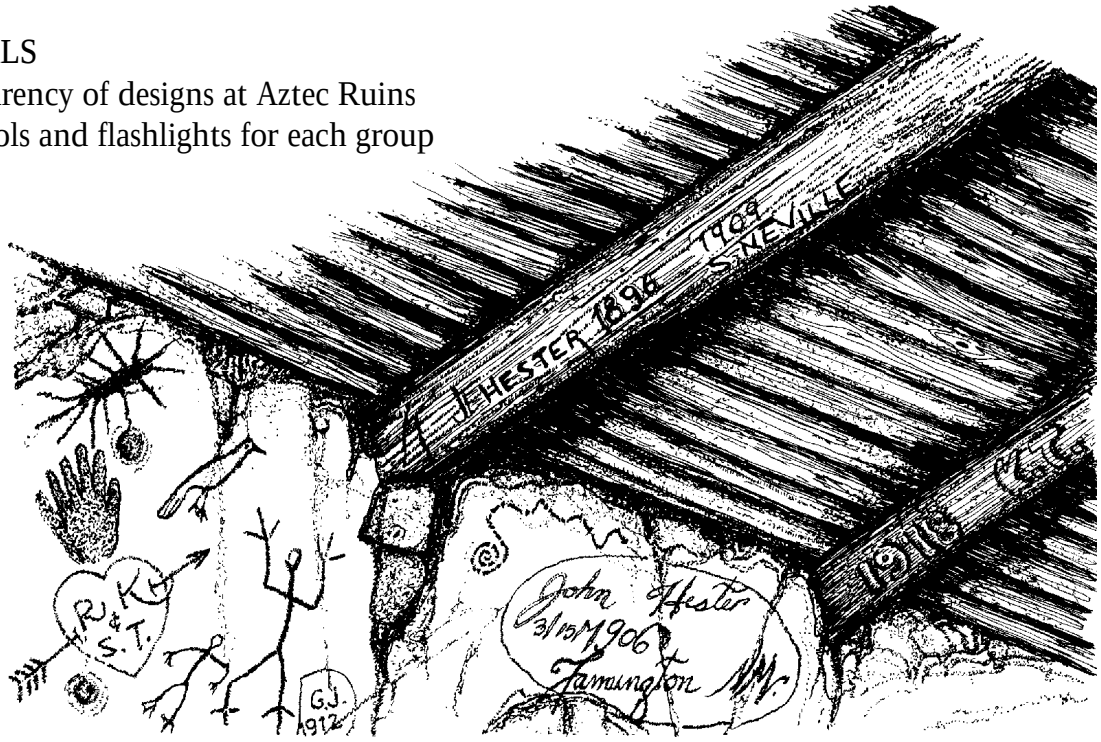
VOCABULARY

pictograph: image painted on a rock surface with mineral paints.

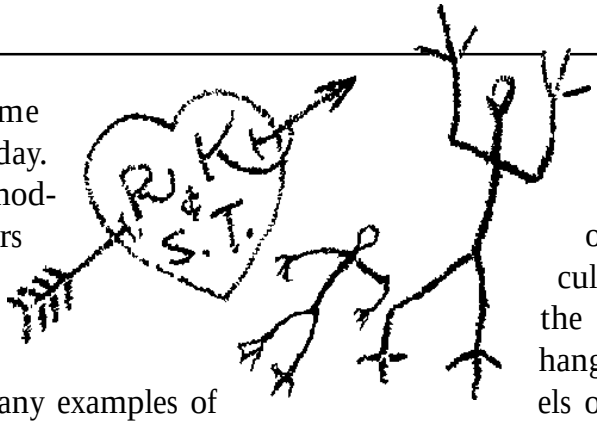
petroglyph: image scratched, incised, or pecked on stone.

graffiti: images or crude writing placed on a wall or public place.

vandalism: willfully or maliciously defacing or destroying public or private property.



BACKGROUND



Graffiti has become quite prevalent today. Some consider it a modern art form. Others consider it vandalism.

Aztec Ruins has many examples of graffiti, most in the form of inscriptions in which visitors wrote their name, the year they visited, and their home town. Many were scratched into or written on the original wood throughout the structures. Some were placed as early as the late 1800s, but many were placed in recent years.

Some visitors to Aztec Ruins today find the graffiti offensive because it intrudes on their experience of the prehistoric structure and mars the historic building. However, some archeologists have used the earlier inscriptions on wood to help them determine that they are original elements placed by prehistoric builders, rather than being placed by early National Park Service stabilization crews.

The inscriptions written by early visitors are considered historic, and the National Park Service will not remove them. It is also very difficult to remove graffiti without damaging stones, mortar, or wood in the process.

More recent graffiti is considered vandalism which damages the monument. These are also not removed. If the persons responsible are found, however, they can be punished legally.

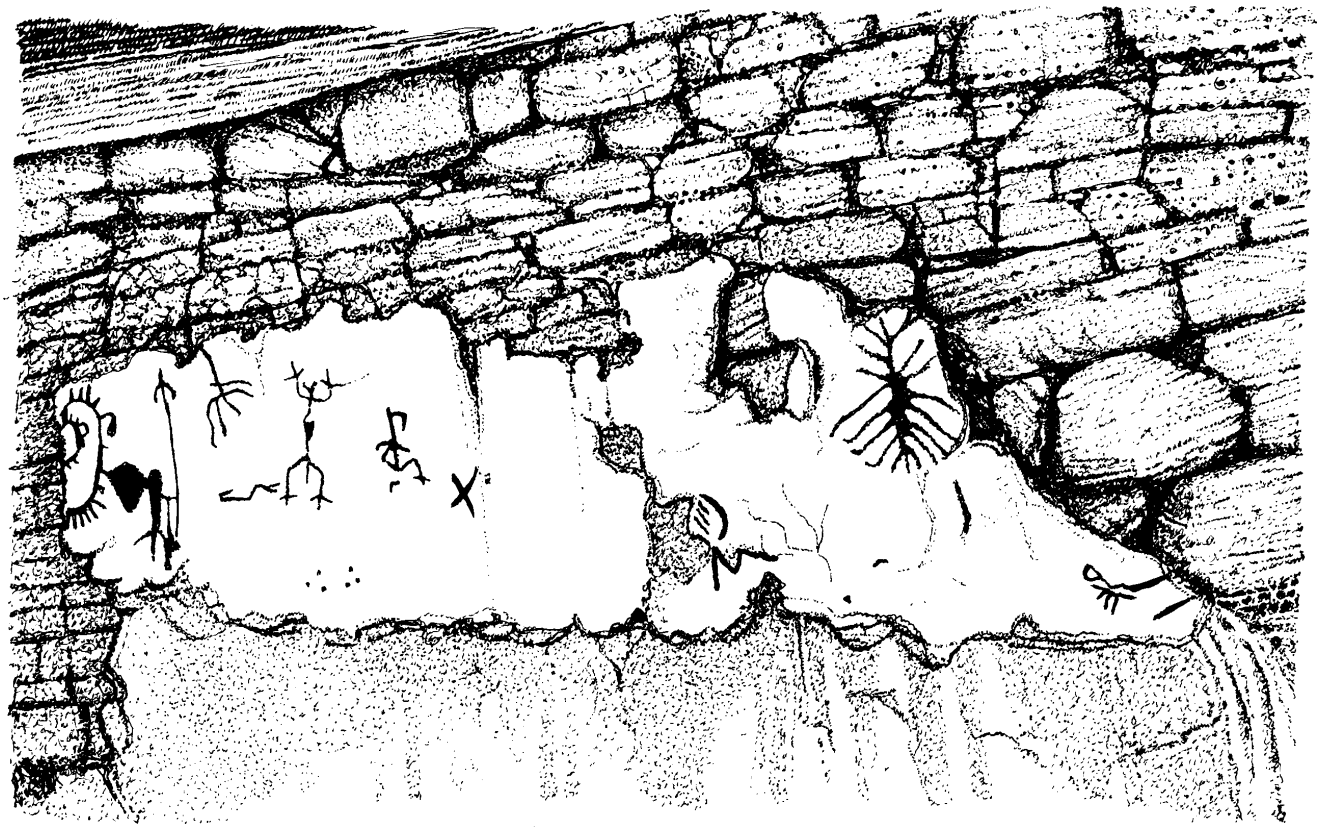
Graffiti is different from petroglyphs and pictographs. The latter are found throughout the world in nearly every culture from past to present. In the Southwest, many rock overhangs protect well-preserved panels of these designs – some with single images, some with hundreds of images placed over hundreds of years. The images may be statements of religious or spiritual beliefs, designations of clans or family groups, directions, markers of stellar and solar events, depictions of stories, or markers of territory. Some believe they are merely artistic expressions. Others say the images themselves have a spirit and are alive.

Many Southwest tribes have oral traditions about petroglyphs and pictographs and their meanings. Members of different clans of the same tribe, or people from different tribes, frequently do not agree on the interpretation of these prehistoric images. Archeologists and researchers have studied and recorded the different styles, patterns, and interpretations of pictographs and petroglyphs, trying to determine who made them and what they convey.

Many Ancestral Pueblo descendants today consider the images and the sites where they were placed sacred. Likewise, sites such as Aztec Ruins where spirits of their ancestors are present are also considered sacred. It is important to them that these places remain unspoiled by others.

There are few examples of petroglyphs and pictographs at Aztec Ruins, primarily because there are no large rock faces nearby suitable on which to create the images. However, there is a pecked spiral on one stone in a room wall. Another room has original plaster on which are painted sets of three triangular designs. Another plastered room has images incised, or cut, into the plaster. Although the images are similar to those created on rock surfaces, they are not true pictographs or petroglyphs because they were placed on plaster, not on rock.

The plaster remnant and its incised images deteriorated considerably due to exposure to the weather since their excavation in the early 1900s. The National Park Service carefully covered the exposed plaster with dirt to halt further decay.



This example shows a wall at Aztec Ruins which has images incised, or cut, into plaster. Although the images are similar to those created on rock surfaces, they are not true pictographs or petroglyphs because they were placed on plaster, not on rock.

SETTING THE STAGE

1. Project a transparency of the incised designs from Aztec Ruins National Monument. Explain to the students that this is a drawing of a room wall at Aztec Ruins that has plaster on it where these images were incised, or cut, into the plaster.

2. Write your name or quickly draw a picture across the projected transparency of the designs on the Aztec panel. Ask the students what word would describe the image you just drew (graffiti). Discuss the definition of the word "graffiti." Have the students seen graffiti before in their community? Where? How did it make them feel? How would they feel if one morning they found graffiti covering a wall of their school building? Their church? Their home?

PROCEDURE

1. Discuss the differences between petroglyph, pictograph, and graffiti. Explain that none of these words accurately describe this incised panel because it was created in plaster, not rock.

2. Share the information about the plaster wall at Aztec Ruins that is now covered and the presence of graffiti at the monument.

3. Take a field trip to Aztec Ruins. Divide students into small groups and complete the following assignments:

   - Each group is assigned one or two rooms along the interpretive trail that have prehistoric roofs.
   - Each group uses flashlights and step stools to search its assigned rooms for graffiti. Record on paper the descriptions of the graffiti, including names, dates, locations, and methods of creation. Include other observations. The letters in the inscriptions may be difficult to read, but ask students to record them the best they can.

4. Teachers should first model the activity by "discovering" and recording the first example of graffiti. Then working in groups, students complete their assignments.

5. As a class, students analyze and present their findings and make additional field observations as needed. Analysis may include the following questions:

   Which room had the highest number of graffiti examples?

   What form does the graffiti most commonly take? (names and dates)

   Were there any names that appeared in more than one room?

   What was the earliest date found? Most recent?

   What was the most common method of creating the graffiti?

   Discuss possible reasons why people wrote their names at Aztec Ruins.

6. Ask students what they think the National Park Service should do about the graffiti examples they found. Share the BACKGROUND information regarding the historic nature and value of some graffiti. Share background information regarding the sacred nature of sites such as Aztec Ruins for today's Pueblo peoples.

CLOSURE

Students choose a name they found inscribed in one of the rooms, then write a letter to that person expressing their feelings about that particular inscription or graffiti at Aztec Ruins. (The person may no longer be alive.) Send the letters to the superintendent of Aztec Ruins National Monument or the local newspaper, or display them at school.

EVALUATION

Students are evaluated on their participation in discussions, their recording sheets, and their letters.

EXTENSIONS

1. Discuss with students an appropriate way for them to record their visit to the monument other than through writing graffiti. Have them sign the guest register in the visitor center.

2. Explore the possible meanings of petroglyphs and pictographs by having the students suggest the meanings of the images on the plaster wall at Aztec Ruins, or of pictographs and petroglyphs pictures in books. Discuss BACKGROUND information related to possible meanings.

3. Have students assess graffiti problems in their school or community and suggest ways to handle them.

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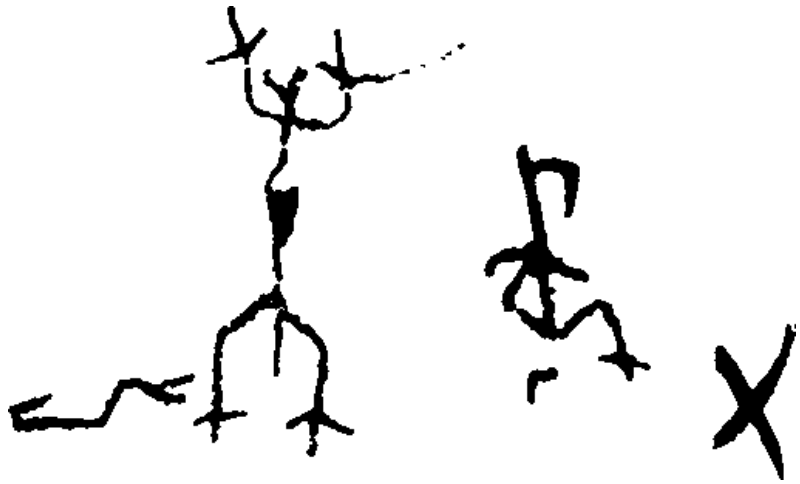


Poetry in Ruins

Social studies, language arts

SKILLS.....Knowledge, comprehension, analysis, evaluation
STRATEGIES.....Observation, discussion, writing, communication, visualization, brainstorming, comparing, contrasting
DURATION.....2-hour field trip to Aztec Ruins; 1 class period afterward
CLASS SIZE.....Any

OBJECTIVES

In their study of Aztec Ruins, students will use sensory perception, imagination, and writing exercises to:

1. Observe and examine the Ancestral Pueblo buildings.
2. Compare and contrast observations about rooms.
3. Speculate on the activities that occurred.
4. Write a poem about an imagined event in the Great Kiva.

MATERIALS

- Loaner trail guide booklet showing numbered markers on trail

VOCABULARY

chinks: small stones stuffed into the mortar of the walls, sometimes placed in decorative patterns.

juniper splints: thin layers of juniper placed above the latillas and below the dirt layer in a roof.

kiva: room with distinctive features, usually underground, probably for ceremonial use.

latilla: cottonwood or aspen pole placed above the vigas and below the juniper splints in a roof.

mano: small stone held in the hand used to grind corn and other substances by rubbing on a larger stone, called a *metate*.

masonry: walls made of stone.

metate: large stone used to grind corn and other substances by rubbing with a smaller stone, called a *mano*.

midden: an area where discarded items were deposited.

mortar: the mud used around stones in walls.

plaza: open flat area surrounded by the rooms of a structure.

vent: small rectangular opening in a wall, usually placed just below the roof, that allowed passage of air.

viga: a log of spruce, Douglas fir, ponderosa pine, or juniper, used as the primary support beam for a roof.

BACKGROUND

The science of archeology helps us learn about and appreciate prehistoric sites. But there are ways to experience them other than through information gleaned by archeology. One way is to create a poem about a visit to Aztec Ruins through using sensory perceptions, imagination, and feelings. In this way, a very personal appreciation for the area is fostered, and a meaningful reminder of the area is removed without causing it harm.

To prepare for the final poetry writing activity in this lesson, the procedures direct students to practice using their senses fully by remaining quiet and expanding awareness beyond things that are obvious and close. First, students are directed to sharpen their sensory skills by visually noticing everything around them. Instead of focusing on the structure immediately before them, they notice the plants, the sky overhead, details of the structure such as the individual stones, the East Ruin (mostly unexcavated and closed to the public), and the hills beyond. Then students allow one sense – hearing – to explore its full reaches while the others recede for a while. They concentrate on listening to the nature sounds around them, so often ignored because the building initially makes such a strong visual impact.

Students continue practicing their sensory skills by examining details of the structure, some enigmatic. For instance, they notice the green sandstone stripes running along the west wall. Their purpose is unknown, but they may have been symbolic and have had spiritual meaning. Most likely, the inhabitants obscured them by plastering mud on the exterior of the pueblo to seal the walls from the eroding forces of the weather. Above the stripes, the ends of the vigas, or roof support beams, jut through the walls. Most of the visible wood is original, effectively preserved by the Southwest's dry climate and sheltered by the overburden of rubble that covered the structure before excavation. Other wall details include the vents, or small windows, placed in the upper corners of the rooms to allow ventilation.

Details of the masonry work provide a fascinating study of technique and pattern, and a compelling connection with the inhabitants. The National Park Service has heavily stabilized and altered portions of the exterior walls by adding new mortar, additional top courses of stone, and in some places rebuilding with imported sandstone. Much of the interior masonry is still original. Close study detects mud mortar, chinking (small stones packed into the mortar between the larger stones), bits of plaster, and even finger and hand impressions in the aboriginal masons' work. (Look for the plaster and finger prints in the small doorway of the first interior room at trail marker #7. Remind students to help preserve the walls. Do not touch or lean on them.)

Examining the larger features of the building, such as the original roof, doorways, and rooms, helps evoke appreciation for their construction and use. The supporting large vigas are Douglas fir, spruce, or ponderosa pine, hauled from at least 20 miles away. They support the smaller poles, called *latillas*, of cottonwood or aspen. Above them are the juniper splints, then a thick layer of mud that serves as the floor of the next story.

The doorways through which the trail passes in the interior rooms are not original, but were constructed by the National Park Service. Original doorways are visible to the south, or right-hand side of the rooms. At times when people inhabited parts of the building, rooms in the rear were mostly for storage, while rooms adjacent to the plaza were for daily living. The uses of the rooms changed over 200 years. In later years, people used the rooms in this building for burial tombs, storage areas, midden deposits, turkey pens, and work areas, while daily living took place elsewhere.

Kivas are usually underground rooms, and are frequently round with special features. People entered small kivas on a ladder through an opening in the roof. Today, Pueblo people still maintain and use kivas for ceremonial activities. The size of the great kiva at Aztec suggests use as a community-wide gathering place for ceremonial or administrative matters. Although widespread in prehistoric times, kivas of this size do not exist in today's pueblos. Aztec's great kiva is reconstructed on the site of the original. It and the other structures at Aztec are sacred today to the descendants of the prehistoric inhabitants, Pueblo peoples such as the Hopi, Acoma, Zuni, Zia, and Laguna tribes of Arizona and New Mexico.

Sharpening the senses and noticing details, small and large, help our imaginations breathe life inside the rooms, on the rooftops, and in the plaza. Within interior rooms, one can smell smoke from woodfires and the aroma of stewed venison; hear the sounds of someone chipping a stone tool, people shuffling through doorways, the voices of old and young, and babies crying; see hides hanging from the doorways, remnants of food preparation and tool manufacture on floors, dried corn hanging from walls, bunches of herbs suspended from ceilings, stashes of clay for pottery making, yucca leaves for weaving into mats and sandals, and middens of food, bone, and pottery discards.

Daily life mostly occurred outside, in the plaza and on the rooftops. This is where one might have seen and heard women replastering walls, men carrying heavy timbers for construction, hunters bringing in their prey, men crafting tools, women carrying water from the river in pots on their heads, children playing with dogs, girls grinding corn using a mano and metate, boys learning how to make projectile points, and travelers from other areas arriving to trade their goods. On ceremonial days, people gathered from the hinterlands for feasting and celebration. Dancers entered the plaza to the beating of drums and shaking of gourd rattles with the people around the plaza intently looking.

Identifying and expressing personal feelings about the area is another dimension of appreciating the site. Feelings about the contrast between being inside and outside can be likened to the inhabitants' daily passages to the outside from inside rooms and kivas. These feelings are explored further when students imagine an event in the great kiva, and then express thir feelings and their imagination in a poem.

SETTING THE STAGE

Before walking through the West Ruin, briefly mention that this place is what remains from the people who built and used the structure nearly 900 years ago. Today, we call them Ancestral Pueblo people. Their descendants are Pueblo peoples from many different tribes who live today in New Mexico and Arizona. One descendant, a man from Santa Clara Pueblo, calls this site "The Place by Flowing Waters." This is a poetic name – we do not know what the people who lived here called it. This man used his imagination and feelings to give it a name that is meaningful to him. The students will journey through the site and do something similar – they will involve their senses, feelings, and imaginations to explore and create a poem meaningful to them.

PROCEDURE

Follow the interpretive trail to the following trail markers:

TRAIL MARKER 2

Direct the students to notice all aspects of the area, such as the plants growing in the plaza, the colors of the stones in the walls, the unexcavated East Ruin beyond the walls of the West Ruin, and the cloud formations above. Students discuss their observations.

Students sit or stand quietly at this stop for several minutes. Direct them to listen to the sounds of nature – such as different sounds of the birds in various locations – in the ruin, picnic area, and neighboring fields. Students discuss how many bird voices and other sounds of nature they heard.

TRAIL MARKER 3

Students discuss their observations about the sandstone wall. Discuss the roof beams projecting from the wall, and the green stone stripes. Students sit quietly and list in their notebooks observations they have made in the course of being outside.

TRAIL MARKER 7

Students discuss observations about their surroundings. Is it dark? Humid? Cold? What is the floor like? Notice the plaster, masonry, and components of the ceiling, and discuss.

TRAIL MARKER 8

Students discuss observations about their surroundings, and then compare this room to the room at trail marker 7. Is it darker? Are there the same number of vents in both? Timbers in the ceiling? Students imagine and discuss what it might have been like when Ancestral Pueblo people lived here.

TRAIL MARKER 9

Students discuss their observations about the differences in this room. They list in their notebooks everything they have observed within the interior of the building.

Continue through the roofed rooms. Encourage students to make observations as they go and write them in their notebooks.

Now in the daylight, students share how they feel about coming outside. Speculate about where the Ancestral Pueblo people spent their time. Students write everything they feel about coming outdoors.

TRAIL MARKER 13
This is the edge of the plaza. Students share their observations about its appearance today. Students speculate and record what it might have looked like and what they might have seen from this spot when it was occupied: children playing; women grinding corn with metates and manos; hunters bringing in a deer; someone plastering a wall; a woman creating a pot...

TRAIL MARKER 18
Students observe an excavated and partially reconstructed kiva. Discuss kivas and their uses among today's Pueblo peoples.

TRAIL MARKER 20
Prior to entering the reconstructed great kiva, discuss how Pueblo peoples today consider this a sacred site.

Students enter the kiva and explore the building. After exploring, students sit quietly in one area. Explain that this was a place where the people of the area held many sacred ceremonies. The people may have sat here long ago and waited for a ceremony to begin.

Students close their eyes while the teacher reads the following:

You are back in this pueblo when the Ancestral Pueblo people lived here, in the Place by Flowing Waters. In the kiva, it is dark and warm, a great fire is burning, and you can smell the smoke of juniper. Many people are seated beside you in a circle along the outside walls. You feel the cool stones of the wall against your back. You remember that in the great kiva, the people joined together Earth and Sky, sun and moon, winter and summer. This was the First House created when the people emerged from the earth.

The great kiva is the place where all the people meet to celebrate the first story. You can hear the rustling of feathers as the dancers enter the room. The dancers are wearing feathers or horns, masks, and they shuffle and dance into the center of the kiva. You watch them dancing and dancing....

Someone presses the button of the taped program (prearrange with a student or chaperone.) Students sit quietly as the drumming and chanting on the tape plays.

After it concludes, read:

As the dancers vanish into the darkness, you come back to the present. After you return, write a poem about the dancers and about the activities that you saw in your imagination.

Students write their poems, either while still in the kiva, or back in the classroom.

CLOSURE

Students read their poems aloud. Brainstorm other ways they can appreciate the site without causing it harm. Examples: write a story, draw a picture, write a play, talk to others about your experience, write a song, take a photograph, visit again.

EVALUATION

Evaluate students' participation in discussion and writing exercises and final written work.

Poems can be illustrated, and final copies displayed in the school, local newspaper, or at Aztec Ruins.

EXTENSIONS

1. Illustrate poems. Prepare final copies, and display for other students in the school to enjoy. Send samples to the local newspaper. Send some to Aztec Ruins, and ask to have them displayed for a couple of weeks.

2. Divide students into small groups, and have each group concentrate on certain rooms or locations along the trail, making and writing observations. Regroup at a specified location to write poems using their lists. Visit the great kiva as a whole class activity.

3. Experiment with writing poetry of different forms, such as haiku, or an anagram poem using words such as "kiva," "Aztec Ruins," or "plaza."

4. Create additional poems using the lists of observations, feelings, and speculations made at the site.

REFERENCES

A Trailguide to Aztec Ruins, Southwest Parks and Monuments Association, Tucson, 1994.

Lister, Robert H. and Florence C., *Aztec Ruins on the Animas Excavated, Preserved, and Interpreted*, Southwest Parks and Monuments Association, Tucson, 1987 Second Edition.

Aztec Ruins National Monument, Southwest Parks and Monuments Association, Tucson, 1992.

Impacts on the Environment

Science, social studies, mathematics, language arts

SKILLS.....Knowledge, comprehension, application, analysis, evaluation
STRATEGIES.....Reading, discussion, scientific inquiry, brainstorming, writing, computation
DURATION.....2 class periods, optional field trip to Aztec Ruins
CLASS SIZE.....Any; work in pairs, then individually

OBJECTIVES

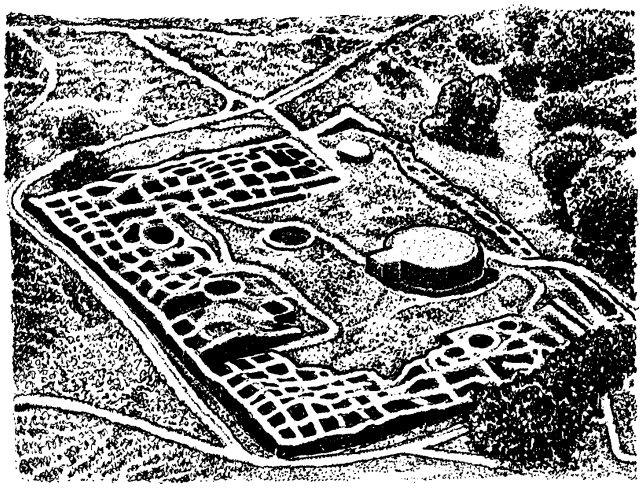
After viewing the trunk of replica artifacts from Aztec Ruins, students will:

1. Infer the amount of materials needed for household use and for construction of the West Ruin.

2. Assess the environmental impacts of the Ancestral Pueblo use of resources for artifacts and construction.

MATERIALS

- Trunk of replica artifacts
- "Prehistoric Buildings" WORKSHEET
- "Settlement Areas" MAP



VOCABULARY

artifact: any object made or used by humans.

chinks: small stones stuffed into the mortar of the walls, sometimes placed in decorative patterns.

core and veneer: a wall using a central core of mud and stones, sandwiched by outer facings of stones in mud mortar.

inference: a conclusion derived from observations.

mortar: the mud used around stones in walls.

niche: a rectangular or irregular recess on a wall face.

observation: recognizing or noting a fact or occurrence.

piñon: a type of pine tree valued for its nutritious nuts.

vent: small rectangular opening in a wall, usually placed just below the roof, that allowed passage of air.

BACKGROUND

Today, most people realize that resources such as water, aluminum, electricity, and gasoline are depletable and should be conserved or recycled. In the same way, prehistoric people needed to be careful when harvesting or collecting raw materials so as not to destroy their supply. For example, they needed to leave younger trees to replace the older ones they harvested. They avoided using piñon trees in their construction, reserving them so they could harvest their nutritious nuts instead. They had to hunt animals at the proper time of year to ensure that young ones would survive and be available for future hunting.

Some of the materials were non-renewable, such as stone and clay. The people had to be aware of these limited supplies, and use them efficiently.

Some archeologists surmise that the Ancestral Puebloans moved from areas that they had occupied for a generation or longer because they depleted the resources that they needed to survive. Repeatedly farming the same fields would deplete the nutrients needed to enable productive growth of corn, beans, and squash. Years of collecting firewood from the same area would force them to travel farther and farther to find more. Over-harvesting of trees, animals, and wild plants could exhaust the dependable supply all too quickly. If a natural disaster, such as several years of drought, occurred, conditions would worsen to the degree that moving to a different area would be more desirable than living with nearby marginal conditions.

People used the buildings at Aztec Ruins and occupied the nearby areas off and on for nearly 200 years. The population of the West Ruin alone could have ranged from 100 to 300 or more people at any one time, depending on the season and time period. During that time span, many people also lived nearby in smaller dwellings. They also required materials and resources from their environment to survive. Some archeologists believe that a severe prolonged drought near the end of the occupation (around AD 1276-1300), combined with the cumulative impacts that the people made on their environment, encouraged them to move to a place with more favorable conditions.

SETTING THE STAGE

In what ways do we impact our environment by using its resources? Consider one resource that we commonly use, such as gasoline or water. How do we obtain it? Is it a renewable or depletable resource? How do we impact our environment by obtaining and using it? What would happen if we depleted that resource?

The Ancestral Pueblo people also made impacts on their environment. These impacts may ultimately have contributed to their migration from this area.

PROCEDURE

1. Review BACKGROUND information with the students regarding the population at Aztec Ruins and the time period during which they were in the area. Show them the "Settlement Areas" MAP indicating the extent of settlement in the area.

2. Examine the replica artifacts from the trunk, using the information provided with the trunk to discuss the function of each.

3. Students choose the names of 10 artifacts from the replica artifact trunk, and list them on a piece of paper.

4. For each item, students infer and write how long each item may have lasted, and explain their reasoning. Consider how many a household (4-8 people) might need, how often a household would use it, and how often it would need replacing. Consider how long an item would last, or get used up, broken, or lost.

5. Distribute the "Prehistoric Buildings" WORKSHEET to students. Review the introductory information on the WORKSHEET with students. Students answer each question individually or in pairs.

6. Discuss students' answers taken from their written work.

CLOSURE

Students individually form and write an inference, or conclusion, about the impact that the people who lived in and around Aztec Ruins made on their environment. Compare and discuss students' statements. Could the inhabitant have been influenced to move because of the impacts they made in the environment? How?

EVALUATION

Evaluate students' inferences regarding how long artifacts last and impacts on the environment, and answers to WORKSHEET questions.

EXTENSIONS

1. Take a field trip to Aztec Ruins. Examine the artifacts on display, and infer about household use of these items as in PROCEDURE 4. Field-check room measurements and sizes of stones, and modify calculations on the "Prehistoric Buildings" WORKSHEET to reflect a better estimate of the materials used. Modify inferences regarding impacts to the environment based on observations made during the field trip.

2. To shorten the lesson, the teacher chooses a sampling of artifacts from the trunk for examination. Students then choose up to 5 artifacts from which to infer longevity.

REFERENCES

Lekson, Steve, et al., "The Chaco Canyon Community," *Scientific American*, Vol. 259, No. 1, pp 100-109, July 1988.

Answers to Prehistoric Buildings WORKSHEET

1. 2 vigas per room 2 vigas = 1 tree
   450 rooms x 1 tree = 450 trees

2. For length: 10 feet = 120 inches
   120 inches ÷ 8 inches = 15 blocks
   For width: 2 feet = 24 inches
   24 inches ÷ 8 inches = 3 blocks
   15 x 3 (Length x width) = 45 blocks

3. 8 feet = 96 inches
   96 inches ÷ 8 inch blocks = 12 blocks

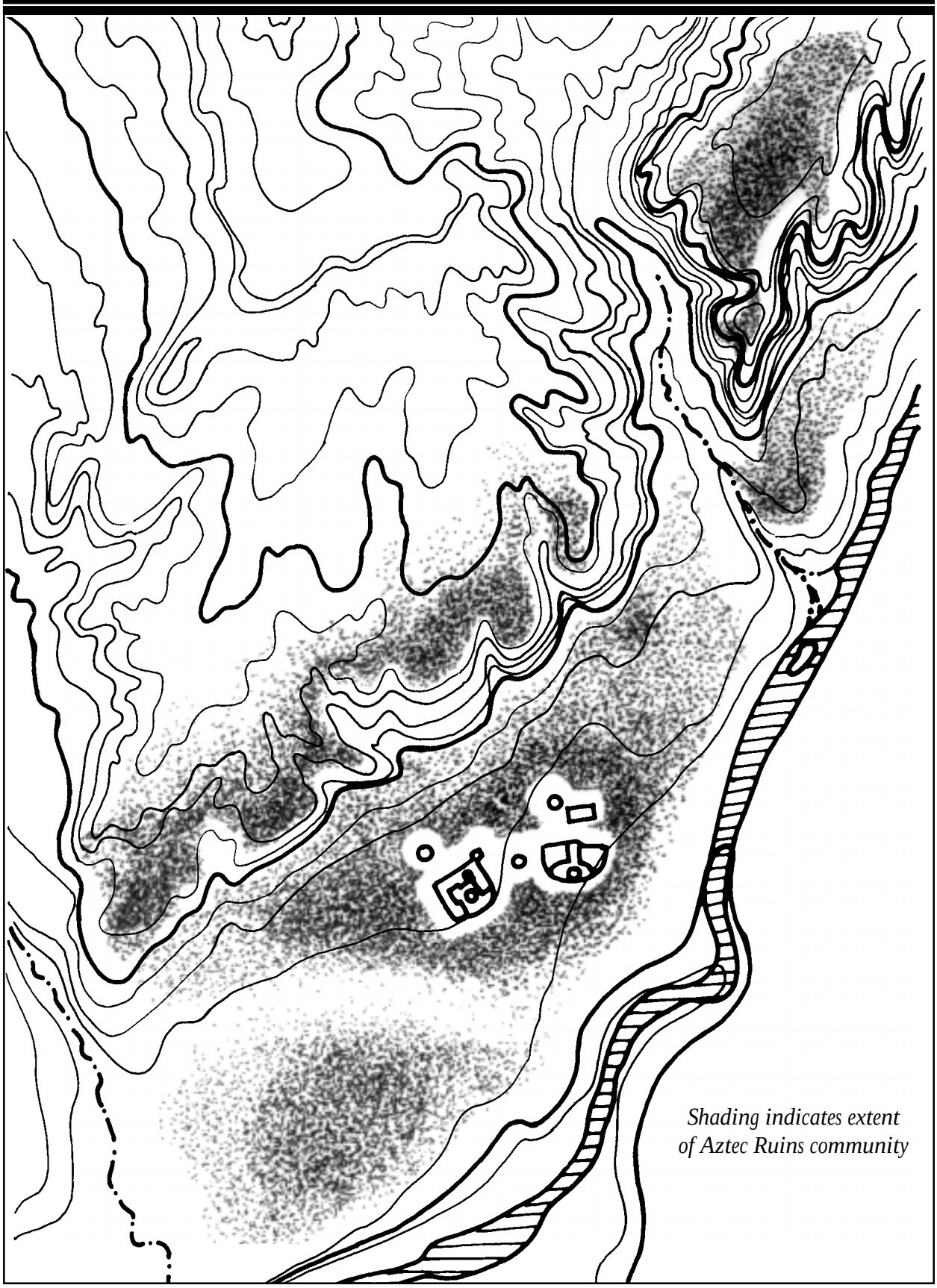
4. 45 blocks x 12 blocks = 540 blocks

5. 4 walls x 540 blocks = 2160 blocks

6. 2160 blocks x 7 pounds = 15,120 pounds

7. 2160 blocks ÷ number of rocks hauled in one day

SETTLEMENT AREAS



PREHISTORIC BUILDINGS

The West Ruin at Aztec Ruins had about 450 rooms. Stones, mud, and wood were used for its construction. How much of these materials did the builders need to build the structure? Make the following calculations to estimate how many rocks and trees they might have used.

Hint: Your answers will be estimates because there are so many variables that affect them. Walls varied in thickness throughout the building, and the rocks used varied from very small chinking stones to large shaped, or *dressed*, stones. Sometimes the people shaped them into loaf forms, sometimes into thin tabular forms. In addition, the walls were laid in a core and veneer construction. Veneers of carefully laid dressed stone sandwiched an inner core of unshaped sandstones and cobbles embedded in a large quantity of mud mortar. As a result, mud was a major part of the wall. Walls were shared between rooms, and many walls had doorways, vents, niches, and other features built into them. All these factors will affect a realistic calculation of resources needed to construct the building.

1. Each roof required an average of 2 vigas, (large support beams). If 2 vigas came from 1 tree, how many trees were needed for 450 rooms?

2. An average size room was 10 ft. by 10 ft. To make a strip of wall that was 10 ft. long by 2 ft. wide, how many 8-inch-square rocks were needed to make one layer?

3. If the Puebloans used individual rocks that were cube-shaped with 8-inch sides, how many rocks would it take to stack, one on top of the other, until the wall reached 8 ft. high?

4. How many 8-inch cube-shaped rocks would they need to build one section of wall that measured 10 ft. long, 2 ft. wide, and 8 ft. high?

5. Each room had 4 walls. How many rocks would they need to build the walls in one room?

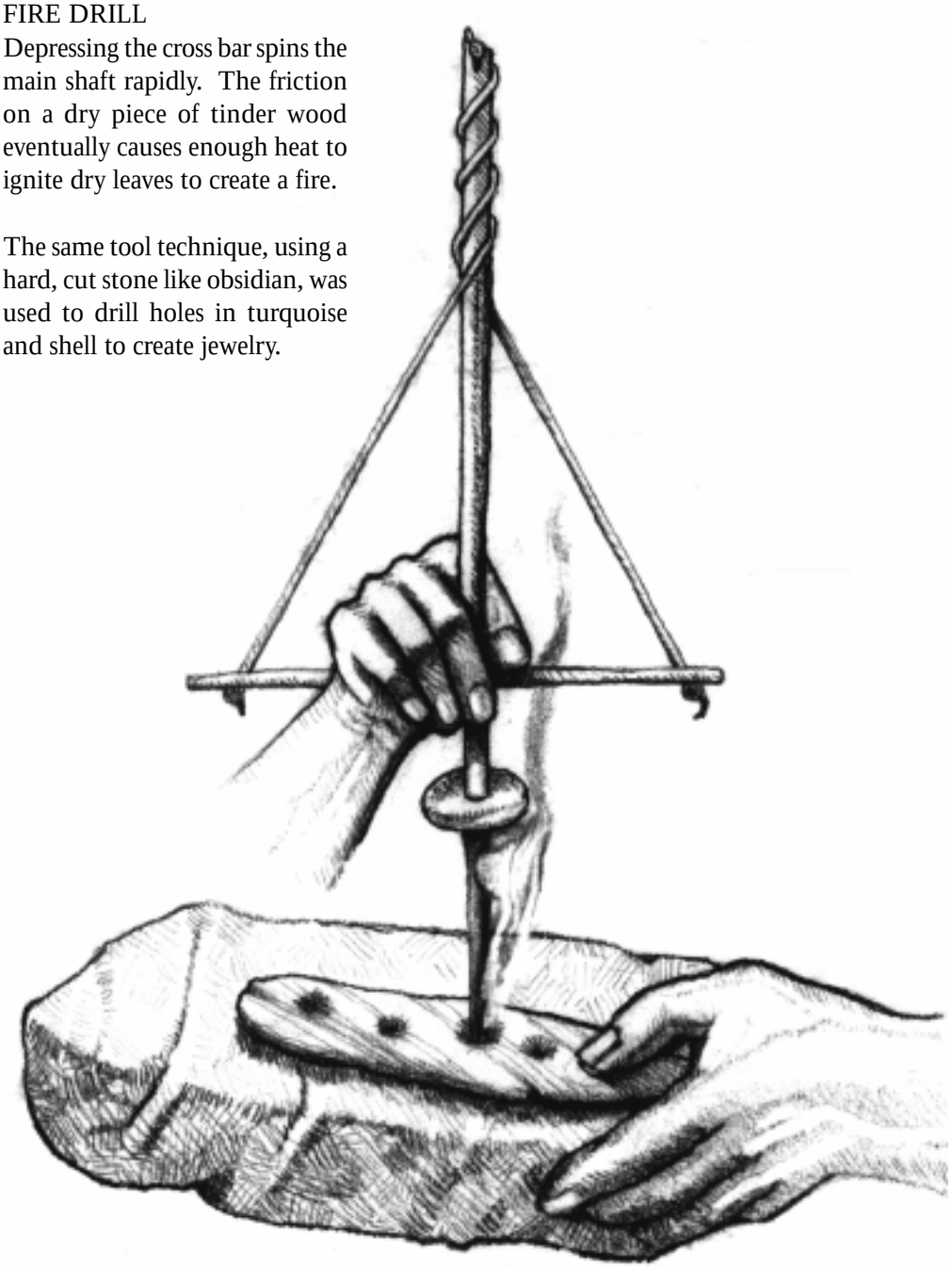
6. If each rock in a room weighed 7 pounds, how many pounds of rocks would they have hauled to build one room?

7. Estimate the number of rocks you could haul one mile in a single 8-hour work day. Use your answer from number 5 to determine how many days you would need to build one room in the building by yourself.

FIRE DRILL

Depressing the cross bar spins the main shaft rapidly. The friction on a dry piece of tinder wood eventually causes enough heat to ignite dry leaves to create a fire.

The same tool technique, using a hard, cut stone like obsidian, was used to drill holes in turquoise and shell to create jewelry.



Now & Then: A Scavenger Hunt

Social studies, language arts

SKILLS.....Knowledge, comprehension, analysis, evaluation
STRATEGIES.....Discussion, brainstorming, inquiry, compare and contrast, writing, analogy
DURATION.....1 class period; 2-hour field trip to Aztec Ruins
CLASS SIZE.....Any; students can work in singles, pairs, or small groups

OBJECTIVES
In their study of Aztec Ruins, students will:

1. Observe and identify artifacts and structures that supported the daily lives of the inhabitants.

2. Compare artifacts and building features of the prehistoric inhabitants to those of people today.

3. Speculate about the relative use and importance of different artifacts and structures.

MATERIALS
- "A Scavenger Hunt" WORKSHEET

VOCABULARY
artifact: any object made or used by humans.

awl: animal bone sharpened at one end, used to punch holes in hides and basketry.

cordage: rope or string made from plant fibers twisted together.

deflector: vertical stone slab or masonry wall between the fire and ventilator shaft that deflected incoming air and reflected heat and light.

digging stick: sturdy stick pointed at one end, used for digging holes for the planting seeds.

feature: something made by humans but not easily picked up or transported, such as a wall, firepit, concentration of artifacts, or doorway.

fire drill: artifact used to start fires where a wooden stick was rotated briskly on another piece of wood, creating friction and heat.

firepit or **hearth**: a stone- or plaster-lined pit used for containing fire.

kiva: room with distinctive features, usually underground, probably for ceremonial use; similar structures are still used by Pueblo people today.

mano: small stone held in the hand used to grind corn and other substances by rubbing on a larger stone called a metate.

metate: large stone used to grind corn and other substances by rubbing with a smaller stone (mano).

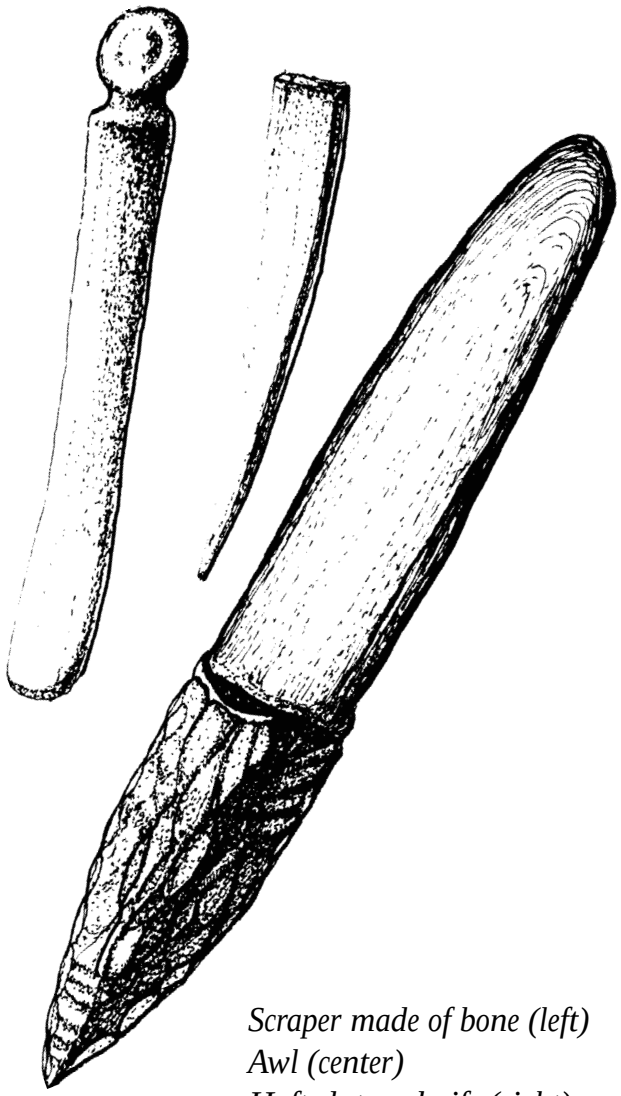
pilaster: low masonry-encased horizontal log or upright masonry pier on a kiva bench.

vault: rectangular sub-floor pit found in kivas; large stone-lined vaults occur in great kivas.

vent: small rectangular opening in a wall, usually placed just below the roof, that allowed passage of air.

ventilator shaft: a tunnel running from the exterior of a kiva to the area of the firepit that allowed fresh air to enter.

yucca: native plant with pointed, fibrous, stiff leaves, used in many ways by Ancestral Puebloans.



Scraper made of bone (left)
Awl (center)
Hafted stone knife (right)

BACKGROUND

Much has changed since the Ancestral Pueblo people lived at Aztec Ruins about 900 years ago. Today we live in an age of computers and technology, plastics and metals, combustible gas-powered engines, and electrically-driven conveniences.

But the Ancestral Pueblo people lived under much different conditions. Lacking the available manufactured, packaged, processed, and preserved goods of today, they instead relied on a vast assortment of raw materials that they gathered and used ingeniously. Despite not having "modern" amenities, they successfully lived in their environment, creating and using the artifacts they needed to survive.

Many of the artifacts we use to accomplish everyday tasks were found in prehistoric times, although some take different forms or are made of different materials. For example, for gardening we use a hoe with a wooden handle and metal end. The Ancestral Pueblo people also used a hoe – but one made with a sharpened stone fastened to a wooden handle. Our needles are slender metal wires pierced with a hole. Their needles were often rodent or bird bones, ground to a point at one end, with an eye pierced through the other. A variation of the needle was the *awl*, made similar to the modern needle but with no eye. Awls were probably used for punching holes in hides or basketry. We use aluminum and stainless-steel pots for cooking; they used ceramic vessels. We use paintbrushes made with a wood or plastic handle and synthetic or animal hair bristles; they used the leaf of a yucca plant, chewed at one end to expose the fibers.

Their shelter also took a different form and used available raw materials. Stone and mud were plentiful, and they traveled to obtain certain trees to construct roofs. At Aztec, the West Ruin was a multi-storied, massive complex of interconnected rooms built around an open plaza. People used the building off and on from the early AD 1100s until about AD 1300, changing and using it in different ways to meet their needs. While at some times it may have been used primarily for administrative or ceremonial purposes, at other times people used it for storage, work areas, latrines, tombs, midden deposits, or, for a small number of people, habitation. In the plaza was a large, semi-subterranean structure called the *great kiva*, which was used for community-wide events. Interspersed throughout the pueblo are specialized rooms called *kivas*, which were probably used for ceremonial purposes.

Some elements, such as doorways and roofs, are similar to ours today, but there are others that we do not have. Kivas and their features are an example. These rooms were frequently round and subterranean, with a central firepit. A ventilator shaft, constructed much like a chimney, allowed fresh air to enter the kiva and feed the firepit. A vertical stone slab or low masonry wall, called a *deflector*, diverted the air entering through the ventilator shaft from rushing over the fire and either extinguishing the fire or allowing it to burn too quickly. Many kivas have a low masonry wall, called a *bench*, encircling the edge. It was probably not used for seating for the occupants, but rather for supporting the pilasters for the roof and/or as a shelf on which to place items.

Archeologists are unable to determine for certain the functions of some of the features in the great kiva. The two large rectangular pits, called vaults, may have been covered with wooden planks and used as foot drums. They may have been filled with dirt and used for winter germination of plants for spring ceremonies, or have had another ceremonial function. The four stone disks found beneath each pillar provided a good footing, but one under each would have sufficed for that purpose. Why four? The number may relate to spiritual beliefs. The raised stone platform with the circular design on it in the north entrance room may likewise have held significance in spiritual beliefs and practices.

The doorways found throughout the pueblo are smaller than ours today and had no hinged doors to easily cover them. However, on some doorways are horizontal wooden poles where the people could have hung a hide or blanket, or propped a large stone slab to effectively seal the doorway. A doorway that we do not commonly see in our construction today is the corner doorway, which connected rooms diagonally. Because corner doors weakened the overall structure and were more challenging to construct, they may have had special ceremonial significance.

Windows – called *vents* – also were much smaller than ours. The builders lined them up in the same corner of adjoining rooms. This provided ventilation from outside to deep interior rooms.

The Ancestral Pueblo people successfully used the materials available to them to create the artifacts and structures they needed. Upon examination, we find that today we have many artifacts and building features in common with these people, although theirs may look different and use different materials. And even though some of our features and artifacts share the same appearance, their intended functions or significance may not be the same.

SETTING THE STAGE

Review the definition of the word "artifact." Students list on a piece of paper at least ten artifacts that they use in their daily lives. Examples: hairbrush; curling iron; clothes; kitchen appliances, such as toaster, oven, blender or can opener; eyeglasses; pencils; automobile; eating utensils such as plates, cups, and silverware.

Review the definition of the word "feature." Students list at least five features in their homes. Examples: central heating, swamp coolers, carpeting, counter tops, glass on windows, faucets, doors with hinges, wood burning stove, or fireplace.

As a group, discuss students' answers from each list. Write responses from both lists on the board without duplicating. Which of these items and features do you think the Aztec Ruins inhabitants had, or had an equivalent for? Circle them.

PROCEDURE

1. Provide BACKGROUND information introducing students to the structures and people of Aztec Ruins. Mention some of the conveniences we enjoy that they did not, such as electricity, plastics, metal, and combustible engines. Nevertheless, the prehistoric inhabitants made tools and artifacts and built their houses from available resources to meet their particular needs, just as we do today.

2. Distribute "A Scavenger Hunt" WORKSHEET to each student. Divide students into pairs or small groups.

3. Take a field trip to Aztec Ruins and complete the following assignments:

   - For each modern artifact listed on the worksheet, find the artifact in the museum or feature in the West Ruin that is similar. Write the name of the artifact next to each. Some items may not have similar Ancestral Pueblo artifacts or features.

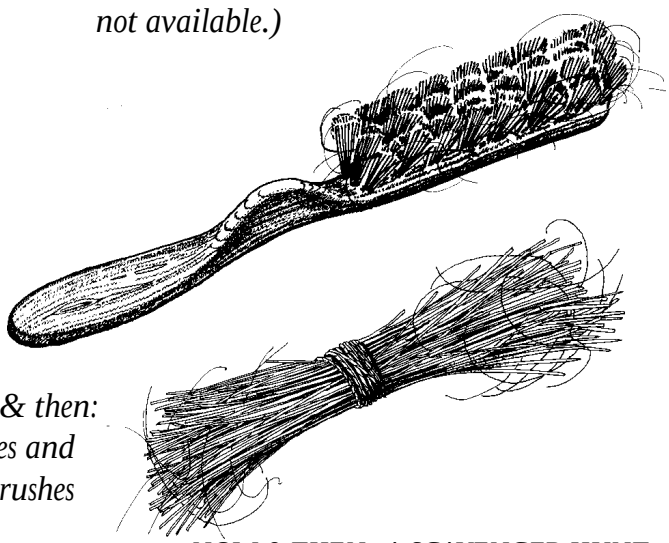
   - List three prehistoric artifacts or building features for which it appears that there are no equivalents in our lives today.

   - Search in the museum and trail (you may need to use the trail guide booklet) for information to answer the remaining questions on the WORKSHEET.

4. Discuss answers from the worksheets. Discuss the following questions:

   What artifacts do we have today that the Aztec Ruins inhabitants appear not to have had?

   What are some reasons why they did not have them? (Examples: no need, raw materials not available, technology not available.)



Now & then: needles and hairbrushes

NOW & THEN: A SCAVENGER HUNT

Listed are artifacts we use today. Find artifacts in the museum or on the trail that appear to be the Ancestral Pueblo version of today's artifacts. Write the name of that artifact or building feature.

1. Shoe
2. Tupperware container
3. Coffee cup
4. Doorway
5. Matches or lighter
6. Twine
7. Stainless steel knife
8. Wool blanket
9. Nintendo
10. Food processor
11. Arrow
12. Telephone
13. Window
14. Bowl
15. Aluminum ladder
16. Roof
17. Fireplace
18. Slipper

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19. List three artifacts or building features for which we do not have a good equivalent or version.

20. Name one artifact or raw material found at Aztec Ruins that tells us that these people either traveled or traded to obtain it.

21. Describe an artifact or building feature whose function is unknown for certain.

22. Name one kind of material or artifact that you would expect the people used, but you did not observe or learn about. Give reasons why you think this material or artifact was not here.

CLOSURE

Summarize findings. Which artifacts do you think were most used by the Ancestral Pueblo people? Explain your reasoning. What building features do you think were most important to the inhabitants? Why?

EVALUATION

Evaluation is based on individual activity sheets, and cooperative participation and individual contributions to discussion.

EXTENSIONS

1. Use the trunk of replica artifacts from Aztec Ruins in the classroom or during the field trip to facilitate discussions about artifacts and their functions.

2. Students write a paper about the artifacts and features that are most important in their lives and why.

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A Trailguide to Aztec Ruins, Southwest Parks and Monuments Association, Tucson, 1994.

Answers to
"Now & Then: A Scavenger Hunt"
WORKSHEET

1. yucca sandal
2. pot with lid
3. ceramic mug
4. doorway
5. wood fire drill
6. fiber cordage and rope
7. stone knife
8. turkey feather or rabbit fur blanket
9. no equivalent
10. metate and mano
11. stone-tipped wood-and-reed arrow
12. no equivalent
13. vent
14. ceramic bowl
15. wood ladder
16. roof
17. hearth or firepit
18. fiber footwear

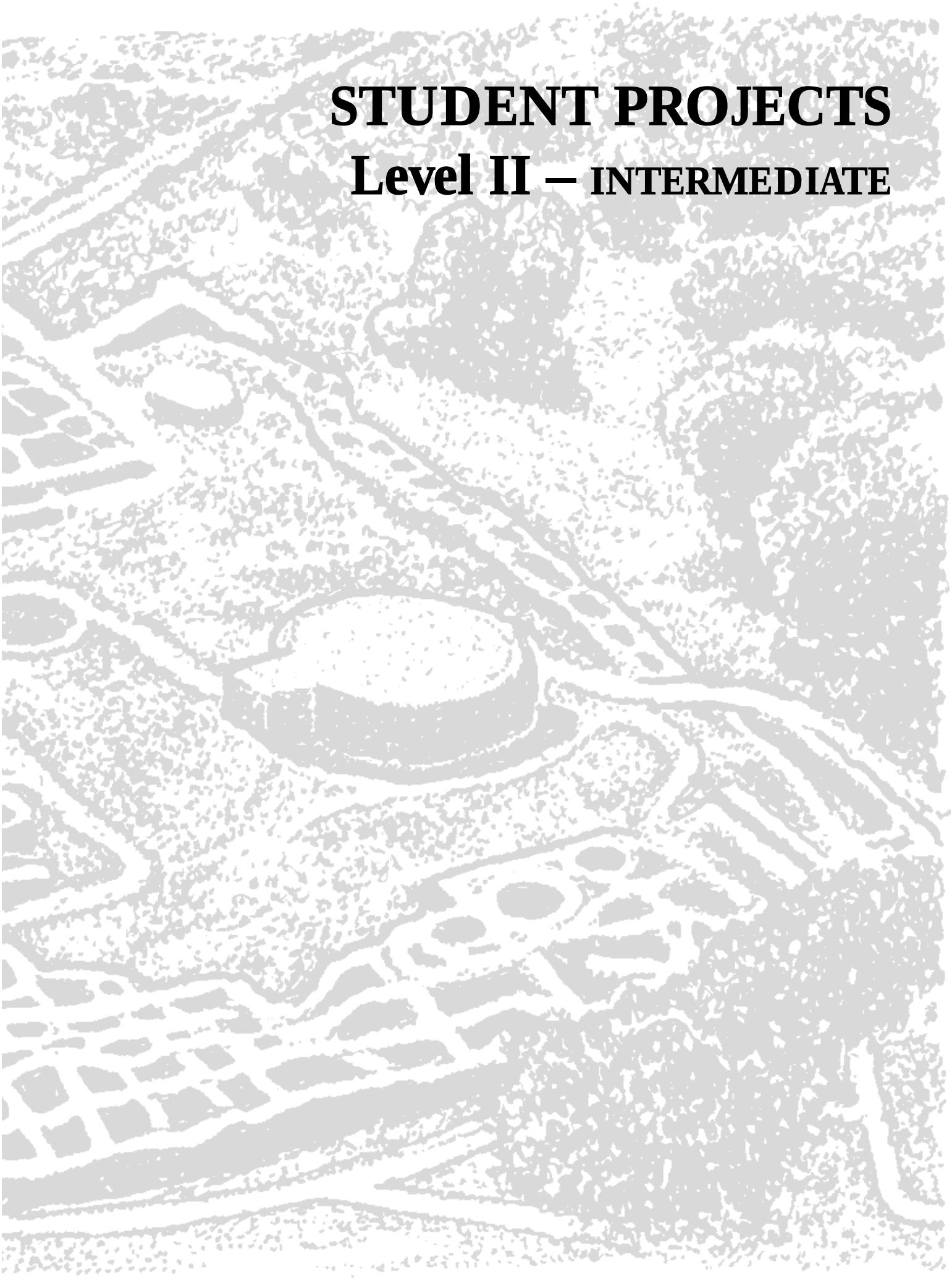
19. Answers are highly subjective and can be interpreted variously, but some answers that could be argued include: vault, ventilator shaft, corner doorway, kiva, deflector, digging stick, throwing stick, potrest

20. Vigas made of Douglas fir, spruce, and pine; shells, copper, turquoise, certain pottery, salt, obsidian, scarlet macaw feathers

21. Vault, corner doorway, greenstone on wall, crystals, stone slabs, animal figures, pottery discs, tchamahia, yucca leaf bundle, miniature vessels, etc.

22. Subjective answers could include: horses; sheep; cattle; written records; a range of foods such as chocolate, wheat, various fruits and vegetables such as peaches, apples, apricots, tomatoes, broccoli; public sewage system; furniture such as chairs and tables; metal axes. Various reasons why these things were not here: some, such as certain foods, horses, cattle, and sheep, were not introduced into this area until the Spanish came in 1540; some perishable items like food and plant remains did not survive the centuries; oral traditions most likely replaced written records; technology was not developed for metals, electricity, etc.

STUDENT PROJECTS
Level II – INTERMEDIATE



Imagination Pots

Social studies, language arts, art

SKILLS.....Knowledge, comprehension, application, analysis, synthesis
STRATEGIES.....Discussion, research, creative exploration, drawing
DURATION.....2 class periods
CLASS SIZE.....Any

OBJECTIVES
In their study of pottery, students will use the trunk of replica artifacts to:

1. Observe and identify different pottery styles.

2. Compare the styles and determine the time periods for pottery sherds.

3. Reconstruct and illustrate an entire vessel using a selected sherd.

MATERIALS
- Pottery sherds from the Aztec Ruins trunk of replica artifacts (or borrow sherds with no provenience from nearby college or museum collections – do not use sherds collected by the children or their families)
- White art paper
- Coloring media: black, red, gray, and white paints, crayons, chalk, or colored pencils
- Sketching pencils
- "Imagination Pots" HANDOUT or reference books that illustrate pottery styles

VOCABULARY
black-on-white: pottery with an overall white, or sometimes gray, surface on which a black painted design has been applied.

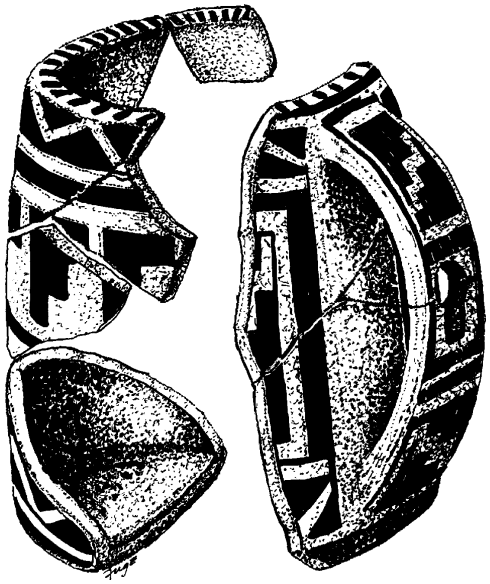
corrugated: unpainted pottery that has coils still visible on its exterior surface.

polychrome: a vessel with two or more colors.

tradeware: pottery not native to a given area.

sherd: a piece of broken pottery.

vessel: a hollow or concave utensil for holding something.



BACKGROUND

Archeologists are often compared to detectives, because they must piece together the past from only a fraction of the original evidence that remains. Often they cannot find enough to give them the "whole picture." For example, archeologists very rarely find whole pots, but frequently find their pieces. One way to help students understand this frustration is to show them pottery fragments, or *sherds*.

Even small pottery sherds can provide archeologists with information. Styles of pottery – the color, design, shape, surface treatment, and its constituents – changed relatively quickly through time, much as styles of clothes and cars change through time for us today. Differing styles of pottery were also made in specific geographic areas throughout the Southwest. By examining styles of pottery sherds and their frequency at a site, an archeologist may be able to determine occupation dates, the presence and extent of trade, relationships with other sites, population, and hints of environmental conditions. These fragments help enable archeologists to piece together a fuller picture.

Pottery sherds and vessels found at Aztec Ruins include both unpainted and painted wares. The unpainted pottery includes plain gray pots, some with their exteriors roughened, and many blackened with soot from long use over a fire. Also unpainted are corrugated vessels, whose exterior surface has a corrugated appearance due to the potter not having obliterated the coils. Sometimes the coils are smoothed, incised, or indented. Corrugated pottery's gray and black colors come from contact with smoke from the firing process and cooking over a fire. Corrugated pottery is commonly found at Aztec Ruins and was constructed throughout the Southwest after approximately AD 950.

The most common painted vessels found at Aztec are called "black-on-white" – named for the black designs over the white surface. The black paint is made from either a mineral or vegetable substance, depending on who made the vessels and when. Black-on-white pottery vessels found at Aztec Ruins include mugs, bowls, short-necked pitchers, bulbous water jars, dippers, small jars, and miniatures. Black-on-white pottery was made beginning about AD 600 throughout the Southwest.

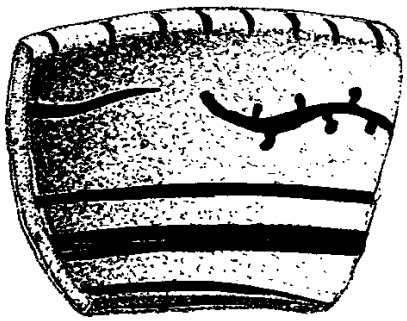
Plain and corrugated vessels are utility wares, mostly used for cooking and storage. The black-on-white and other painted vessels are known as service wares, used for serving and other uses, but not for cooking. We also have our utility and service wares – specific vessels for cooking and storing food and others for serving and everyday use.

Another category of pottery found at Aztec Ruins is tradeware – vessels that did not originate at Aztec Ruins but were acquired through trade. Most of those found at Aztec Ruins are painted, and are recognized by their multiple colors (polychrome) or a distinctive black-on-red design. Inhabitants at Aztec Ruins traded for these wares from the south.

Archeologists seldom try to reconstruct a vessel design on the basis of only one or two sherds. Usually a large number of sherds are needed. However, rim sherds can be used to reconstruct vessel shape or approximate vessel size.

Nonetheless, potsherds capture everyone's curiosity. There is an unsettling feeling about finding only a part of a whole, and curiosity and imagination begin to conjure up the complete picture.

[Author's note: This lesson was inspired after a trip to Aztec Ruins National Monument, during which our Project Archeology class visited the East Ruin, a site closed to the general public. Members of the class "oooohed and ahhhhed" every time someone discovered a sherd lying on the ground. We held them in the palms of our hands, and could only wonder about their makers. We returned them to their exact locations. The feeling we all experienced that day was indescribable. I found a sherd that has had somewhat of a haunting effect on me that has not left. The sherd looked like this:



I wanted to know more . Did the pattern represent corn, a plant, or a geometric design, or did I not have enough information to complete the picture of what its maker had intended? This lesson will encourage students to use what they have before them to imagine and create the larger picture.]

SETTING THE STAGE

Students examine the various replica pottery samples. (If using actual artifacts borrowed from a university, tell the students that these have lost information that they might have contained because they are lacking provenience – and that they should NEVER pick up sherds for this very reason.) How does it feel to have just a part of a bigger thing? What questions does it arouse that you cannot answer? Archeologists must try to piece together a bigger picture from fragments. This is often frustrating work.

PROCEDURE

1. Share the BACKGROUND information regarding the value of pottery sherds and the kinds of information they can give. Using tradeware sherds, explain that their presence at places like Aztec Ruins shows that the people traded. Share information on styles of pottery: black-on-white, corrugated, and polychrome.

2. Students examine pictures of different pottery styles from the “Imagination Pots” HANDOUT or reference books, and compare these to the styles on the sherds. Use these references to determine the time periods of the sherds.

3. If using replicas or sherd samples, each student selects a sherd that particularly intrigues him/her. If sherds are not available, cut copies of pictured pots into pieces and give one to each student.

4. Students sketch the sherd they have chosen. Each student then sketches (using art paper) what they think the entire pot may have looked like, based on the sherd's pattern.

5. After completing the sketch, students use watercolors, crayons, chalk, or colored pencils to paint their imaginative pot or bowl. They are limited to the four colors of white, black, red, and gray, because these are authentic colors found on prehistoric pottery from this area.

6. Allow sketches to dry overnight and display!

CLOSURE

Summarize the importance and value of each individual's interpretation of the past through this example. Emphasize that there is no right or wrong interpretation, but simply that different people may interpret things differently. Review the idea that archeologists must solve the past "like a puzzle with a lot of the pieces missing."

EVALUATION

Check that each student produced one finished product – a complete vessel re-created from the design inspired by one sherd – and have them show that sherd from the collection or pictures of pots.

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Swentzell, Rina, *Children of Clay: A Family of Potters,* Lerner Publications, Minneapolis, 1992.

BLACK-ON-WHITE PATTERN STYLES

Chaco

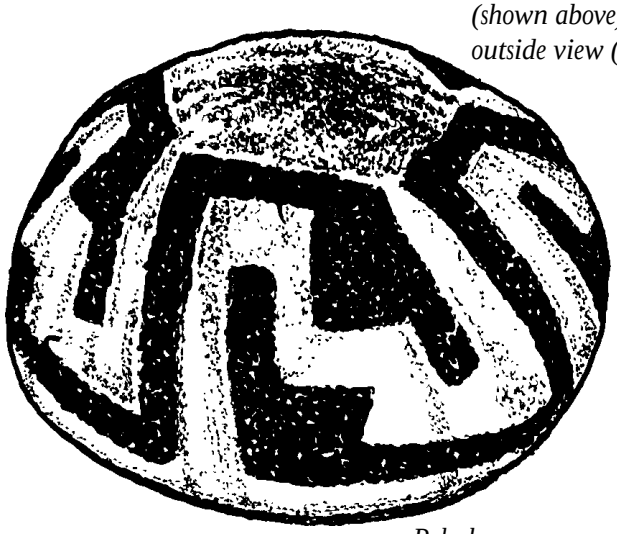
Mesa Verde

Kayenta

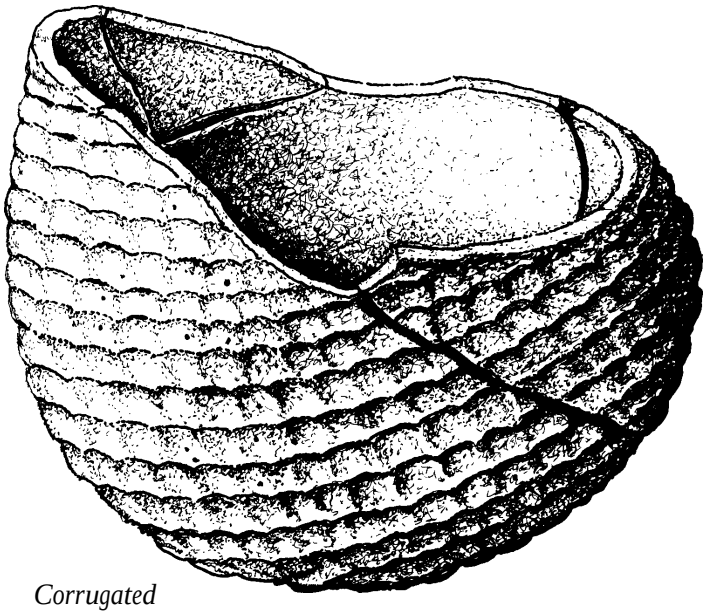
IMAGINATION POTS

Polychrome inside view (shown above); outside view (below)

Black-on-white



Polychrome



Corrugated

PHOTO BY JIM FUGE

"The clay is very selfish... The clay says 'I want to be this, not what you want me to be.'"

Rose Naranjo

"The clay knows when you are interested."

Rena Kavena

"You are never lonesome as long as you have clay."

Evelyn Vigil

Quotes from *Talking With the Clay*

Living in the Past, Present & Future

Social studies, language arts, science

SKILLS.....Knowledge, comprehension, analysis, evaluation
STRATEGIES.....Brainstorm, categorize, compare and contrast, discuss, draw, research skills
DURATION.....2 class periods and field trip to Aztec Ruins
CLASS SIZE.....Any

OBJECTIVES

In their study of culture and Aztec Ruins, students will:

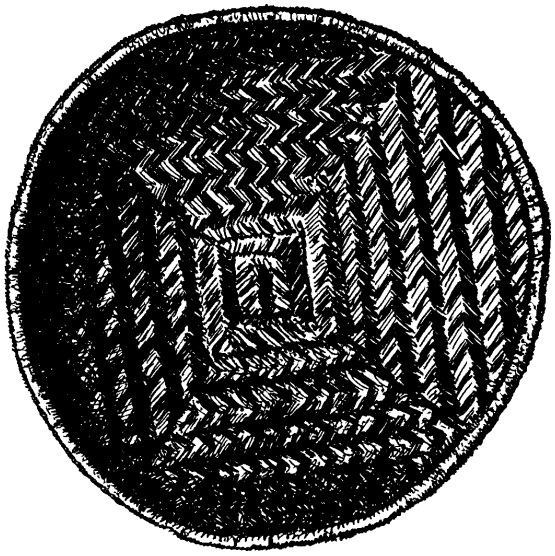
1. List and compare different ways that past, present, and future people meet basic human needs.

2. Identify evidence indicating how the Aztec Ruins inhabitants met their basic needs.

3. Assess how incomplete information about a culture impacts the interpretations of archeologists.

MATERIALS

- "Meeting Basic Needs" HANDOUT for each student.



VOCABULARY

archeological site: a place where human activity occurred and material remains were left.

archeology: a method for studying past human cultures and analyzing material evidence (artifacts and sites).

artifact: any object made or used by humans.

culture: the set of learned beliefs, values, behaviors, and tools shared by members of a society.

inference: a conclusion derived from bservations.

observation: recognizing or noting a fact or occurrence.

time capsule: a collection of artifacts specifically placed in a container to be opened in the future.

BACKGROUND

All people past and present have basic needs that must be met. Some of them include:

- The need for food and water.
- The need for protection from the elements (clothing and housing).
- The need for continuation of the culture (marriage, kinship, education).
- The need for explanation (religion, philosophy, science).

Archeologists learn how people met these basic needs by making observations about artifacts and archeological sites. Usually the artifacts they find today are just a fraction of the number of things the people originally made. From these few clues, archeologists can then make *inferences*, or conclusions based on the observations. Because they do not have complete information, their inferences about how past people met their basic needs may be inaccurate or incomplete.

At Aztec Ruins, archeologists have observed artifacts and examined the remains of structures that the Ancestral Pueblo people used. These things provide evidence – but not the full story – regarding ways in which they met their basic needs. Discarded animal bones of deer, mountain sheep, coyote, water fowl, beavers, and turkeys, and plant remains – dried squash stems, corn cobs, and beans – hint at their diet. Projectile points, arrow shafts, and digging sticks indicate methods for procuring or raising their food.

Multi-room buildings, such as the West Ruin and smaller structures nearby, give us clues about how the Ancestral Pueblo people protected themselves from the elements. Fragments of yucca sandals, woven cotton garments, and turkey feather and rabbit skin blankets suggest their attire. Evidence indicating how they perpetuated their culture is more elusive because material artifacts may not explain how they dealt with kinship, marriage, and education. Structures such as the kiva and treatment of the dead help us understand how they met their need for explanations of the world. Artifacts that are unusual, difficult to obtain, or indicate that a great investment of energy was required to make them may also relate to their religion or philosophy of the world. These include macaw feathers (obtained by trade from Meso-America), unusually shaped and carefully painted pottery items, highly polished stone blades called *tcamahias*, pipes, and crystals.

In a sense, archeological sites, with their associated artifacts, are like time capsules. Although the Ancestral Pueblo people did not intend their "site" to be excavated and studied in the future, they nonetheless left archeologists a record of themselves at a given time through the buildings and artifacts that have survived the centuries.

SETTING THE STAGE

1. Brainstorm what human beings need in order to live.

2. Distribute the "Meeting Basic Needs" WORKSHEET. Help students categorize the needs and write them in the left vertical column of the worksheet. Examples: food, water, shelter, clothing, transportation, religion.

PROCEDURE

1. Working in groups of three or four, students fill in the "Present" column of the WORKSHEET, giving examples of how people today fulfill the basic needs listed in the left column.

2. Share the background information about how archeologists make inferences about people of the past based on surviving clues from artifacts and sites.

3. Take the field trip to Aztec Ruins and complete the following assignments:

- Students will complete the "Past" column on their WORKSHEET by researching the evidence present at Aztec Ruins. Students explore the site and museum, searching for artifacts, structures, and information that will help them answer how the inhabitants provided themselves with shelter, clothing, food, water, religion, and the other "needs" they have identified on their worksheets. They may want to draw pictures of the artifacts or buildings that they observe.

4. While at Aztec Ruins, discuss with students evidence that is missing that would help them better understand how the inhabitants met their needs (examples: lack of information regarding religion and education; lack of examples of clothing and food). Relate this lack of evidence to the challenges that archeologists face in making inferences about people of the past through the few clues that survive.

5. If time permits, the class can compare and contrast the answers to the "Past" and "Present" columns of the WORKSHEET while at Aztec Ruins.

6. After the field trip, brainstorm how people will meet their basic needs in the next 800 to 1,000 years. Students complete the "Future" column.

CLOSURE

Discuss the idea that archeologists in the future will make inferences about us in the same way that present archeologists make inferences about the people who lived at Aztec Ruins. Would they have a complete picture? What might be "missing" from the record? What will they think of us?

EVALUATION

Evaluate completed activity sheets and student participation in discussions.

EXTENSIONS

1. Imagine that your class is to place a time capsule containing five items in the foundation of a new school that is under construction. What items would you place in the time capsule, and why? Each student draws pictures of the five items they would place in the time capsule. Students exchange their pictures with a partner, who develops three inferences about the "culture" that placed these items in the time capsule. In a class discussion, compare the contents of and inferences made from each student's time capsule. What might future archeologists infer about our culture from these items? What might they infer about their context? Will they learn something positive about our culture? Is there a way to send a message to the future? What should we say?

2. Make a time capsule as a class project. Get permission to place it in a building under construction in your area.

3. Make individual time capsules using shoe boxes. Decorate and place pictures of items or the actual items in the boxes. Open the capsules at the end of the school year. Are these items as important as when they were first placed in the capsule?

4. Mix pictures drawn of the artifacts from Aztec Ruins and items in the students' time capsule together. What might archeologists infer from such a mixture? How are the items out of context? Relate this to the damage that people who disturb archeological sites cause. Discuss federal laws protecting archeological resources.

5. Students write a story about being an archeologist of the future. What would life be like in the future? When you find a time capsule in the ruins of a 20th-century school, what might you learn about the students who placed it there?

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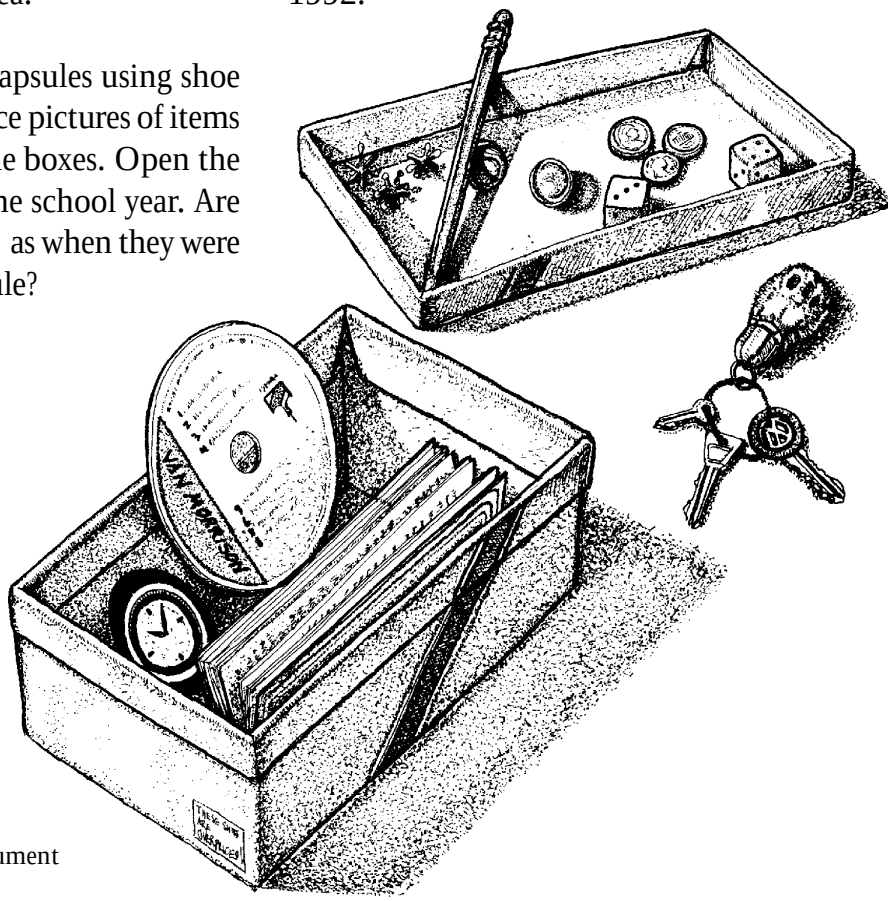
A Trailguide to Aztec Ruins, Southwest Parks and Monuments Association, Tucson, 1994.

Aztec Ruins National Monument, Southwest Parks and Monuments Association, Tucson, 1992.



MEETING BASIC NEEDS

BASIC NEEDS	PAST	PRESENT	FUTURE

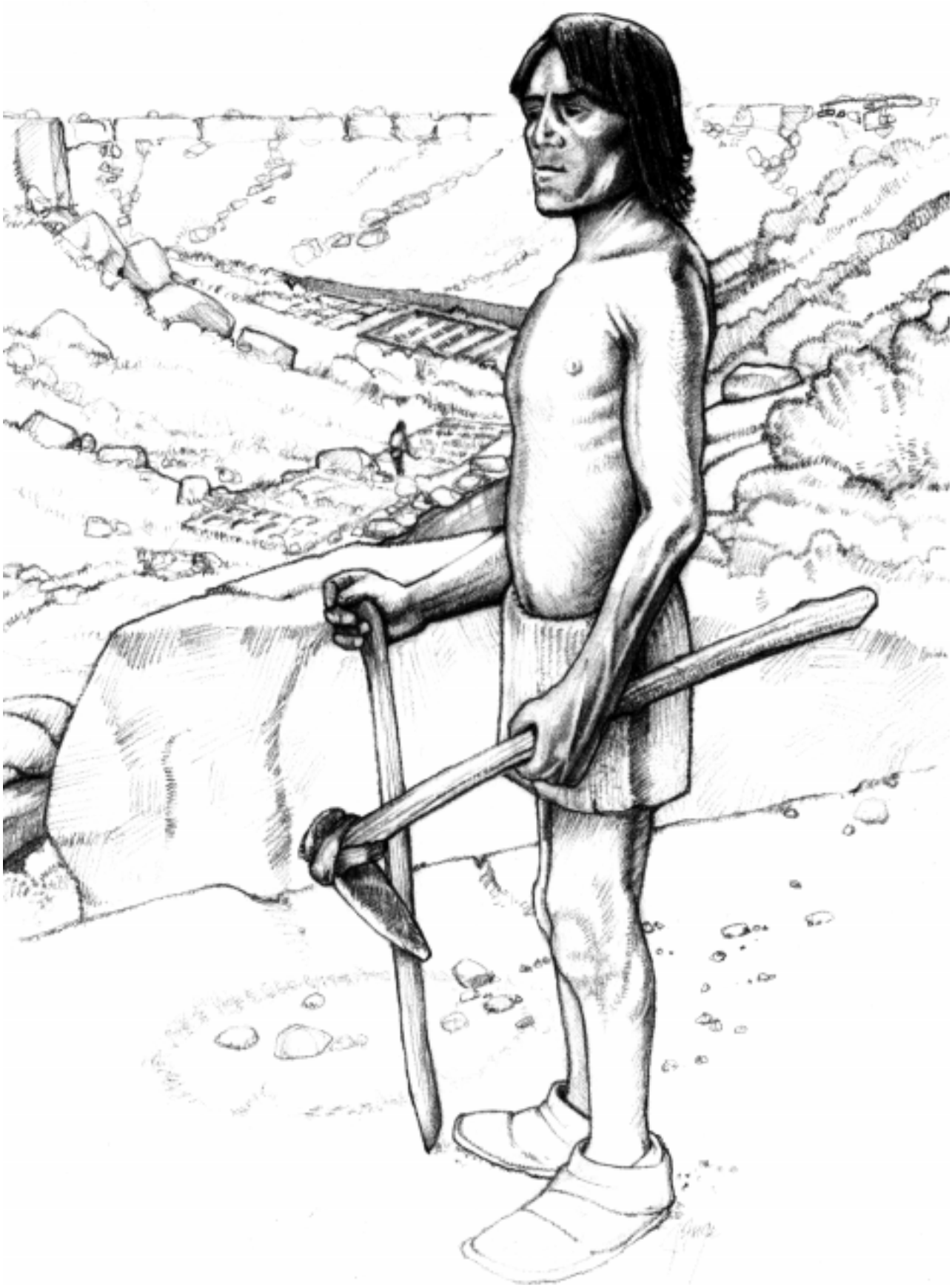


Figure from Vroman photo, circa 1900

The Life of an Artifact

Language arts, social studies

SKILLS.....Knowledge, comprehension, application, analysis, synthesis, evaluation
STRATEGIES.....Discussion, problem solving, writing, sequence, scientific inquiry
DURATION.....2 or 3 class periods
CLASS SIZE.....Any, but with a large class the artifacts may need to be shared

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OBJECTIVES

In their study of Ancestral Pueblo people, students will use the replica artifact trunk to:

1. Investigate the functions of artifacts.
2. Make observations about an artifact.
3. Derive inferences regarding an artifact's construction.
4. Combine their observations, inferences, and knowledge into creative writing about the life of the artifact.

MATERIALS

- Trunk of replica artifacts from Aztec Ruins

VOCABULARY

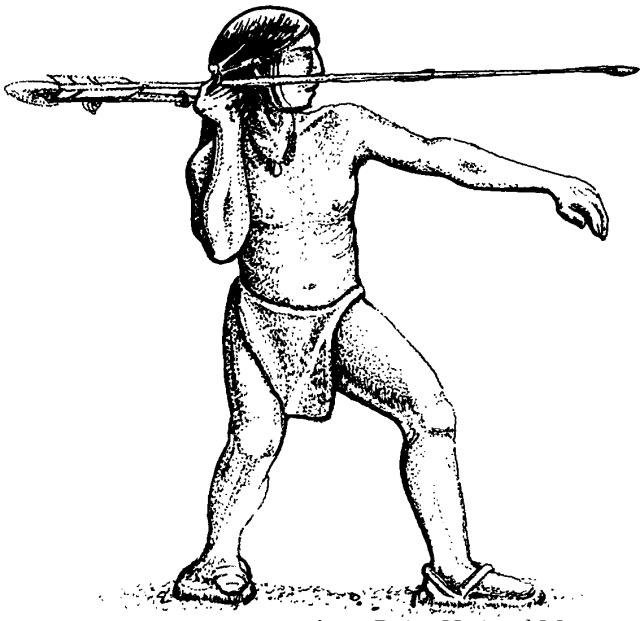
artifact: any object made or used by humans.

chronological order: an arrangement of events in the order in which they occurred.

hypothesis: a proposed explanation accounting for a set of facts that can be tested by further investigation.

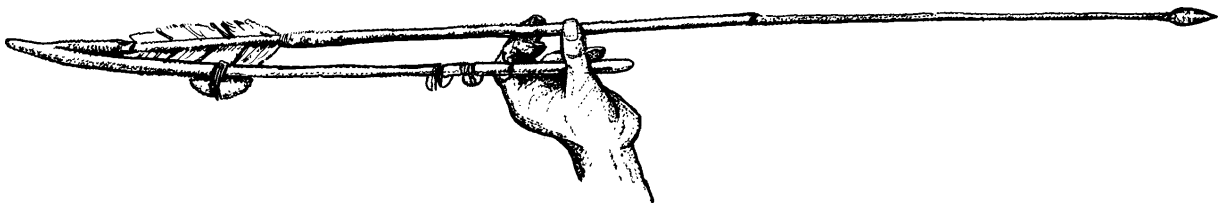
inference: a conclusion derived from observations.

observation: recognizing or noting a fact or occurrence.



Archeologists use observation and inference in the scientific method to help them answer questions about prehistoric peoples. When investigating artifacts, *observations* are statements that can be made based on what is directly observed. An *inference* is a conclusion derived from observations, but cannot itself be observed. An inference often comments about the behavior of the people who used the objects. For example, observation of a projectile point might include: it is sharp; it is black. Inferences might include: a man made this artifact; it was used to kill rabbits; it is made from stone from New Mexico.

A *hypothesis* is a chosen inference that the archeologist will attempt to confirm or disprove through testing. Example: If this projectile point was used to kill rabbits, we would expect to find microscopic traces of rabbit blood on it.



The idea of *chronology*, or arranging events in the order in which they occurred, is also important in trying to understand the past.

Ancestral Pueblo people created objects, or *artifacts*, that served their basic needs, using the resources available to them. These needs are similar to those we have today, such as the need for food, clothes, tools, medicine, shelter and protection from the elements. Over time they changed the form of their artifacts to better suit their particular needs. For example, earlier Ancestral Puebloans used tightly woven or pitch-sealed baskets to cook their food. They could not place the baskets directly over the fire, but they could drop hot rocks into the liquid, replacing them with others as they cooled. The introduction of pottery made cooking much easier, because they could place ceramic vessels directly over the fire. The form, construction techniques, design, and styles of pottery also changed over the centuries, adapting to the particular needs and preferences of the people.

Tools used for hunting is another example of artifacts that changed to fit needs. For several hundred years, the *atlatl*, or spear thrower, was used widely for hunting. Later, the bow and arrow were introduced, and proved to be superior to the atlatl in speed, portability, and accuracy. The use of the atlatl then declined.

In the making of these artifacts, Ancestral Pueblo people may have shared an attitude similar to some of their descendants. Today, some Puebloan peoples believe that artifacts are living beings with spirits. With this belief, an artifact would be born when it is made, live while it is in use, and eventually die. Artifacts may have held special powers by virtue of their uses, their users, materials they were made from, and locations in which they were made or used. For some, the spiritual activity of creating an artifact is more important than the product that is created; the process aligns the maker with the greater movements of the universe.

SETTING THE STAGE

1. Discuss an invention that makes life easier for us today. Someone created it to meet a specific need. In the same manner, the Ancestral Pueblo people created objects to meet their particular needs. Brainstorm some of those needs. Examples: the need for food, clothes, tools, medicine, shelter, and protection from the elements.

2. What conveniences do we have today that people did not have 100 years ago? Examples: electric toothbrush, electric pencil sharpener, food processor, computer, telephone, automobile. How did these conveniences come to be? In a similar fashion, over time the Ancestral Pueblo people developed and used new tools that served their particular needs more efficiently and effectively. Share the examples of pottery replacing baskets for cooking, and bows and arrows replacing the atlatl.

PROCEDURE

1. As a group, quickly view each replica artifact in the trunk. Students will infer their construction and investigate their functions and occurrence at Aztec Ruins later in the lesson.

2. Divide students into pairs or small groups and randomly distribute the artifacts among them, or have each student select an artifact from the trunk by a fair method, such as by drawing a number.

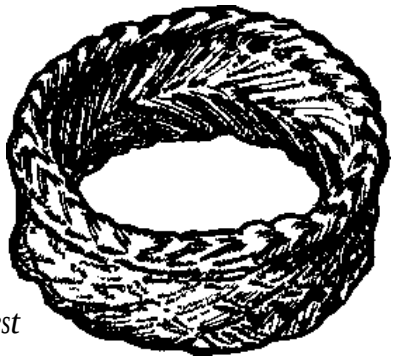
3. Review the terms *observation* and *inference*. Students write observations about the artifact. Examples: it is long; it is made of wood; it is sharp.

4. Without dismantling it, students scrutinize the object to infer how it was made. They then write inferences about its construction on their paper. Examples: the wood was soaked and straightened; a man chipped the point in an hour.

5. Students infer how their object was used. The teacher then shares background information included in the replica trunk regarding the inferred use of the artifacts and their occurrence at Aztec Ruins.

6. Students pretend that they are the object, assuming its perspective. Using first person ("I"), students combine their observations, inferences, and knowledge into a story that creates a “life” for the artifact. Examples: "I began my life as a rock," or "I was once just grass blowing in the wind." Remind students about chronological order. Tell them to not reveal the name of the artifact being described, but to paint a clear picture of the possible steps taken to make it. Students may want to include their interpretations of how the user related to the artifact in a personal manner.

7. After students complete their stories, shuffle stories and distribute them to students randomly.



Pot rest

CLOSURE

1. Divide students into pairs. Each pair will evaluate the paper they each received and determine the artifacts it describes.

2. Each student reads aloud the paper received, and tells what artifact it describes. The writer of the story verifies the reader's guess of the artifact's identity. Students whose artifacts were guessed incorrectly are able to learn what went awry in their writing through peer and teacher feedback.

3. Compare students' stories with background information from the trunk regarding the artifacts' construction.

EVALUATION

Students are evaluated on observation and inference worksheets, and skill in writing their stories.

EXTENSIONS

1. Imagine that the ancient people had newspapers. Write a simulated newspaper article describing the invention of this particular artifact.

2. Students research and report to the class about the time period, area, resources, and people from whence the artifact came. Students could research further its particular occurrence and use at Aztec Ruins.

3. Make this a verbal exercise whereby the student conferences with the teacher only, or verbally shares his/her ideas with the class as opposed to putting it in writing.

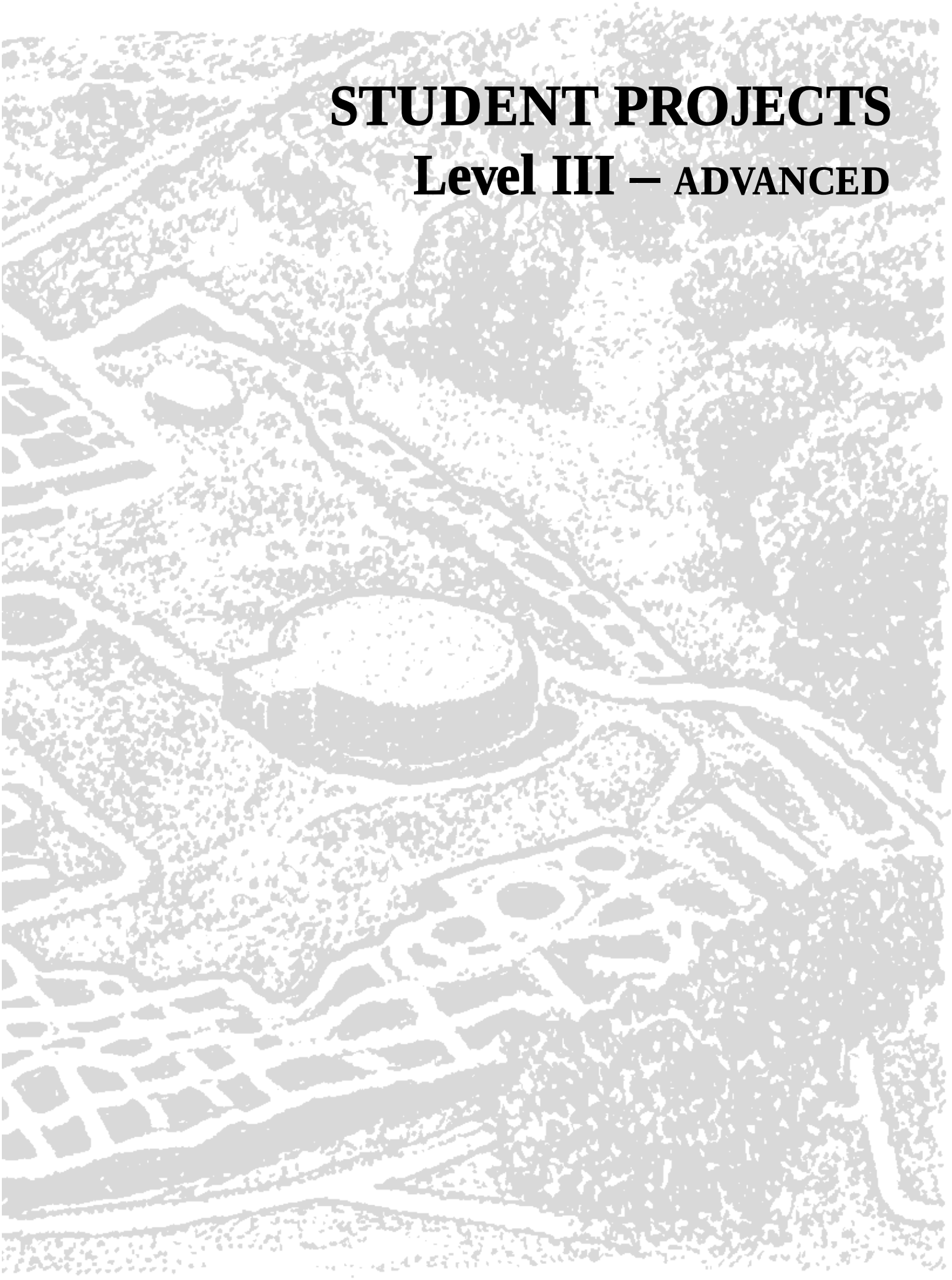
4. Students tape record the assignment and allow an aide or student helper to put the recording on paper.

5. Students create a *hypothesis*, or testable inference, about the construction of their artifact. Students test the hypothesis by attempting to recreate the artifact at home.

REFERENCES

Barnett, Franklin, *Dictionary of Prehistoric Indian Artifacts of the American Southwest*, Northland Printing Company, Flagstaff, 1991.

STUDENT PROJECTS
Level III – ADVANCED



Investigating Great Houses

Math, social studies, science, language arts

SKILLS.....Knowledge, comprehension, application, analysis, synthesis, evaluation
STRATEGIES.....Scientific inquiry, decision making, problem solving, writing
DURATION.....2 class periods, 3-hour field trip to Aztec Ruins
CLASS SIZE.....Any, groups of 4 or 5

OBJECTIVES

In their study of the application of the scientific method to a question about building the West Ruin, students will:

1. Form a hypothesis, and develop a procedure to test it.
2. Make observations to test their hypothesis.
3. Make inferences regarding the behavior of the Aztec builders.
4. Evaluate the hypothesis.
5. Compare and evaluate the effectiveness of procedures used to test a hypothesis.

MATERIALS

- Approximately 150 dominoes, Legos®, or similar rectangular solids for each 4-5 person team; store in ziplock bags
- 2 12-foot tape measures
- Calculator (optional)
- "Map of West Ruin" HANDOUT

VOCABULARY

data: information, especially information organized for analysis.

great house: large pre-planned multi-room structure surrounding a plaza.

hearth or firepit: a stone- or plaster-lined pit used for containing fire.

hypothesis: a proposed explanation accounting for a set of facts that can be tested by further investigation.

inference: a conclusion derived from observations.

kiva: room with distinctive features, usually underground, probably for ceremonial use; similar structures are still used by Pueblo people today.

mealing bin: a pit, usually rectangular and slab-lined, in which metates were set for use.

observation: recognizing or noting a fact or occurrence.

pithouse: dwelling excavated in the earth.

BACKGROUND

Archeologists call the large multi-story structures found at Aztec Ruins and other places "great houses." They consisted of multiple stories surrounding a flat open plaza, with exterior earthen berms, mounds, middens, and roadways defining access and enhancing their appearance. Great kivas, large subterranean kivas that were probably used for community-wide activities, are frequently associated with great houses. The area within Chaco Culture National Historical Park was the center of this style of architecture and contains many of these buildings that have anywhere from 100 to 700 rooms. Throughout the northern part of the Southwest, the appearance of great houses suggests the widespread influence of the people of Chaco Canyon.

At the same time people in the Southwest built great houses, they also built other structures they used for habitation. Some consisted of one or two rows of interconnected rooms in a single story, while others were multi-story buildings of hundreds of interconnected rooms.

We can see some of these large pueblos tucked into cliff overhangs in national parks and monuments such as Mesa Verde National Park in Colorado and Navajo National Monument in Arizona. In other areas in the Southwest, builders placed them on mesa tops or river valleys near dependable water supplies.

The great houses differ from the large buildings at Mesa Verde in that they required a greater degree of planning, followed a consistent layout, and required more energy to build. Constructing one was not just a matter of stacking single story residential style rooms.

Great house rooms are usually larger, the walls higher and thicker, and the masonry more intricate – requiring more materials and labor. Locating, transporting, preparing, and placing the stones, timbers, and mortar for such a massive job required well-organized teams of workers. Archeologists think that builders constructed major sections of great houses as single projects, reflecting the need for prior planning.

In early years, archeologists assumed that great houses were built to house a large community of people. But because of their monumental scale, the planning required, and the great energy invested in building them, they now suggest that the people built them primarily as public buildings – for ceremonial, administrative, and/or trading functions.

The largest of the great houses at Aztec Ruins is called the West Ruin. The interconnected rooms formed three stories in places and had about 450 rooms. The reconstructed great kiva is situated in the enclosed plaza.

Although the evidence is unclear, some feel that early in the building's 200-year period of use, a small number of caretakers lived in the structure year round, with periodic influxes of people using it for ceremonies or other purposes during certain times of the year. Later in its history, people modified the building and used rooms for a variety of purposes, including work areas, storage, tombs, middens, rituals, and latrines. Some archeologists believe in these later years that they used the building to a certain extent for habitation, while they also built small houses adjacent to its exterior for that purpose. In addition, nearby they lived in masonry structures of 10 to 50 rooms as they had throughout much of Aztec's history.

Like other scientists, archeologists use the scientific method to help answer questions about the great houses and their builders. The scientific method begins with a question such as "Why did they build the great houses?" A *hypothesis* is a proposed explanation to the question and it can be tested by further investigation. It is based on observable facts gained through prior knowledge and experience. A hypothesis for this particular question could be: "If the scale of construction demonstrates a large investment of energy, then the great houses were built for reasons other than habitation." Archeologists undertake a procedure to test the hypothesis. Based on the testing, they accept, reject, or revise the hypothesis. They may also make additional *inferences*, or conclusions derived from observations and testing.

An archeologist must use accurate data and a good procedure to yield valid inferences. Early archeologist Earl Morris inferred a population of about 1000 people in the West Ruin based on a poor procedure and data. First, he determined the ratio of inhabitants to total number of rooms in an occupied pueblo of the time. Morris then applied that ratio to the total number of rooms in the West Ruin. Morris incorrectly assumed that the building functioned primarily for habitation as in modern pueblos, and so inflated the population estimate through making an invalid comparison.

A more accurate procedure is to count the number of rooms in the West Ruin that contained hearths or mealing bins – which indicated a living area for one family group. For the West Ruin, mealing bins and hearths were overlooked, undiscovered, or poorly reported, thus leaving archeologists with little data on which to base estimates of how many people used the building as habitation. Nonetheless, if the West Ruin follows the pattern present in most great houses of very few hearths and mealing bins, then we would not expect to find a large population actually living in the rooms – perhaps only between 100 and 300 people or fewer, depending on the time period.

SETTING THE STAGE

Brainstorm with students and write responses to the following question on the board:

What are examples of public buildings we have today?

Examples: post offices; performance halls; courthouses; shopping malls; schools and universities; museums; churches; airports and train terminals; monuments and visitor centers.

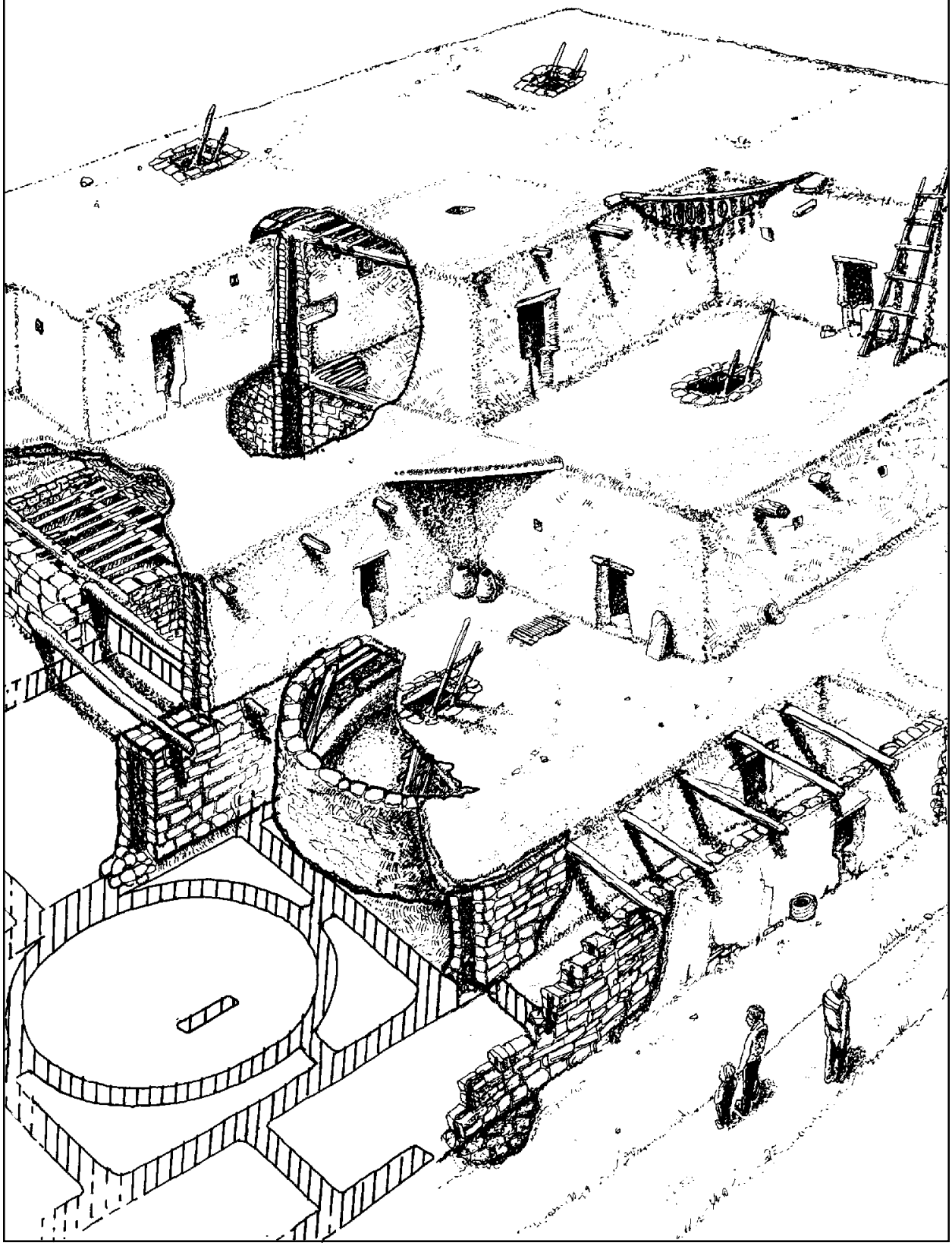
Share BACKGROUND information regarding the West Ruin and great houses, their characteristics, occurrence, and recent archeological thought regarding their function. Emphasize their primary purpose as public buildings, not as habitations.

Write the following research question on the board:

Did the builders of the West Ruin save materials and labor by joining rooms in multiple stories?

Explain to students that they will attempt to answer this research question by forming and testing a hypothesis. Have them write the question in their notebooks.

Artist's reconstruction of northeast corner of West Ruin



PROCEDURE

1. Briefly review steps and concepts in the scientific method: research, question, observation, hypothesis, procedure, inference.

2. Students write a possible hypothesis that addresses the research question in their notebooks under the heading "hypothesis." It should be in the form of an explanation that can be tested. To help them develop it, suggest that they draw on their prior knowledge, experience, and observations of places like Aztec Ruins. Example: If the builders stacked rooms in stories so that they shared walls and floor/roofs, then they used fewer materials per room and less labor than in building single-story rooms.

3. Distribute dominoes or Legos® to work groups. Students write the heading "Procedure" in their notebooks, with a subheading "data." Students carry out a procedure to test the hypothesis in the classroom. This may involve constructing models of single-story and multi-story rooms of shared walls and ceiling, and recording the number of blocks used for each. Students may expand their model both horizontally and vertically to experiment with use of the materials. Record results in student notebooks.

4. Discuss the data from students' model building. Review the meaning of "inference." Based on the data suggested by the model-building, discuss possible inferences about prehistoric building behaviors.

5. Explain the assignment for the field trip to Aztec Ruins. Distribute the "Map of West Ruin" HANDOUT to each work group. Show students the areas on the map where they will conduct their research:

   - Students will test the hypothesis by comparing amounts of materials used in single story rooms to those in multi-story rooms in the West Ruin. They will measure the height, width, and thickness of walls in both single story and multi-story rooms.

   - Students record their measurements under the "data" section of their notebook.

   - Students also make observations that will help them test the hypothesis. Compare materials and construction of the single-story structures with multi-story structures. For instance, are the stones smaller and/or better dressed in one than the other? Do the mortar types vary? Do the types of stone differ? Do wall widths differ? Students record their observations under a heading marked "observations."

   - Students need to consider and record observations regarding the condition and completeness of the walls.

6. Take the field trip and complete the assignments.

7. While on site, discuss the observations and data the students collected. Compare them with the data from the pre-field trip model-building exercise. Discuss possible explanations for discrepancies. Discuss the implications of using a good procedure based on valid information when using the scientific method (research the real thing, otherwise you will have worthless data upon which to base the evaluation of the hypothesis and drawing of inferences.) Discuss Earl Morris' population estimate from the background information as an example of using a poor procedure.

8. Based on the data yielded by the procedure and the observations made, students write at least one inference under the heading "Inferences" in their notebook. Discuss. Examples: the builders of the multi-story buildings made the walls thicker to support the added weight of the upper stories. The builders used materials that would allow them to build the fastest way possible. The builders wanted to impress other people with the size of the building.

9. Evaluate the original hypothesis developed in PROCEDURE 2. Accept, reject, or revise as necessary.

CLOSURE

Review the specific steps in the scientific method and how they were applied in this lesson. Students discuss their results in view of the original question: Did the builders of the West Ruin save materials and labor by joining rooms in multiple stories? As a final entry in their notebooks, students consider their experiences on their field trip and write a question about Aztec Ruins that might be answered by the scientific method.

EVALUATION

Teachers evaluate students' participation in discussions and the thoroughness and neatness of their notebook entries.

EXTENSIONS

1. During closure, ask students to consider how their question about Aztec Ruins might be answered by writing a hypothesis and a procedure for testing it.

2. To shorten the lesson, omit OBJECTIVE 5 and steps 3, 4, and the portion of 7 that use and evaluate the model building procedure in the classroom.

3. Students research Chacoan great houses and the structures found in cliff overhangs at Mesa Verde National Park. Create written lists comparing and contrasting the two, focusing on the architecture and functions of the buildings. Challenge the students to brainstorm hypotheses that explain why people began building the larger multi-story buildings in each place.

4. Add additional math elements by having students complete the “Prehistoric Buildings” WORKSHEET included in the “Impacts on the Environment” lesson.

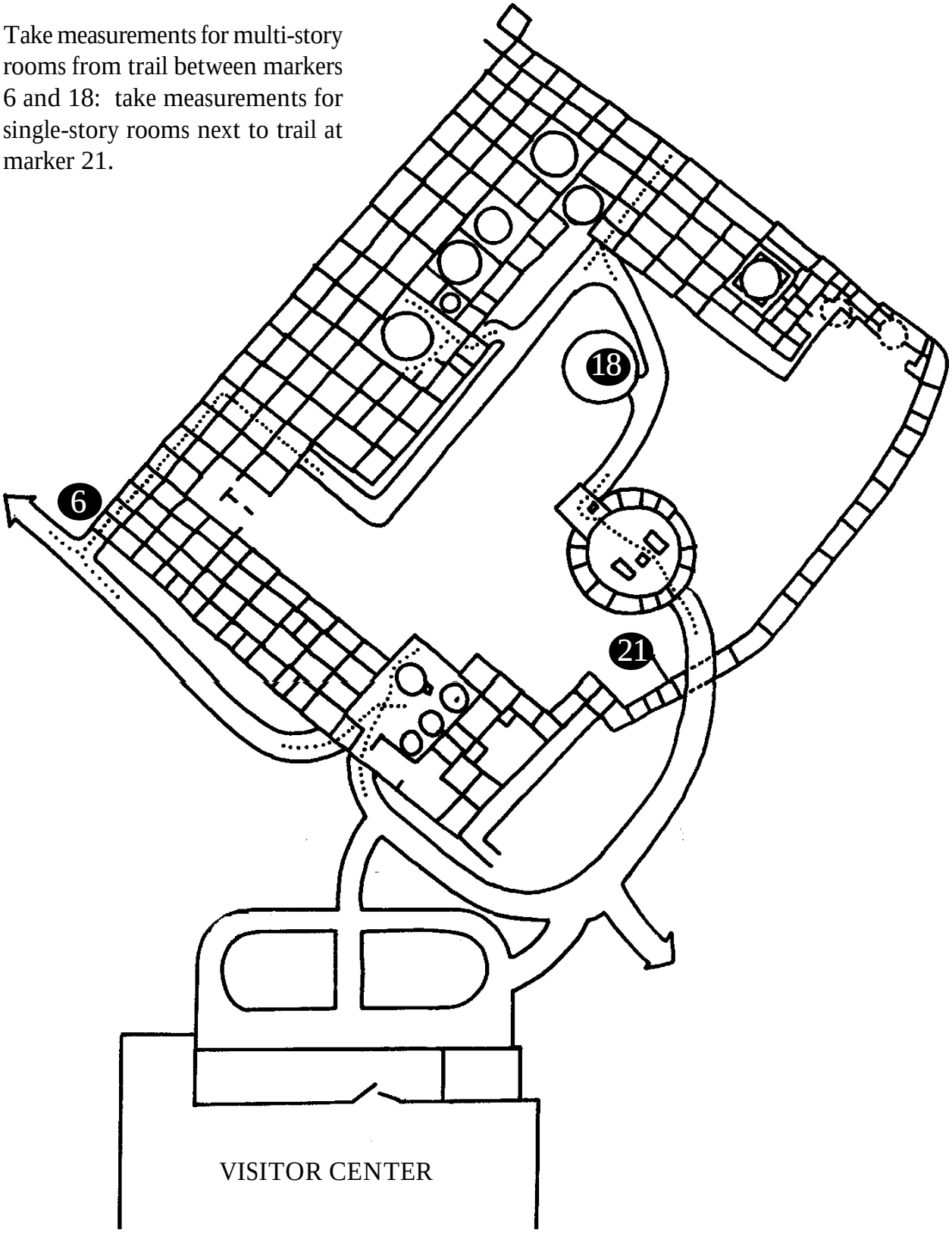
REFERENCES

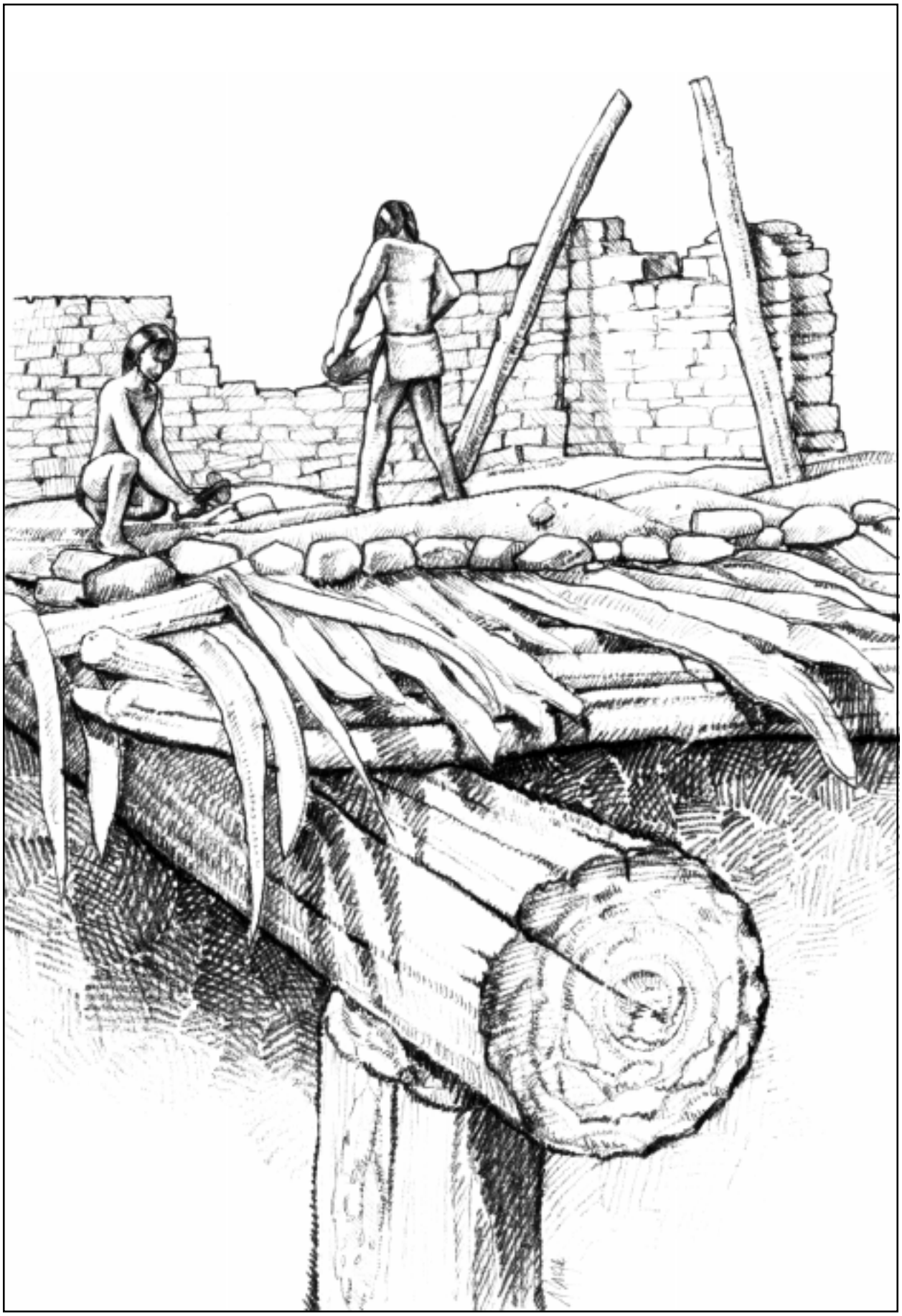
A Trailguide to Aztec Ruins, Southwest Parks and Monuments Association, Tucson, 1994.

Lekson, Steve, et al., *The Chaco Canyon Community,* Scientific American, Vol. 259, No. 1, pp. 100-109, July 1988.

MAP OF WEST RUIN

Take measurements for multi-story rooms from trail between markers 6 and 18: take measurements for single-story rooms next to trail at marker 21.





Raising the Roofs

Math, social studies, science, language arts

SKILLS.....Knowledge, comprehension, application, analysis, synthesis, evaluation
STRATEGIES.....Classification, discussion, problem solving, research skills, scientific inquiry, using scale
DURATION.....2 class periods, 2- to 3-hour field trip to Aztec Ruins
CLASS SIZE.....Any; in groups of 2 or 3

OBJECTIVES

In their study of prehistoric roofs at Aztec Ruins, students will use the scientific method to:

1. Draw a map of a prehistoric roof in the West Ruin, labeling materials used, and using compass, measuring tape, and graph paper.

2. Investigate the origin of and materials used in prehistoric roof construction.

3. Test and assess a hypothesis that helps answer a question about roof construction.

MATERIALS

- Graph paper, metal tape measure, ruler, compass, pencils, and step stools for each student group
- Maps of the Four Corners region
- Topography maps

Optional

- CD-ROM program "U. S. Atlas," found on *Mindscape For Multimedia* for IBM PC and compatibles
- Computer with CD-ROM drive, drawing program, and word processor

VOCABULARY

classification: systematic arrangement in groups or categories according to established criteria.

data: information, especially information organized for analysis.

dendrochronology: determining the age of a tree by counting its rings; the study of tree ring dating.

hypothesis: a proposed explanation accounting for a set of facts that can be tested by further investigation.

inference: a conclusion derived from observations.

juniper splints: thin layers of juniper placed above the latillas and below the dirt layer on a roof.

latilla: cottonwood or aspen pole placed above the vigas and below the juniper splints in a roof.

viga: a log of spruce, Douglas fir, ponderosa pine, or juniper used as the primary support beam for a roof.

BACKGROUND

This lesson, as presented, may be too complex for lower grades. Teachers can simplify and reduce the time needed by undertaking just a portion of the lesson, or by omitting computer use. Refer to number 4 in EXTENSIONS *at the end of this lesson for ideas on how to use portions of this plan.*

Archeologists answer questions about people who lived in the past. They use the scientific method to guide them in their research. It involves observation, inference, hypothesis development, and procedures to test the hypothesis. After making observations based on what an archeologist can readily see, he/she proposes *inferences*, or reasons, to account for an observation. A *hypothesis* is an inference that the archeologist chooses to confirm or disprove through testing.

This lesson guides students through testing and evaluating a hypothesis that addresses this research question about roof construction: "How much time and energy did the people at Aztec invest in constructing the roofs?"

Although there could be many ways in which an archeologist might go about answering this question, he/she would need to make some initial observations and inferences, and then develop a hypothesis. A hypothesis chosen for testing in this lesson is: "If the wood used was not available in the local area, then builders must have transported it."

He/she would conduct research to test the hypothesis. Part of the research would involve investigating and classifying the materials they used into species of wood, size, and amount used, and observing how they were used in construction. He/she would need to determine the likely source of the wood, then classify the wood into categories of "easy to obtain" (locally available, easy to use, easily transported) or "difficult to obtain" (not locally available, difficult to transport.) Based on the research, he/she could reject, accept, or revise the hypothesis, and evaluate its relevance to the original research question.

The interpretive trail at Aztec Ruins passes through several rooms in the West Ruin with intact original roofs, where we can observe details of construction, determine amounts of material used, and identify wood species. The science of tree-ring dating, or *dendrochronology*, not only enables archeologists to identify wood species, but also helps determine cutting dates for some species of wood, such as fir, Douglas fir, spruce, and sometimes ponderosa pine and juniper. Cottonwood and aspen rarely yield cutting dates. Cutting dates and species identification can tell archeologists the years and seasons in which wood was collected, how often structures were repaired, and how far builders traveled to obtain wood.

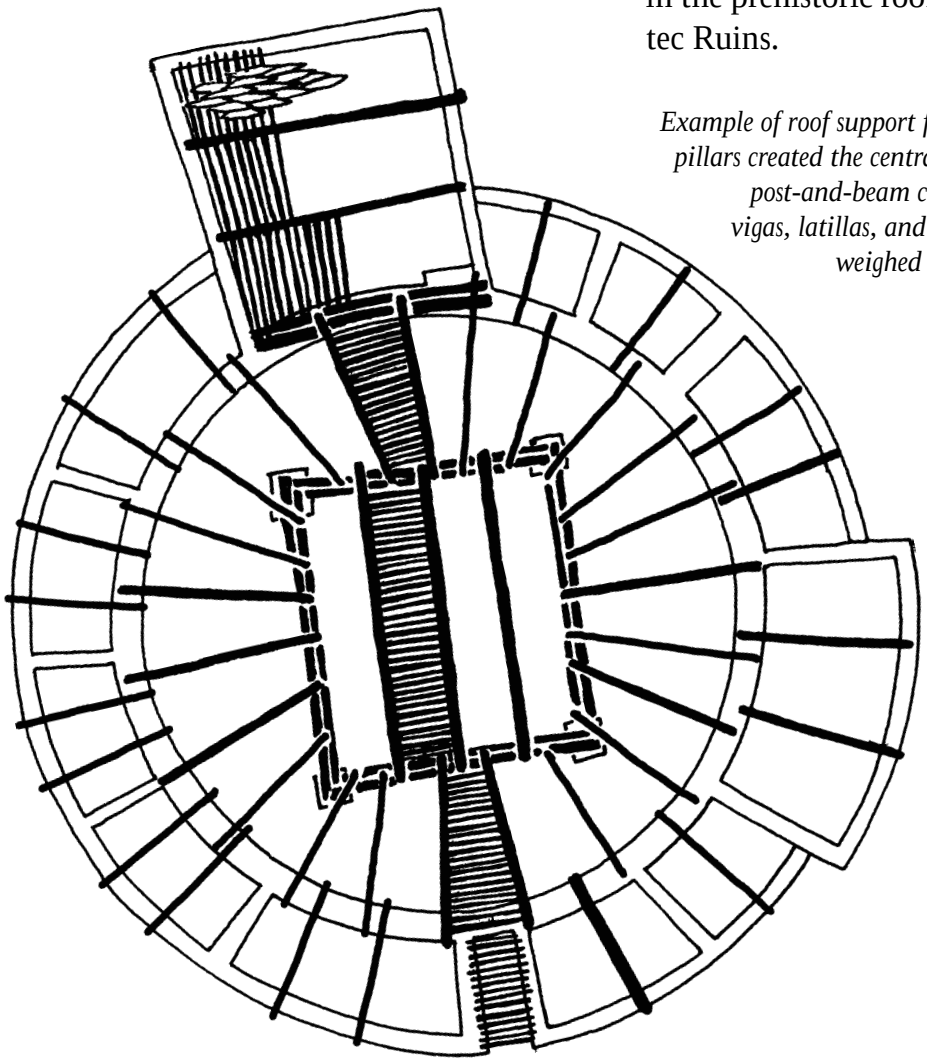
Analysis of wood samples shows that builders used various species of wood in roof construction. The large support beams, or vigas, are of fir, Douglas fir, spruce, and sometimes ponderosa pine or juniper. The smaller poles above the vigas, called *latillas*, are made of either cottonwood or aspen – scientists are unable to tell which because they are so closely related. Above the latillas are short sections of split juniper, called *juniper splints*. These are in turn covered by packed dirt, which serves as the floor of the room above.

Both juniper and cottonwood could have been obtained nearby. However, other species grow in moister, higher elevations, and would have been transported from at least 20 miles away, depending on the species.

Transporting wood from distant sources was a challenge. Most archeologists believe that the wood was carried by hand, because there is no evidence for wheeled carts or beasts of burden. Some believe logs were floated down rivers, while others believe this was impractical. There are remnants of "roads" running far across the region in straight lines and connecting major sites – but their function is uncertain. Some archeologists suggest that they were used as routes for hauling wood.

SETTING THE STAGE

1. Ask the students to look up at the classroom ceiling and observe and name the materials used for its construction.
2. Pose the question: "How much time and energy did the builders invest in constructing this roof?" Using the background information as a guide, make observations about the roof construction, and discuss possible classification of the roof materials to help answer this question. Examples: easy to obtain, hard to obtain, easy to use, difficult to use.
3. Tell students that they will conduct field research at Aztec Ruins and work with a hypothesis to help answer this question: "How much time and energy did the builders invest in constructing the roofs?" Share the background information with the students regarding the diversity of species used in the prehistoric roof construction at Aztec Ruins.



Example of roof support for great kiva. Four large pillars created the central square. Radial pattern post-and-beam construction supported the vigas, latillas, and juniper splints. The roof weighed an estimated 90-95 tons.

PROCEDURE

1. Divide the class into several teams of three to six students.

2. Distribute graph paper, compass, ruler, and measuring tape to each team. If step stools are available, distribute one per team.

3. Take the field trip and complete the following assignments. First, show students the vigas, latillas, and juniper splints on the visitor center ceiling to make sure they can identify them.

   - Each team chooses a room on the interpretive trail that has a roof.

   - Each team uses the tools given to them to draw a map of the roof. Use the compass to orient the roof in the proper direction. Use the tape measure to measure and record the size of the room, length and size of the logs, and spaces between logs.

   - Use a legend to label the vigas, latillas, and juniper splints on the map.

4. Write the research question on the board: "How much time and energy did the people at Aztec invest in constructing the roofs?" Share the BACKGROUND information relating to archeologists' use of the scientific process, and review the definition of a hypothesis.

5. Introduce the following hypothesis that can help answer this question: "If the wood used was not available in the local area, then builders must have transported it."

6. Ask the students to suggest ways they can prove or disprove the hypothesis. Examples: determine which wood species used to grow in the local area; determine if enough of a species grows in the local area.

7. Review the background information regarding the different wood species used in roofs. Students research the environmental conditions (altitude, precipitation, soils) under which each species naturally grows.

8. Students use reference books to infer the closest origin for each species of wood used in the roof construction. If a computer is available, access the program "U.S. Atlas" on *Mindscape* CD-ROM to research the information.

9. Based on the research, classify the wood types into categories of "difficult to obtain" and "easy to obtain," where easily obtainable materials would be available within a five-mile radius.

CLOSURE

Review the hypothesis. From the research conducted, evaluate it. Revise the hypothesis if necessary. Discuss the extent that research of the hypothesis helped answer the original question, "How much time and energy did the people at Aztec invest in constructing the roofs?"

EVALUATION

Students are evaluated for their maps and participation in class discussions.

EXTENSIONS

1. Using their maps of the roofs, students determine the number of linear feet of each species needed for the construction of their roof. Discuss as a class, or in small groups of students, how much wood was required for building the entire structure. (There are about 450 rooms in the West Ruin, each requiring a roof.)

2. On a computer, students make a representation of their roof using the draw program.

3. Make inferences regarding how wood for the vigas were transported from higher elevations to the building area. Example: wood was carried using wheeled carts over roads, logs were floated on rivers. Develop a testable hypothesis from one of the inferences, then discuss the research needed to help test it. Example: If the builders transported them via rivers, then the logs should show evidence of wear from being knocked by other logs as they traveled down a river. Test by closely examining vigas for evidence of this kind of wear.

4. For lower grade levels or teachers less experienced in scientific inquiry, use portions of this lesson as separate lessons. For example, one lesson could focus on mapping a modern ceiling and a prehistoric ceiling (OBJECTIVE 1, PROCEDURES 1-3). Another lesson could investigate the origin and transporting of roof materials (PROCEDURES 7-9, EXTENSION 3). To shorten further, share the background information regarding environmental conditions under which different species grow instead of having students research this. Another lesson could focus on roof construction and computer simulation (PROCEDURES 1-3, EXTENSION 2).

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Lekson, Steve, et al., The Chaco Canyon Community, *Scientific American*, Vol. 259, No. 1, pp 100-109, July 1988.

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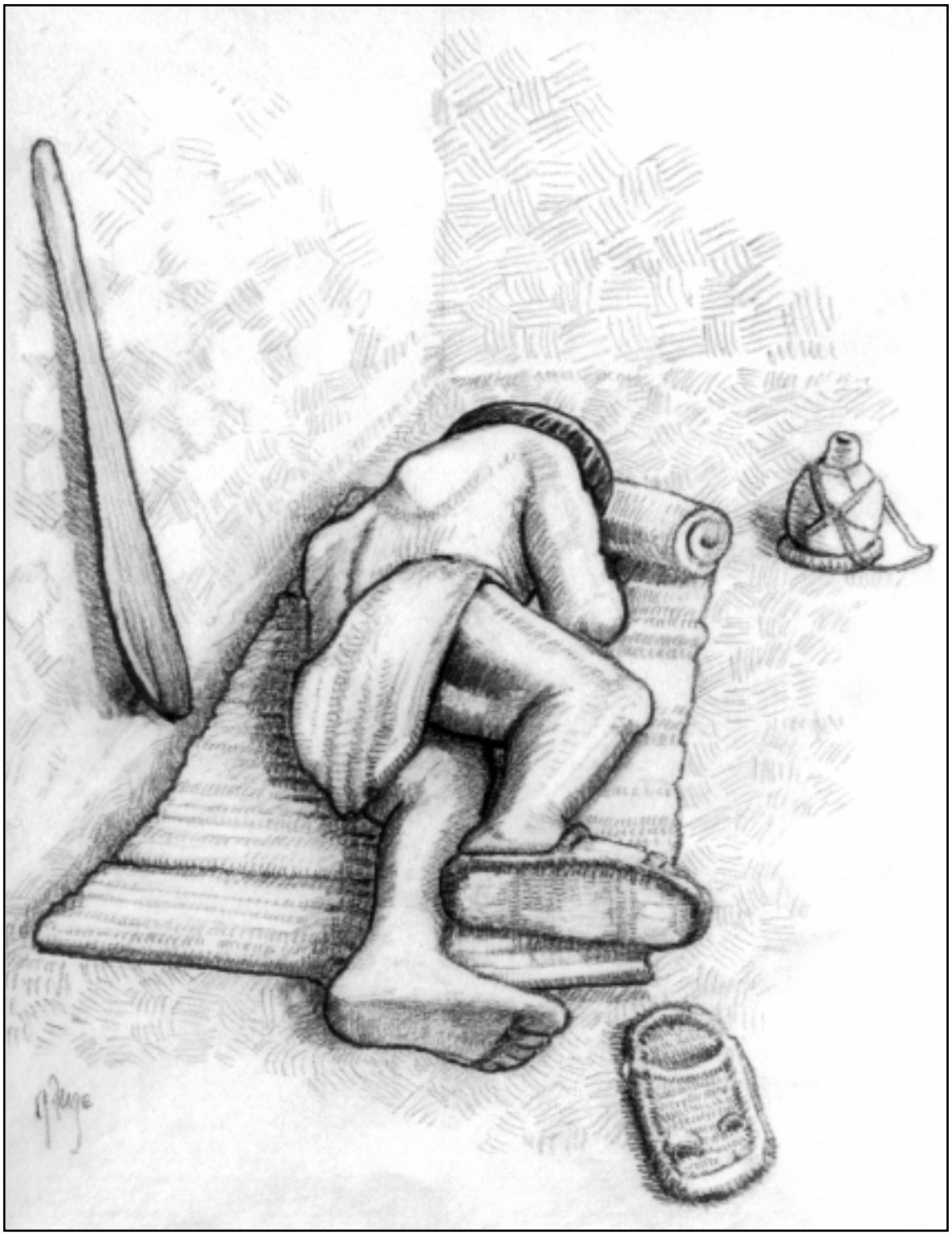


What Happened Here?

Language arts, social studies, science

SKILLS.....Knowledge, comprehension, application, analysis, syntehsis, evaluation
STRATEGIES.....Discussion, categorizing, decision making, writing, problem solving, values clarification
DURATION.....2 class periods
CLASS SIZE.....Any

OBJECTIVES

In their study of archeological sites, students will use the trunk of replica artifacts to:

1. Categorize artifacts according to their use.

2. Hypothesize activity areas by placing artifacts within an imaginary site.

3. Assess the impacts of vandalism to the site.

MATERIALS

- Trunk of replica artifacts from Aztec Ruins National Monument
  Optional:
- Graph paper
- String for making a grid
- Measuring tapes

VOCABULARY

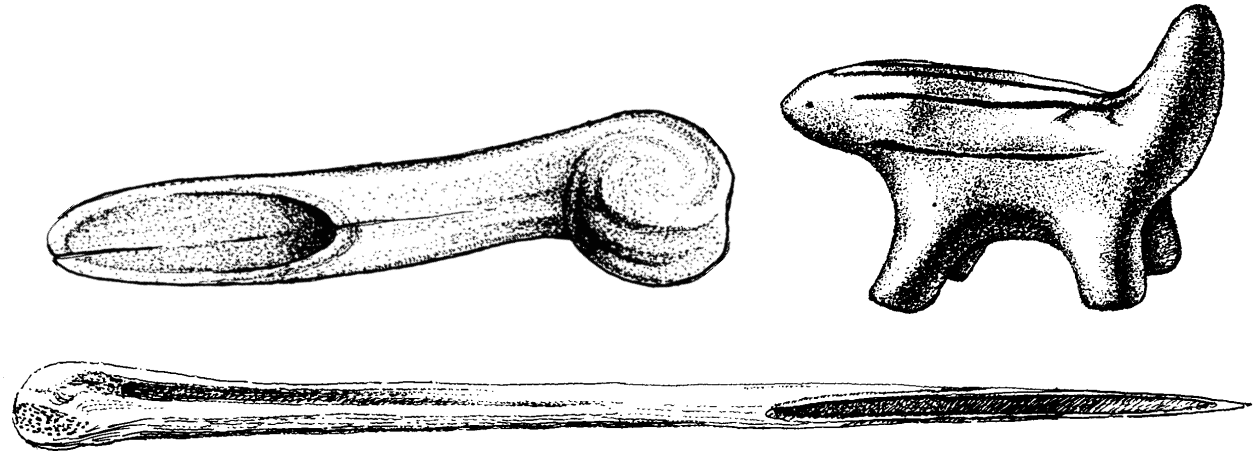
archeology: a method for studying past human cultures and analyzing material evidence (artifacts and sites).

archeological site: a place where human activity occurred and material remains were left.

artifact: any object made or used by humans.

context: the relationship artifacts have to each other and the situation in which they are found.

vandalism: willfully or maliciously defacing or destroying public or private property.



BACKGROUND

Teacher and students should have a firm understanding of the fundamental concepts of archeology before using this lesson. Basic concepts and lessons 1-8 presented in Intrigue of the Past *form the foundation of this lesson.*

Archeologists rely on surviving material remains from people of the past to answer questions about their behavior. The *artifacts* encountered and their *context*, or placement in relationship to everything else, can yield valuable clues for archeologists' interpretations of what activities occurred. Archeologists are careful to consider all artifacts and information when making inferences, rather than focusing on one or two artifacts to the exclusion of others. An artifact and its context may seem insignificant to an archeologist one day, yet could prove to be a crucial piece of information for another archeologist later.

It is important for archeologists to accurately and thoroughly describe their observations for the benefit of other archeologists. Archeological sites are frequently investigated many times by one or more archeologists.

Aztec Ruins has been repeatedly examined through the years. Archeologist Earl Morris, who headed the first excavations in the 1910s, made many inferences regarding the people who used the site based on the recovery of thousands of artifacts. However, because the science of archeology and its techniques were still in their infancy, Morris did not keep thorough records of the contexts of artifacts. He concentrated on recovering and describing artifacts that were beautiful and/or unusual, rather than noting contexts or describing common artifacts such as pottery sherds, discarded animal bones, and building materials.

His excavations have consequences for archeologists today, who attempt to answer questions about the people of Aztec Ruins based on his excavations. Incomplete or inaccurate records prevent them from reconstructing a full story of what happened at Aztec Ruins.

There were also instances of vandalism and theft, commonly known today as "pothunting," at Aztec Ruins. Early local people made their way into rooms, removing artifacts, altering walls, and thereby permanently changing the information available to us today. Sherman Howe, a local person who participated in one of these events as a schoolboy, later lamented the destruction of information that resulted from his group carrying away pottery, baskets, jewelry, sandals, mats, human remains, and other items. The treasure seekers dispersed the objects throughout the community, where they ended up in shoeboxes or on mantels, their stories lost, and their significance reduced to mere curiosities.

In recent years, Congress has passed stronger laws to protect archeological sites on federal lands. Most states have also passed laws protecting burials on both private and state lands. Penalties and fines for disturbing or removing items from these sites can be severe. Despite these laws, however, looting and vandalism remain a problem, especially in the Southwest where numerous sites are relatively well preserved, widely dispersed, and inadequately patrolled.

The descendants of the people who lived in this area – the modern day Pueblo peoples – also mourn the destruction of these sites, but for different reasons. Many express sadness, and even outrage, about their ancestors being disturbed. Many believe that when a person's burial is displaced, his or her spirit journey is interrupted. It is important to them that such remains, with accompanying funerary offerings, return to the earth at the site where they were buried so that their ancestors may continue their journey.

SETTING THE STAGE

Ask students to think about the different rooms in their home and the different activities that happen there, the kitchen and bedroom for instance. Name and compare some of those activities. Ask students to close their eyes and imagine that they are standing in an archeological site. How big is the site? What are the people doing?

PROCEDURE

1. Open the artifact trunk and arrange the artifacts on a table so that they are visible to the class.

2. Identify and categorize the artifacts according to their uses. Group the different categories on the table. (To save time, the teacher may want to "pre-categorize" artifacts for the discussion.)

3. Clear an area in the classroom and circle the students around you, thereby delineating the "boundaries" of the site.

4. Pose the questions:

   What activities may have taken place here in this site?

   What area(s) of the site would be used for each activity?

   Students place the artifacts within the site where they would logically belong. They do not have to use all the artifacts in the trunk.

5. Students close their eyes while the teacher moves one or two artifacts to different, inappropriate locations within the site. Students then re-evaluate the site for illogical placement of artifacts. What might account for such placement? Examples: animal activity; vandalism and looting; construction activities. How might the misplaced artifacts affect an archeologist's interpretation of what happened there?

6. Students close their eyes while the teacher removes several artifacts. Ask students to identify which artifacts are missing (some may not be able to.) How would they know if artifacts were missing from an actual archeological site? How might missing items influence the interpretation of the site? Share the background information regarding Earl Morris' work and Sherman Howe's activities at Aztec Ruins.

7. Share BACKGROUND information on Pueblo peoples' feelings about the disturbance of their ancestral sites. Students write a short paper discussing the impacts of vandalism, both to the archeologist and to Pueblo peoples.

CLOSURE

Share the reports with the entire class. Review the basic concepts of archeology and how they were applied in this lesson.

EVALUATION

Evaluate students' papers and participation in discussions.

EXTENSIONS

1. The teacher may want to treat this lesson as two lessons. Concentrating on categorization of artifacts and their logical placement in a site could be the first lesson, and the importance of context and the impacts of vandalism could be the second.

2. Have students lay out a grid on the site, and draw the site on graph paper, carefully noting the placement of each object in relationship to others.

3. In teams, or individually, students write a report of their findings at the site, concentrating on how artifacts help archeologists decipher the behavior of those who lived there.

4. Students evaluate the thoroughness of another group's report of the site. Determine whether another archeologist has a complete picture of the site in order to make his/her own inferences.

5. Have the students write short stories from the point of view of an artifact that is vandalized or removed by looters from a site. In expressing the artifact's view, encourage students to incorporate aspects of how modern day descendants might feel, and to describe what might happen to the vandals and the stolen item when captured.

REFERENCES

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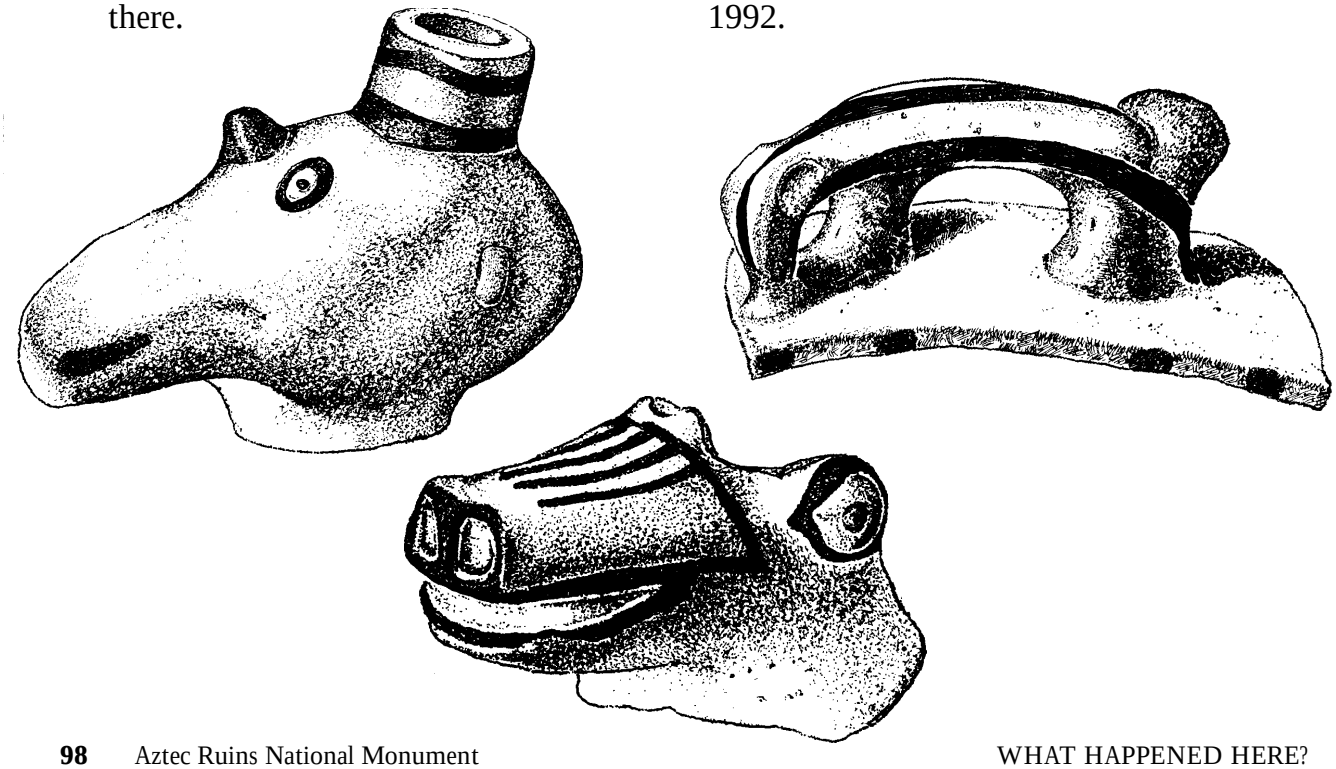
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