FLORIDA PUBLIC ARCHAEOLOGY NETWORK

Archaeological Technology

Students learn how modern archaeologists utilize excavation, carbon-dating, curation, and publication to develop our understanding of Florida's early people.

STUDENT LEARNING GOALS:
Students will understand the archaeological process and will be able to construct and excavate a model archaeological site.

SUNSHINE STATE STANDARDS ASSESSED:
Science

- SC.7.E.6.6 Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.
- SC.7.L.16.4 Recognize and explore the impact of biotechnology (cloning, genetic engineering, artificial selection) on the individual, society and the environment.
- SC.7.N1.1 Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
- SC.7.N.1.5 Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.
- SC.7.N.2.1 Identify an instance from the history of science in which scientific knowledge has changed when new evidence or new interpretations are encountered.
- SC.7.N.3.2 Identify the benefits and limitations of the use of scientific models.
- SC.8.E.5.10 Assess how technology is essential to science for such purposes as access to outer space and other remote locations, sample collection, measurement, data collection and storage, computation, and communication of information.
- SC.8.N.1.1 Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
- SC.8.N.1.3 Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.
- SC.8.N.1.5 Analyze the methods used to develop a scientific explanation as seen in different fields of science.
- SC.8.N.1.6 Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.
- SC.8.N.4.2 Explain how political, social, and economic concerns can affect science, and vice versa.

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Social Studies

SS.7.G.1.3 Interpret maps to identify geopolitical divisions and boundaries of places in North America.

SS.7.G.2.3 Explain how major physical characteristics, natural resources, climate, and absolute and relative location have influenced settlement, economies, and inter-governmental relations in North America.

SS.8.A.1.2 Analyze charts, graphs, maps, photographs and timelines; analyze political cartoons; determine cause and effect.

SS.8.A.1.7 View historic events through the eyes of those who were there as shown in their art, writings, music, and artifacts.

Language Arts

- LA.7.1.6.2 The student will listen to, read, and discuss familiar and conceptually challenging text.
- LA.7.4.2.2 The student will record information (e.g., observations, notes, lists, charts, legends) related to a topic, including visual aids to organize and record information, as appropriate, and attribute sources of information.
- LA.8.1.6.2 The student will listen to, read, and discuss familiar and conceptually challenging text.
- LA.8.4.2.2 The student will record information (e.g., observations, notes, lists, charts, legends) related to a topic, including visual aids to organize and record information, as appropriate, and attribute sources of information.

Visual Arts 6th-8th Grades

- VA.68.C.3.4 Compare the uses for artwork and utilitarian objects to determine their significance in society.

RESOURCES:

Ashley, Keith & Rolland, Vicki. "Where's the Corn in Peninsular Precolumbian Florida?" Presented at the 74th annual Society for American Archaeology Conference. Atlanta, Georgia, April 22-26, 2009.

"Augustine.com." 17 February 2012. <http://www.augustine.com/history/castillo/castillo5.php>

"Beyond Archaeology – Teaching Archaeology in the Classroom 2011" 29 March 2012. <http://www.flpublicarchaeology.org/resources/BeyondArtifacts2011.pdf>

Christensen, M. Hansen K. and Kutzke, H. "New materials used for the consolidation of archaeological wood –past attempts, present struggles, and future requirements" <http://www.woodculther.com/wp-content/uploads/2009/09/ChristensenMikkel.pdf>

"Difference Between Archaeology and Anthropology." 14 February 2012. <http://www.differencebetween.com/difference-between-anthropology-and-vs-archaeology/>

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Hamilton, Donny L. "Basic Methods of Conserving Underwater Archaeological Material Culture. <*http://www.history.navy.mil/branches/UA_%20Conserv.pdf*> *Nautical Archaeology Program, Department of Anthropology, Texas A&M University, Spring 1997.*

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McGee, Ray and Nodine, Bruce. "Sampling and Excavation Strategies at Hontoon Island (8-Vo-202) Florida. The Florida Anthropologist. Vol. 41, No. 1. March 1987.

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Purdy, Barbara. "Investigations at Hontoon Island (8-Vo-202), An Archaeological Wetsite in Volusia County, Florida. An Overview and Chronology." The Florida Anthropologist. Vol. 41, No. 1. March 1987.

Randall, Asa and Sassaman, Kenneth. St. Johns Archaeological Field School 2003-2004: Hontoon Island State Park. Technical Report 6. Laboratory of Southeastern Archaeology. Department of Anthropology. University of Florida. 17 February 2012. <http://www.anthro.ufl.edu/LSA/publications/LSATechReport6.pdf>

Richter, D., Mercier N., Valladas H., Jaubert J., Texier J, Brugal P., Kervazo, B., Reyss, L. Joron, L., Wagner G. "Thermoluminescence dating of heated flint from the Mousterian site of Be´rigoule, Murs, Vaucluse, France." <http://www.eva.mpg.de/evolution/staff/richter/pdf/07-Richter-J-ArchaeologicalSciences.pdf> Journal of Archaeological Science 34 (2007) 532e539.

"Upper Catawba Valley Archaeology." 17 February 2012. <http://www.unc.edu/~crodning/ctwbarch.html>

PICTURE SOURCES (Image URLs and Permissions):

Archaeologist screening artifacts, http://flpublicarchaeology.org/gallery/cache/wcrc/driftwood/driftwood-011_595.jpg, courtesy of the Florida Public Archaeology Network, West Central Region

Archaeologists screening with water, courtesy of the Florida Public Archaeology Network, Northeast Region

Excavation http://upload.wikimedia.org/wikipedia/commons/thumb/4/48/Iowa_archaeology_edgewater.JPG/220px-Iowa_archaeology_edgewater.JPG

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Excavation in Shell Midden with Archaeologists, courtesy of the Florida Public Archaeology Network, NE Region
Excavation in Shell Midden with Feature, courtesy of the Florida Public Archaeology Network, Northeast Region
Spanish Glass Beads http://www.missionsanluis.org/_images/hispanicVillage_beads.jpg

Photographs and illustrations without attribution were provided by Kelley Weitzel MacCabe.

MATERIALS LIST FOR "Constructing a Midden" LAB:
For each pair of students: 1 foil loaf pan (most are 8" x 4" x 2.3" deep) (20.3 x 10.2 x 5.8 cm).
For class: Midden materials you must include:

- 2-4 cups of yellow sand
- 8-10 cups of light gray soil
- 8-10 cups of dark brown soil
- 8-10 cups of crushed shell or small bits of shell
- small, broken pottery sherds
- ½ cup of dried kidney beans
- ½ cup of charred quinoa seed
- ½ cup of dried acorns
- ¼ - ½ cup of tiny glass beads

A selection (or all) of the following materials should be offered to students:

- tiny bits of stone debitage
- chips of bone
- larger pieces of shell (of more than one species if possible: whelk, oyster, clam, mussel, snail, coquina)
- ½ cup dried corn kernels, sunflower seeds in shell, pumpkin seeds in shell, or gourd seeds
- copper beads or wire
- tiny nails

Teacher Tips: ***For stone debitage***: *Try to find chipped aquarium gravel that is whitish-gray. This is inexpensive at pet stores and superstores.* ***For bone:*** *You can salvage poultry, pork, or beef bones from your meals. Remove all meat. Allow to dry completely. Shatter with a hammer. Please use safety glasses.* ***For pottery***: *Purchase a small pot, preferably unglazed and either gray or black. (Terra cotta color will probably be the easiest to find, however.) Shatter it with a hammer. If you can find two pots that will appear obviously different, even after shattering, provide both pots to the students, one labeled prehistoric, the other Contact Period.* ***For shells:*** *Look at the beach, (coquina are a great size, but larger shells are fine too). If you need to, you can purchase bags of shells at craft stores. Smash many of them, but leave at least 1-3 whole ones for use by each student team.* ***For beads:*** *Purchase tiny glass beads at craft stores.* ***For seeds:*** *Use the leftover bean and quinoa seeds from the Agriculture activities. Quinoa toasts to dark*

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brown or black in 3-4 minutes. See the Flotation Teacher Tips for more information on charring the seeds. Quinoa seeds must be charred, or they will not float up in the follow-up Flotation activity. ***For nails****: Purchased nails (which are obviously very different from 1500s Spanish nails) should be tiny. You can file or snip the points if you have safety concerns. Provide no more than one per student group.* ***For copper:*** *Both copper beads and wire are available inexpensively at craft stores. Prehistoric cultures in Florida traded for copper as a status item. They beat the copper pieces flat and engraved designs on them, or rolled the beaten copper into beads. The Building Technology unit shows some of the designs engraved on copper breastplates from the Mount Royal site in Putnam County.* ***For soil:*** *During test excavations, it proved very difficult to tell the difference between gray and brown soil. There simply wasn't enough light getting into the unit to differentiate the two colors. Consider using brightly colored sands instead of natural soils. Because sand particles do not stick together unless wet, you will need to moisten the midden (not soak it) after construction. Be sure to excavate it within a day or two so that the sand will remain moist. Covering the container with foil will help retain moisture.*

ANSWER KEY FOR "Constructing a Midden" LAB:
Students will answer the planning questions and record their methodology for constructing the midden. They will submit the answers to the questions for Prehistoric Midden Record and Historic Mission Record. These records will be used by the students who actually excavate the midden, to see how close their units came to accurately representing the entire site.

MATERIALS LIST FOR "Excavating a Midden" LAB:
For each pair of students: 1 model midden, 8-10 sandwich bags, a sharpie marker for labeling bags, 1 putty knife, 1' of string, 8 toothpicks, 1 metric ruler, paper and pencil for record-keeping, and a shoe box or similar stackable container for storing bagged artifacts. For class: Material to cover work surface (foil, wax paper, or newsprint). ***Teacher Tips****: Plan where you will store (curate) the boxes of artifact and soil bags for the duration of the excavation, screening, and flotation labs.*

ANSWER KEY FOR "Excavating a Midden" LAB:
Students will produce their Research Question for this excavation and an excavation plan (including sketch). They will submit bagged artifacts for each level of two different units along with the midden which should now have two excavated units with straight edges and bottoms. A sketch and/or digital photo of the strata should be included, along with a collection of observations made during excavation.

MATERIALS LIST FOR "Screening for Artifacts" LAB:
For each pair of students: Construction record for the midden they excavated, 3 screens (½", ¼", and 1/8"), 10-15 sandwich bags, a sharpie marker for labeling bags, paper and pencil for record-keeping. For class: Material to cover work surface (foil, wax paper, or newsprint).

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Teacher Tips: *Constructing screens for each student group will require a significant outlay of funds, perhaps $100. Please review the cost breakdown to decide if you wish to make fewer and have the students take turns with the equipment. ½" roll of hardware cloth: $10, ¼" roll of hardware cloth: $10, 1/8" roll of hardware cloth (available online, usually not at hardware stores) $25 including shipping, Ziploc 20 oz. disposable food containers, eight 5-packs $26, 1 roll of duct tape $5, 1 set of tin snips $15. The hardware cloth can't be bought in smaller units than what's listed above, so decreasing the number of screens you make will only save funds on the plastic containers, as well as construction time. Splitting the cost with other educators who wish to do this activity is a good option for cutting costs. Contact your regional FPAN office to see if they can offer any assistance.*

How to make a screen: Use an Exacto knife to (carefully) cut a 3" square window in the bottom of the container. Use tin snips to cut the hardware cloth into 3.75" x 3.75" squares. Wire cutters will work, but because the blades are so short, it makes the job more difficult – and you will be cutting a lot of hardware cloth. Invert the container. Place the square of hardware cloth on top. Ensure that no sharp points stick out past the edge. Use duct tape to secure the hardware cloth on all four sides. Use a sharpie marker to label the screen size on the container. Repeat so that each student team has one screen of each size. After use, brush all dirt and debris off of the screens. Ensure that they are completely dry. Store until you need them next year.

Bottom of 1/8" screen

Top of 1/8" screen

Dirt and artifacts in 1/8" screen

Screened artifacts

ANSWER KEY FOR "Screening for Artifacts" LAB.

Answers to screen test: Students will submit lists of materials recorded for each size screen. They will compare the lists and decide which screen is appropriate for use at this excavation site. They will produce bagged, labeled artifacts from each as well as bags of soil for use in the flotation activity.

Answers to Excavation: Students will submit bagged artifacts. They will create lists of artifacts found in each cultural stratum. They will answer Analysis questions regarding what they found, including what they learned regarding their Research Question.

Answers to Follow-up: Students will compare their artifact lists with the records of all artifacts in the midden. What did they miss? How well did the 2 units represent the entire midden site?

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MATERIALS LIST FOR "Flotation" LAB: Per pair of students: bagged matrix (soil) materials from midden excavation, container (plastic jar or bowl), 1 aquarium fish net, 8 bags, a sharpie, a large bowl or bucket, paper towels to dry samples and to clean up spills. ***Teacher Tips***:
Preparation for teacher demonstration of flotation: Toast quinoa seeds to carbonize the seeds. (It only takes about 3-4 minutes to char them in a dry skillet over high heat. Remember that quinoa will pop like corn, so expect some of the seeds to be jumping during the charring process.) Charring dries the seeds so that they will float up in this experiment. Native peoples used parching (light charring) as a method to preserve foods (without refrigeration). The carbonized seed coat doesn't react much with the environmental components (like heat and moisture), so it isolates the seed from environmental effects like rotting. Also, this form of carbon isn't readily metabolized by decomposers, so the carbonized seeds aren't broken down by living organisms either. That's why they last in the archaeological record.

To make your test flotation sample for the class, add a tablespoon of cooled, charred quinoa seeds, along with a tablespoon of tiny glass beads to five tablespoons of dirt. Mix together and bag as a flotation sample. Reason for Teacher Demonstration: Because the student excavations cover just over 30% of their model midden, they may not have glass beads or charred seeds in their flotation sample. By doing a presentation up front, they see the process, so they know that they're doing it correctly even if no artifacts are recovered. Procedure: Because charred seeds easily slip through 1/8" screens, and because they're the same color as the soil, many sites were believed to have no plant remains at all - until flotation was invented in the 1970s. Plan to do 4-6 flotations. Have a bowl ready (to pour into), your net (to use as a sieve for the light fraction), and a source of water. See the student articles for descriptions of terminology like light fraction and flotation.
STEP 1: Pour your sample into your container with plenty of water, then stir to get the dirt into suspension. The seeds will begin to float up to the top.
STEP 2: Pour off the water through your net. Do not allow the muddy portion containing glass beads at the bottom to pour out. Archaeologists would remove the "light fraction" from the sieve, bag it, and proceed to the next flotation. To reduce the number of bags collected by each group in this activity, you may wait to bag the "light fraction" until all of the flotations are complete.
STEP 3: Start flotation #2 by adding more water to the sample in your bowl and stirring. Decant floating material on top through the sieve.
STEP 4: Repeat again 1-3 times, until it appears that you have removed all of the seeds from the mud and glass bead mixture.
STEP 5: For your last flotation, instead of stirring, just slosh the water around in the container a bit. Decant any remaining floating material through the sieve.
STEP 6: Spread the light fraction from the sieve on a paper towel to dry.
STEP 7: Add a bit of water to the original container and slosh around so that it's easier to pour the remaining material, "the heavy fraction" into the net (sieve).
STEP 8: Rinse with water, until you're basically left with tiny glass beads. (Spanish glass beads came in a variety of sizes, ranging from a tiny 7 mm to a very large 2.5 cm. Many had been part of rosary necklaces used in Catholic ceremonies.)

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ANSWER KEY FOR "Flotation" LAB:
Students will produce labeled bags of light and heavy fractions for each level excavated. They will submit a list of artifacts (beads) and biofacts (seeds) found in each cultural strata and answer the analysis questions regarding their finds. If students find no artifacts or biofacts, they should simply note this, along with any other pertinent observations.

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Author of *The Timucua Indians – A Native American Detective Story* and *Journeys with Florida's Indians*

STUDENT ARTICLES, EXPERIMENTS, & ACTIVITIES:
1) What is Archaeology?
2) LAB: Creating a Model Midden
3) LAB: Excavating a Model Midden
4) Different Kinds of Archaeology
5) A Case Study: Wet Site Archaeology at Hontoon Island
6) LAB: Screening for Artifacts
7) Flotation – Collecting Tiny Artifacts and Biofacts
8) LAB: Field Flotation
9) How Old are these Artifacts?
10) Now You've Got the Artifacts. What Do You Do With Them?
11) What Have you Learned and How Will you Tell Others?

NEW TERMINOLOGY:

archaeology, bundle burial, carbon-13, carbon dating, charnel house, charred, Contact Period, culture, curation, datum, excavation, flotation, isotope, matrix, Mesoamericans, midden, nitrogen-15, polyethylene glycol (PEG), publication, screening, sieve, Spanish mission, Spanish olive jar, sponge spicules, stratigraphy, thermoluminescence dating, timelines

Several websites with good definitions for archaeological terms:
http://archaeology4kids.tripod.com/id38.html
http://mdah.state.ms.us/hpres/arch_vocab.php
http://www.archaeologywordsmith.com/lookup.php?category=&where=headword&terms=feature

ASSESSMENT OPTIONS:

Writing Prompt #1: Your school was starting construction on a new swimming complex when native artifacts were discovered at the construction site. Digging was halted to allow

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archaeologists to study the site. No burials were discovered, but the archaeologists believe that significant information will be lost if the site is not properly excavated. They have asked the school to delay construction for three months to allow a proper excavation. This delay means that the pool will not be available until next year – after you will have moved on to high school. Think about whether the excavation should be permitted, even though it will prevent an entire grade level from ever using the pool. Write a letter to your principal to convince her that your opinion is the correct one.

Writing Prompt #2: Archaeologists frequently study middens – ancient trash piles – to learn more about the peoples who once lived in the area. Think about the things that modern humans throw away, and what future archaeologists might learn about us from our trash. Write to explain three conclusions a future archaeologist might draw based on the information he collects from a modern midden (landfill).

Assessment #1: Based on your reading of the article titled, "What Is Archaeology?" explain how the fields of archaeology and history are fundamentally different. Give one example of how they have worked together to solve a mystery in the past.

Assessment #2: Based on the article titled, "How Old Are These Artifacts?" explain why carbon dating and thermoluminescence dating can work together to pinpoint the timeline for a site. Be sure to explain which materials each method can date. You do not need to explain the specifics of how each method works.

Assessment #3: Based on the article titled, "Now You've Got the Artifacts; What Do You Do With Them?" discuss the meaning of the word "curation," and describe some of the challenges of ethical curation, including storage, preservation, and publication.

Assessment #4: Archaeologists have recently excavated what they believe to be the very first Spanish fort at St. Augustine. Look in the section titled "LAB: Creating a Modern Midden." The excavation photo shows a portion of the first Spanish fort at St. Augustine. The feature in the lower left had been completely covered by shell midden. What can you interpret about the history of this site based on stratigraphy?

Classroom Technology Strategies

Connect Writing Prompt #2 (modern middens) and Technology:
Question: How is NASA involved in Florida archaeology?
Internet article:
http://www.nasa.gov/centers/kennedy/about/aerospace_arch.html

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Student Learning Enhancement

Making New Connections: The Archaeology unit covers a broad range of topics, and the list of **New Terminology** reflects this:

Excavation: archaeology, bundle burial, charnel house, charred, datum, excavation, material culture, flotation, matrix, midden, screening, sieve, stratigraphy

Analysis of Artifacts and Data: carbon dating, Contact Period, culture, isotope, Mesoamericans, nitrogen-15, publication, Spanish Mission, Spanish olive jar, sponge spicules, thermoluminescence dating, timelines

Preservation and Storage: curation, polyethylene glycol (PEG)

After reading the unit, show students this grouping of words. Ask them to decide which word list matches each heading. Pull two words at random from these lists and ask the class to discuss how the two words are related. **For example, nitrogen-15 and PEG**. Nitrogen-15 is the stable isotope remaining after C-13 breaks down. These isotopes are both part of the carbon-dating process that provides archaeological dates for once-living things, like canoes made from trees. PEG is a preservative that preserves waterlogged artifacts, like canoes made from trees. *Extra note: PEG and other preservatives cannot be applied to wood that will be carbon-dated. It will contaminate the sample and disrupt the dating process.*

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