TIMUCUAN TECHNOLOGY

A MIDDLE GRADE FLORIDA CURRICULUM

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CREDITS

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Note to teachers:

Teacher Resources, Sunshine State Standards and Answer Keys are available online at **http://flpublicarchaeology.org/timucuan**

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INTRODUCTION

WHO WERE THE TIMUCUA?

STUDENTS TAKE A QUICK LOOK AT THE PEOPLE WHOSE TECHNOLOGY THEY'LL BE STUDYING.

HOW DO YOU PRONOUNCE THE NAME "TIMUCUA"?

First of all, there is no correct Timucua way to pronounce this name. It probably came from the Timucua word, "*thimogona*," which meant "enemy," but we're not even sure how they pronounced that word. Many historians and archaeologists give the word a Spanish pronunciation: tee-moo-kwa. Regardless of pronunciation, if you say the name with respect, you are saying it correctly.

WHAT DID THE TIMUCUA LOOK LIKE?

We can't be sure what they looked like, but a modern artist named Theodore Morris has given us some good ideas. Morris has studied Florida's early people and produced portraits that represent several of these cultures. The painting on the left portrays a Timucua man and his child. The painting on the right portrays a woman harvesting shellfish at the beach.

Courtesy of Theodore Morris

Courtesy of Theodore Morris

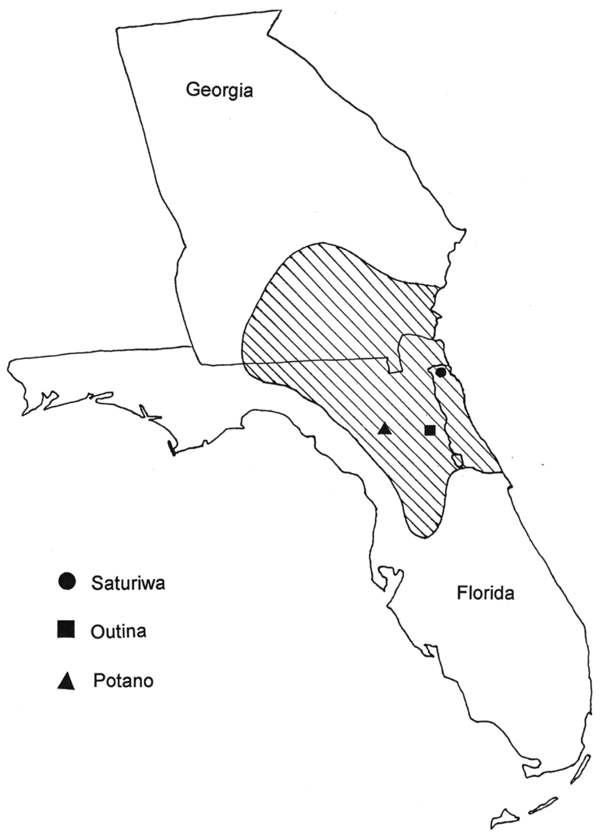
WHO WERE THE TIMUCUA?

WHEN DID THE TIMUCUA LIVE IN FLORIDA?

Native peoples have lived in Florida for the past 12,000 years. Around 2,500 years ago, these migratory peoples began to settle down. Groups in different parts of Florida developed their own regional cultures. As time passed, these cultures changed and adapted to meet new challenges. The "Timucua culture" (or lifestyle) was in place about 200 years before the Europeans arrived. However, archaeologists don't refer to these groups as "Timucua" until the Europeans arrive and begin recording histories. The Timucua, and other native groups met by the Europeans, are called historic peoples. In Florida, the historic period begins in the early 1500s. For the Timucua, it ended in 1763, when the few remaining Timucua people left Florida and moved to Cuba with the Spanish. The last known Timucua person died in Cuba in 1767. The Timucua have no known descendants today.

WHERE DID THE TIMUCUA LIVE?

The Timucua lived in north Florida and southeast Georgia. This map shows their territory and the villages of three major headchiefs.



SO, WHO WERE THE TIMUCUA?

These native peoples were never united into a single group. Instead, groups of allied villages were ruled by the leader of the most powerful village in the area. This ruler was called a headchief.

Eastern (coastal) Timucua peoples depended far more on water resources, while the Western (inland) Timucua grew more crops. Their cultures were sometimes very different.

So why were they all called by the same name? All of these groups spoke dialects (variations) of the same language. As a result, European explorers classed them all as a single people. How many dialects were spoken? Historical research suggests that as many as eleven distinct dialects were spoken across the region. The dialect spoken by the coastal Timucua (find "Saturiwa" on the map) was called, "*Mocama*," which means "saltwater" in the Timucua language. In Outina's territory down along the St. Johns River, the Timucua spoke a dialect called, "*Agua Dulce*," which means "fresh water" in Spanish. In Potano's territory (interior of Florida), the Timucua spoke a dialect called (mysteriously) "Potano."

INTRODUCTION

WHO WERE THE TIMUCUA?

Historians and archaeologists prefer to call all of these people "Timucua-speakers." This name shows that they shared a language without suggesting that they were actually a political unit.

A NOTE ON DATES

Archaeologists do not use BC and AD when referring to dates. Instead they use BCE (before the Common Era) and CE (Common Era). The new acronyms mean exactly the same thing as BC and AD, but the newer terms do not refer to religion. So, when you read a date in these lessons, BCE = BC and CE = AD.

THESE LESSON ARE TITLED "TIMUCUA TECHNOLOGY." SO, WHAT EXACTLY IS "TECHNOLOGY"?

It is the designing of tools and techniques to solve problems. What kinds of problems did the Timucua need to solve?

- How can we help a child with a terrible cough? (Solved with Wild Plant Technologies)
- How can we take down a meter-wide tree? (Solved with Pyrotechnology – use of fire)
- How can we catch enough fish to feed the village? (Solved with Animal Technologies)

These units are divided into 6 different native technologies. In addition to the three listed above, you'll find Tool technologies, Agricultural technologies, and Building technologies. You'll also see four units that discuss the modern technologies that archaeologists and historians use to learn about the Timucua. These include "Excavation," "Archaeology Beyond Excavation," "Historical Documents," and a section about Theodore de Bry – the man who created the engravings (pictures) of the Timucua that all Florida kids see in their textbooks.

Each unit has hands-on activities, like:

- Building sections of palm-thatched walls (Building Technology)
- Coiling Timucua-style clay pots (Tool Technology)
- Weaving and dying rope with natural materials (Wild Plant Technology)
- Mastering the physics of spear-fishing (Animal Technology)
- Carving models of three Florida canoes and testing them for speed (Archaeology - Beyond Excavation)
- Creating and excavating model archaeological sites (Archaeology)

Get ready to get dirty, get wet, and learn a crazy amount of information about the Timucua.

CHAPTER I

CHAPTER ONE

THEODORE DE BRY'S TIMUCUA ENGRAVING'S-FACT OR FICTION?

STUDENTS DISCOVER HOW AN INACCURATE INTERPRETATION OF HISTORICAL DOCUMENTS CAN HAVE FAR-REACHING CONSEQUENCES.

WHAT'S THE CONTROVERSY?

In 1591, Theodore de Bry published a book about the French explorations of Florida. He claimed that the artwork had been created by artist, Jacques Le Moyne, an eyewitness at the French colony in Florida. Who was de Bry? He was a Belgian engraver who had never even been to America. Engravers made copies of pictures onto copper plates so that they could be printed in books. Photocopier technology had not been invented in the 1500s.

This is a de Bry engraving of a Timucua religious ceremony to ensure a good harvest.

Religion leaves very few marks in the archaeological record. In this instance, a posthole in the ground would be the only remains of this village-wide ritual.

Historians were dazzled by these engravings. What an amazing resource! The images and text provided a window into Florida's past, a way to learn about the extinct Timucua people.

In time, however, historians and archaeologistsbegan to acknowledge the glaring errors scattered throughout these engravings.

1) The Timucua have European facial features.
2) The vegetation and the mountains don't belong in Florida.
3) The deer is a European Red Deer.
4) The war clubs shown in battle scenes are clearly Brazilian.
5) The shell bowls used for the Black Drink ceremony should be made from whelk shells. Instead, they're made from a chambered nautilus, a Pacific sea shell.
6) The alligator in the alligator hunt has external ears and eyebrows, and it's far too big.
7) Timucua villages did not have palisades (walls) built around them, and the huts weren't so close together.
8) The Timucua did not use recurved hunting bows.
9) And there is far too much similarity between these engravings and the ones that de Bry engraved about other cultures.

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THEODORE DE BRY'S TIMUCUA ENGRAVING'S-FACT OR FICTION?

In 2005, Florida archaeologist Jerald Milanich published an article in *Archaeology* journal. This article provided evidence that de Bry had fabricated these engravings. It seems that he used a mixture using a mixture of European eyewitness accounts, borrowed images from other cultures, and his own imagination to create the images himself.

Why are a few faked pictures such a big deal? The problem is that de Bry claimed the engravings were true descriptions of Timucua life. And with the "original artist" dead, there was no one to set the record straight. De Bry could claim anything he wanted. So de Bry's work stood as "truth" for a long time. For years, archaeologists and historians have worked diligently to understand what these images could teach about the Timucua.

No one knew that de Bry had inserted falsehoods and fantasy into his engravings. The research based on this faulty information produced conclusions that were also full of errors. These flawed conclusions were written into social studies books, museum displays, and informational signs at parks, spreading de Bry's falsehoods even further.

Now that we know these engravings are fabrications, where do we go from here? Very few images of Contact Period Native Americans exist, so de Bry's engravings are used constantly. They can be found at museums and parks from south Florida all the way up to Virginia. It will take a long time for news about these not-so-true images to spread, and even longer before park signs and school textbooks are updated.

In the mean time, should we stop using these images as teaching tools? Not at all. These engravings provide a unique opportunity for modern Floridians to build a connection with the Timucua. We've always known the Timucua didn't have the European features engraved by de Bry, but his engravings still helped us feel a connection with our ancient neighbors.

De Bry's engravings are fabrications, just one man's interpretation of what life might have been like for the Timucua. We can still learn from the engravings. But we must always seek an additional source to back up our conclusions. What kinds of sources?

1) Other historical documents
2) Archaeological excavations
3) Botanical studies of plants native to Florida
4) Bioarchaeology clues about what the Timucua were eating (analysis of skeletal remains)
5) Comparative anthropological studies (making comparisons with modern native cultures)

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THEODORE DE BRY'S TIMUCUA ENGRAVING'S-FACT OR FICTION?

WHO WAS JAQUES LE MOYNE?

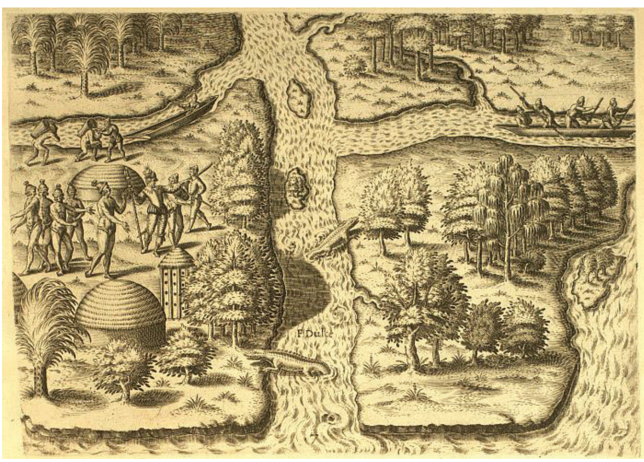
Jacques Le Moyne was a French artist and mapmaker. In 1564, he joined the French expedition to found a colony in the New World. His job on the mission was cartographer – map maker. In 1565, the Spanish attacked Ft. Caroline and killed most of the French. Le Moyne was one of about twenty survivors that escaped and sailed back to Europe.

After his death in 1588, de Bry approached Le Moyne's widow to try and purchase any illustrations he had made during his stay in Florida. De Bry claimed to have bought these illustrations and the descriptions that went along with them. He then used these materials to create a book about the French experiences in the New World, titled *A Brief Narration of Those Things Which Befell the French in the Province of Florida in America . . ..*

Above: Jacques Le Moyne's Apple, photo from Wikipedia

Unfortunately, none of Le Moyne's Florida drawings can be found today. This is unusual because many other memoirs and illustrations from that time period have been recovered. In addition, we have about 50 botanical illustrations that Le Moyne produced after his return to Europe. So, what happened to the Florida illustrations?

Historians are finding good evidence that de Bry never actually owned Le Moyne's artwork. What kind of evidence? Le Moyne's botanical works show exceptional attention to detail. The apple above includes realistic observations, like the faint outlines of the apple's core and leaves damaged by insects.



De Bry's engraving of rivers and vegetation

To the left, de Bry's engraving of Florida rivers includes a variety of plant life. None of the trees are readily identifiable as Florida species. In fact, the palm trees in the upper and lower far left don't look anything like sabal palms. The weeping willow to the middle right is native to China, not North America. It seems unlikely that Le Moyne – with his exquisite attention to botanical detail – would make mistakes like these. Any Florida illustrations made by Le Moyne were likely destroyed when the Spanish attacked Fort Caroline. Until someone finds the Le Moyne originals, historians and archaeologists have agreed that de Bry composed the Florida illustrations himself and attributed them to Le Moyne. Why? He probably felt he could sell more books if the images seemed to come from an eyewitness account.

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THEODORE DE BRY'S TIMUCUA ENGRAVING'S-FACT OR FICTION?

THE MAN WHO CAUSED THE MISCHIEF: THEODORE DE BRY

Theodore de Bry was born into a family of Belgian engravers. He published several volumes of engravings and histories that introduced Europeans to the exploration of the Americas. He never travelled to America. Instead, he relied on personal memoirs and paintings created by people who had made the journey.

He engraved John White's watercolors of the Algonquin Indians alongside the text written by English explorer, John Harriot. The book, titled *A Briefe and True Report of the New Found Land of Virginia*, came out in 1590. It sold extremely well. In the introduction to this book, de Bry tells readers that he had intended to publish a book on Florida natives first, because the French were in Florida well before the English were in North Carolina (called Virginia back then). Only a year later, in 1591, de Bry published his next volume about the New World, finally able to focus on the French experience in Florida. The book, titled *A Brief Narration of Those Things Which Befell the French in the Province of Florida in America,* was also quite a money-maker.

In 1593, de Bry went on to publish a third book in this series, which included the descriptions and engravings of many Europeans who had visited the New World. It was titled *Grand Voyages* to America. It included, among others, the stories and engravings associated with Hans Staden's capture by the Tupinamba Indians of Brazil.

De Bry produced a huge number of engravings throughout his lifetime. After his death, his sons continued his legacy, completing several projects that he'd left unfinished.

Today, historians and archaeologists believe that de Bry fabricated "Le Moyne's" Florida engravings. He "borrowed" images from John White and Hans Staden, and lifted complete sections of text from the memoirs of French explorers. Why did he do this? There are two schools of thought. Perhaps they are both true.

The first points out that these "borrowed" images and stories made his books more sensational and easier to sell. More sales meant more profit. The second focuses on his strong belief in the Protestant faith. De Bry was raised a Protestant. When he was young, his family had to leave their home in the Netherlands to avoid persecution by Spanish Catholics. As a result, de Bry detested the Spanish, who had already made great strides in colonizing the New World. He became passionate about promoting Protestant colonies to compete with the Spanish ones.

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When he engraved scenes showing the brutality of the Brazilian natives, he was showing their need for Christian teachings. When he engraved European features on these same native peoples, he made them seem more approachable. They were just people who needed missionaries to teach them a better way. Those elements of De Bry's work may have been designed to encourage Protestant colonists to go to the New World - and overcome the Spanish Catholic presence that was already growing strong.

It may have been a combination of greed and religious passion that moved de Bry to fabricate the Timucua engravings. Were his books meant to be sensational and entertaining? If so, readers during de Bry's time probably knew this and accepted that many of the images were works of fiction. (It was the modern readers who mislabeled his book as a factual documentary.)

Was there a religious agenda behind his manufacture of the Timucua engravings? Historians still aren't sure, but they continue to search through old documents hidden in ancient libraries. Maybe someday, one of them will find a letter de Bry wrote or some other bit of evidence to explain his motives. At present, all of the evidence suggests the Timucua engravings are complete fabrications, whatever his motives. Considering the way he "borrowed" from other artists and writers, the following quote from de Bry seems a bit ironic.

"In conclusion, I ask most earnestly that if anyone else should be found attempting to pirate this book of mine (for nowadays, there are many dishonest people who try to get the benefit of another's work), that no credit should be given to the counterfeit copy, for I have put many secret marks in my drawings which will certainly cause confusion if they are omitted."

Technology Note: De Bry mentions secret marks in his engravings. Are these some of the first watermarks? A watermark is a pattern or design added to a paper to ensure authenticity and prevent counterfeiting. It may be easily visible or only visible when held against the light.

WHO WAS JOHN WHITE?

John White was an English artist who joined the first English colony to the New World. In 1585, his ship landed in North Carolina, and White created several watercolor images of the Algonquin native peoples who lived in the area.

In 1590, his watercolors were engraved by Theodore de Bry and included in a book about the experiences of the English in the New World. Because most of White's original watercolors are still in existence today, we can tell by first hand observation, the changes that de Bry made when he engraved

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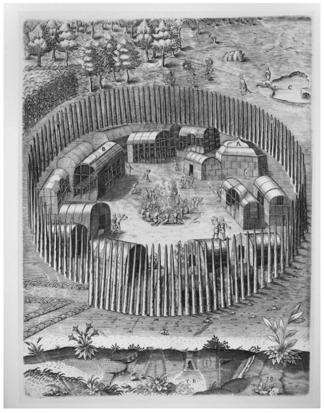
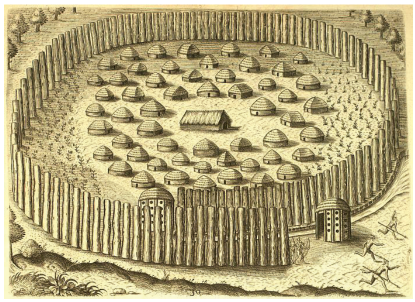
them. The Virtual Jamestown website, at http://www.virtualjamestown.org/images/white_debry_html/jamestown.html displays many of White's watercolors alongside de Bry's engravings, along with commentary that compares the two. It's an excellent historical resource.

DO YOU SEE ANY SIMILARITIES?



A de Bry engraving of an Algonquin village, attributed to John White, courtesy of the British Museum

VS.



A de Bry engraving of a Timucua village, attributed to Jacques Le Moyne

Note: The Timucua did not have palisades around their villages.

When preserving animal meat, they didn't smoke the animals whole, but cut them into strips.

De Bry also engraved images for Hans Staden's memoirs. Look ahead to check out the cannibals' grill. Compare it to the grills to the left. Hmm, de Bry seems to have made a habit of "borrowing" images.

A de Bry engraving of the Algonquins cooking fish, attributed to John White, courtesy of the British Museum

VS.

A de Bry engraving of the Timucua preserving their meat, attributed to Jacques Le Moyne.

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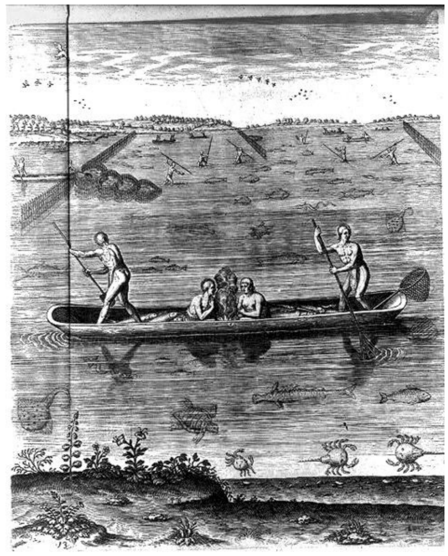
COMPARING JOHN WHITE ORIGINALS WITH DE BRY ENGRAVINGS

Johns White's Original Watercolor of Fishing by North Carolina Indians, courtesy of the British Museum

VS.



De Bry's Engraving of White's Watercolor of Fishing by North Carolina Indians, courtesy of the British Museum

De Bry's Engraving of Le Moyne's Artwork of St. Andrews Sound, Georgia, showing weirs

Modern Fishing Weir in Nantucket Sound, Photo courtesy of shareendavisphotography.com

Fishing Weirs – Historic and Modern. Fishing weirs are permanent fence-like fish traps used by native peoples around the world. The upper left image, by John White shows a long fence with a simple box enclosure (North Carolina). The upper right, engraved by de Bry, is supposed to be an exact copy of the first, but he changed the structure of the weir completely. The lower left, also by de Bry, depicts several Georgia weirs that look mysteriously similar to the altered North Carolina weirs. The lower right shows a modern weir in Massachusetts. The modern weir has a heart-shaped structure which is similar to de Bry's fanciful weir engravings, above and to the left. Had he seen pictures of actual heart-shaped weirs in the 1500s? Or did he create them out of his imagination?

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WHO WAS HANS STADEN?

Hans Staden was a German soldier. He joined an expedition bound for South America, and became shipwrecked off the coast of Brazil in 1549. He was captured by the Tupinamba Indians and spent six years as a captive before his return to Europe in 1555. In 1557, he published an account of his captivity titled *True Story and Description of a Country of Wild, Naked, Grim, Man-eating People in the New World, America.*

In 1593, Theodore de Bry engraved illustrations to match Staden's story and included them in his book, Grand Voyages to America. The image to the lower is an example of de Bry's engraving work for this book.

Staden's original book had been illustrated using the woodcut technique. Wood was carved so that all of the white space in the image was carved away, leaving only thin lines which would transfer ink to the page. Woodcuts became popular in bookmaking around 1460, but eventually lost popularity to a different illustration process: engraving. In this process, a sharp tool scratched the image onto a sheet of copper. Its popularity was based on its ability to produce finer detail than woodcuts.

The images below both depict the same act of cannibalism witnessed by Staden during his captivity with Brazil's Tupinamba Indians. The image on the left is a woodcut from Staden's 1557 book. The image on the right is an engraving from de Bry's 1593 book.

Woodcut of Cannibalism witnessed during Staden's Captivity, courtesy of jrbooksonline.com/cannibals_Image3_sm.jpg

Note how much more detail the engraving allows, compared with the woodcut.

This improvement in European printing technology provided a much more realistic feel to accounts from the New World.

De Bry's Engraving of Cannibalism witnessed during Staden's Captivity. Photo by Wikipedia

Today, the archaeologists at the Florida Public Archaeology Network (FPAN) use website technologies to educate modern Floridians about the past. In the same way, these early printing technologies helped 16th-century Europeans learn more about the New World.

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WAR CUBS FROM BRAZIL

These images are each cropped from larger engravings. The one on the left by Hans Staden depicts the Tupinamba people in Brazil (published in 1557). The one on the right is from de Bry's Timucua engravings. Both the war clubs and the headdresses are very similar. Historians now believe that de Bry plagiarized both the war club and the native headdresses, lifting them directly from Staden's work and inserting them into his images of the Timucua. Since Le Moyne didn't even arrive in Florida until 1564, there's no question about which image was made first.

De Bry Engraving of Hans Staden's captivity in Brazil. Courtesy of the Department of English, University of California, Santa Barbara

De Bry Engraving of Timucua Indians at War, attributed to Le Moyne

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ANALYZING THE DEER HUNT

"The Indians hunt deer in a way we have never seen before. They hide themselves in the skin of a very large deer which they have killed some time before. They place the animal's head upon their own head, looking through the eye holes as through a mask. In this disguise they approach the deer without frightening them. They choose the time when the animals come to drink at the river, shooting them easily with bow and arrow." Text and image attributed to Jacques Le Moyne.

Native Americans across eastern North America used deer hide disguises to approach deer undetected (from downwind, of course).

De Bry's engraving suggests that the Timucua used this method as well. Because deer hides don't last in the archaeological record, we must depend on comparisons with other native cultures to corroborate this conclusion.

How can we be sure de Bry didn't copy this from a story he heard about a different native group?

This is a modern rendition of the de Bry engraving by artist, Brett Pigon.

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THEODORE DE BRY'S TIMUCUA ENGRAVING'S-FACT OR FICTION?

ACTIVITY - WHAT'S WRONG WITH THIS PICTURE?:

BACKGROUND: Historic engravings often include inaccuracies (elements that are not quite true). When studying these engravings, historians must utilize critical thinking skills to decide which parts of the engravings are true and which are not.

Questions to Ask about this Engraving	Critical Response
Did the original artist actually witness a native deer hunt?	Eye-witness accounts provide the most accurate information.
Or did the native people just describe the deer hunt to him?	Errors might occur because of language translation difficulties.
If they described the hunt, did they tell him the truth?	Humans throughout history have exaggerated their hunting and fishing stories.
Did the artist draw the deer hunt picture right then?	Drawing while the story is fresh in mind allows for the highest accuracy.
Or did he draw it later from notes, a sketch, or from memory?	The more time between the original experience and recording it, the more chance that details are forgotten or changed by memory.
Did the artist work with the engraver who made the image into a printable format?	Collaboration with the original artist would increase the accuracy of the final engraving.
Did the engraver copy the original drawing faithfully?	This would be far more accurate than an engraver who changed parts to suit his own artistic style.
Did the engraver actually copy the original images? Or was the engraving composed from unrelated texts?	The information in the engraving may still be based on historically accurate data, even if that data was a written story about the New World instead of a drawing.
Was the deer hunt engraving describing a Timucua technique? Or did the engraver borrow the deer hunt disguise from another native group?	Once it became clear that de Bry was borrowing images from other cultures, historians began to question whether this image even depicts a Timucua hunting style.
Did the engraver have an agenda other than the production of quality engravings?	If the engraver is trying to make more money, he might sensationalize his engravings to increase his sales.

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ACTIVITY - WHAT'S WRONG WITH THIS PICTURE? continued:

INSTRUCTIONS: Review the clues below. Use them to describe inaccuracies in the de Bry engraving.

1) Look closely at the deer in the engraving and compare to the deer photos below.

Inaccuracies in the appearance of the deer include…

Florida White-tailed Deer
Photo by Wikipedia

European Red Deer
Photo by Wikipedia

2) Many Florida rivers and lakes are dark brown due to tannic acid released from acorns and dead leaves. This phenomenon is common in the southeastern US and around the Amazon basin in South America. It is uncommon in Europe. *What inaccuracies do you see in the appearance of the water:*

3) Compare the habitat portrayed in the de Bry engraving with its modern counterpart. With only de Bry's engraving to use as a reference, what misconceptions might a 16th century European have about the environment in Florida?

CHAPTER 2

CHAPTER TWO

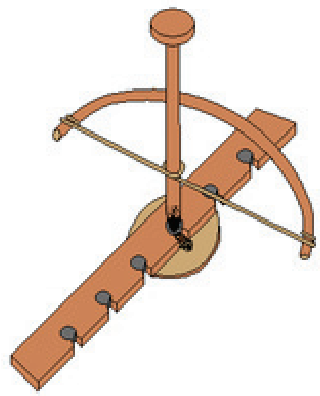
PYROTECHNOLOGY

STUDENTS LEARN THE PROPERTIES OF FIRE AS THEY STUDY HOW THE TIMUCUA USED FIRE TO SOLVE THE PROBLEMS OF DAILY LIFE.

WHAT IS PYROTECHNOLOGY?

Pyrotechnology is the use of fire to enhance your everyday life. Today, most people in the western world don't depend directly on fire. Some might have a wood fireplace that warms their homes in the winter. Others might roast hotdogs and s'mores over campfires on vacation. And a few people (like mechanics and chefs) use flaming blow torches as tools. For the rest of us, fire's only useful to light up nice-smelling candles, right? Well…unless there's a power outage. In extreme cases, when all the flashlights are out of batteries, modern Floridians do still depend on fire.

How did the Timucua start fires? They used a tool called a bow drill. This is an advanced version of rubbing two sticks together to create friction. A fire bow is only about two feet long. How does it work? The spindle (a short section of wood) is twisted into the string of the fire bow. When the bow is moved back and forth, it turns the spindle, twisting it in one of the little depressions in the fireboard below. The disc on top allows the user to apply a slight downward pressure on the spindle. This pressure keeps the spindle from jerking out of the tiny depression while it spins. Plenty of friction is created as the spinning action rubs the spindle against the fireboard. When done properly, this friction produces a tiny pile of black ash and a spark. At this point, the fire-maker sets down the bow and lifts the spark onto a nest of tinder. (Tinder is a material that catches fire easily, like cattail fluff.) Next, he or she blows lightly on the tiny glowing ember, giving it oxygen so it will lick into flame. It takes a tremendous amount of practice to master this skill.



Fire Drill, photo by Wikipedia

When the moving bow rubs against the fireboard to create friction, MECHANICAL ENERGY is converted into HEAT ENERGY. When the friction generates a spark, HEAT ENERGY is converted into LIGHT ENERGY and HEAT ENERGY. Combustion occurs when this spark begins to burn the tinder material. At this point, the tinder's CHEMICAL ENERGY is converted to HEAT ENERGY and LIGHT ENERGY.

CHAPTER TWO
PYROTECHNOLOGY

ACTIVITY – WHAT FIRE PRODUCTS DID THE TIMUCUA USE?:

BACKGROUND: The Timucua used four products of fire to improve their daily lives: light, heat, smoke, and ashes. The table below lists each of these fire products along with various Timucua needs satisfied by fire. As you read the following paragraphs, fill in the table to reflect which fire product the Timucua used to satisfy each need.

Timucua Need or Task	Light	Heat	Smoke	Ashes
Seeing at Night				
Staying Warm				
Cooking				
Repelling Insect Pests				
Making Clothing				
Antiseptic and Healing				
Shaping Wooden Tools				
Firing Pottery				
Making Stone Tools				
Building Houses				
Making Canoes				
Managing Forests				
Warfare				

CHAPTER TWO

PYROTECHNOLOGY

LIGHT AT NIGHT

Back in the 1500s, fire wasn't an obsolete technology. Sure, the Timucua's ancestors had been using pyrotechnology for thousands of years. But it hadn't gone out of style. In fact, fire influenced every aspect of Timucua life. It was as common as flipping a light switch. If the Timucua wanted to light their homes at night, fire was their only resource. Today, we light our homes using electricity. In most power plants, electricity is created by generators. These generators are powered by turbines. The turbines are turned by steam. The steam is made by boiling water. The water is boiled by burning fossil fuels. Hmm. That's fire isn't it? Perhaps we use more pyrotechnology today than we realize.
Fire Resource Used: LIGHT

STAYING WARM

Florida is a warm state, but temperatures do drop below freezing in winter. The Timucua lived in palm huts that had an open smoke hole in the roof and a low open doorway. During cold snaps, the temperature inside could really drop. Leather clothing and fur blankets help to warm the people, but not the house. If the Timucua didn't want the water in their water bags to freeze overnight, they needed to heat the air inside their huts too. Fire was the logical solution. The Timucua burned tree branches as fuel. Those trees spent their lives soaking up the sun's energy and storing it in their leaves, roots, and branches. When their wood was burned, that stored solar energy was released as light and heat.

The trees used photosynthesis to turn LIGHT ENERGY (sunlight) into CHEMICAL ENERGY (wood). The Timucua used fire to turn CHEMCIAL ENERGY into HEAT ENERGY and LIGHT ENERGY.
Fire Resource Used: HEAT

THIS DIAGRAM DESCRIBES WHAT HAPPENS WHEN WOOD BURNS IN A FIRE:

Wood + A Little Heat + Oxygen	*FIRE* ⟶ *BURNS*	Light + LOTS of Heat + Carbon Dioxide + Water Vapor Gas

CHAPTER TWO
PYROTECHNOLOGY

ACTIVITY - BALANCING CHEMICAL EQUATIONS:

BACKGROUND: Wood is made mostly of cellulose, a carbohydrate. If complete combustion occurs, the only end products are carbon dioxide ($C0_2$) and water vapor (H_20). Most fires have incomplete combustion. Why? Because the mix of oxygen, heat, and fuel aren't quite right. Incomplete combustion makes ash and smoke along with $C0_2$ and H_20.

When balancing a chemical equation, be sure that the same number of carbons, hydrogens, and oxygens are found on each side. Look at this equation for complete combustion. How many water vapor molecules (H_20) are needed to balance this equation?
Hint: 60_2 is 12 oxygens. 6 x 2 =12. The formula for cellulose (wood) is $C_6H_{12}0_6$.

$$C_6\,H_{12}\,0_6 + 6\,0_2 \longrightarrow 6\,C0_2 + \underline{\qquad}\,H_20$$

6 Carbons	=	6 Carbon
12 Hydrogens	=	12 Hydrogens
18 Oxygens (6+12)	=	18 Oxygens

CREATIVE COOKING

Fire provided the Timucua with more than just light. It also provided energy for cooking food. Why cook? Cooking helps to preserve food. Hard-boiled eggs last a lot longer than raw eggs. Cooking can also remove toxins or bacteria. No reason to get food poisoning if you don't have to. Cooking improves taste. Many wild vegetables are so bitter that no one would want to eat them raw. The cooking process leaches out the bitterness. And most importantly, cooking reduces the amount of energy you use in the process of eating. Wild apes spend almost half of their time eating because it takes that long to find and chew the raw foods. Think about it. Both meats and vegetables become more tender during the cooking process. Consider the difference in chewing required when eating a raw carrot versus a cooked carrot.

How did the Timucua do their cooking? They could cook meat on a spit over an open fire, boil soups and vegetables in a pot of water over a fire, or roast meat in an underground pit oven using hot coals. Most modern Floridians use stoves, microwaves, and ovens. We hardly ever use fire for cooking anymore. Oh, except for grilling. And gas stoves. And for making those yummy flaming desserts.
Fire Resource Used: HEAT

CHAPTER TWO

PYROTECHNOLOGY

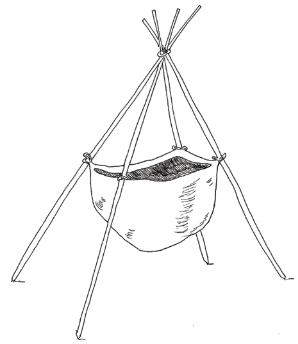
The Timucua didn't have refrigerators or freezers to preserve food. To prevent spoiling, they dried foods instead. Fruits, like grapes and plums, can be dried in bright sunlight. But meat will spoil long before it can sun-dry. (Flies lay eggs in the meat too. *Ugh.*) The Timucua solved this problem by cutting venison (deer meat) into thin strips, then hanging these strips above a smoky fire. The heat of the fire dried the venison. Without moisture, bacteria can't grow. Instant preservation! And since bugs don't like smoke, the egg-laying flies stayed away too.
Fire Resources Used: HEAT and SMOKE

Corn was also preserved by drying. Its dried kernels were hard to grind up – and impossible to chew. So the Timucua softened them by soaking them in lye. What is lye? It is potassium hydroxide (KOH), a compound found in wood ash. If you pour water into a bowl of wood ashes, it creates a yellowish liquid called lye - a very caustic material. When dried corn is soaked in lye, its cell walls begin to dissolve. This allows the kernels to absorb moisture, soften, and swell. The swollen corn is called hominy, and it's much easier to grind up than before. Lye also increases corn's nutritional value. It denatures (breaks down) corn proteins. This frees up the vitamin niacin so that humans can digest it.
Safety Note: Lye is extraordinarily corrosive and will burn through several layers of skin.
Fire Resource Used: ASHES

When the Timucua baked cornbread or cattail bread, they did not have yeast or baking soda to help it rise. As a result, their breads were fairly dense and flat. They did have access to one leavening agent: fire ashes. One of the many compounds found in wood ash is called "potash" or potassium carbonate ($KHC0_3$). This didn't make bread rise nearly as high as modern baking soda (sodium bicarbonate, $NaHCO_3$), but it did help a bit. How? Both compounds release carbon dioxide gas during the cooking process. These gas bubbles make the bread lighter and fluffier.
Fire Resources Used: ASHES

CHAPTER TWO
PYROTECHNOLOGY

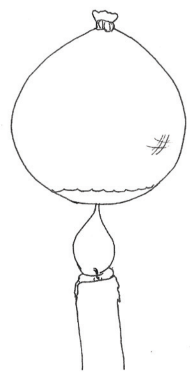
EXPERIMENT- COOKING BEFORE POTTERY:



BACKGROUND: In North America, pottery was invented on the Florida-Georgia coast about 4,000 years ago. Long before that, native peoples were cooking soups using pots made from deer hide. First, they suspend the pot over the fire pit. Next, they filled the pot with water and let the water soak into the hide a bit. Then they built up the fire. As long as the level of the water in the pot was higher than the level of the flames, the pot did not burn. It worked because water is an excellent conductor. The water drew heat away from the hide pot and into the water, meat, and vegetables. If the water boiled too low, the fire would touch a dry spot on the hide. *Uh-oh.* Holey pot. Leaking soup. Bad day.

EXPERIMENT: Instead of hide pots and campfires, we'll experiment with balloons and candles. First, put on your safety goggles and blow up a balloon. Once your balloon is tied, move your second balloon and cup of water to the side.

Light your candle. Hold the air-filled balloon high above the candle flame. The first balloon represents a hide pot with no water inside. Slowly lower your balloon. How close do you think you can get to the flame before it pops? And it WILL pop. With no water inside, there's nothing to carry the flame's heat away from the rubber surface of the balloon.



Now pick up balloon number two. Pour ¼ cup of water into the balloon. Blow it up to the same size as your first one. Lower the balloon towards the flame. The water-filled section of balloon should be closest to the flame. Does it pop? The water inside the balloon is conducting heat away from the balloon surface.

Next, hold the balloon beside the candle and move it towards the flame. The water is still at the bottom, not at the side where the flame will touch. Do you think it will pop?

The balloons in this experiment serve as models for the Timucua hide pot. How are the balloons different from actual hide pots? How could these differences affect our experiment?

____

____

CHAPTER TWO
PYROTECHNOLOGY

THE PREHISTORIC WAR ON BUGS

Smoke served as an important insect repellent in Timucua homes. At night, when the Timucua slept, mosquitoes and gnats could fly right into the palm huts and nibble on the people. To prevent this, the Timucua lit tiny smudge fires under their sleeping benches. These small fires used dried corn cobs as fuel. Smudge fires surrounded the sleeping person with a bit of smoke and kept the biting bugs away.

Other Florida bugs (including carpenter bees, carpenter ants, and termites) eat wood or tunnel through it. Timucua huts would have made a tasty treat. To keep these pests in check, the Timucua probably left a fire burning in their huts all day and night. The smoke discouraged wood-damaging insects from moving in.

Fire Resource Used: SMOKE

Interesting Fact: Modern bee keepers use smoke to cover up their bees' pheromones. What are pheromones? They're the warning smells that bees make when their hive is in danger. With these pheromones masked, bees can't instant message each other to ATTACK. The bee keeper is able to open the hive and remove some honey without being mobbed by angry bees. Did the Timucua use smoke to harvest honey? The best answer is "maybe." The European Honey Bee was introduced to North America by the Spanish in the 1600s. The Timucua living after this time might have used smoke to harvest honey. But before the Spanish came, there were no honey bees (and no honey) in Florida.

FASHION IN THE FIFTEEN-SIXTIES

De Bry engraving of Timucua fashion

Timucua people didn't wear a lot in the way of clothing. They did use loin cloths year round. (A loin cloth is like a bikini bathing suit.) And they wore long, flowing matchcoats to keep them warm in the cold weather. They needed blankets for wrapping babies, and leather for making packs and bowstrings.

Changing a fresh animal pelt into a baby blanket required a bit of skill and - of course - fire. First you needed to scrape away the fat, hair, and blood vessels. To ease this process, hides may have been soaked in a lye solution (made from ashes and water). This caustic liquid loosened the hair follicles so they were easier to scrape away.

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PYROTECHNOLOGY

Next, the Timucua spent hours stretching and twisting the hide near a smoky fire. The fire's heat helped to dry the hide, preventing the growth of bacteria. The constant stretching broke apart the hide's collagen fibers (connective tissues). This made the hide soft and flexible – temporarily. Without wood smoke, the hide would harden as it dried, just like a rawhide dog bone. So what did the smoke do? Wood smoke contains formaldehyde, and this gas bonded to the fibers so they could never link back together. This made the hide be permanently soft and flexible. That's a quality you want in your loin cloth.

Fire Resources Used: ASHES, HEAT, and SMOKE

The Timucua are known for their use of tattoos. Rene de Laudonnière, a French explorer, wrote that "Most of them ornament their bodies, arms, and thighs with handsome designs. The ornamentation is in permanent color because it is pricked into the skin." The higher-ranked members of the village had more tattoos than anyone else, an easy-to-recognize sign of status. These permanent dotted designs were probably tattooed into their skin using bone needles. Wood ashes rubbed into the holes served as a blue dye. The ashes also helped to reduce the risk of infection, an important consideration in a time before antibiotics. When the ashes were rubbed into the holes, they formed a physical barrier (like a Band-Aid), which crusted over and protected the injured tissue. The presence of ashes also sped up the body's production of fibroblasts. What are fibroblasts? They are tiny fibers that help to bind wounded skin together, allowing it to heal. One study reports that wounds treated with ashes healed three days sooner than those treated with a modern antibiotic ointment. Who knew?

De Bry engraving of Chief Saturiwa preparing his men for battle. Remember, this is NOT considered an accurate depiction of their tattoos.

Fire Resource Used: ASHES

The Timucua also used fire to create medicines. For example, they boiled cherry bark to create a medicinal tea that eased coughing. They boiled other medicinal herbs in water to create steam which was inhaled.

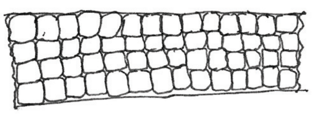
Fire Resource Used: HEAT

CHAPTER TWO
PYROTECHNOLOGY

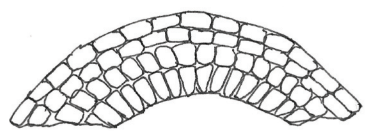
WOODEN TOOLS

The Timucua needed wood to make hunting tools: straight pieces for spears and arrows, curved pieces for bows. Since tree limbs bend as they grow, perfectly straight branches are pretty rare. The Timucua combined the technologies of fire and steam to straighten and curve branches into any shape they needed.

How do heat and steam bend wood? The combination of heat and moisture weakens the cell walls inside the wood. This makes the wood more flexible, so it can be compressed a lot (squeezed smaller) or stretched just a little. If the wood is held in the new shape until it dries, its new shape becomes permanent.



In the straight wood to the left, the tree's cells are roughly the same size and shape. Look at the bent wood to the right. Heat and steam have weakened the cell walls, allowing the cells to change shape. The cells on the inside of the curve are compressed together, while the ones on the outside of the curve are stretched.



Steam-bending wood may seem like an obsolete art. After all, it's easier to just buy a modern bow and arrow, right? But if you want to play acoustic guitar, be glad the technology is still around. That's how artisans make the curved sides of fine guitars and violins even today.

Fire Resource Used: HEAT

FIRING POTTERY

To make pottery, the Timucua mixed water and clay to create a soft, pliable material that is slicker than Play-Doh. They coiled the wet clay into the shape of a container, and as the clay pot dried, it hardened. This was only a physical change. It was not permanent. If the dried pot got wet, it became squishy again.

Replica of Florida native pottery

Florida's early people learned that heating the dried clay in a 760°C (1400°F) fire made it permanently hard. How does this process work? Clay is a mixture of alumina, silica, and water molecules that are chemically bonded together. Once the fire is hot enough, the clay's water is released, allowing the silica and alumina to bond tightly to each other. Now the clay has been changed to a ceramic. It can't absorb water anymore. That's a good cooking pot.

Fire Resource Used: HEAT

CHAPTER TWO
PYROTECHNOLOGY

ACTIVITY – CONVERTING TEMPERATURES:

BACKGROUND: Scientists worldwide use the metric system, but modern Floridians are more familiar with standard units. The Timucua had no standardized measuring system for temperature, but they had a clear understanding of the temperatures that affected health, foods, and tools. How clear is your understanding of metric units for temperature? Use the formulas below to complete the table, converting between standard and metric units.

FAHRENHEIT TO CELSIUS:

$$C = (F - 32) \times \frac{5}{9}$$

CELSIUS TO FAHRENHEIT:

$$F = C \times \frac{9}{5} + 32$$

Important Timucua Temperatures	Degrees Fahrenheit	Degrees Celsius
Water Freezes	32° F	
Healthy Body Temperature	98° F	
Water Boils		100° C
Heat-treating Chert		350° C
Firing Pottery	1400° F	

Interesting Fact: Both the Fahrenheit and Celsius scales were invented by European scientists in the 1700s while the Timucua were still living in Florida!

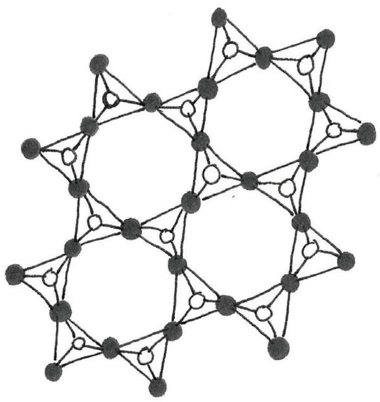
CHAPTER TWO
PYROTECHNOLOGY

STONE TOOLS

Raw Chert

Chert is the only tool-making stone found in Florida. It is usable in its raw state, but the Timucua improved its quality using fire. First, they chipped out the basic shapes of the tools they wanted to make. Then they buried the half-made tools in a bed of sand beneath a fire. When chert is heated to about 350°C, it becomes more glass-like. This allowed flint-knappers to create finer sharp-edged tools, like knives and projectile points. Fire-treating also makes chert about 50% easier to crack, so it became much easier for the flint-knapper to shape. Unfortunately, these heat-treated tools were too fragile to be used for rough work like chopping or pounding. Heavy-duty tools, like axes and hammers, were made from whelk shells instead.

How does a fire make chert more glass-like? Well, scientists aren't exactly sure. They do know that chert is actually a type of quartz. Like quartz, chert is made up of molecules in a crystalline framework.



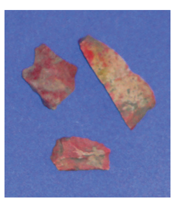
Above:
This is a diagram of the solid crystal structure of quartz. The black dots are oxygen atoms. The white dots are silicon atoms. Each oxygen atom is bonded to SIX other atoms. These bonds give the stone its strength and make flints and cherts useful tool-making materials.

Heat seems to remove water molecules trapped in this framework, so the molecules of crystal can pack more tightly together.

Heat also affects the bits of iron impurities stuck in the framework. Heat turns iron into hematite (red iron oxide). This gives fire-treated chert a reddish color.

When this red hematite melts, it helps to glue the crystal structure even more firmly together. How does all of this help make sharper-edged tools?

When a flint-knapper works with raw chert, any crack he makes is a bit ragged. It zig-zags around the crystals.



Fire-treated Chert Chips (Debitage)

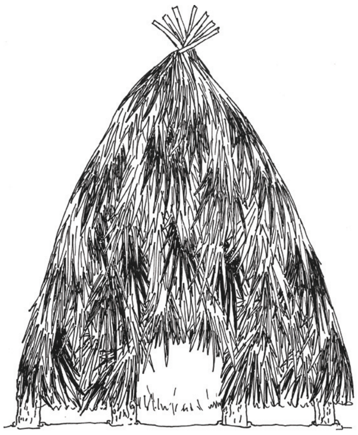
In fire-treated chert, the bonds between crystals don't break. Instead, the stone cracks cleanly through the middle of the crystals, creating a smooth, sharp edge.

Fire Resource Used: HEAT

CHAPTER TWO
PYROTECHNOLOGY

HOME SWEET HOME

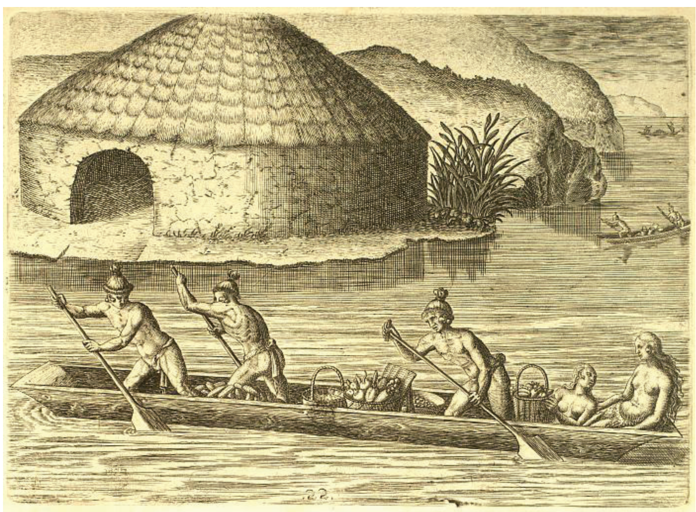
A Timucua hut required about eight tree trunks, each about 8-10 inches in diameter. Steel axes did not exist in Timucua times, and it would take a LONG time to chop all of those trees using a shell axe. Instead, the Timucua carefully set a fire at the base of the tree, so the flames would char and soften the wood. After they extinguished the fire, they used shell axes and chisels to chip away the blackened wood. Then they set another fire. After it burned for a while, they extinguished it and chipped away the char again. This saved time and effort.



Palm-thatched Hut, courtesy of the University Press of Florida

When building a council house, they needed much larger trees, some weighing over 1,000 pounds. Chopping even one tree like that with native tools would take days. It's possible that they girdled the trees well ahead of time (cutting away the bark all the way around the trunk) to weaken them. By combining fire and shell tool technologies with this technique, native Floridians were able to harvest these massive trees.

CANOE BUILDING



De Bry engraving of Timucua men canoeing to storehouse

When the Timucua made a dugout canoe, it was a major undertaking – even after they'd cut down the three-foot wide tree. It would take weeks to chip out a canoe shape using only shell tools. The Timucua shortened this time to only a few days with the use of fire. Hot coals were placed along the length of the log. After the coals burned down into the wood, the coals were removed, and the Timucua chipped away the charred material below. Then they added coals again: burn, chip, burn, chip, burn chip. They slathered wet clay across the parts of the log that should not be burned, then continued chipping and burning. When the interior of the canoe was smooth and uniformly deep, the canoe was complete. Florida archaeologists discovered one dugout with a hole burned right through the side. *Oops.*

Fire Resource Used: HEAT

CHAPTER TWO
PYROTECHNOLOGY

LAND MANAGEMENT AND HUNTING

The Timucua intentionally used fire to manage their lands. Their goals were to prevent wildfire, enhance agriculture, and improve hunting. Community fire drives were staged towards the end of winter, just before spring planting. The fire was carefully planned so that it would burn across the agricultural fields. The stems from last year's crop, along with any weed growth, burned away and were returned to the soil as ashy nutrients.

The fire was allowed to burn through some forestland too. Its flames and smoke flushed animals towards hunters waiting with bows and arrows. As the fire burned through the woods, it thinned out the forests' thick tangle of saw palmetto, greenbriar vines, and leaf litter. Left alone, these materials could have fueled an uncontrollable lightning fire. But the Timucua's carefully planned burn transformed them into nutrients for the forest soil. As a bonus, birds like quail love the open spaces created by burns. Quail populations increased, and so did quail hunting for the Timucua. These planned burns were designed to end when winds blew the flames toward a river or marsh where the water extinguished them.

Today, state and US forestry services use prescribed fire to manage public forests. This improves the habitat and prevents dangerous wildfires. We've learned a thing or two from the Timucua.
Fire Resource Used: HEAT and SMOKE

WARFARE

The Timucua understood fire's destructive power. When one chief declared war on another, he ordered that flaming arrows be shot into the roofs of flaming arrows into the roofs of the enemy's huts. The huts were made of dry palm fronds, grape vines, and tree trunks. They were highly flammable. They were also fairly small, only 25 feet wide. The people inside could escape easily, so no one was killed. But the enemy was now faced with plenty of rebuilding work, and not much time to wage war in return. Like all Timucua uses of fire, this was an effective strategy.
Fire Resource Used: HEAT

De Bry engraving of Timucua warfare

PYROTECHNOLOGY

ACTIVITY – GETTING TO KNOW FIRE:

BACKGROUND: The Timucua used fire in every aspect of their daily lives. They knew how fire responded to wind and breath, how its heat affected clay and chert, and how its smoke impacted bugs. They understood which parts of a fire were hottest and knew how to use fire as a tool without hurting themselves or their environment.

This intimate understanding of fire developed through simple, everyday observation. Because the Timucua had neither clocks nor thermometers, they had to estimate the times and temperatures for cooking, firing pottery, and heat-treating chert. The more experience they had, the better their time estimations.

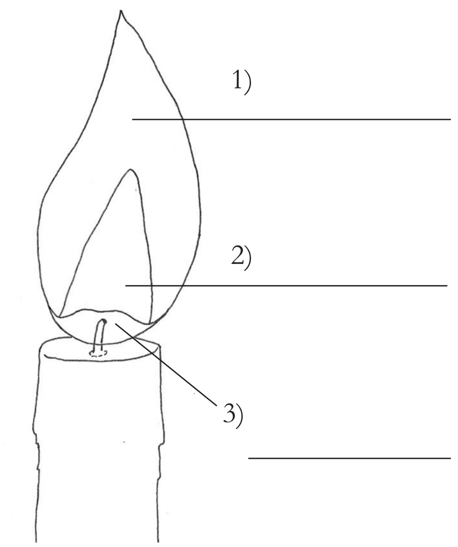
A campfire reaches temperatures between 900°C and 1100°C. Candle wax burns up to 1400°C, significantly hotter than the fires the Timucua had.

TEMPERATURE AND COLOR OF CANDLE FLAMES

Color	Color Name	Temperature in Celsius	Temperature in Fahrenheit
	Red	700-900°	1300-1700°
	Shadowy Orange	1100°	2000°
	Yellow	1200°	2200°
	Faint White	1300°	2400°
	Blue	1400°	2600°

ACTIVITY – GETTING TO KNOW FIRE continued:

INSTRUCTIONS, PART I: Wear your safety glasses throughout this experiment. Do not touch the flame. Observe your candle flame. On the flame diagram, use colored pencils to fill in the colors you observe in your candle flame. Write the name of each color on the line provided. Use the table titled "Temperature and Color of Candle Flames" to complete statements a) - c).



a) The HOTTEST part of the flame is located:

____

b) The COOLEST part of the flame is located:

____

c) The SMOKE (if any) is located:

____

INSTRUCTIONS, PART II: Blow gently on the flame for at least five seconds without blowing it out. Observe any changes that occur in the shape of the flame, the color of the flame, and the color, amount, and location of smoke. Record your observations on the lines below.

Flame Shape: ____

Flame Color: ____

Smoke: ____

PART III: Blow the candle flame out. Observe any changes in the smoke (color, amount, location, odor) as well as the appearance of the wick. Record your observations on the lines below.

Smoke: ____

Wick: ____

CHAPTER 3

CHAPTER THREE

TOOL-MAKING TECHNOLOGY

STUDENTS LEARN HOW THE TIMUCUA USED NATURAL MATERIALS TO MAKE TOOLS - AND HOW THESE TOOLS HELPED THEM TO SURVIVE.

WHAT IS TOOL-MAKING TECHNOLOGY?

Except for a few animal species (including apes, crows, and elephants), humans are the only tool-makers on the planet. Every human culture creates and uses tools. Tool-making is more than simply picking up a sharp shell and using it to chop wood (that's tool USE). Tool-making is the intentional creation of tools to solve problems. Interestingly, modern Floridians don't spend much time making their own tools. If they need to chop down a tree, they buy an axe. Or they hire someone to chop the tree for them. If they had to make their own axe, they probably wouldn't know where to start. In the modern world, work has become very specialized. Specific people do specific things. Most of our tools are not made by people at all. They're made by machines.

Life was very different in early Florida. There was little specialization. Every woman knew how to make pottery. Every man knew how to knap stone points. Everyone understood how to carve wood, bone, and antler. Everyone knew how to manufacture shell tools. They did not attend school to learn these skills. Instead, mothers and fathers, aunts and uncles, grandmothers and grandfathers made tools as daily life required, and the children observed and asked questions. Timucua kids were expected to master these tool-making skills as they approached adulthood, in the same way that modern kids are expected to learn to read, to swim, and to drive a car.

What are Tools? Tools are items used to make something or solve a problem. They are not consumed (used up) in the process. For example, glue is not considered a tool because once it is used, it cannot be used again. A clay pot, however, is a tool. It can be used many times. Tools can be classified according to the kind of work they do. (Many tools do more than one thing, so they can fall into more than one category.) The Timucua made each of these types of tools.

Tools that Cut or Crush: awl (pierces leather or skin for tattooing); axe (cuts wood); chisel (chips bits of wood from a dugout log); drill bit (drills holes in shells or bone to make jewelry or net weights); knife (for cutting meat and hides); and mortar and pestle (for grinding corn)

Tools that Move Things: bow (flings an arrow), canoe and paddle (transports people and materials), containers (to hold materials and make it easy to transport them), hammer (chips chert flakes off of stone points), lever (lifts heavy things), pottery paddles and implements (move and reshape the clay), scrapers (remove hair or fat from animal hides)

Tools that Cause Chemical Changes: fire drills (for starting combustion reactions – fires)

Tools that Guide and Measure: net gauge (for ensuring the holes in a fishing net are all the same size)

CHAPTER THREE
TOOL-MAKING TECHNOLOGY

Tools that Shape Things: hammer (to shape a chert point by chipping flakes of stone), hammerstone, knives (to carve bone, antler, and wood), scrapers and pottery paddles (shape pottery)

When analyzing data, archaeologists try to interpret the purpose of the artifacts they find. A shell with a sharpened edge was probably a cutting tool. A stone point with no wear at all was probably ceremonial, and not a functional tool. However, in many cases, it is impossible to clearly assign a purpose to each tool. Instead, archaeologists record the artifacts according to their material, which can be proven by chemical analysis. Let's look again at the tool items listed above, this time categorized by what they're made of.

Stone: drill bit , hammerstone, knife, scraper

Teeth and Spines: awl, drill bit, fishing spear tip

Bone and Antler: awl, hammer, net gauge, scraper, tool handles

Wood: bow and arrow, canoe and paddle, container (wooden bowl, grapevine basket), fire drill, lever, mortar and pestle, pottery paddle, tool handle

Shell: axe, chisel, container (whelk shell bowl), hammer, net gauge, net weight, scraper

Clay: container (clay pot)

CHAPTER THREE

TOOL-MAKING TECHNOLOGY

ACTIVITY – GROUPING MODERN TOOLS:

INSTRUCTIONS, PART I: For each of the categories below, list two modern tools that fulfill that function.

Tools that Cut or Crush: ______________________ ______________________

Tools that Move Things: ______________________ ______________________

Tools that Cause Chemical Change: ______________________ ______________________

Tools that Guide and Measure: ______________________ ______________________

Tools that Shape Things: ______________________ ______________________

INSTRUCTIONS, PART II: Look at each of the tools in your answer above. Think about what materials these tools are made from. Write each tool in the box below its primary material. If it has more than one main material, put it in both categories. The categories "metal" and "plastic" are provided. Feel free to add other categories on the lines below should you need them.

Tools Made From Metal

Tools Made From Plastic

Tools Made From ______________________

Tools Made From ______________________

CHAPTER THREE

TOOL-MAKING TECHNOLOGY

Most of the tools we use today are made of metal, plastic, or both. The Timucua had neither of these resources. Plastics had not been invented yet. And Florida soils have no hard metals, like iron. A bit of soft copper was traded down from the Appalachian Mountains, but these meager resources were made into jewelry or ceremonial items, not functional tools. So, what did the Timucua use instead of metal or plastic? That depended on the job they needed to do. North of Timucua territory, in areas with plentiful stone, stone was used to make most of the tools. The only stone in Florida was chert. And much of Timucua territory had no chert deposits at all. They had to trade to get it. As a result, if a tool could be made of something else, it was.

LET'S TALK ABOUT STONE TOOLS

Stone tools have been in use for a long time. How long? About 3.2 million years. That's right… million. That's long before Homo sapiens (that's us) roamed the planet. In fact, it predates the species Homo completely. Most likely, these first tool makers belonged to the species Australopithecus. Their simple pebble-shaped tools were used to crack the long bones of animals to get at the nutritious marrow inside.

Okay, let's fast-forward almost 3.2 million years. *Homo sapiens* have become expert stone tool-makers. They've migrated across the Bering Land Bridge, and 12,000 years ago, they're using stone tools to butcher mammoths alongside the Aucilla River in NW Florida. As time passes, the stone tools get smaller. Native peoples are no longer hunting giant mammoths, so they don't need huge points to pierce elephant hide. Smaller stone points are used to hunt and butcher smaller animals, like deer, rabbits, and turkeys. By Timucua times, the bow and arrow have also been invented. These require tiny, light points to fly effectively. Unlike their Archaic ancestors, the Timucua people had settled, for the most part, in one location. Since they weren't moving around as much, they no longer had access to lots of chert sources. They had to use the poor quality chert available near home. How do we know? Archaeologists have compared the chert used to make Timucua artifacts with the chert found in outcroppings around Florida. This gives us a good idea of where the raw materials were coming from.

So, what exactly is chert? It's a quartz-like stone with a strong crystalline structure. When it breaks, it forms sharp edges, which makes it useful in creating cutting tools. Technically, chert is silicon dioxide ($Si0_2$). It is found in limestone, which forms the base rock for the entire state of Florida. Why? About 50 million years ago, while Florida was under the ocean, billions of tiny skeletons of ocean planktons settled to the bottom. These eventually became limestone. As time passed, the ocean levels dropped, and Florida limestone was exposed. It was covered by a thick layer of dirt and debris, but in some places, the limestone was still fairly close to the surface. Acidic rain water seeped down through the soil and into cracks in the limestone. A few cracks grew massive and formed caves or sinkholes. Other cracks simply filled with minerals as Florida went through its repeated underwater and above water cycles. Eventually, these minerals solidified into different kinds of rock. When the

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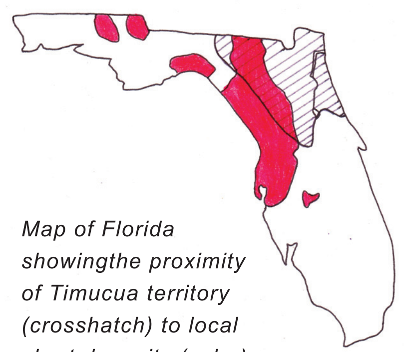
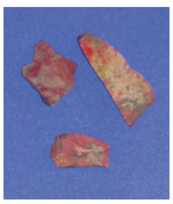
invading mineral was silicon dioxide (perhaps from ocean diatoms or fresh water sponges) the mineral is called chert. Check out the map showing the location of Florida chert. The cross-hatch area shows Timucua territory. Some of the more westerly groups lived in areas that had chert outcroppings.



Map of Florida showingthe proximity of Timucua territory (crosshatch) to local chert deposits (color)

So, what's the difference between chert and flint? When you're talking stone tools, flint is a better material because it is made up of smaller crystals which allow it to take a sharper edge. It's usually dark gray or black, and a bit shinier than chert, which is dull, opaque, and whitish-gray. Florida only has chert. To improve the quality of the chert, native tool-makers heated it with fire.



Fire-treated Chert Debitage

Heat-treating Chert: Because chert can explode when heated, the Timucua probably heated it underground. First, they chipped out the basic shapes of the tools they wanted. Why? If they tried to heat-treat big chunks of chert, the middle of the chunk would not get hot enough to change its crystalline structure. Next, they built a fire and allowed it to burn down to hot coals. These coals were scooped into a pit in the ground. Then they placed their small, half-worked pieces of chert onto the ashes and covered the whole thing with dirt. Finally, they built a large fire above the buried pit, which was allowed to burn down over the next 24 hours. When dug up, the heat-treated stones were often reddish in color with a bit of a shine.

Actually, that was the easy part. Flint-knapping takes years to master. It's not just knocking two stones together. It's physics in action. Force must be applied – enough to chip the stone, but not shatter it. This force must be applied in the proper location. If you take a chip from the middle of a point before thinning the ends, you've created a weak middle. Your point will snap in two. So you start at the edges. The force must be applied in the appropriate direction (towards an edge to take off a tiny spall and sharpen the edge) or down the length of the point to take off a long section that thins the entire blade. The force must also be applied at the proper angle. Accurate force and direction make the difference between removing a long, thin flake and breaking your point in two.

Percussion Flaking: Percussion is hitting one object with another. The tools of choice were a round, palm-sized, chert hammerstone and an antler hammer (made from the thick base of a deer's antler). They used a chert hammerstone for striking large chunks of stone and breaking off usable pieces. Another good use was chipping out the basic tool shapes before firing. However, hammerstones deliver so much force they can damage finer, thinner points.

Two Pre-Timucua Points, Right one snapped in half. Found in Duval County, FL

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That's when the antler hammer comes in. Antler absorbs some of the shock of percussion, instead of transferring the full force to the chert. This gives the flint-knapper finer control.

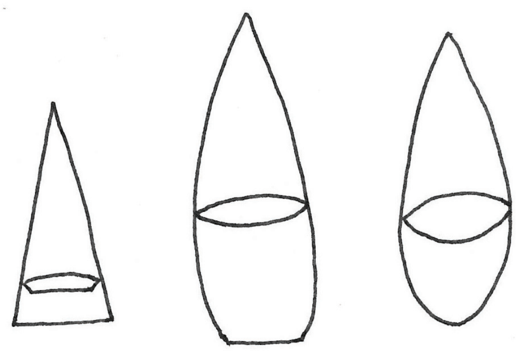
Pressure Flaking: Using this technique, native toolmakers pressed the thin tine of an antler against the edge of the point they were crafting. They used pressure, rather than a strike, to break off tiny chips. Pressure flaking was usually used at the end of the tool-making process, when the flint-knapper was putting the final touches on his point.

Indirect Percussion Flaking: This technique combines percussion and pressure flaking. The flint-knapper holds the antler tine against the edge of the point. Then he uses the antler hammer to strike the tine. You get the precision of pressure flaking with the greater force of percussion flaking.

Pinellas Point, courtesy of Dr. Stephen Granger

Timucua Era Stone Points: What could all of this pressure and percussion create in the hands of a skilled Timucua knapper? If he was lucky, he made what is known today as a Pinellas Point. 3 cm long x 2 cm wide x ½ cm thick. Teeny-tiny. Many Pinellas points are finely worked on only one side, with the other side appearing as though it had just been chipped from the core. These points were perfect little isosceles triangles with no stem, the most effective arrow point achievable with the least effort.

Two other points are common in Florida during the Timucua timeframe (1560s – 1760s). The Ichetucknee was more leaf-shaped and slightly larger at 4.5 cm. It was usually found in northwest and central Florida. The Tampa point was leaf-shaped and about the same length. However it was very roughly worked, with a thick cross-section at 1.2 cm. This point was generally found from Tampa Bay up through the same area as the Ichetucknee.



1 2 3

Sketches of Timucua Era Projectile Points:

***1**) Pinellas Point*
***2**) Ichetucknee Point*
***3**) Tampa Point*

***Note:** The markings in the middle represent the shape of the point through its width: the one-sided Pinellas point, the 2-sided Ichetucknee, and the 2-sided, very thick Tampa.*

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Archaeological Note: Stone points are called "projectile points," not "arrowheads." Why? It's not always possible for archaeologists to tell if the point was an arrowhead, a spear point, a scraper, a drill, or a knife.

What's the basic flint-knapping process? The Timucua flint-knapper probably held the chert core tightly with a piece of leather protecting his palm. He struck the core with an antler hammer, applying force along the length of the stone. This detached a long flake, suitable for making into knives, projectile points, drills, or awls. He continued detaching flakes until the core was too small to provide useful tool material. Next, these tool blanks were fired. After they were cooled, an antler hammer was used to begin detail work. Using percussion flaking, long thin chips were detached from one of the flakes. This detail work occured on both sides for Ichetucknee and Tampa points, but only on one side for Pinellas. Next, the antler tine, either on its own (pressure flaking) or being struck by an antler hammer (indirect percussion flaking) was pressed downward and outward to detach tiny flakes from the edges of the blade. This straightened any curve present in the blade and sharpened the edge even further.

Modern Percussion Flaking
photo by Wikipedia

What happened when a stone tool broke? Since it took so much effort to make stone tools, the Timucua didn't just throw them away when they broke or became blunt. Stone tools could be resharpened using pressure flaking. As you might imagine, each sharpening event chips a bit more off of the tool's edges, making it smaller. Tools were likely resharpened until they were too small to be useful. What about points that snapped in half? The broken end was blunted and smoothed a bit. This turned it into a scraper for use in the hide-making process. Back then, "reduce-reuse-recycle" wasn't just an environmental slogan. It was a way of life.

Archaeological Note: Because points became smaller with each sharpening, archaeologists rarely use size to identify projectile points.

What is debitage? All of those stone flakes and chips make a huge, sharp mess. This mess is called debitage (deh-bee-tazh). Archaeologists look for debitage deposits as a way of pinpointing where stone tools were being made. Even if they can't find stone tools, debitage provides evidence of their manufacture. At one site in Hernando County (southwest of Timucua territory), archaeologists found 546 stone tools and 41,000 pieces of debitage.

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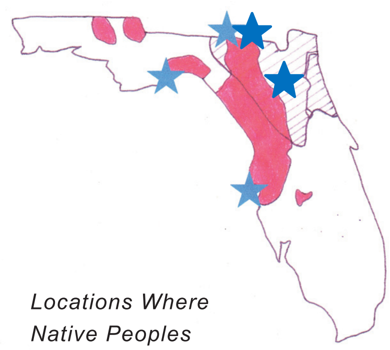
What can we learn from experimental archaeology? Experimental archaeology is a study which recreates the actions of extinct cultures. A modern flint-knapper can knap one tool using percussion flaking, another using pressure, and another using indirect percussion. The remaining debitage from each method can be compared to the debitage found at archaeological sites, helping the archaeologist to assess which methods were in use.

Replica of a Stone Scraper

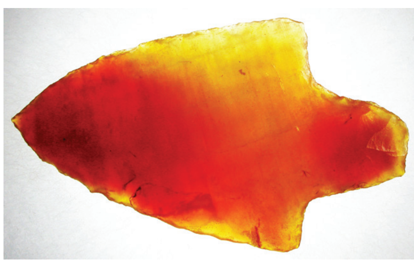
Modern Flint-knappers often practice their knapping skills on the ceramic seats, lids, and basins of discarded toilets. When they become proficient, they switch to using real chert. Limestone quarries can often provide samples of chert for free. After all, it's a junk material found within limestone. Taxidermists and hunters can donate antler. But please remember, knapping is an inherently dangerous art. Safety glasses and leather gloves are a must. And as for cuts, it's not IF you're going to get cut, it's WHEN.

Agatized Coral, courtesy of the Museum of Florida History

One other Tool Material: Archaeologists occasionally find projectile points made from another local stone: agatized coral. Corals are tiny marine animals which have a limestone shell. Many corals clump together to form a coral reef. Sometimes, silicon dioxide from the water replaces limestone in these corals, and the animal becomes fossilized. This process takes about 30 million years. What you end up with is geodes. When you crack open the geode, you find a glassy material filled with ribbons of color. Agate (the base for the word, "agatized") is another name for chert.



Locations Where Native Peoples Found Agatized Coral



Agatized Coral Newnan Point, Claudia, courtesy of Dr. Steve Granger

Agatized coral is the Florida State Mineral. Points made from this material are particularly beautiful – and rare. There are only a few spots near Timucua territory where this stone can be found. These spots are the sites of ancient coral reefs, now underground. Modern rivers are cutting down into these old reefs and eroding away chunks of stone. Crack one of these geodes open, and you'll find agatized coral inside. Florida's native people knapped this beautiful stone just like the more common forms of chert. Look again at the map showing Timucua territory and chert deposits. Stars have been added at the sites where people still find agatized coral today.

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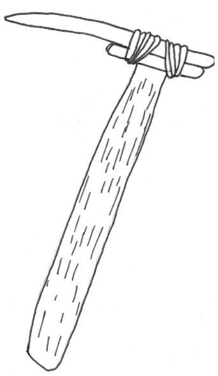
WHAT DID THE TIMUCUA MAKE WITH SHELL?

What shells did the Timucua use for tools? The most useful shells for tool-making were the whelks. Lightning whelks, at lengths of up to 40 cm (16"), provided plenty of sturdy tool-making material. However, the smaller knobbed whelks (at 23 cm or 9") are much more common in northeast Florida waters and midden sites. Mussel shells were also used – for thin, fragile items like fish hooks. Oyster shells, cockle shells, and arc shells were perforated (a hole was knocked in them) and tied to the bottoms of fishing nets as weights. Quahog clams are very thick and sturdy. They were used for bowls and even as anvils (hard work surfaces on which nuts or other objects were struck or cracked).

Left: *Oyster shell net weight*
Right: *Oyster shell*

Both Pre-Timucua, found in Duval County, FL

How did the Timucua shape the shells? Cutting whelk shells is challenging. Since whelk axes are tough enough to chop a live tree trunk, you know it takes a lot of force to break one on purpose. If you simply slam it with a rock or another whelk hammer, one of four things might happen. 1) You smash the whelk, destroying it completely. 2) You smash your hammering tool completely. 3) You smash both tools completely. 4) Neither tool is damaged at all. In other words, brute force isn't effective. Two less forceful methods have been suggested. The Timucua probably used both, selecting the first for making heavy tools, like axes, anchors, or chisels. The second was probably reserved for making ceremonial or decorative items, like shell bowls, gorgets (breast plates), and ear spools.



Shell Celt

Method 1 for Cutting Whelk Shells: Actually, there was a bit of bashing in the first step, when the lip (outer whorl) was removed. To prevent shattering, the Timucua struck the whelk at very specific spots, depending on how much of the whorl they wanted to remove. What did they strike it with? They probably used a shell celt (a specialized tool, usually for woodworking). The celt (pronounced selt) was actually made from a whelk shell whorl and hafted onto a wooden handle. The Timucua struck the whelk at just the right spot to weaken or fully detach the outer whorl. If it came off in one piece, great; that piece could be made into another tool. If not, well, archaeologists find A LOT of shell debitage in middens.

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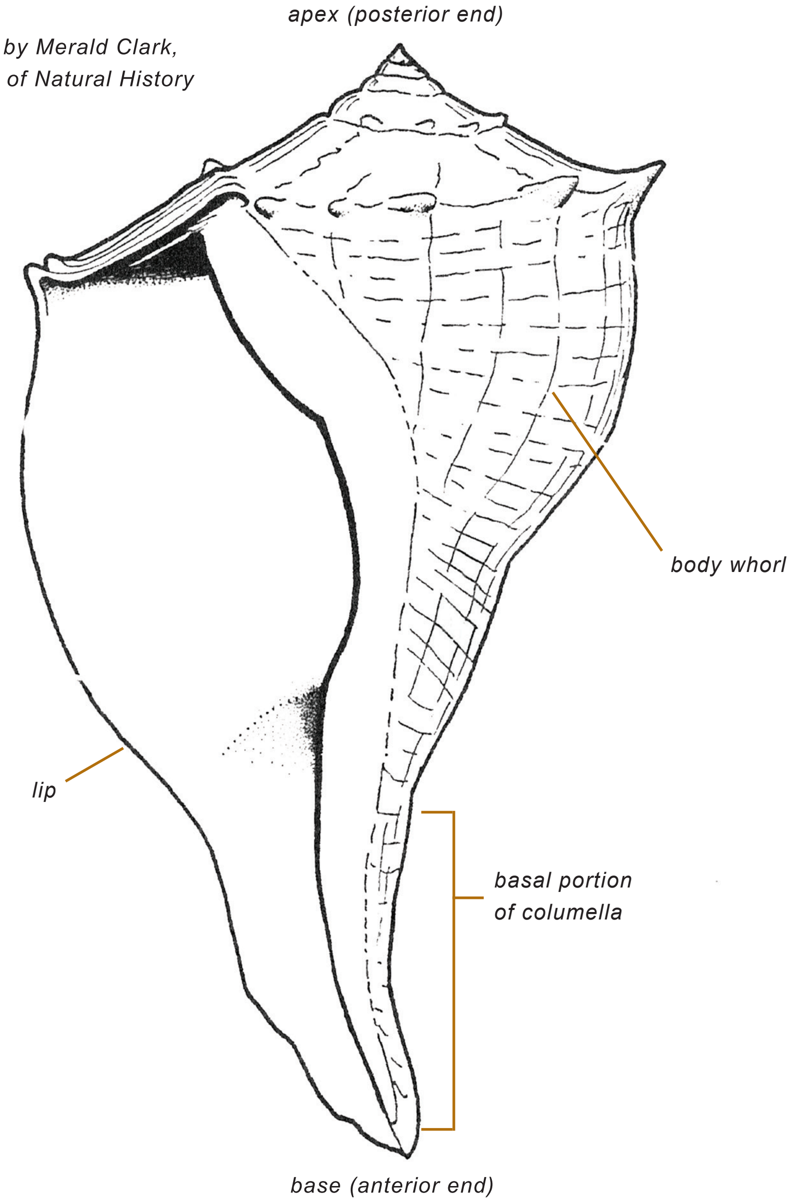
Whelk Anatomy, Drawing by Merald Clark, courtesy Florida Museum of Natural History



Once the outer whorl was removed, the toolmaker could further modify the tool into an axe or hammer. Alternatively, he could remove the columella (spiral) from the center of the shell. Columellae were made into cutting tools (chisels), perforators (pointed awls for poking holes), hammers, pulverizers (for processing acorns, etc.), sinkers for nets, and jewelry. So, how did they get that twirl out of the shell? It's a bit like creasing a piece of paper to make it easier to tear a straight line. The Timucua used a stone or shell tool to peck tiny holes across the columella in a straight line. Then, when they applied force to the shell (perhaps by indirect percussion) the columella broke where they wanted it to. Now the columella was free of the shell. Rough edges were smoothed using a sandstone grinder. These grinders were also used to abrade the bottom tip of the shells into a sharp angle. That created the cutting surfaces of axes and chisels.

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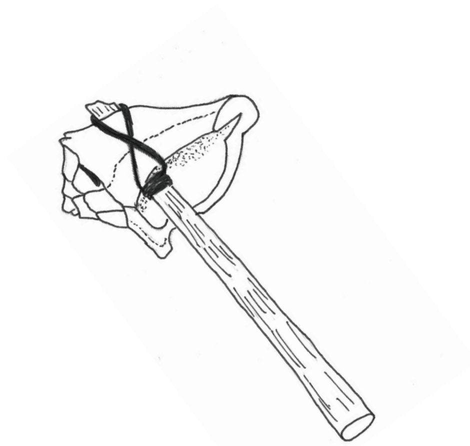
Method 2 for Cutting Whelk Shells: For jewelry items like gorgets and beads, as well as shell cups used in the Black Drink Ceremony, the Timucua used no bashing and no smashing. Stone tools were used to actually cut the shell. Sound time consuming? You have no idea. One experimental archaeologist used stone tools to score lines deep into the whorl of a whelk shell. It took six and a half hours to detach a single piece from a knobbed whelk. He went on to process this whelk into the following useful parts: one bowl, three pieces of columella, and 17 bead-sized pieces. It took 23 hours. Then he drilled a hole in each bead (add 20 minutes per bead). It's clear why these were prestige items. If it took days to make them, the artisan could demand a high price in trade. After all, he couldn't be out hunting, fishing, or gardening during the construction process. Some specialization probably existed in Timucua villages, but for the most part, everyone could make everything. Someone had to be the best though, and the most skilled artisans were always in demand for prestige items.

Shell Gorget, found in Marion County

Shell Beads

Both on Display at Fort Caroline National Memorial

Whelk Shell Axes – Outer view is a modern replication



Sketch shows interior view with binding.

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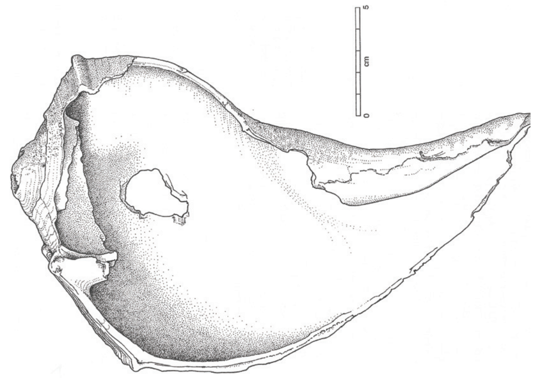
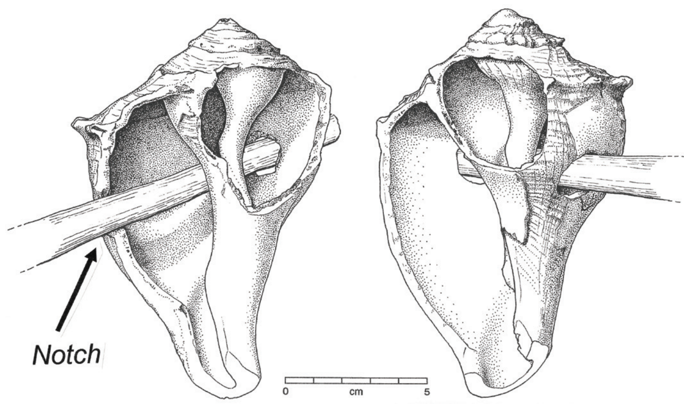
Two Lightning Whelks
(Busycon contrarium)



Lightning Whelk Bowl or Dipper –
Used in the Black Drink Ceremony. The columella has been removed.

Drawing by Merald Clark, courtesy of the Florida Museum of Natural History

Knobbed Whelk made into a hafted tool. A notch was cut in the side where a handle passed through. (Busycon carica), found in Duval County, FL



Two Hafted Lightning Whelk Axes

Left image: *Type A Tools have one hole and one notch cut in the shell for a handle to pass through.* ***Right image:*** *Type B Tools have 2 full holes for a handle to pass through.*

Drawing by Merald Clark, courtesy of the Florida Museum of Natural History

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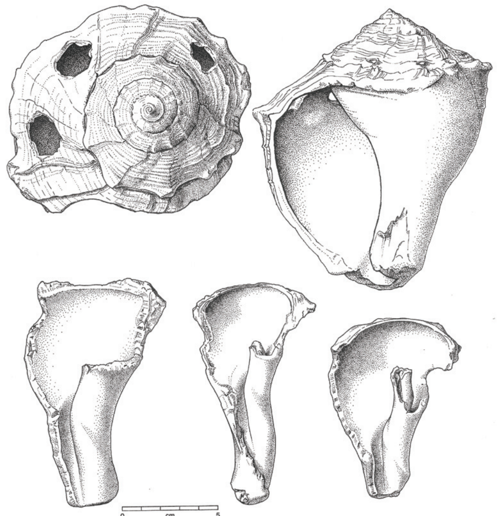
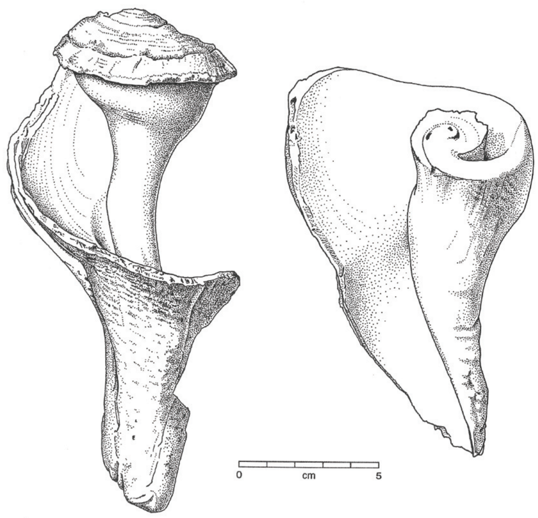


Two Types of Whelk Shell Hammers.

The columella is the strong part of the shell, the part used for hammering. It can be used even when the outer whorl breaks away.

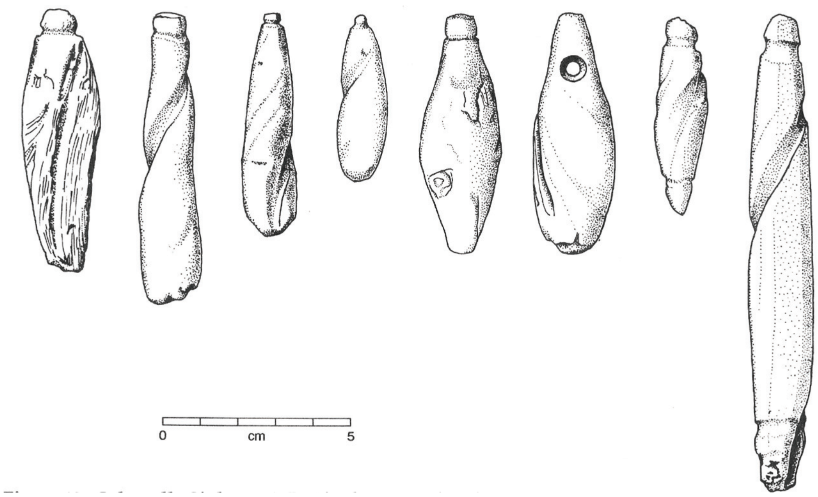
Drawing by Merald Clark, courtesy of Florida Museum of Natural



Lightning Whelk Tools

***Left image:** a hammer or pounder*
***Right image:** a hand-held grinder or pulverizer.*

Drawing by Merald Clark, courtesy of the Florida Museum of Natural History



Whelk Columella Sinkers or Pendants.

Archaeologists once considered these jewelry, but now, they are classed as fishing weights. Notice the fish face carved on the 4th sinker from the left.

Drawing by Merald Clark, courtesy of the Florida Museum of Natural History

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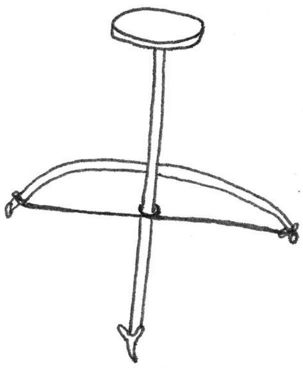
LET'S TALK ABOUT OTHER ANIMAL MATERIALS (TEETH, SPINES, BONE, AND ANTLER)

Tiger Shark Teeth
photo by Wikipedia

What did Florida's native people do with shark's teeth? They made tools, both from recently hunted sharks and from fossilized teeth, like the ones you find on the beach. What sharks did they hunt? One non-Timucua site in southeast Florida produced more than 150 sharks teeth, including lemon, tiger, hemipristis, sand, and mako sharks. These incredibly sharp teeth were attached to handles via a hole drilled through their base. Both the tips of these teeth and their convex (outwardly bending) edge, show wear, including scratches, cracks, and chips. This wear is consistent with the marks we would expect to see on a well-used knife. Fresh sharks' teeth were also used for drilling, poking holes, and as studs on striking weapons, like clubs. The Timucua also utilized sharks' teeth to make tools, but not as extensively as the south Florida cultures.

Fossilized teeth are no longer as sharp, but they're very durable. Long narrow fossilized teeth, like a sand shark's, made excellent awls. Sturdy triangular Megalodon teeth made good scrapers. And sharks' teeth jewelry never goes out of style.

Megaladon Fossil Tooth,
photo by Wikipedia



Bow drill

How did they drill a hole in a shark's tooth (or the canine tooth of land mammals)? They used a stone drill point, hafted on a long, narrow wooden handle. After placing the drill tip against the tooth, they used a bow drill to spin it against the tooth. How did this work? The handle of the drill was twisted into the string of a short bow. When the bow was moved back and forth, it spun the handle. The disc on top allowed the user to apply downward pressure, forcing the spinning drill bit down into the shark's tooth, shell bead, or other material to be drilled. Once they had drilled half way through, they'd flip the object over and drill from the other side. When the holes met in the middle, the drilling job was complete.

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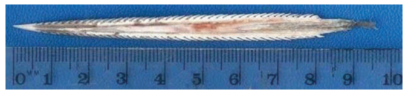
<u>What did the Timucua do with stingray spines?</u> Southern stingray spines can be up to 15 cm (6”) long. They have very sharp points as well as serrated edges. The Timucua used them to tip fishing spears (similar to a gig). These stabbing tools could be used to hunt bottom-dwelling marine animals, including flounder, crabs, and other stingrays. Stingray spines, like other sharp native tools (stone projectile points, bone knives, and shell axes) were sometimes used as weapons.



Stingray Spine, photo by Wikipedia

Deer Antlers

<u>What did the Timucua do with antler?</u> Deer antler bases and tines were used to knap chert points. An “arrow wrench” was another tool made from antler. A hole was drilled in a piece of antler (or leg bone). Then a hot, steam-heated arrow was inserted through the smooth hole. The wrench allowed the Timucua to safely hold the hot arrow. Now, they could exert pressure on the arrow shaft to bend or straighten it as needed. Antlers were also used as tool handles. They’re solid all the way through, unlike long bones which are hollow. As a result, great force could be applied to antler tools, force which would splinter bone. How did the Timucua cut the dense material of antlers? They used a stone knife, scoring it all the way around and then deepening this cut until they could snap the antler in two. Sometimes this meant cutting through an inch of solid antler – no easy task.

<u>What did the Timucua do with bone?</u> Deer long bones were cut to make long thin shapes like harpoon points, fishing gorges and hooks, hair pins, awls, needles, and knives. Turtle shells were cut into small rectangular net gauges. During the tool-making process, bones were soaked to soften them, and then cut with stone knives. Since long bones are hollow, they were worked differently than antlers.

SW Florida Awl
Courtesy of Roadrunner Artifacts

Deer Leg Bone

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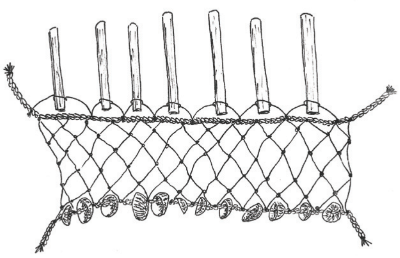
For example, to make four awls, the Timucua used a stone knife to score a line all the way down two opposing sides of the bone. They kept scoring deeper and deeper until they could snap the bone into two long pieces. They repeated this procedure with the halved sections until they had four long narrow pieces of bone. Next, they rubbed each bone piece with a sandstone abrader. An abrader is something rough that wears down the item it rubs. Sandpaper is an example of a modern abrading tool. The bone pieces were abraded until they were the shape of giant bone needles, one end ground very sharp for poking holes. The other end was blunt, perhaps with decorative carvings. The entire tool was abraded until it was smooth and round. Hairpins were made in a similar fashion, except the narrow end was blunt. Needles could be made by grinding the pieces of bone very thin. A bow drill with a tiny stone point was used to drill the hole for pulling sinew thread.

Making a knife or harpoon meant spending more time scoring and less time grinding. To start, the final shape of the knife blade or harpoon was etched onto the bone. Then a stone point was used to score deep lines into the bone along the etched outline. After A LOT of scoring, the piece could be detached from the rest of the bone. Then it could be sharpened to an incredibly dangerous edge by grinding with sandstone.

Section of a Softshell Turtle Shell, useful for making net gauges

Net gauges were often made from shell or wood, but several made of bone have also been discovered. What kind of bone? The average deer leg bone is neither wide enough nor thick enough to make a rectangle of the appropriate sizes. The same goes for antler. Turtle shells did provide a large, fairly flat surface area. These shells would have been etched to outline the size of the net gauge needed, then deeply scored. Once the rectangles were free of the shell, sandstone abraders could make them smooth so they wouldn't catch on the net fibers.



A native-style net, courtesy of the University Press of Florida

<u>What exactly is a net gauge?</u> When making your own net, you need to ensure that all of the diamond-shaped openings are exactly the same size. The Timucua held the rectangular net gauge within the diamond they were tying, using it to properly gauge where to tie the next knot. This produced a symmetrical net with standard-sized holes. Nets designed to catch larger fish had larger holes. Nets designed to catch small or young fish had very small holes, forming a fine mesh. Even today, modern nets are tied with the same knots.

Shell net gauge, found in Duval County, FL

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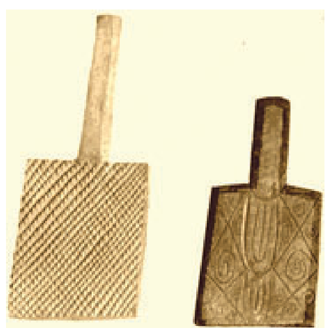
We've been talking a lot about sandstone abraders. Where exactly did the Timucua get sandstone anyway? The only rough stone found in Florida is coquina. But the abraders found on Timucua sites are made from sandstone. The closest sandstone outcroppings are in northern Georgia and eastern Alabama. The presence of these sandstone abraders in Timucua territory provides evidence of trade. **Interesting Note:** Shark skin is as abrasive as sandpaper. It was probably used for polishing jewelry and hairpins.

LET'S TALK ABOUT WOODEN TOOLS

What trees did the Timucua use? Pine was the primary wood used to make canoes. Hickory was an excellent material for bows. Cypress was made into a few canoes and plenty of bowls, mortar and pestles, and float pegs for nets. Tool handles were made from a variety of hardwood trees, including Florida Privet, Bumelia, Ash, and Oak. Poles (hut supports) were made from pine. One bird figurine was made from Red Cedar. Woody vines like grapevine were used for weaving baskets and building huts.

How did the Timucua process wood? They manipulated wood in several ways: burning and chipping, chopping and carving, and bending with steam. They also boiled woody vines then peeled them to use in basketry.

Burning and Chipping: The pyrotechnology lesson discusses the burn and chip method. Here's a quick recap. Wood is tough to chip. So, when creating canoes, large wooden bowls, and mortars for pounding plant foods, the Timucua let fire do much of the work. They carefully monitored a low blaze that charred the wood, softening it so they could use a shell chisel to remove the char. Then they would burn a bit more and chip a bit more until they had reached the desired depth. The inside of a bowl could be scoured with sand or a piece of sharkskin to smooth the grain of the wood. The outside could not be burned, so the outsides of these items were chipped into shape with shell tools. A huge number of woodchips were created during these projects. Like the chips left by flint-knapping, these woodchips are called debitage. The "burn and chip" method was also used to fell trees for canoes and house construction.



Cherokee Pottery Paddles, photo by Wikipedia

Chopping and Carving: The Timucua used shell axes to chop tree trunks and branches into useful sizes. Once a length of wood was prepared, the bark was scraped or peeled away with a stone scraper. Stone knives were used to carve these peeled pieces of wood into handles for tools and into pestles for pounding corn. The Timucua chopped tall, narrow pines to serve as levers, very helpful for heavy lifting jobs. Long, narrow canoe paddles were also carved. Short, squat pottery paddles were carved with intricate designs. When pressed onto unfired pottery, the designs transferred to the clay pot. Because wood

TOOL-MAKING TECHNOLOGY

rots away, archaeologists have yet to find one of these pottery paddles in Florida.

However, they have found individual pots – miles apart from each other – which were made with the same paddle (it had a tiny crack in it that transferred to the clay along with the pattern.)

ANCIENT WOODEN TOOLS

Atlatl Thrower, photo by Wikipedia

Long before the Timucua, about 7,000 years ago, Florida's native people were making a hunting tool called an atlatl (at-lat-el). By using an atlatl (spear-thrower), a skilled hunter could propel a dart 200 times harder and 6 times faster than using a spear alone.

Florida atlatls are compound tools, made of more than one material. The thrower itself is a carved wooden shaft about the length of your arm. The back end had a small carved piece of antler sticking up. This formed a spur that hooked into the back of a six foot long, flexible dart. Many atlatls had a bannerstone (weight) added to the middle of the shaft which helped balance the cast. (Bannerstones were actually stones in other parts of the country, but in Florida, they're often made from antler!)

The atlatl is actually a lever. It increases the length of your throwing arm and gives you an extra elbow joint. Why did the Timucua's ancestors switch to using a bow instead? Atlatls work best in wide open spaces, where it's easy to manage those six to eight foot darts. As Florida became less savannah-like and more forested, the long darts weren't as practical. It also takes more practice to master the atlatl than to master a bow and arrow. Finally, you can shoot a bow from many positions, even sitting or kneeling. Atlatls require you to be standing.

Historical Note: When the Spanish conquistadors invaded Mexico, the Aztecs went back to using atlats, because they could penetrate Spanish armor.

Archaeology Note: Atlatl spurs made from antler have been found at the 7,000 year old Windover Site, just south of Timucua territory in Brevard County. They've also been found at the Key Marco Site in southwest Florida, dating to 6,500 years ago.

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WOODEN ARTWORK

Owl Totem,
photo by Wikipedia

Florida's native people carved more than just tools. They produced artwork and ceremonial objects – big ones. A group of pre-Timucua carved the owl totem which is currently displayed at Fort Caroline National Memorial in Jacksonville. In 1955, this 3.7m (12') structure was found in the St. Johns River muck down in Volusia County. It is the largest pre-Columbian carved object in Florida, and is dated to about 1300 AD. Although the details are not visible in this picture, individual feathers are carved all the way around the sides and back. Shell, stone, and shark's teeth were used as carving tools. In 1977, two smaller carvings, a pelican and an otter were found together. They are less than three feet tall, but the details and workmanship suggest they were created by the same artist. Very few wooden artifacts are preserved in North Florida because most of the mucky wet sites capable of protecting wooden artifacts are found further South. Who knows what amazing carvings have simply disintegrated?

Key Marco Cat,
photo by Wikipedia

Key Marco Mask,
photo by Wikipedia

ACTIVITY – SOAP CARVING:

BACKGROUND: Florida's native peoples used both carving and abrading to shape wood into useful tools, works of art, and ceremonial objects. North Florida's Owl Totem, is an impressive example of their skills. The Key Marco site in southwest Florida also produced impressive carvings, including the panther and mask shown above.

INSTRUCTIONS: Instead of carving wood with stone knives, you will be carving soap with wooden tools. You will start with two tool blanks – popsicle sticks and toothpicks. Either tool, unmodified, will do the job of carving the soap. However, you should modify at least one of the blanks by abrading it on a concrete sidewalk. You can square the edges, sharpen them to a point, grind wavy patterns into the sides, whatever you think will help you carve your bar of soap into something recognizable...within the time constraints set by your teacher.

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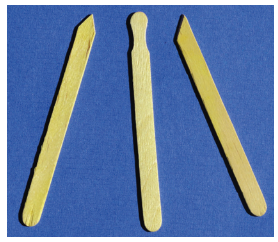
ACTIVITY – SOAP CARVING continued:



Your carving can be extremely simple (like a leaf) or extremely complex, like the Key Marco panther. However, it must be something the Timucua would have recognized. No carved IPOD players or cans of Red Bull. Be careful while you are carving. Even popsicle sticks and toothpicks can cut and tear skin with enough force behind them. You will need to experiment to figure out the best way to remove flakes of soap without digging huge, unwanted gouges through your design. Be sure to keep your debitage under control. If you are carving outside, do not allow soap flakes to fall onto the ground. Rain will wash them into the rivers where the fragrances and antibacterial elements in the soap can damage the environment. **One precaution:** Although the Timucua soaked bone to soften it, soap will soften TOO much if you wet it. Keep your bar of soap dry during this activity. **After you complete your carving, answer the questions below.**

1) How did you modify your tools? What tool shape(s) did you create? Sketch it (them) here.

2) Which carving processes worked well? Which did not?

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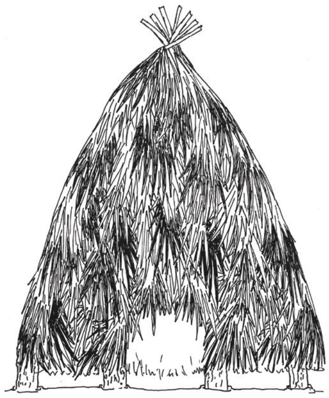
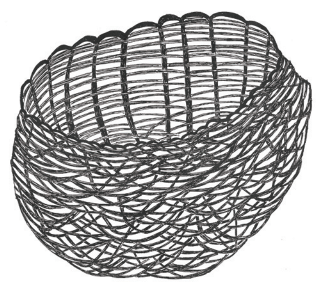
OTHER PLANT-BASED TOOLS

The inner bark of trees was stripped and twined into cord. The cord was used for fishing line, fishing net, and rope needed for hut construction. Rivercane is a tall bamboo-like grass that grows in Florida's freshwater wetlands. The woody stems could be used as arrow or dart shafts. Gourds were dried, emptied of seed, and carved into useful containers.



Palm-thatched Hut, courtesy of the University Press of Florida

Bending with Steam: Both hunting bows and the short bow used for drilling were first chopped and then carved into shape. Steam was applied to the bow, allowing it to bend under pressure instead of cracking. Once the bow cooled and dried, it held the new shape. This same process may have been applied to the pines poles used as supports in Timucua huts. Straight poles forced together and tied in the center would be under great stress, always straining to spring free. Poles bent by steam would come together naturally. They would not resist being tied together, so the poles would experience very little stress. This vastly extended the life of the structure. Wooden arrows were straightened, instead of bent, using the same method.



Grapevine Basket, courtesy of the University Press of Florida

Peeling and Weaving: Woody plant parts, including grapevines and sabal palm roots could be boiled (or soaked) and then peeled to make excellent weaving material. Six vines trimmed to the same size, perhaps 60 cm (2'), were laid out criss-cross (like a tic-tac-toe grid). They served as the spokes for a basket that would be about 30 cm (1') wide. Next, the Timucua started weaving a thinner vine over and under the spokes to form a circle. They tucked in the end, then began to gently ease the spokes upward to form the sides of the basket. Additional grapevines were woven in and out of the spokes until the basket reached the desired height. Then the long ends of the spokes themselves became weavers, looping over and under the other spokes until the ends were tucked in. Once all of the spokes were woven in and tucked, the poking edges were

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LET'S TALK ABOUT CLAY POTTERY

How did the Timucua find clay for their pottery? They dug clay from the edges of rivers and creeks. This clay had to be "plastic" (flexible) enough to pass a few simple tests.

- Could it be rolled into a smooth ball?
- If yes, could the ball be rolled into a finger-length rope without cracking?
- If yes, could that clay rope be wrapped around a finger without cracking?
- Then you've got clay that can be made into a pot. Now you lug the basket of wet clay back to the village. (If you're lucky, you were out in your canoe when you found it. Wet clay is heavy.)

How did they process the raw clay? Raw clay isn't like Play-Do. It's full of impurities that must be removed – bits of stick and shell, gritty sand, pond slime, etc. The Timucua mixed the clay with lots of water, then let it stand a few days. During this time, the organic impurities floated to the top and were scooped off. The heavier, non-living impurities settled to the bottom. The pure clay particles remained suspended in the water. This clay suspension was poured into shallow containers while the large impurities were left behind. After a few days, the water evaporated out of these shallow pans, leaving dry, powdered clay. Next, the clay powder was pounded (with a shell hammer or wooden pestle) until all the lumps broke apart and it was perfectly smooth. Now, it was time to add a temper.

Fiber-tempered Orange Period pottery, found in Duval County, FL

What's a temper? A temper is something you add to the clay to help it resist shrinking and cracking while being fired. Florida's earliest potters (2,000 BCE) added fibers like Spanish moss. When holding a sherd of fiber-tempered pottery, you can actually see the tiny holes and squiggly lines where the fibers burned away during the firing process.

Sand or grit is another kind of temper. This became commonly used around 500 BCE. Both were used off and on throughout northeast Florida's history. Sand-tempered pottery has tiny sand particles added as a temper, while grit-tempered has larger particles added.

Far Left: *Sand-tempered, incised with an awl*
Right: *Grit-tempered, stamped with a carved paddle*

Both pottery sherds were found in Duval County, FL

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TOOL-MAKING TECHNOLOGY

St. Johns pottery uses a different form of temper, one that is unique to the northeastern Timucua area. It became popular around 500 BCE, and uses the silica endoskeletons of freshwater sponges as a temper.

The *endo-what*? Freshwater sponges grow under logs in Florida lakes and streams. They are invertebrates, having no backbone to support their bodies. Instead, their bodies are filled with tiny spiny spicules (pins) made from silica. Because these pins occur inside the sponge's body, it is considered an *ENDO*skeleton. (People have endoskeletons, too. Bugs have exoskeletons.)

These supporting pins are made of silica. Silica is the same material that makes up sand and clay. These tiny pins provide support for the sponge's body. After a sponge dies, its body disintegrates into the water and settles into the soil at the bottom. As a result, these spicules can be found both in the lake soils and in the sponges themselves.

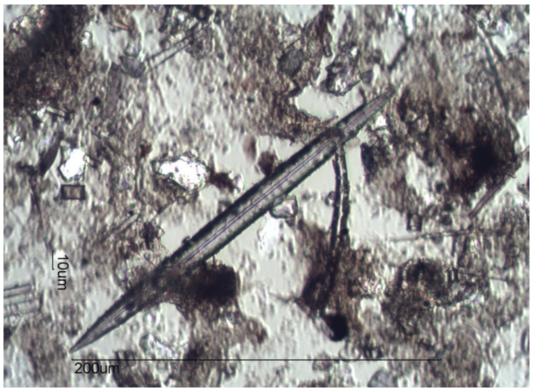
St. Johns Pottery Sherds (pieces)

Left: *Undecorated / plain sherd (this is the most common St. Johns pottery found in Duval County, FL).*

Right*: Sherds are stamped with a carved paddle design. Found in NE FL*

Freshwater Sponges are often only a few centimeters long.

Photo courtesy of R. Korth, UW Extension Office



Freshwater Sponge Spicule, courtesy of Russ Crutcher's MicrolabGallergy.com

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This sherd was decorated with a check-stamp paddle. It has both gritty and chalky traits and includes a repair hole.

St. Johns pottery is easy to identify because it feels and looks very chalky. It also has a "sandwich" appearance. This describes how the outsides are light colored (the bread of the sandwich) while the inside is dark (the jelly in the middle). This pottery is soft enough to scratch with your fingernail, but it still made sturdy vessels for cooking and storage.

Archaeologists sometimes find intermediate forms, which include two different traits. For example, a pottery sherd may be both gritty and chalky. This mixing of traits may indicate a time of cultural change. Why did people change the type of pottery they made? Sometimes a better technology was invented. St. Johns pottery is much lighter than the old fiber-tempered pottery. Other times, a new group of people moved into the area, bringing a different style of pottery. Archaeologists can use changes in pottery types to interpret changes in culture that occurred long ago.

Pottery-making took a lot of time and effort, so pots weren't thrown away when they developed small cracks. Instead, they were repaired. A hole was drilled on each side of the crack, and a cord was tied through the holes. This reinforced the crack so it wouldn't split further.

A Pottery Revolution: Archaeologists have long known that St. Johns pottery was made from clay containing lots of sponge spicules. Until about ten years ago, everyone assumed that these spicules were just a natural part of the clay. Native potters in other parts of the state didn't use this "spiculate" [spi-Q-lut] clay. As a result, other cultures had to trade with the northeastern Timucua to get St. Johns pots.

A few years ago, archaeologists began wondering, "where did the Timucua find those spiculate clays? They tested clays all over Florida. A few clays had small amounts of spicule in them, but nowhere near enough. Some St. Johns pots are composed of 20% spicules. That means that one-fifth of the total pot was made of sponge spicules. That's a huge amount. None of the researchers could find a natural clay source with such a high percentage of spicules.

Archaeologists began to wonder if St. Johns potters had added the sponge spicules on purpose. Cultures in other parts of the world have collected living sponges from lakes, dried or burned them, and then added the remaining spicules to clay like any other temper. The idea that Timucua potters had processed and added the spicules themselves was new and radical. In fact, it's still not accepted by many. The best evidence for this hypothesis occurred when an archaeologist found a St. Johns pot with 20% spicules alongside a clay source with no spicules. Chemically, the clay in the pot and the clay in the ground were identical. At some point, between the clay source and the finished pot, St. Johns potters had added spicules. Plenty of research still needs to be done, but the tide is turning towards this new understanding of sponge spicule tempers.

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<u>So, how did the Timucua actually make a pot?</u> First, the clay was processed to remove impurities and add tempers. Next, the clay was wedged or kneaded to get any air bubbles out. Finally, it was time to start coiling. They rolled the clay out into long ropes, perhaps 30 cm long (1'). Sounds easy, right? Wrong. The Timucua had no clean, flat tables to work on. If you roll clay on the ground, it picks up too much sand and starts to crack apart. They did all of their rolling in the air. That takes muscle. Next, they used a basket or pot or even a lined pit in the ground as a mold to help shape their pot. Why not build the pot flat on the ground? Timucua pots were all round-bottomed. This helped them settle into fire ashes or soil when cooking and serving. You can't build a round-bottomed pot on a flat surface. So, they used a form. Some pottery bottoms have been found that still show impressions of the materials they were sitting on.

Timucua women started by coiling a rope of clay in the bottom of the form. They lifted the coil out and gently smoothed all of the lines together, then returned it to the form. Next, they added another clay rope, which stacked up on the outer edge of the base. After each clay rope was added, they smoothed the inside and outside. When the pot was tall enough, they removed it from the mold and worked more on smoothing away all of the lines. Until the pot is fired, it must sit upside-down, to preserve the round bottom. The walls of the pot must be compressed before the firing process begins. The more compressed the walls, the more waterproof the pot will be.

They compressed the walls of the pot using a paddle and anvil. The anvil could be a piece of wood or even a broken piece of an old pot. You hold the anvil against the inner wall of the pot, so when you strike the outer wall with the pottery paddle, it doesn't warp the shape of the pot. The anvil could be rubbed all over the inside of the pot, to smooth and compact it even more. The paddling and rubbing make the pot's walls smooth, sturdy, and thin. If the paddle is carved with a design (like check-stamp or complicated-stamp), these designs will be transferred to the soft clay. Some paddles were wrapped with cord, net, or fabric. Others were left plain. After the Timucua started growing corn, dried corn cobs were sometimes used instead of paddles to compress the pot walls. Each cultural group had its own stamping styles. Archaeologists use these styles to establish a time and place for the manufacture of particular pots.

Replica Pot

<u>Were the pottery paddle designs just there to look nice?</u> They were attractive, but these designs served two other important functions. 1) All of those bumps and ridges made it easier to grip the pots so there was less chance of dropping and breaking them. More importantly, the ridges in the design increased the pot's surface area. More surface exposure allowed the pot to heat more quickly – so the food cooked faster.

<u>What about the firing process?</u> The completed pots were allowed to thoroughly air dry. When many pots were ready to be fired, they were gathered together (still upside-down) and placed on the ground. A ring of firewood was built about 2-2.5 meters (6-8') around the dry pots. That's a lot of firewood.

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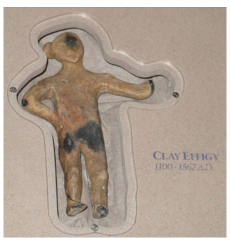
The fire was started several feet away from the pots so that they would heat slowly. Gradually, more wood was added closer to the pots. Eventually, much later in the day, a pile of brush was piled right over the pots, and the fire consumed it. The fire needed to get up to 760°C (1400°F). Pottery actually glows red when it's become hot enough, but the Timucua couldn't see that through the blazing wood.

Replica Pot

The replica pot to the right exhibits a fire shadow. The parts which are black were heated in the absence of oxygen. Without oxygen, combustion is incomplete, leaving soot behind. This darkens the pot. The lighter parts were heated in the presence of oxygen, so no soot. The amount of oxygen reaching a pot can change as logs shift on the fire. Vessels in the very center of the pile of pots received less oxygen. The Timucua actually tried to limit oxygen to their pottery fires. Why? There are only two ways to produce really hard pottery. One is to use extremely high temperatures. That's not possible in an open fire. The other is to reduce the oxygen available. Towards the end of the firing process, they probably tossed organic matter (like leaf litter) over the fire, and perhaps dirt over that. This blanket of soil and organic matter blocked out most of the airflow.

After the coals burned out, the pottery was left in the fire pit to cool slowly. This prevented cracking due to temperature shock. Pots that did crack could be recycled, though. One method was to stack the cracked pieces around and over the soft pots before you fired them. Can you guess why?

Oxygen reduction! Pottery sherds could also be reused as grinders. Since sandstone grinders were a trade item, it was helpful to have backups you could find locally. Broken pottery would be like a medium to fine sandpaper. The broken pieces could also be used as anvils when paddling pottery. And even the tiny bits could be crushed and added to raw clay as a temper. This is called grog-tempering. Reduce, Reuse, Recycle.



Human Clay Effigy, found in Marion County

Clay Effigies: Can you see the fire shadows on this human effigy to the left? An effigy is an object made to look like a person or animal. This effigy was found at Lake Kerr (a bit south of Palatka) in the southern part of Timucua territory. It has been tentatively dated to between 1100 and 1562 CE and is on display at the Fort Caroline National Memorial. Very few clay effigies have been found in Florida. Are these effigies an example of pure artwork, or did they have spiritual significance? Effigy pots are a bit more common than effigies. Because they are found only with human burials, they are considered to have spiritual significance. This turkey vulture effigy pot was discovered in a mound along the Aucilla River, the northwestern boundary of Timucua territory. It was crafted by the Weeden Island culture, a group that lived well before the Timucua (from 200-700 CE).

Turkey Vulture Effigy pot, Collections of the Anthropology Division of the Florida Museum of Natural History, FLMNH Cat. No. A20086

TOOL-MAKING TECHNOLOGY

ACTIVITY – POTTERY COILING:

BACKGROUND: Like all subsistence activities, making pottery took time, effort, and patience. If a Timucua potter did shoddy work, she wasn't just stuck with a shoddy pot. She was stuck with broken pieces of a shoddy pot. Then she had to start all over again. As you coil your own pot, work slowly and carefully. Air-drying clay usually comes already mixed and ready to go. You will not have to dig, soak, separate, dry, pound, add tempers, or wedge the clay before you coil. You will not have to gather firewood, reduce oxygen levels, or wonder if your pot will crack and splinter during firing.

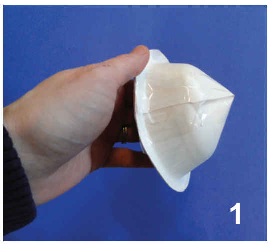
INSTRUCTIONS:

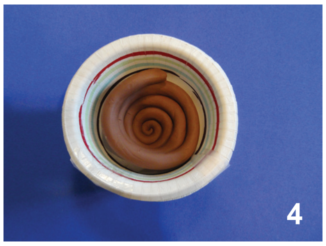
STEP 1: Construct a Form. Before starting to work with your clay, you'll need to construct a form. This will allow you to coil a round-bottomed pot. Take a paper bowl and cut it from edge to center. Slide the sides across each other to decrease the size of the bowl and give it convex base. Tape it well. Place your form into a small plastic bowl so that it will sit upright.

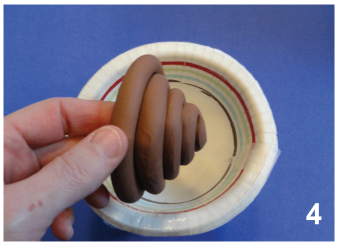
STEP 2: Make your clay flexible. Tear your clay into manageable-sized chunks. Choose one and begin to squeeze it between your hands. Tossing quickly from hand to hand (with a squeeze on each catch) also works to get it flexible. You will need to soften all of your clay in this way.

STEP 3: Roll Clay Ropes. Squeeze one ball into a cylinder, then use your hands to roll it out. Stop when it's as thick as a child's pencil (1-1.5 cm). The clay rope should be uniform, with no thin spots. If it gets too thin, break it there and use it as two separate pieces, or squash and re-roll.

STEP 4: Start Coiling. Bend one end of the clay rope, and start coiling inside your form. The form will give your pot a convex bottom.



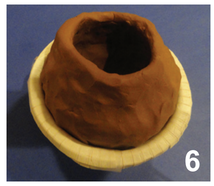




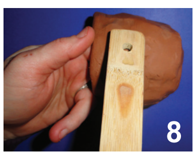
ACTIVITY – POTTERY COILING continued:

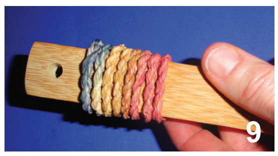
STEP 5: Blend the Coils. Use a Popsicle stick to gently blend the inner coils together. Too much pressure can destroy the pot. After the inside is smooth, pick up your pot base and smooth the outside. Whenever you put pressure on the outer wall, your fingers must apply equal pressure to the inside.

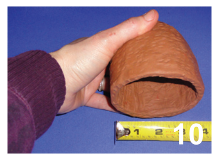
STEP 6: Repeat steps 4 and 5 (smoothing as you go) until your pot is finished. If can't you get your pot out of the mold to smooth the outer coils, just smooth what you can reach for now.



STEP 7: Remove Pot from the Form. Gently pry the pot out of the form using a Popsicle stick. OR cut the form away from the pot. Smooth any outside coils you couldn't reach earlier.







STEP 8: Use a plain pottery paddle to firmly pat the outside of the pot WHILE firmly supporting the inside with your fingers. Continue patting, including the bottom, until the outside is completely smooth. Re-smooth the inside, using fingers and stick. Cracks will probably have opened from the stress of the paddle. When you are done, set the pot upside-down to protect the round base.

STEP 9: Use a cord-wrapped paddle to further compress the outside of the pot. Be sure you exert equal finger pressure from the inside. This will add the characteristic cord marks to the pot.

STEP 10: Set your pot in a safe location (upside-down) and permit it to dry as directed. After it is completely dry, it can be stored upright. Ultimately, you should create a nest for it out of natural materials or fabric, so it won't tip over and break. While impractical for us, the round base had many advantages for native people. It balanced well on natural, uneven surfaces. It made for easier stirring (no corners for food to get stuck in) and caused more uniform heating of the pot. It also spread the shock of impact, so the pot was less likely to crack if dropped.

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TOOL-MAKING TECHNOLOGY

ACTIVITY – POTTERY COILING continued:

SAFETY TIP: Because the Timucua did not use a glaze on their pottery, none of their pots were truly waterproof. Air-dried clay is also unglazed; you should not use this pot for food or drink.

1) What did you find most challenging about coiling your pot?

2) What modern repetitive activity do you participate in that is most like pottery coiling?

CHAPTER 4

CHAPTER FOUR

ANIMAL TECHNOLOGY

STUDENTS LEARN HOW THE TIMUCUA UTILIZED WILD ANIMALS FOR EVERYDAY SURVIVAL.

WHAT IS ANIMAL TECHNOLOGY?

While some Timucua grew crops, all villages depended primarily on hunting and gathering. We normally think of "gathering" as something you do with plants. But coastal peoples, like the Timucua, spent a great deal of time gathering shellfish, including oysters, clams, mussels, whelks, and even tiny coquina. Can you imagine trying to shuck enough of those tiny clams to make a meal? Of course not. You'd spend more energy opening the shells than you'd gain by eating the tiny clams.

Coquina, photo courtesy of Kimber Herrera

For a food to be useful, it had to provide the people with more energy than they used up while catching it, processing it, and eating it. The Timucua had to make choices we never consider today, because we don't hunt, gather, and process our own foods. Someone else, or a machine, spends all of the energy it takes to prepare food for consumption. The only part most modern Floridians participate in is the eating. Hmm. Maybe that's why this country is facing an epidemic of obesity. We don't use up any energy to get the foods we eat.

Well, that's not quite true. Adults spend forty or more hours per week working to earn money that can be traded for food. Whether they're building houses or typing at a computer, they're using energy to earn that money. But even so, there's still a huge disconnect between the food we eat and how it gets to our table. How many people do you know that have hunted their own food? Collected chicken eggs from a hen house? Eaten vegetables from their own garden? You may know a few, but the majority of people get their food solely from stores and restaurants.

Life for the Timucua was very, very different. Nearly every daily task related in some way to food: finding it, collecting it, hunting it, butchering it, preserving it, cooking it, storing it, protecting it from animals, and of course, eating it. So how did they effectively process coquina?

1) They rinsed handfuls of the tiny clams to remove sand.
2) They plopped them into a clay pot and added water.
3) They collected wood to build a fire and boil the water.
4) The water's heat killed the tiny coquina clams and popped open the shells.
5) The nutrients in the tiny clams dissolved into the boiling water around them, creating clam broth (like chicken broth in a can, right?).
6) They strained out the shells, probably using an open weave basket.
7) The remaining broth was full of protein. They drank it alone or used it to boil vegetables and make a stew.

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The Timucua still used energy making the coquina broth, but nowhere near the amount they would have used prying open each ¼ inch clam individually. This is an example of food technology. It's not just about which animals you eat. It's about getting that animal into an edible form without spending too much of your own body's energy in the process.

Animal technologies depend in part on having the right tools – spears, traps, collecting baskets. But most animal technologies are about 1) gaining **knowledge** about the species you're hunting and then 2) developing **methods** for finding, killing, and processing that species.

LET'S TALK SHELLFISH

All Timucua groups lived near some kind of water body: a salt marsh, a beach, the intracoastal waterway, a river, or a lake. The kinds of shellfish they harvested depended on the water body they lived near. The Timucua living near the salt marsh collected millions of oysters. These sharp-edge shellfish thrive in the changing salinity of a marsh. How do we know the Timucua ate oysters? Archaeologists have found enormous piles of native trash, called middens. These piles include broken bits of stone tools and pottery, pieces of animal bone, and lots and lots of shells. Some of these shell middens reach 75 feet tall. Others, called sheet middens, are only a few inches thick, but might stretch for four miles. Archaeologists study these middens to learn what the Timucua were eating. Near the salt marshes, some middens are more than 90% oyster shell.

Above: *Oysters growing in a salt marsh, photo by Wikipedia*

Below: *Whelk shell tool*

<u>How did the Timucua harvest oysters from the marsh?</u>

First, they would go out into the salt marsh at low tide, when the oysters and the mud flats were exposed. They could just walk up to the big clusters of oysters and pick them up. (Don't you try it without leather hand protection. Oyster shells are sharp.) The Timucua probably didn't bring the whole cluster of oysters home, though. The oysters on the bottom and in the middle of the cluster were often dead, and many young oysters – too small to harvest – were also attached to the cluster. So, how did they break off the edible ones? The Timucua probably used a whelk shell hammer to bash adult oysters off of large clusters. Then they tossed the rest back into the marsh mud. This served three purposes.

1) It lightened the harvester's load.
2) It returned young oysters to the marsh to continue growing.
3) The returned clusters provided hard surface for future baby oysters to attach to.

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Florida middens do NOT contain huge clumps of oysters that were harvested dead and never opened. This suggests that the Timucua brought back edible individual oysters, not entire clumps of shell.

They probably tossed the collected oysters into baskets slung across their backs. This allowed them to gather without interruption throughout the low tide period. It takes a lot of effort to harvest oysters, but it is a fairly safe activity, and it doesn't require years of skilled training. As a result, many native societies considered shellfish gathering a task for women and children.

Ribbed mussels are another shellfish that grows in the salt marsh, often in and among the oyster clusters. They were probably collected right along with the oysters. **<u>How did the Timucua gather mussels?</u>** These shellfish are about 10 cm (4") in length and have thin dark brown shells. They attach to each other or to the base of marsh grasses with thin, hair-like filaments. The Timucua did not need prying sticks to harvest the mussels. Instead, a sharp bone or stone knife would have been helpful for cutting the attaching filaments.

Atlantic ribbed mussel, photo by Wikipedia

Have you ever heard the saying: "Only collect oysters in months with an 'R'?" In modern times, pollutants and bacteria in coastal waters make it unsafe to harvest shellfish during summer months (May, June, July, and August). Many shellfish are filter-feeders, meaning they suck nutrients and dead bits of plants and animals from the water. They also suck in the pollutants, including a deadly toxin created by an algae bloom called Red Tide. Today, the Florida Fish and Wildlife Conservation Commission tests waters all over the state and makes announcements to alert citizens to the presence of Red Tides. Four hundred years ago, the Timucua didn't need these alerts. Red Tides and coastal pollution were not big issues back then, so they could collect oysters and mussels during summer months if they wanted to.

Some Timucua lived near intracoastal areas, instead of living on the mainland side of a marsh. The intracoastal area is found where narrow barrier islands run along the coasts of Florida. For the Timucua, the western side of these islands was bordered by salt marsh. (The marshes were created gradually as rivers dropped their silt before flowing into the ocean.) The environment on the eastern side of these islands was totally different - sandy beaches and the waves of the Atlantic Ocean. This beach habitat provided the Timucua with several useful shellfish species, including clams, whelks, and - of course - coquina.

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Small Quahog Clams, photo by Wikipedia

How did the Timucua harvest quahog clams? As with oysters, this was a low-tide harvest, perhaps by women and children. Tiny holes in the sand indicate the presence of a clam below. They could have dug up the clams with hands or a simple digging stick. Often, several clams could be found together, then tossed into a collecting basket. Clam shells found in shell middens are often 12 cm across (5"), large enough for use as bowls and dippers. Archaeological studies show that these clams were occasionally gathered in the summer, but more often in winter and spring. Why? During the summer, clams undergo heat stress, and as a result, they weigh less. Harvesting them in summer would provide less food per clam. Also, the clams breed in summer, and many modern fishermen note that clams taste bad while breeding. So, the Timucua's focus on winter and spring harvest could have been practical or just a matter of taste.

How did the Timucua harvest whelks? These gastropods (snails) can reach 41 cm (16") in length, and can provide much more meat than a clam or oyster. In addition, archaeologists have found a variety of tools (axes, hammers, and chisels) as well as ceremonial bowls made from this species' large shells. Whelks can be hand-collected in spring through fall in shallow, coastal waters. Whelks eat other shellfish, like clams, but they only eat about once a month. They spend the rest of their time buried under the sand. It is duringthese hunting forays that they are easy to collect.

Knobbed Whelks, photo by Wikipedial

Two Live Whelks on a Mud Flat in North Florida, courtesy of The Timucuan Paddle Page

And what about the coquina we spoke of earlier? They burrow just beneath the surface of the sand – not where the waves are crashing – but further upland, where a bit of water washes gently over the sand. The Timucua probably watched as a soft wave retreated to the ocean, looking for the tiny feathery filters that these mollusks use to capture bits of food. The filters retreat as the wave leaves. But since coquina tend to live in colonies, one whelk-shell-shovel could scoop a hundred of these tiny shells. They may have been tossed into a loosely woven basket, so that waves could wash through it and remove some of the sand. Because coquina live in colonies, once the Timucua had scooped an area clear, they would probably move down the beach searching for more of the tiny filter feeders. These shells are found in intracoastal middens, along with a mixture of whelks and quahog clams. They're also found in tiny middens on their own. Perhaps these locations were used by individual families to process coquina.

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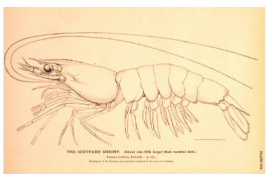
Donax variablis,
photo by Kimber Herrera

Archaeology Note: When you find coquina on the beach today, they're often 10-11 mm long (< 1/2"). In archaic shell middens (3000 BCE – 500 BCE), Donax shells were substantially larger, with most between 10 and 22 mm (0.4" – 0.86"). They even found one 25 mm Donax, which is an inch long! The difference between a half inch and a whole inch may not seem like much, but when it describes a 100% increase in length, it really is a big deal. Scientists don't know yet why this clam's size decreased so much over the past 5000 years. Was climate change a factor in their growth? Or environmental toxins? Further studies are needed to figure out this change.

<u>How did the Timucua harvest crabs and shrimp?</u>

Blue crabs can be captured using baited lines as well as traps. A baited fishing line dangled in the water will often attract a crab in less than five minutes. When the crab pinches on to the bait, the line is pulled up, and the crab is scooped in a dip net. Some native peoples fashioned crab traps from saplings and baited them with dead fish. These worked just like modern metal traps.

Blue Crab,
photo by Wikipedia



Shrimp,
photo by Wikipedia

Catching shrimp required a different technique. Here's what modern shrimpers have learned.
The best shrimping in the St. Johns River is during the months of July, August, and September. During the day, shrimp stick to the deeper channels in the middle of the river, so fishing with a cast net that will sink 20 feet or so is a good way to harvest them. Did the Timucua make nets that would sink that far? Because nets aren't preserved in middens, archaeologists can't say for sure. Deep nets aren't needed for night shrimping, because shrimp migrate into the grassy shallows at river edges each night. To catch shrimp at night, you need bait. Modern shrimpers use bait made of ground, dried fish and clay – two things the Timucua had in abundance. Modern nighttime shrimpers toss bait into shallow water from a canoe. Then they shine a light. When the shrimp come for the bait, they use a cast net or fine-meshed dip nets to haul in the catch. Did Timucua use bait? These biodegradable materials would not last in a midden, so we may never know. However, crab shells, as well as the tiny mandibles (mouth parts) of shrimp, have been found in middens, proving that the Timucua possessed the technology to harvest these tasty crustaceans.

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Freshwater Mussels, photo by Wikipedia

While many Timucua groups lived near salty or brackish water, others lived further inland near ponds and along freshwater rivers. At these inland sites, the Timucua gathered freshwater shellfish, including mussels and snails. Freshwater mussels look similar to their salt marsh cousins. Most species prefer to live in the muddy bottoms of streams and rivers, though some live in lakes as well. The Timucua may have waded into these shallow waters,squishing their toes through the mud to feel around for the smooth shells. Freshwater mussels can be pulled up by hand and tossed into a collecting basket, then cooked like a clam or oyster. To modern Floridians, salt marsh mussels are tasty, while freshwater mussels are not. The Timucua living near fresh water clearly utilized the freshwater mussels – regardless of our modern sense of taste.

Archaeology Note: In one study, archaeologists counted the number of fresh water mussel shells in middens found across Kentucky, Tennessee, Ohio, Mississippi, Illinois, and Alabama. They found that the numbers of one mussel species were consistently high for nearly 5,000 years. Then, about 1,000 years ago, the number of mussels in these middens dropped sharply. This occurred just as corn agriculture was becoming well established in that part of North America.

Were the native people filling up on corn instead of mussels? Or did this midden change have more to do with habitat destruction? Agriculture opens up fields, allowing rains to carry extra soil into streams, rivers, and lakes. It's tough for filter feeders (like mussels) to filter food from the water when the it is choked with dirt.

Even today, many mussel species are disappearing because human activities disturb their habitat. What kinds of human activities?

1) Deepening rivers by dredging
2) Straightening river channels to ease boating
3) Reinforcing river banks to create safe, solid banks for water recreation
4) Creating pollution as a byproduct of daily life
5) Overharvesting (collection of mussels for their pearls)
6) Accidental introduction of exotic zebra mussels

Apple Snail, photo by Wikipedia

In addition to mussels, the Timucua also collected freshwater snails, including the Florida Apple Snail. These snails often hide in the plants floating near the edges of lake and streams. They are very well camouflaged. Apple Snails have both a gill and a primitive lung, so they can breathe both in the water and out. This allowed them to leave the water at night to search for plant foods and to lay their eggs. The Timucua probably collected them by hand. It required no tools

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and little strength, but did require skill at spotting them. Snails would have been cooked thoroughly because they can carry diseases deadly to humans.

Archaeology Note: If you're interested in seeing a freshwater snail midden, visit Lake Ashby Park in Volusia County. A road was cut right through this midden, so you can get a good look at all of the snail shell refuse that created this ancient trash pile. Hontoon Island and the Ocklawaha River are also good spots to look for snail shell middens.

ACTIVITY - HOW DID THEY USE THE ANIMALS THEY HUNTED?:

BACKGROUND: The Timucua utilized every part of the animals they hunted, wasting nothing. Many modern products are still made from animals, but we no longer know which animal parts are used. The Timucua were intimately aware of where their food, tools, and other products came from.

List of Animal Parts: Antler, Bone, Fat, Feathers, Fish Air Bladder, Hide, Hooves, Muscle, Sharks Teeth, Shell

INSTRUCTIONS: Work in teams of two. Use deductive logic (make your best guesses) to match each item in the table to the animal part it was made from. When completed, discuss as a class to form a consensus about which items were made from which animal part.

ANIMAL PARTS THEY UTILIZED

Item the Timucua Made	Animal Part it was Made From
Clothing	
Fish Hook	
Net Floats	
Cup, Chisel, Axe	
Tool Handle	
Lotions and Conditioners	
Meat	
Glue	
Drill Bits	
Fletching on Arrows	

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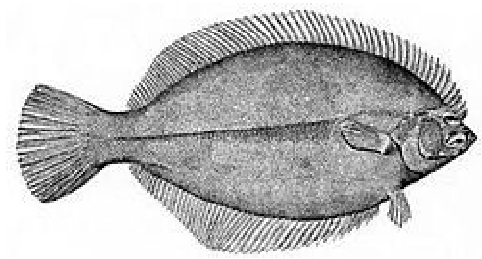
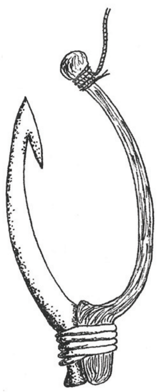
LET'S TALK FISH

Fish made up a huge portion of the Timucua diet. Native peoples possessed a variety of technologies for hunting fish, including gigs, baited hooks, gill nets, seine nets, cast nets, hand-held nets, fish traps, and weirs.



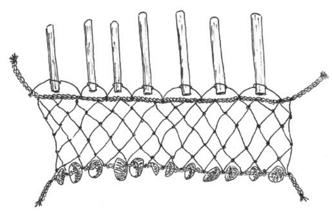
Flounder,
photo by Wikipedia

Gigs – What's a gig? It's a long wooden pole, about 2.5 to 4 meters (8-14') long, tipped with three or four sharp tines (made of wood or stingray spines). It is a stabbing tool used to hunt fish that rest on the sandy bottoms of the intracoastal. The Timucua probably gigged flounder from a canoe during late fall and early winter nights. We think they lit a small fire in their canoe, built atop a fire-proof platform of clay. The flounder's body was hidden under the sand, and the light helped the Timucua to spot the flounder's eyes. Then they stabbed at the eyes, pinning the fish to the sandy bottom until it was still. Female flounder reach 63 cm (25"), so this was sometimes a real challenge.



Fish hook, courtesy of the University Press of Florida

Baited Hooks – The Timucua did not use fishing poles, but they did use lines and hooks. Straight bone hooks are called gorges (gor-jez). More advanced curved hooks, made of bone and wood combinations were also used. Bits of cut up fish, crab, or shellfish served as bait. When trying to catch sea trout, red drum, and black drum, the Timucua dropped a single baited line from a boat in the salt marsh or intracoastal. In freshwater lakes, bass could be caught on hooks and lines baited with crayfish. Trout and sunfish hit better on baits like grubs, caterpillars, or grasshoppers. Tidal and freshwater creeks were a great spot to catch catfish using cut bait on a trotline. What's a trotline? It's a long piece of cord stretched across a creek. Several lines are tied along the cord, each dangling into the water with baited hooks. The Timucua needed to watch their trotline carefully to prevent scavenging crabs from stealing their catch.



Prehistoric Gill Net, courtesy of the University Press of Florida

Gill Nets – The Timucua manufactured nets with holes in many sizes, designed to catch differently sized fish. Long gill nets may have been rolled out into intracoastal waters from a canoe. How did these gill nets work? Gourds, light-weight wood, or inflated air bladders could be attached to the top to provide floatation. Shell or clay weights were attached to the base of the net. The combination of floats and weights held the net like a wall in the water. The holes were made big enough so that a fish could get its head part way in, and then become tangled around its gills. Strong, medium-sized fish, like sea catfish, pinfish, and jacks were captured with gill nets.

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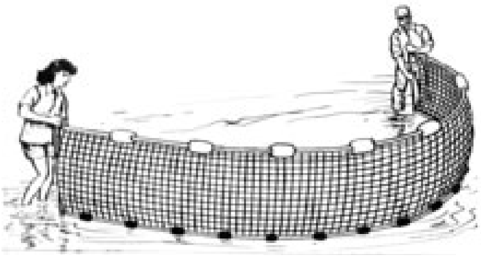
Seine nets – These nets work a bit differently. The holes in the net are smaller, meant to trap rather than entangle. One end is held at the shore, while the other is deployed in a large half-circle. Smaller seine nets can be played out by hand (like the one illustrated). Longer ones could be lowered into the water from canoes. As the deep end of the net is dragged toward shore, all of the fish trapped within the arc are beached.

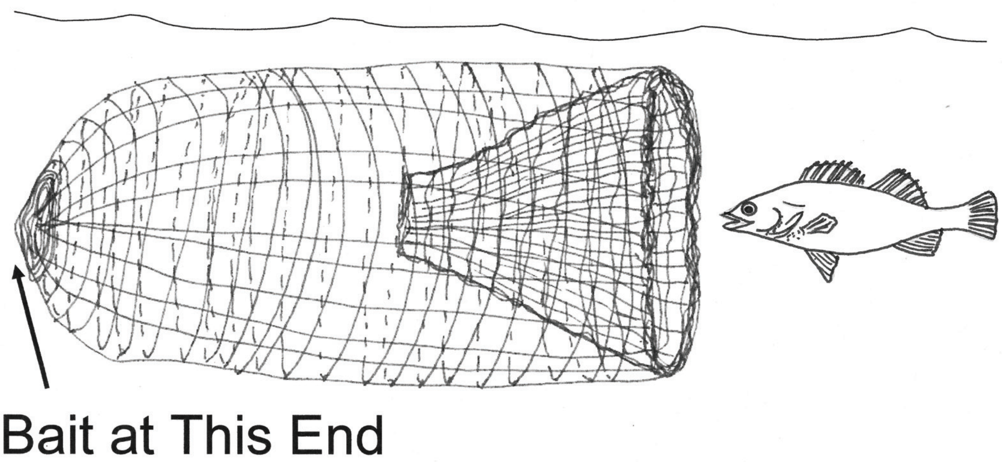


A Small Modern Seine Net, photo by Wikipedia

Cast Nets – These nets were made to be thrown. A long cord attaches at one end to the wrist of the thrower and at the other end to a large panel of net. Around the edges of the net are shell weights. When the net is cast, the edge weights drag the panel of netting towards the bottom. When the caster tugs on the cord, any fish or shellfish caught under the panel are scooped into the net's center. Pinfish, mullet, shrimp, and bait fish can be caught when casting from the shore into marsh grasses. They could also cast into deeper waters from a canoe.

Dip Nets – These hand held nets had a very fine mesh. In addition to shrimp, they could be used to capture bait fish and other small edible fish (around 20 cm or 9"), including silver perch and star drum.

Fish Traps – These basket traps were woven from long, slender saplings. They were constructed with one long, narrow basket inside another. One end was wide open, allowing the fish to enter as it sought the bait. The back of the inner basket was narrow. It allowed the fish to swim through into the big outer basket to get the bait. But it didn't allow the fish back out again. Catfish and black crappie are two examples of fish caught in traps.



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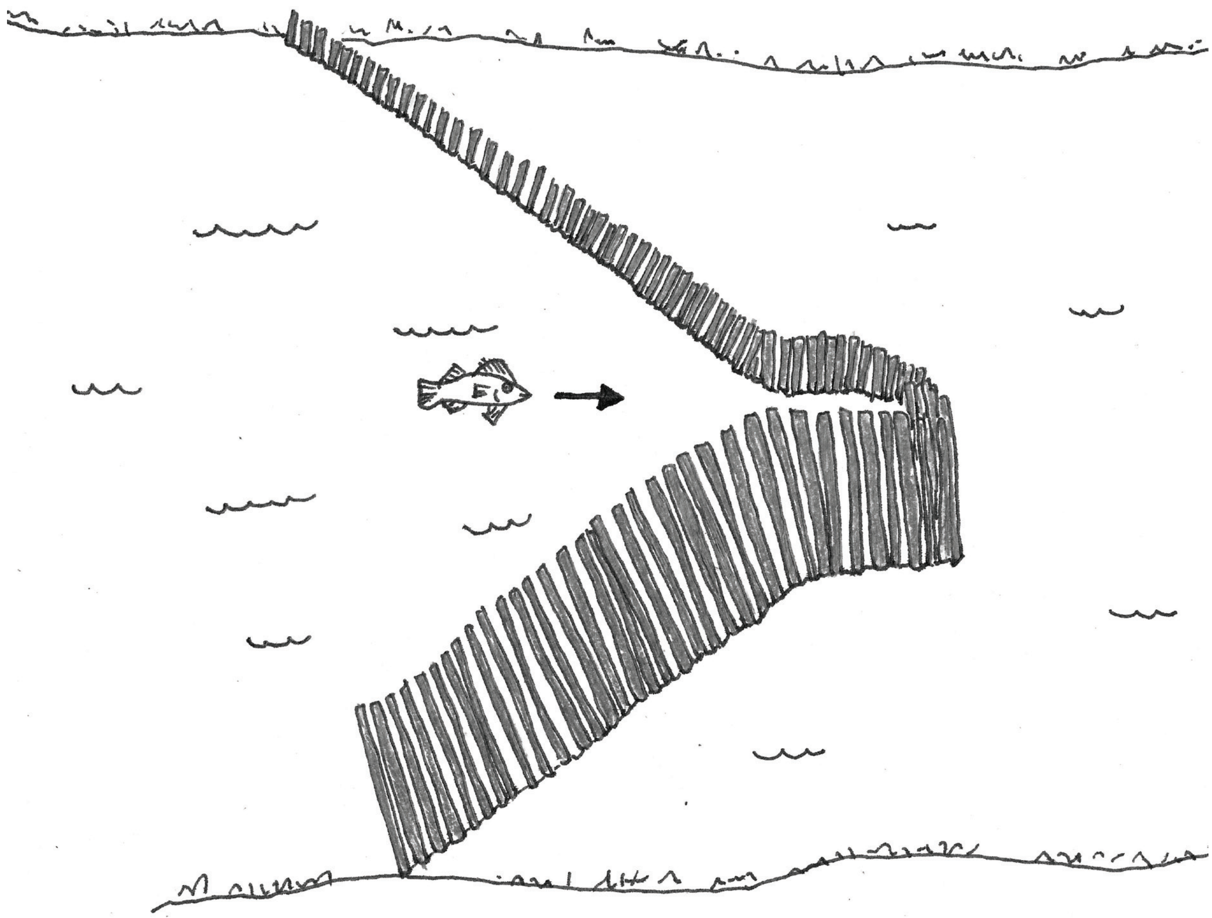
<u>Weirs</u> – What's a weir? It's a semi-permanent fish trap, a bit like a fence, set up in a tidal creek. French explorers described Timucua weirs as mazes in the water. Some weir fences spanned the entire creek, funneling the fish towards a trap or pen. The trap could be gated shut at low-tide, blocking the fish's escape with the outgoing tide. The trapped fish could be netted or speared by people in canoes. Many mullet, black crappie, and sharks were caught in weirs.

Some native cultures built weirs that prevented fish from escaping at high tide too. Trapped fish could live in these man-made enclosures for days, weeks, or longer - until they were needed for food. The fish were actually living in these watery pens. Weirs that included long-term pens may have been a form of early aquaculture (fish-farming).

Aquaculture is a thriving industry in modern Florida. Alligators, shellfish, and catfish are examples of water animals raised for food today. In addition, water plants and tropical fish are raised in Florida for non-food purposes, like landscaping and the pet trade.



ACTIVITY - REFRACTION & GIGGING FOR FLOUNDER:

BACKGROUND: Light travels at different speeds through air than it does through water. So, when light passes from air into water (a denser medium), it bends. This is called refraction, and it causes items in the water to appear in a different place than their actual location. The bending of light makes hitting your target more challenging. When someone is gigging for flounder, they jab the gig from the air into the water. They are looking through two substances (air and water) with differing densities, so the flounder's position will be distorted. In the following activity, you will practice "gigging" in the air, then "gigging" in the water and compare the two experiences.

INSTRUCTIONS, Part I: Fill a clear glass with water. Place a colored straw or a pencil in the glass. Observe that the straw appears broken because light bends as it travels from air into water.

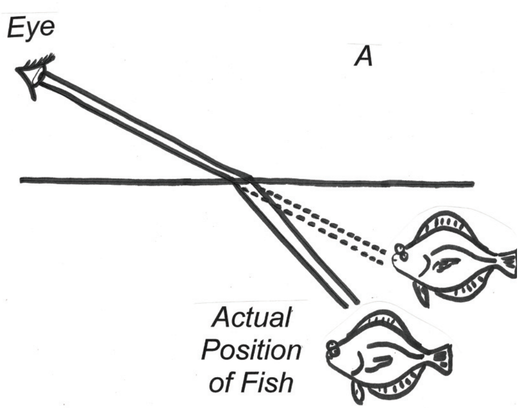
INSTRUCTIONS, Part II: Stand about two feet from the fish target. Use your dowel (model gig) to take ten stabs at the fish suspended in air. Gigs are stabbed, not thrown, so the dowel should not leave your hands. Stand in an upright position with the tip of your gig at least a foot away from the fish. Record the number of stabs that hit the mark. Next, use your dowel to take ten stabs at the model fish suspended in water. Once again, record the number of stabs that hit the mark.

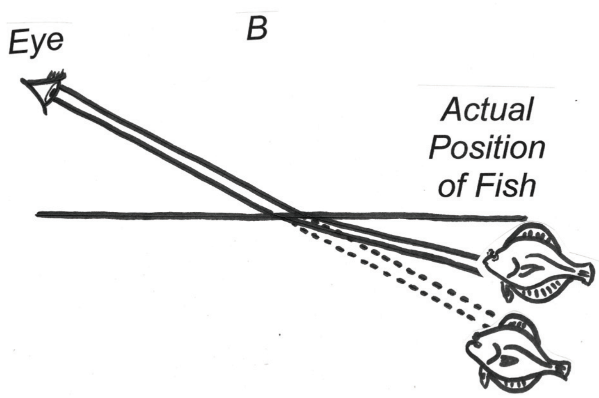
1) Gigging in the Air - Number of Stabs (out of 10) that Hit the Mark: _______________

2) Gigging in the Water – Number of Stabs (out of 10) that Hit the Mark: _____________

3) As time allows, continue stabbing until you are hitting the fish regularly. You are now getting a sense of how to adjust your aim. Do you need to aim closer (lower) or further away (higher) to actually hit the fish? ______________________________________

4) Which diagram accurately shows how light bends when it passes into water?





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WHAT OTHER WATER ANIMALS DID THEY HUNT?

The Timucua hunted other water animals, including mammals, birds, and reptiles. Let's start with mammals. River otter bones are present in Florida middens. These animals were probably tracked to locations where they slid down into the water. Here, they could be hunted with snares or bow and arrow. Dolphin bones have been found periodically in middens. These may have been hunted or simply found when dead dolphins washed upon the beach. Manatees were not hunted in Florida. The Caribbean and Mexican Indians did hunt them, and in these locations, archaeologist find ceremonial and everyday items made from manatee parts. Because archaeologists do not find manatee-related artifacts in Florida, we assume the Timucua did not hunt these animals.

What about Aquatic Birds and their Eggs? Water birds, including ducks, herons, egrets, cormorants, pelicans, gulls, and more, were hunted with spear or bow and arrow. Eggs could be collected by hand.

What about Aquatic Amphibians and Reptiles? Bones of aquatic frogs, turtles, snakes, and alligator have been found in Timucua middens. Turtle eggs were probably collected by hand. Alligator eggs…well, that's a bit more dangerous.

Pond Frogs were hunted at night, using a gig (like a flounder). Frogs were not pinned to the deep bottom of a pond the way flounder were pinned in shallow intracoastal waters. Instead, the fisherman makes a sharp stab and pulls the frog from the water.

Snapping turtle hiding under a log, photo by Wikipedia

Turtles were hunted in different ways depending on the species. Soft-shell and other aquatic turtles could be scooped up with long-handled nets. Sliders and other hard-shelled pond turtles could be caught using baited hooks and lines.
Florida snapping turtles were probably hunted with a digging stick. How did that work? Ponds with plenty of vegetation around the edges are excellent snapper habitat. The murky water makes it tough to see the snappers though. That's where the digging stick comes in. The turtle hunter paddles his canoe along, poking down into the pond muck with a stout stick. If he pokes something hard, he's found a snapper's shell. Snapping turtles can deliver savage bites, so the goal is to swirl the stick around until the snapper bites it. Hopefully, the snapper will continue to bite the stick, while the turtle hunter reaches down and grabs both the front and back of the snapper's shell. With care, a 25-pound snapping turtle can be hefted out of the water.

What about marine turtles? Archaeologists have found evidence of sea turtle bones in Timucua middens, but most of the evidence for turtle hunting is in South Florida and the Caribbean. It is likely that sea turtle hunting in Timucua territory was opportunistic. "Hey, there's a turtle laying eggs on the beach. Let's grab it!"

Aquatic snakes could be hunted with spears or bows and arrows.

THAT BRINGS US TO ALLIGATORS

Alligators can be hunted with stone-tipped spears. They can also be hunted with long bows, if the bow has at least 35 pounds of draw weight. This provides enough force to pierce a young alligator's hide. Alligator bones are found in Timucua middens. This suggests that the Timucua possessed the technology to make spears and bows strong enough to hunt them.

De Bry engraving of an alligator hunt

The text below is attributed to the French artist Le Moyne, based on his experiences in Florida in 1564.

"This is how they attack alligators. Near the river they put up a little hut full of cracks and holes. In this hut, one of their men keeps watch. From his hiding place he can see and hear the animals, even if they are a long way off. Then the alligators, driven to the shore by hunger, give themselves away by their loud bellowing, which can be heard at a great distance. The watchman in the hut now calls his companions, who are waiting in readiness, and they set out for the hunt. They take with them a ten-foot pointed pole, and when they come upon the monster – who usually crawls along with open mouth, ready to attack – they push the pole quickly down its throat. The rough tree bark of its sides prevents the pole from slipping out again. Then the beast is turned over on its back and killed by beating it with clubs and piercing its soft belly with arrows. The alligators are such a menace that a regular watch has to be kept against them day and night. The Indians guard themselves against these animals just as we guard ourselves from our most dangerous enemies.

A Year-Round Menace? Unlikely. April and May begin alligator mating season. It is only during the spring that males bellow to attract females, and females respond with bellows of their own. This is probably what the French heard. Male alligators travel overland for great distances to find females. Perhaps the use of guard huts to protect the village took place only in the spring each year, when male alligators ventured beyond their normal range.

Historical Note: Did you know that the French originally named the St. Johns River the River of May because they landed there on May 1st? This puts them in Florida right in the middle of alligator breeding season. Hmmmm.

Alligators generally hunt in the water or at the water's edge. They use a dash and grab technique, not a "run across the land, mouth wide open, straight at a bunch of guys with a really long pole" technique. During times of drought, alligators will move overland in search of a new water source. However, humans are not their normal prey. Displaced from their homes, alligators would have been even less interested in confronting a group of hunters.

Mouth Wide Open? Alligators do bask on land with their mouths open; it's how they cool off. So, perhaps (unlike the French description), Timucua hunters focused on resting alligators. When alligators are on the move, their mouths are usually shut or just barely ajar. One exception is a female protecting her nest. She will dart forward with her mouth open to scare off a potential egg predator. Hatching usually takes place in August and September; however, a female alligator would not put her nest near an area used by people. It's unlikely the Timucua would choose such a dangerous target anyway.

Jamming a Pole in the Alligator's Mouth? Maybe so. On the Nicobar Islands (between India and Thailand), there's a group of people called the Shompens. They are modern hunter-gathers living in a tropical climate, which includes crocodiles. To hunt these crocs, they approach them while they're basking (sound familiar?) and push a pole that is long, but soft, into the crocodile's mouth. Gators and crocs have a bite reflex. If anything touches the area near their back teeth, they bite down – really hard. The croc's teeth embed in the soft wood, making its teeth useless as a defensive weapon. (Of course, whipping its tail or slamming its head back and forth can still create plenty of damage.) The Shompens hunters, even today, use this pole-and-spear method to hunt crocodiles. The Shompens don't flip the crocs though. Maybe the Timucua didn't either?

Historical Note: Take a look back at de Bry's alligator hunt engraving. We'll take a moment to review the parts we KNOW are false. The alligator in the front would be over 40 feet long. Even 400 years ago, gators weren't that big. They Timucua are hunting two of these large dangerous animals at the same time right next to each other. Does that seem wise? Where are the plants? Florida was a wild place. The only smooth ground was the salt marsh at low tide, not the best place to hunt gators since the hunters would sink and get stuck. The bows the Timucua used were long bows, not European recurved bows as shown. The men should be wearing loin cloths. Why go naked around

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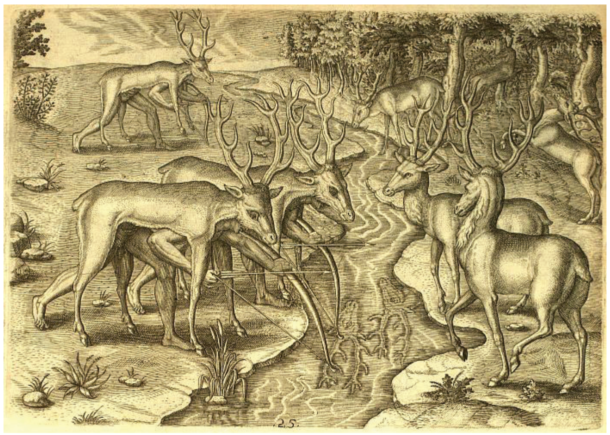
something as dangerous as an alligator's jaws? In addition, this engraving was clearly made by someone who had never seen an alligator. The external ears, eyebrows, and long wiggly fingers make this creature look more like a dragon than an alligator.

LET'S TALK LAND ANIMALS

The Timucua collected a few terrestrial animals by hand, including box turtles and gopher tortoises. Most other species moved quickly enough that the Timucua needed hunting tools to catch them. Animals like bear, deer, wolf, fox, raccoon, panther, squirrel, beaver, muskrat, snakes, quail, and turkeys were all hunted with **spear** or **bow and arrow**. Small to medium-sized mammals were also hunted using snares or traps.

Deadfall traps involved balancing a heavy log on a stick. A trigger with bait is added. When the animal grabs the bait, it pulls on the trigger stick, dropping the heavy log. The animal (perhaps a raccoon) is trapped underneath. **Snares** are made of loops of cord that are hung vertically in a narrow animal path. When the animal charges down this path, its head goes through the loop. When it struggles, the movement releases a catch that springs the cord high. This strangles the animal and lifts it out of the reach of scavengers.

Fire drives increased the efficiency of bow hunting because smoke and fire drove the animals towards waiting hunters. **Tracking technologies** leave no mark in the archaeological record, but this sort of wisdom was indispensible in hunter/gatherer/agriculturist societies like the Timucua. We know they possessed these technologies because we see the evidence of successful hunts in the middens, but we really don't know exactly how they stalked animals. It's only by comparing them with other groups (like the Shompens) that we can make educated guesses.



De Bry engraving of a deer hunt

For example, **deer hide disguises** were used by native peoples across eastern North America. Deer hides were processed with the head and antlers still attached. Hunters wore these hides draped over their head and back. Then they crouched down on all fours, moving in ways that mimicked natural deer movements. This helped to camouflage them as they approached the deer downwind (so the deer couldn't smell them.) Because other native groups on the East Coast used deer hide disguises, we can surmise that the Timucua did something similar. Because deer hides don't last in the archaeological

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record, we have to rely on historical documents (like de Bry's engraving) for clues about their use. Look back at the unit on de Bry's engravings to review this piece of artwork.

WHY DIDN'T THE TIMUCUA USE DOMESTIC ANIMALS?

The only domestic animal the Timucua used was *Canis familiaris*, the dog. Domestic dogs travelled across the Bering Land Bridge with the Paleoindians around 10,000 BCE The descendents of these dogs were part of Florida's native cultures long before the Spanish arrived.

What did these dogs look like? European explorers described the domestic dogs living with tribes far north of the Timucua. These northern dogs weighed about 20 pounds and were the size of a Shetland sheepdog. They often lived on the fringes of a village (not inside the homes), and only accompanied humans on hunting trips. These dogs were not the cuddly little puppies that share our homes today. They were working dogs that earned food and protection from predators by helping with hunting. European descriptions also note that they howled (like wolves) rather than barking.

Dogs were domesticated 12,000 years ago, and there is evidence of dog burials on the east coast of North America as early as 2000 BCE. How were dogs domesticated? Wolf packs have a natural dominance structure. There's an alpha male and an alpha female. Wolf cubs who could accept humans as their alphas were able to be domesticated. Wolf puppies are playful, just like dog puppies. But as they grow up, they lose their playfulness and no longer accept new members to the pack. This means that your wolf would try to kill every new person visiting (invading) your home. So what changed? Basically, a few alterations in DNA (mutations) stopped wolves from growing up. Sure, they became physically mature, but emotionally, they stayed puppies. This produced the playful, friendly animals we know as dogs today. During this transformation, dog faces became shorter and wider, and they changed from howlers to growlers. They are still happiest in a pack and are loyal to their alphas (owners).

Interesting Fact: The wolves living in Florida during Timucua times were not gray wolves (*Canis lupus*). They were red wolves (*Canis lupus rufus*), which are now believed to be a hybrid species between gray wolves and coyotes. They are largely extinct in their former habitat (up the East Coast into Canada), but have been reintroduced in South Carolina, North Carolina, and to islands off the west coast of Florida.

Archaeologists discovered this dog adorno near Shields Mound in Duval County (dated 900-1,200 CE). It is a decorative element, once part of a clay pot.

Courtesy of archaeologist, Dr. Keith Ashley

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Archaeology Note: In size, the Timucua dogs were about the size of a small collie (20-60 pounds), fairly small compared to the 200-pound war dogs (mastiffs) that the Spanish brought. Archaeologists discovered a dog burial in the northern part of Timucua territory (up in Georgia). The dog had a musket ball in its leg and was buried in a shallow grave. This, along with other nearby artifacts, demonstrates contact between the Timucua village and the Spanish in the early 1500s.

Photo of Dog Burial, provided by archaeologist, Dr. Jerald T. Milanich

The Timucua didn't domesticate dogs. They inherited them. So why didn't they domesticate cows or goats, pigs or horses? Simply put, those animals didn't live in Florida. Horses became extinct along with the mammoth 10,000 years ago. Pigs and cows were introduced by the Spanish. To domesticate something, you have to have the raw materials: an appropriate animal species. The only animal living in Florida that has been domesticated elsewhere is the turkey. In Central America, turkeys were domesticated by the Aztecs around 800 BCE, mostly for ceremonial use of their feathers. Later, around 200 BCE, they were domesticated again by the Ancestral Puebloans in the American Southwest. If corn domestication made it across North America, the idea of turkey domestication probably did too. So why didn't the idea catch on? Taking care of animals is a lot of work. The Timucua had no big cities requiring large-scale food production. Why bother domesticating animals if you don't have to?

The Spanish did introduce domestic animals to mission sites. These pigs, chickens, and cows were raised for use by the Spanish missionaries and the citizens of Spanish St. Augustine. There are Spanish records of complaints by the Timucua about the habitat damage caused by cows grazing on native hunting grounds. The Timucua themselves preferred hunting wild animals to caring for domestic ones. They did hunt feral pigs released into the forest by the Spanish, but they never fed these animals or tried to domesticate them.

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DOMESTICATION OF ANIMALS AROUND THE GLOBE

	Animal Species	When it Was Domesticated	Where it Was Domesticated	What the Animal Was Used For
A	Dog	12,000 BCE	Middle East	Meat, Hunting Aid, Labor
B	Pig	10,000 BCE	Middle East	Meat, Hides
C	Goat	9,000 BCE	Middle East	Meat, Milk, Fur, Hides, Dung for Fuel
D	Cow	6,000 BCE	Middle East	Meat, Milk, Hides, Labor
E	Chicken	6,000 BCE	Southeast Asia	Eggs, Meat, Feathers
F	Horse	4,000 BCE	Eastern Europe	Meat, Labor, Transportation
G	Alpacas	3,500 BCE	South America	Fur to Make Cloth, Transportation, Meat
H	Guinea Pig	3,500 BCE	South America	Meat
I	Turkey	800 BCE	Central America	Feathers, Meat, Eggs

ACTIVITY – WHERE WERE ANIMALS DOMESTICATED?

BACKGROUND: Some animals, like the pig, were domesticated in several locations. Others, like the alpaca, were domesticated in only one spot. Once domesticated, these animals were traded to nearby peoples, eventually crossing oceans to other continents.

INSTRUCTIONS: Use the information in the table titled, "Domestication of Animals Around the Globe," to fill in the map below. Write the appropriate letters in the circles on the map to show which animals were domesticated in each region.

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CHAPTER FIVE

WILD PLANT TECHNOLOGY

STUDENTS LEARN HOW THE TIMUCUA UTILIZED WILD PLANT AS FOODS, CLOTHING, TOOLS, AND MEDICINES.

WHAT IS WILD PLANT TECHNOLOGY?

The Timucua utilized every part of their environment, living and non-living. The living parts of their environment included plants, animals, and fungi. The non-living parts included water and minerals. The Timucua observed each part of their environment, noticing what parts could be helpful and what parts might be dangerous.

This kind of natural observation is called Aristotelian science. Whoa…what kind of science? Aristotelian (uh-ris-toe-teel-ee-un). Aristotle was a philosopher born in 384 BCE in Macedonia (north of Greece). At that time - over 2,000 years ago - the Timucua's ancestors were already using the principles of observational science. But they did more than just observe the natural world. They also put that knowledge to good use. Aristotelian science means organizing your observations in logical, practical ways. We're not exactly sure how native peoples applied observational science. Perhaps it went something like this.

- Modern science tells us that willow tree bark contains a natural pain remedy, but it's hard to imagine someone with a bad headache deciding to chew a willow branch.
- So how did they make this discovery? Native hunters may have observed male deer chewing willow branches while shedding their antlers.
- Perhaps they reasoned that shedding antlers gave the deer headaches.
- Someone decided to test willow bark on people to see if it actually cured headaches.
- They observed the effects of willow bark on the person's headache.
- It worked! The active chemical in willow bark is salicylic acid. It's also the chemical name for aspirin, a pain medication still in use today.

The Timucua did not try to analyze the chemical composition of willow bark. They did not do a series of scientific tests with controlled variables. Instead, they observed what worked and applied it to solve problems.

"Technology" is the use of scientific knowledge to design tools or techniques that solve problems. Through careful observation of plants and animals, the Timucua were able to solve a variety of daily problems.

- What can we use to make clothing?
- What materials can we use to build strong huts?
- How do we find, cook, and preserve plant foods?
- What can we use to make hunting tools?
- How can we heal injuries and illnesses?
- What will stop the bugs from biting us?

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Wild plant technology is more than just picking and eating raw berries. By observing the natural world, the Timucua developed tools and processes that are still useful to Floridians today.

FOOD PLANTS

Many of the food plants eaten today were not available to the Timucua. Bananas, apples, and oranges did not grow in prehistoric Florida. Neither did wheat, which is used to make most modern breads and cereals. Even without these foods, each season brought the Timucua a wealth of plant materials which could be collected and processed into soups, sauces, and breads. Look at the list below to see a few plants they used for food.

What did the Timucua do with fresh fruits? Many fruits were collected and eaten fresh from the tree (like persimmons), from the vine (like blackberries), from the shrub (like blueberries), from palms (like saw palmetto), and even from cacti (like prickly pear). In addition to being eaten fresh, many were dried and preserved for winter (like grapes, plums, and black cherries). Many fruits were used to flavor stews and breads as well. Some fruits were really challenging to process. The fruits of prickly pear cactus are covered in tiny hair-like spines that embed deep in the skin. Ouch! Once the spines are removed from these fruits, they taste a lot like kiwi.

Interesting Fact: *Most fruits are only available in the summer, while the plants are producing seeds.*

What did the Timucua do with fresh vegetables? Many wild vegetables are tough and bitter. Very few would have been eaten raw. Some examples are greenbriar stem tip and young pokeweed leaves. Most would be boiled into stews and soups. They used many different plant parts in their soups, including leaves (like wood sorrel), inner leaves (sabal palm hearts), and stems (onions - yes, they're stems).

Interesting Fact: *Wood sorrel has three times as much iron as a serving of spinach!*

How did the Timucua make teas and seasonings? They collected leaves (and sometimes berries) from aromatic plants. Bunches of leaves were tied together and hung to dry. To make tea, these dried leaves were soaked in boiling water. The smell and flavor of the dried leaves transferred to the water, creating tea. A lemony tea was made from the berries of winged sumac. Sassafras roots made root beer tea. And horsemint leaves taste like, well…mint. To make seasonings for stews and meats, dried leaves were added to the stew pot as it cooked over a fire. Bay leaves add a savory flavor. Peppergrass seeds add spice. And saltwort tastes…salty.

How did the Timucua make gum and candy? Tree sap contains sugars made by the tree during photosynthesis. These sugars made excellent gums and candies for the Timucua. To make gum, native peoples began by scraping a bit of bark from a sweetgum tree. The tree responds to this injury by

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leaking sap to cover the wound. After several days, the sap hardens and can be scraped off and chewed as gum.

Making syrup and candy from maple trees took a little more effort. Sap was collected in a bowl as it dripped from a hole drilled into the tree. The collection process took place over several days in late winter. The sap was boiled for about 20 hours. That's right, two whole days. It took 86 gallons of red maple sap to produce just one gallon of maple syrup. [That's four trees' worth! Don't worry; it doesn't kill the tree.] Boiling the sap even longer evaporated more water from the mix. Finally, you get maple sugar. It sounds like the Timucua would have used more energy making the sugar than they got in return from eating it. Maple syrup and sugar would have been a very special treat.

After the Spanish introduced the European honey bee to Florida, the Timucua may have been able to use honey as a sweetener too. (The bees have done all the work of converting sweet flower nectar into concentrated, evaporated honey.)

How did the Timucua process nuts, grains, and starchy roots into bread? The Timucua collected nuts *(acorns and hickory nuts)*, grains (*pigweed and wild rice*), and starchy roots *(cattail, greenbriar, and coontie)* because these foods are high in carbohydrates – food energy. Unfortunately, processing these raw materials into food also takes a huge amount of human energy. **Acorn and hickory nut** shells had to be cracked and removed. Both could be eaten as nuts, pounded to make flour, or boiled to make nut oils. (Today, many people use sunflower oil to cook with.) Hickory nuts have a mild-taste, similar to pecans. Acorns, however, are extremely bitter. They contain high levels of tannins (tannic acid), which can be toxic if too much is ingested. The Timucua had to process the acorns to leach out this bitter chemical.

Hickory Nuts, photo by Wikipedia

How? Cool, running water is the easiest way to wash out the tannins. Since the Timucua lived before the invention of the kitchen faucet, they had to find a more natural alternative. Many native cultures submerged bags of shelled acorns in fast-flowing streams or buried crushed acorn meal in the sand of the river banks or swamps. In the first case, the flowing water washed away the tannins as it flowed by. In the second, the river or swamp water seeped through the sand and slowly washed the tannins away. Two different European accounts describe the Timucua burying ground-up acorn meal. They don't mention that it was buried near a stream or swamp, but it's a good guess that these acorns were buried near water. One account notes that acorn meal was left underground for eight days while the tannins leached away.

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Was that the whole process? Not quite. The acorn dough still needed to be baked. One European account describes balls of dough being pressed onto sticks and held over the fire to cook. Another explains that the dough was cooked by sprinkling very hot water over small loaves. The fire's heat changed the squishy dough into a dense, solid bread. (This process, like all baking, is a chemical change.) Because acorns have no "gluten," the natural leavening material in wheat, native breads were usually very dense and flat.

Acorns, photo by Wikipedia

What other grains and roots did the Timucua gather and cook? **Pigweed** grains are the size of a pencil point, so it took a lot of work to collect enough seeds to cook with. **Wild rice** grows in water, so the Timucua would have collected it from a canoe. Next, they probably heated the rice to crack its hulls, pounded it to loosen the hulls more, and finally sifted it to collect the edible bits.

If you think that's a lot of work, the starchy roots will blow your mind. Digging up a 75-pound **greenbriar** root took a fair amount of time and energy. The roots were probably sliced and dried for several days in the sun. Next, they were crumbled into a bowl of water, where the starch sank to the bottom, and the stringy fibers floated to the top. After pouring off the water and strings, the starch could be dried, ground up, and then used as flour for bread or thickening stews.

Cattails, photo by Wikipedia

Cattails are even more time consumptive. First, the Timucua had to tug them out of a muddy swamp. Next, they probably peeled them; crushed them, and let the starch settle out in a bowl of water. After several rinses in water, the cattail starch was finally ready to use as flour. In summer, cattail pollen could also be collected from the spikes on top of the plants and used as a flour substitute.

Coontie palm is the most outrageous root the Timucua used. Coontie requires the same digging, peeling, chopping, boiling, and washing. But after all that…coontie roots are still deadly poisonous. Coonties are in the cycad family. These primitive plants are built to defend themselves against dinosaur-sized predators. When cycad plants are crushed, they release cycasin, a chemical which breaks down to form the poison cyanide. Producing a deadly toxin when your leaves are damaged is a good way to stop animals from munching your leaves. Peeling, washing, and boiling remove some of the toxin, but the root is still deadly. How did the Timucua overcome this powerful defense system? They probably left a paste of coontie starch and water sitting

Coontie palm, photo by Wikipedia

for several days. Bacteria from the air settled into the paste and began to ferment the material. During the fermentation process, these bacteria broke down the toxin, allowing the cyanide to escape as a gas. Now is the coontie edible? Not yet. The fermented starch still needed to be sun-dried for several days. At this point, most of the toxins were gone. You read that right…"MOST." And all of this work just got them flour. They still had to bake it into bread before they could eat it.

Interesting Fact: *Have you ever eaten Tapioca pudding? It's made from the cassava plant. This deadly plant requires the same level of processing as coontie to prevent cyanide pudding poisoning.*

People living in subsistence cultures worked incredibly hard to process food into useful forms. Wild plant technologies like drying, peeling, chopping, boiling, and fermenting were often the difference between life and death.

MEDICINES

For the Timucua, some plants were used as both a food and as a medicine. In some cases, these plants were also deadly poisonous. How can that be? Look at the modern garden-variety potato. Its tubers are delicious. We bake 'em. We mash 'em. We fry 'em. But its berries are toxic. For the Timucua, the difference between toxic and tasty depended on 1) the part of the plant used, 2) the age of the plant, 3) the season it was harvested, 4) how it was processed, and 5) how much was eaten.

NEVER, EVER EAT A WILD PLANT.

Plants protect themselves from predators by producing chemicals in their leaves, stems, and fruits. These chemicals work in two main ways. ONE: They inflict pain on the predators immediately - while the plant is being chewed. TWO: They make, OR they make the animals sick later, when digestion occurs. Either way, the animal learns not to eat that plant.

The same chemicals that make a plant dangerous as a food source also make it potentially useful as a medicine. Today, many companies manufacture herbal medicines. These medicines claim to improve or cure health problems. These claims have not been formally proven in a laboratory environment, and the safety of these herbs is not tightly regulated.

In many cases, herbal remedies have been used for generations. The native peoples shared these cures with early pioneers who passed the information on to their children and grandchildren. Scientists have evaluated many of these herbal medicines. When their tests prove a correlation between taking the medicine and getting better, an herbal medicine is on its way to becoming an FDA-approved drug.

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When native peoples used herbal medicines, there was usually a spiritual component to the cure. Prayers, spoken charms, and prohibitions on behavior (don't do X while taking this medicine) were an important part of the cure. Virtually all knowledge of Timucua spirituality has been lost. Many modern native cultures have begun projects to record the medical and spiritual practices of the elders.

Most native cultures had thousands of herbal remedies. Some, everyone knew (like taking Ibuprofen for muscle aches today), while many others were only dispensed by a shaman or herbalist with extensive training. We've already discussed willow bark as a pain medication. Below, we'll look at five more, which (like willow) have been incorporated into modern medicines.

Witch Hazel is a delicate tree with wispy yellow flowers and wavy-edged leaves. Its bark contains high amounts of chemical tannins. Tannins act as an astringent, which means they shrink tissues. Traditionally, witch hazel been used to ease itching and heal scratches. Because it is gentle on the skin, witch hazel is getting a lot of interest today as an acne medicine.

Witch Hazel, photo by Wikipedia

Elderberry, photo by Wikipedia

Elderberry is a tall shrub with bunches of dark berries. Native peoples used its flowers to make a medicinal tea for sinus congestion. Cooked elderberries were also used as food, but raw elderberries contain cyanide-forming chemicals, just like Coontie. Today, many herbal remedies for congestion and cold-prevention contain dried elderberry flowers.

Passionflower is a twining vine with large, showy purple flowers. Native peoples used its stems and leaves to make a relaxing tea. Today, passionflower extract is used in many European sedatives. It is also a popular herbal remedy for anxiety in the United States.

Passionflower, photo by Wikipedia

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Saw Palmetto, photo by Wikipedia

Saw Palmetto berries contain large amounts of sugar and oil, which made them a useful food for the Timucua. In 1696, the shipwrecked Quaker merchant, Jonathon Dickinson, described the taste of saw palmetto berries as "rotten cheese steeped in tobacco juice." Mmmm. The Timucua also used these fine-tasting berries to make a medicine for prostate problems. Today, saw palmetto prostate remedies are a $70 million industry in Florida.

Black Cherry trees provided the Timucua with tiny edible cherries. Unfortunately, the leaves, wood, and seeds contain cyanide-forming chemicals…so don't swallow cherry pits! The white inner bark (not the tough outer bark) has been used as a cough medicine throughout American history. People came to associate the cherry tree with effective cough medicines. When pharmaceutical companies needed to choose a flavoring for their cough medicines, they chose cherry flavor. These medicines actually contain no cherry bark, but it was a great marketing idea! (NOTE: You can still purchase herbal cough medicines that contain cherry bark, if you look hard enough.)

Black Cherry, photo by Wikipedia

INSECT REPELLENT

Florida is known for its bugs. If it's not gnats, it's mosquitoes. If it's not mosquitoes, it's biting flies. During some seasons, it's all three. And don't forget the arachnids: ticks and itch-inducing red bug mites. The Timucua needed protection from these biting bugs even more than we do today. They couldn't retreat into bug-free, air-conditioned buildings. We learned in the pyrotechnology unit that bugs don't like smoke. This is true, but you can't carry your smoky fire with you while collecting oysters on the mud flats. The mud flats offered their own help, though. The Timucua could slather a thick layer of mud on their skin as a barrier against biting bugs. It gets a bit itchy though as it dries.

So what did they do? Well, they probably ate a lot of **Wild Garlic.** Biting bugs do not like the smell or the taste of garlic. When you eat a lot of garlic, the garlicky odors come out in your breath, your sweat, your blood, and your urine. The bugs won't be able to stand you. Of course, your friends might not be able to stand you either. Well, maybe if you all smelled that bad….

Wild Garlic, photo by Wikipedia

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Luckily, native peoples had one other method for protecting themselves from insect bites. They learned which plants naturally repel insects. The basic method is crushing a handful of the plant's leaves and rubbing the leaves on all of your exposed skin. Luckily, insect repellent plants are PLEASANTLY aromatic. Once you've rubbed these on your skin, you smell nice to your friends and you smell unappetizing for bugs. Just be sure which plant you're rubbing on your skin. If you accidentally use poison ivy, you'll have more to worry about than bug bites.

Waxmyrtle, photo by Wikipedia

Waxmyrtle is a Florida shrub that is sometimes used in landscaping because its leaves are green all year. It has waxy gray berries that early settlers used to make candles. And the leaves, when crushed, smell a bit like a spicy Christmas tree. The aromatic oils in these leave repel mosquitoes and gnats – and even some biting flies.

Sassafras is a tree that native peoples and early settlers used for many purposes: drinks, medicine, and insect repellent. Its large, soft leaves were sometimes crushed and rubbed on the skin. Other times, the large leaves were pinched to release their essential oils, then rolled it into tiny tubes and tucked behind each ear. This kept the bugs from swarming around the face.

Sassafras, photo by Wikipedia

American Beautyberry, photo by Wikipedia

American Beautyberry is another plant with a long history of folk use. Its large, soft leaves were crushed and rubbed on the skin to repel bugs. In landscaping, it is also prized for its bunches of violet-colored berries.

Because insects are becoming resistant to chemicals like DEET, the US Department of Agriculture is researching possibilities for new repellents. In 2006, they discovered two insect-repellent chemicals in Beautyberry leaves: callicarpenal and intermedeol. Each worked as well as DEET for repelling mosquitoes. In 2007, these chemicals were also proven to repel 100% of black-legged ticks for three hours. And in 2008, fire-ants were added to the list of bugs these natural chemicals could repel. Safety trials are needed before this repellent can be marketed to the public. In 2011, scientists discovered how to synthesize callicarpenal in a laboratory, so wild populations of American beautyberry won't have to be demolished to manufacture this repellent.

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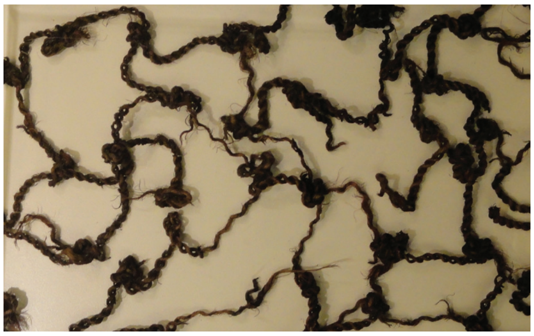
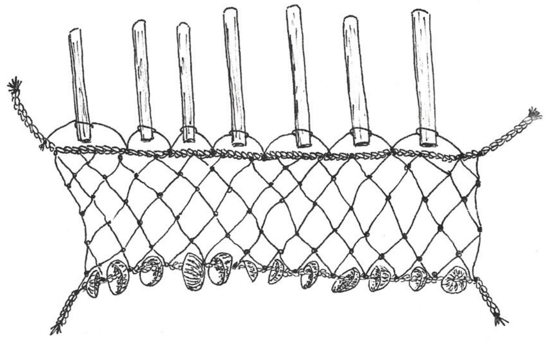
TEXTILES (WOVEN MATERIALS)

Very few plant materials last in the archaeological record. Over thousands of years, the baskets, cloth, and ropes have simply rotted away. The only glimpses we get of early Florida textiles are bits of fabric and fishing nets, that have been preserved at underwater archaeology sites. The water protected these artifacts from oxygen, so they didn't rot away.



Prehistoric net recovered from the Key Marco site. (Key Marco is a non-Timucua wet archaeology site in southwest Florida.)

On display at the Florida Museum of Natural History.

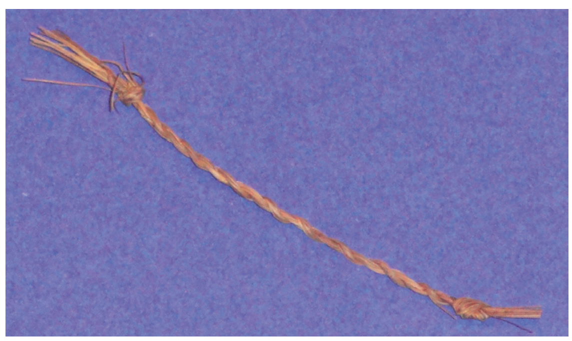


Sketch of an early Florida fishing net, courtesy of the University Press of Florida

At dry archaeology sites, cord-marked pottery provides more evidence of textile use. Cords woven from palm, palmetto, and inner tree bark were wrapped around a wooden paddle, and then pressed into the wet clay during the pottery-making process. This left a perfect impression of the cord on the finished pot.

Replica pottery paddle wrapped with cord

Cord Marked Pottery, courtesy of Keith Ashley. Can you see the marks made by cords?



2-Ply Rope made from Sabal Palm threads, modern replica

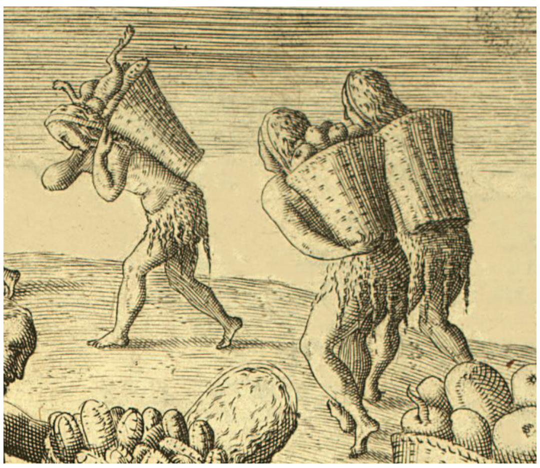
CHAPTER FIVE

WILD PLANT TECHNOLOGY

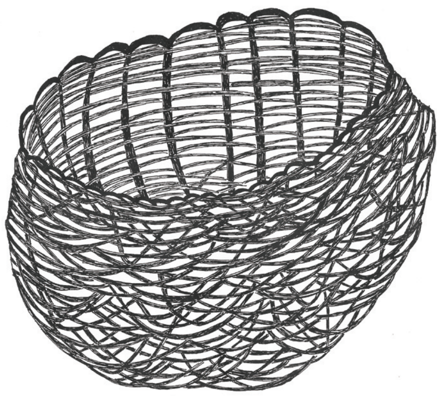
The French explorers described the Timucua women as wearing a sash or skirt made of woven Spanish moss. Spanish moss isn't actually a moss. It's an epiphyte – an air plant – related to the pineapple. It's that curly gray stuff that hangs from oak trees. When Spanish moss falls to earth, it becomes a habitat for redbugs, so don't kick it around (unless you really want to itch). The Timucua probably collected the moss from the trees (above the redbug zone). Then they boiled it to remove its outer layer, leaving only the curly, wiry inner core. Yarn could be spun from the moss fibers, then woven to create Spanish moss cloth.

Interesting Fact: *Spanish moss was also called "Old Man's Beard" and "Spanish Beard.".*

Baskets and mats are also textiles. Palm leaves, palmetto stems, and grape vines made excellent weaving materials. Gathering these materials took a lot of time and effort. How did native peoples decide which plant to collect? It depended on the tool they needed to make. Sable palm roots made excellent fish traps. Cattail leaves made durable mats. Peeled grapevine made sturdy baskets. Basic mat-weaving is a simple over-and-under process, but basket weaving is a much more challenging skill. Native peoples are often quite artistic when making these textiles, but for the Timucua, weaving wasn't just an art. It was a survival skill.



De Bry engraving of Timucua women carrying food



Grapevine basket, courtesy of the University Press of Florida

Compare the European-style baskets in the de Bry engraving (left) with the drawing of a Timucua-style basket (right). How are they similar? How are they different?

The Timucua used wood from trees to make everything from tool handles to canoes to hut supports. Check out the unit on Tool Making Technologies to learn more about the tools made from wild plants. Because wood was also used as fuel for fire, the Pyrotechnology unit can tell you even more about how the Timucua utilized wild plants.

CHAPTER FIVE
WILD PLANT TECHNOLOGY

ACTIVITY – ROPE WEAVING:

BACKGROUND: The Timucua used threads, cords, and rope for a variety of purposes: straps for carrying things, bindings to lash things together, materials used in sewing and weaving, and especially lines and nets for fishing. When making cordage, they needed to gather long thin strands of plant material. Collecting these fibers took a lot of effort. To collect the inner bark, they had to strip off a long section of outer bark, leaving the smooth, white inner bark. Then the inner bark had to be split into strips only 1/16th of an inch wide. Wow.

Different weaving materials were used in different ways. Barks had to be kept wet during the weaving process (to keep them flexible). Palm strips needed to be dried for weeks (so they wouldn't shrink within the woven product). The Timucua developed these methods (technologies) through observation, practice, and experimentation.

Now, it's your turn. Instead of collecting parts of living trees, we will be using raffia to practice our rope-weaving skills. Raffia is a palm tree native to Madagascar (an island to the southwest of Africa). Its leaflets can reach six feet in length. The material we'll be using is a thin membrane from the underside of these leaflets that is very easy to dye. In Africa, raffia's leaf fibers are used to make baskets, cloth, and rope, while its leaves and stems are used in construction as support poles and roofing materials. Much like Florida's sabal palm, raffia is an all-purpose plant.

INSTRUCTIONS: Work in teams of two. You will each be weaving a rope, so you should each gather approximately 8 strands of raffia. Line up the 8 strands as neatly as possible. Tie a knot in one end. You will be weaving a short section of rope, so use a pair of scissors to trim the free ends of the raffia to about 8 inches.

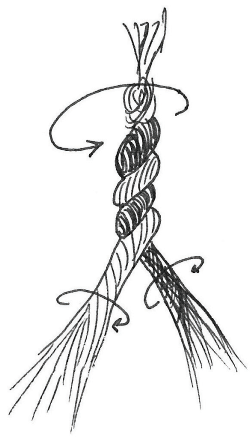
WILD PLANT TECHNOLOGY

ACTIVITY – ROPE WEAVING continued:

Have your partner hold the knotted end of your raffia. Next, divide the strands into two roughly equal sections. Your goal is to twist each bundle independently clockwise (to the right). If you need to twist one bundle at a time, that's okay. Twist one for about an inch, but don't let it go! It will unravel, wasting all of your work. Grip it tightly while you're twisting the other bundle clockwise.

Once you've got an inch twisted TIGHTLY for each, then you can wrap them around each other COUNTERCLOCKWISE (to the left). For every wrap to the left, you need to give each bundle a twist to the right. It is the combination of twisting to the right and wrapping to the left that gives this rope its strength.

Twist each bundle of raffia to the right (clockwise). Do not relax your hold, or the twists will unravel.



Wrap the twisted strands around each other to the left (counter-clockwise). For every wrap, give the bundles a quick twist to the right to tighten them.

CHAPTER FIVE
WILD PLANT TECHNOLOGY

ACTIVITY – ROPE WEAVING continued:

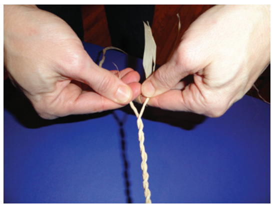
Now, continue wrapping to the left (with a clockwise twist between each wrap) until you get close to the bottom of the twisted area. Congratulations! You've just made one inch of rope. Stop wrapping, and start working on your next inch of twist (to the right, to the right, to the right). You've got to keep tension on the twisted raffia so it doesn't unravel. Your goal is to reach at least four inches. When you finish wrapping to the left and twisting to the right, tie the bottom of the rope in a tight knot. Now it's your partner's turn to weave while you anchor his or her rope.

After your partner is done, give the ropes a tug test. Each of you should hold tightly to opposite ends of a rope. Pull as hard as you can. If you've woven it properly, the rope will not tear. From those wispy straw-like strands, you've woven a very strong piece of 2-ply rope. It is called 2-ply because you wrapped 2 twisted bundles together. In the table below, check out the breaking strength of some natural material cords.

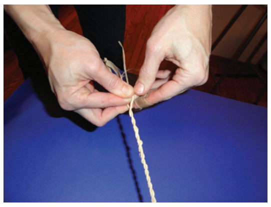
Breaking Strengths of 2-Ply Ropes

Plant Used	Part of Plant	Diameter of Cord	Breaking Strength
Sabal Palm	Leaf	1/16"	15 pounds
Cypress	Inner Bark (Stem)	1/8"	16 pounds
Cotton, machine-made	Seed Fiber	1/16"	17 pounds
Sabal Palm	Leaf	1/8"	20 pounds
Spanish Moss	Leaf	1/4"	50 pounds
Mulberry	Inner Bark (Stem)	1/8"	73 pounds

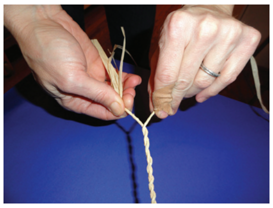
Where do you think raffia rope fits into this table? The 1/8" raffia rope pictured below was able to support 55 pounds. Compared to other 1/8" cords, it ranked second, but it is the highest ranked leaf material in this comparison.



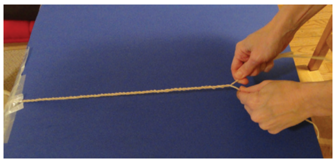
Pull tight.



Wrap to the left, switching the fiber bundles from one hand to the other.



Twist each to the right to tighten.



Weaving a long section of 2-ply rope.

WILD PLANT TECHNOLOGY

ACTIVITY – USING NATURAL DYES:

BACKGROUND: Native peoples used a variety of natural materials to make paints and dyes. Paints were used on animal hides, on feathers, and on wooden objects (like the masks and animal carvings found at Key Marco).

Woodpecker painting, Key Marco, FL, photo by Wikipedia

Native peoples often made paints from minerals. One mineral that archaeologists have discovered on Timucua sites is "ocher." What is ocher? It's clay that contains oxidized minerals. When iron is exposed to oxygen, it oxidizes (rusts). This rusty red clay is called red ocher, and native peoples used it as a red dye. Unfortunately, red and yellow ochers, don't occur in Timucua territory. The closest naturally occurring ocher is in southeast Alabama. This provides good evidence for trade between the native peoples who lived in the Florida and Alabama regions. One method for making primitive paint was to grind up the ocher, then mix it with water and glue made from boiled animal hide. These paints were then added to the surface of a material. This caused a physical change in the painted object because the paint did not actually bond to the wood or hide.

Dyes work differently. They do bond to the hide or fabric, causing a permanent chemical change. Some dyes will naturally bond to fibers. These are the same natural materials that stain clothes today (grass, coffee, grapes). Other natural dyes will wash right out of fabric. In these cases, dyers must add a mordant (or fixative). The Timucua probably used tannins as a mordant. Tannins are the chemicals in leaves and acorns that turn Florida streams brown. Tannins can be produced by boiling galls (the tiny ¼" balls that grow on the bottoms of oak leaves).

Why do mordants (like tannins) help dyes bond to fibers? Mordants bond easily to the fiber you want to color. Next, you add the dye, and the mordant bonds to that as well. In effect, the mordant forms a chemical bridge between the dye and the fiber. (The word "mordant" actually means "to bite" because it helps the dye bite into the fiber.)

CHAPTER FIVE WILD PLANT TECHNOLOGY

ACTIVITY – USING NATURAL DYES continued:

INSTRUCTIONS: Review the table listing natural materials and the dye color they produce when boiled. Each student should choose one material to use in dying their raffia rope **AT HOME.**

Color Dye Produced	Plant Part Used	Plant Material Needed
Light Brown	Stem	Onion Skins (from 2 red or yellow onions)
Dark Brown	Leaves	2 Teaspoons of Tea Leaves
Dark Brown	Seeds	2 Teaspoons of Coffee Grounds
Near Black	Seeds	1/2 Cup of Walnuts in the Shell (In the fall, collect wild hickory nuts instead.)
Blue	Fruit	1/2 Cup of Blueberries, Crushed
Red	Root	1/2 Cup of Chopped Beets

STEP ONE – MAKING THE DYE BATH: Place your plant materials in a pot of water. Bring to a boil, then reduce the temperature to a simmer (lowest temperature that will continue a slight boil). Allow to simmer for one to two hours. This will draw the colors out of the plant material and into the water. Meanwhile, soak your raffia rope in clear water.

STEP TWO – STARTING THE DYEING PROCESS: Allow the colored water to cool enough so that you can handle it without risk of injury. Pour the dyed water into another container through a strainer. Discard the plant materials. Place your raffia rope into the dyed water.

STEP THREE – DEEPENING THE COLOR: Allow your raffia rope to soak overnight.
IMPORTANT: After you remove your raffia from the water, allow it to air dry completely before rinsing it. After it dries, the dye should stay in place even if you rinse it.

STEP FOUR - SHARING YOUR RESULTS: Place some of the pigmented water in a watertight container. Bring the container and your dyed raffia to class and compare your results with classmates. Brainstorm reasons for varying results.

CHAPTER FIVE
WILD PLANT TECHNOLOGY

ACTIVITY – USING NATURAL DYES continued:

1) How did results vary between raffia ropes dyed with the SAME materials?

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List 2 possible reasons for this variation.

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2) How did results vary between raffia ropes dyed with DIFFERENT materials? (I.e. How did the different brown dyes compare to one another?)

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List 2 possible reasons for this variation.

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3) Dyeing items takes time and effort, yet it does not improve their function at all. Consider why native peoples were willing to spend time and energy on a task that was not related to survival. Write your conclusions here.

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Raffia Dyed in Onion Skins – Brown

Raffia Dyed in Blueberries – Blue

Raffia Rope – Natural Color

Raffia Dyed in Beets - Crimson

CHAPTER 6

CHAPTER SIX

AGRICULTURAL TECHNOLOGY

STUDENTS LEARN HOW THE TIMUCUA AND THEIR ANCESTORS UTILIZED DOMESTICATED PLANTS.

WHAT IS AGRICULTURAL TECHNOLOGY?

Maybe we should start by asking, "What is agriculture?" Agriculture is the growing of plants and the raising of animals. The purpose of agriculture is to provide people with food, fibers, fuel, labor, and other resources. These articles discuss the tools and processes that helped the Timucua solve agricultural problems. How can I prevent weeds from taking over the garden? How do I keep pests away from my crops? How should I store the grain so it won't spoil before we can eat all of it?

These problems are common to all farmers, whether they're living in a native village, working a small family farm, or employed by a modern corporation. The family farm (which has largely disappeared) developed a number of technological solutions. Cows pulled plows to break up the soil and discourage weed growth. Scarecrows kept birds off the corn. Barns provided dry places to store grain. The small farmer needed many different solutions because he was living the full definition of agriculture. His farm produced food for fibers, fuel, animals for labor, and more. He grew crops like corn, wheat, and rye to provide **food** his family and their domestic animals. Other crops, like cotton and flax, provided **fibers** to make cloth (cotton and linen). Animals like pigs, turkey, and cows provided meat for food. Animals like cows, goats, and chickens provided milk and eggs for **food**. Sheep and goats provided furry **fibers** to make wool clothing. Dried plant stalks were burned as **fuel**. Horses, cows, and dogs were bred to be **laborers**, pulling wagons and plows or protecting property. The farm also produced other **agricultural resources** like linseed oil (a wood preservative made from flax plants), and cowhide leather (for clothing, furniture, and horse bridles). The family farm did it all. They possessed the technology to grow everything the family needed plus a bit more to sell.

Times have changed. Modern farms are owned by corporations, not families. These enormous farms raise a single crop or animal species. Their focus is high production, and they usually only produce one crop (monocropping). Because the farmer focuses on only one plant, he can put all of his time and energy into finding solutions relating to that species. Since a wheat farmer isn't wasting time milking cows, feeding goats, or hoeing corn fields, he can produce very high yields of wheat. This can lead to quite a profit, unless a drought or disease or insect pest wipes out the entire crop. Then monocropping becomes a catastrophe. Unfortunately, new technologies can't guarantee a happy ending.

CHAPTER SIX
AGRICULTURAL TECHNOLOGY

THE DAWN OF AGRICULTURE

<u>How it all started:</u> America's earliest native peoples did not grow crops. Instead, they travelled around hunting animals and gathering plant foods. During their travels, many of these groups discovered single locations which met most of their needs. They began to settle down, spending most of the year in one spot. Their villages were often near rivers, which provided drinking water and highways for canoe travel. These rivers also provided habitat for the water plants and animals that native people used. Forest plants and animals flourish near rivers too, providing even more resources. Once native peoples became settled, they developed an intense understanding of the natural patterns of the plants and animals living there. This understanding eventually led to agriculture.

<u>Northeast Florida wasn't the best spot for agriculture.</u> Why? For one thing, the area has very sandy soils. Sand doesn't hold water well, and it often lacks important nutrients. As you travel north and west, soils become richer and more clay-like. Higher clay content helps the soils hold onto water and nutrients. As a result, agriculture became more important for the the Western (inland) Timucua and less important to the Timucua on the northeast coast of Florida.

When it comes to agriculture, rivers are even more important than soils. The earliest farmers settled near rivers that flooded every year. Why? Floodwaters deposited loads of silty soil across a wide floodplain. This nutrient-rich silt replaced the minerals used up by last season's crops. The floods actually fertilized the fields for next year's planting. North Florida rivers don't produce annual floods, so the soil minerals weren't being replenished. The fields just became more and more depleted with each planting season.

AGRICULTURAL TECHNOLOGY

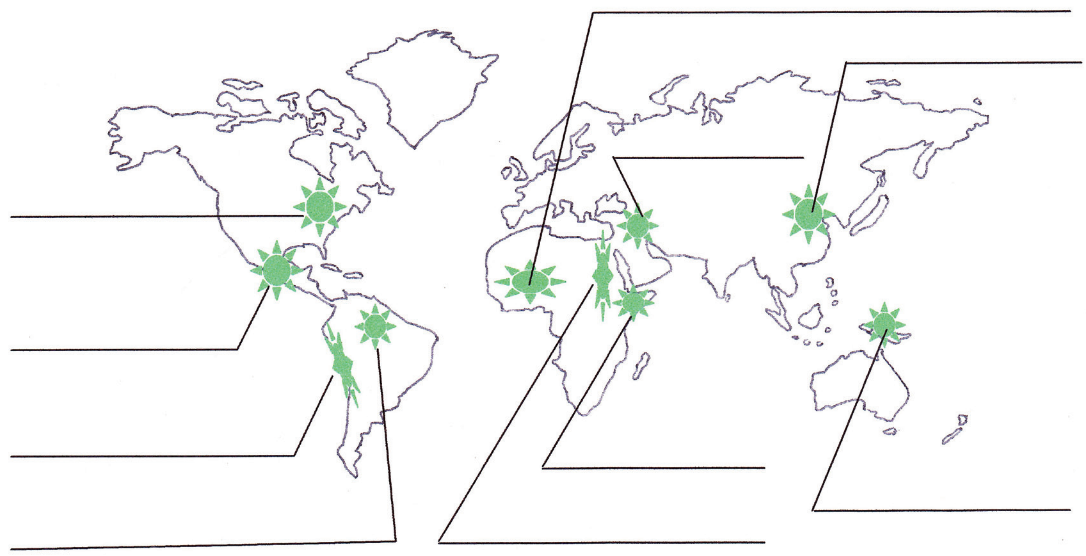
ACTIVITY – WHERE DID AGRICULTURE BEGIN?:

BACKGROUND: In eastern North America, the prehistoric "hot spots" for agriculture were in Tennessee, Arkansas, Illinois, Kentucky, Missouri, and Alabama. Each of these sites was associated with an annually-flooding river. Scientists have discovered nine other locations around the world where man first domesticated crops.

INSTRUCTIONS: With a partner, review the list of locations below. On the map titled, "Sites of Early Plant Domestication," write in the names for each location where plants were first domesticated.

LIST: Amazon River, Andes Mountains, China, Eastern North America, Ethiopia, Fertile Crescent, Mesoamerica, New Guinea, Nile River Valley, West Africa

SITES OF EARLY PLANT DOMESTICATION



CHAPTER SIX
AGRICULTURAL TECHNOLOGY

HOW IT BEGAN

Chenopodium, photo by Wikipedia

Welcoming the weeds: Native peoples already knew which useful plants grew in each habitat. They knew when to harvest them. They knew how to prepare these plants as food or make them into tools. In time, they began to notice even more. When villages settled into one location, large open spaces were created. The newly disturbed, sunny earth was a perfect habitat for weedy species. Native peoples living in the river valleys of eastern North America recognized these weeds. They were already harvesting chenopodium from the wild. Its nutritious leaves, tiny, broccoli-like flowers, and incredibly small seeds were all edible.

How do archaeologists think agriculture began? Here's one possibility. When wild chenopodium seeds were being collected and processed, some fell to the ground and were forgotten. The next spring, they sprouted… right next to the grain-processing area. It was quite convenient, much easier to harvest.

During the next year, more of these useful weeds grew up from seeds that fell from adult plants. Perhaps a young native woman noticed a new batch of chenopodium springing up in a patch of freshly disturbed soil. With her digging stick, she breaks up more soil. Then she tosses in some chenopodium seeds left over from last season. Later that year, two large patches of chenopodium are flourishing. Her village has just started cultivating a grain crop.

Bigger seeds: But has she domesticated chenopodium? Not yet. Archaeologists consider a plant domesticated when its seeds show evidence of change. That means humans are selecting the traits they want their plants to have. How do they do this? Well, since the native peoples were eating chenopodium's seeds, they probably preferred plants that produced larger seeds. Larger seeds were easier to harvest and provided more food. Native peoples harvested seeds for food, and saved the largest ones to plant the following year. After many years of selectively planting larger seeds, native gardens were filled with plants producing bigger seeds than the wild variety.

Seed Types starting from the Left:

quinoa (chenopodium quinoa),
sunflower seed,
pumpkin seed,
kidney bean,
corn kernel

AGRICULTURAL TECHNOLOGY

Thinner seed coats: Archaeologists searched for additional clues to prove that plants were being domesticated. What they found was thinner seed coats. Thinner whats? The seed coat protects the seed, stopping moisture from reaching the tiny embryo inside. The seed cannot germinate until a natural process (like being eaten and pooped out by an animal) damages the seed coat. Once that happens, water can get in, and the plant embryo can grow.

Plants with thinner seed coats can't completely block out water, so they germinate more quickly. These early germinators were able to shade out their slower-growing cousins, so they survived to produce seeds more often. Most of the seeds were eaten, but some were saved for next year's planting. Years of this simple artificial selection produced even more early-germinating plants (with very thin seed coats). Once a seed coat has decreased to 21 microns (a micron = one thousandth of a millimeter), it is considered a product of a domesticated plant.

WHAT CROPS DID THEY PLANT?

Domestication was just the beginning. The Late Archaic Period (3,000 BCE – 500 CE) was a time of great change in early Florida. Pottery was invented, and trade was expanding through the Southeast. This trade brought domesticated plants to Florida. Crop species weren't actually domesticated in Florida, but north Florida's native peoples were quick to adopt agricultural technology as it spread southward. Groups with access to good agricultural lands gained wealth and status. Leading individuals in these groups (like chiefs and shamans) now had much higher status than the average person. These strong central leaders were able to coordinate huge community projects, like the construction of sand mounds. (See the unit on Building Technologies.) Regional cultures were developing too. Before this time, most Archaic peoples had pretty similar ways of life. But once they started settling into villages, each group adapted to its own specific environment. These specialized groups would later become the Timucua, Apalachee, Calusa, and other historic native cultures.

Squash may have been the first. For a long time, people believed that squash (like corn, pumpkins, and beans) was domesticated in Mexico and later traded to the East Coast. However, by analyzing squash proteins, scientists have proven that two different strains of squash were domesticated. One was the parent to later pumpkins and zucchini. That was domesticated in Mexico. The other, parent to the yellow squashes, was domesticated in Missouri about 3075 BCE. But if we really want to talk about firsts, the bottle gourd wins the prize. It was actually transported into North America by Paleo-Indians migrating across the Bering Land Bridge. Paleo-peoples didn't grow the bottle gourd for food. Instead, they used its tough outer rind to make buckets, ladles, and floats for fishing nets.

CHAPTER SIX
AGRICULTURAL TECHNOLOGY


Sunflower, photo by Wikipedia

<u>Sunflowers: when did they join the show?</u> Wild sunflowers, with little 10 cm (4") flowers, are native to the East Coast of North America, just like squash and chenopodium. They were domesticated about 2864 BCE in the Tennessee area. Archaeologists believe them to be domesticated because they discovered an increase in the width of the achene. *The width of the what?* An achene (ay-keen) is the thin little hull that surrounds the actual seed in a sunflower. Native peoples were selecting for seeds with more nut inside, and replanting the biggest ones. In time, this artificial selection translated to wider achenes in the sunflower populations.

Scientists once thought that sunflowers were domesticated in two different places, the eastern US and Mexico. The earliest evidence of sunflower domestication occurs in both places around 2,800 BCE. However, genetic studies conducted in 2011 support a different conclusion. The two sunflower varieties are so similar that scientists now believe both are descended from a single domestication event, occurring on the East Coast. Perhaps sunflower seeds were traded west just like corn was traded east.

Interesting Facts: Sunflower seeds were eaten as nuts, boiled for their oil, and made into bread. The hulls were used to make a purple dye. The seeds were also used to make cough medicine. Did you know that this all-purposeplant is also great for environmental clean-up? Sunflower plants can absorb toxins (like arsenic) from the soil. In 1986, they were even planted around Chernobyl to absorb radioactive Strontium-90 released during the Chernobyl disaster.


Sunflower seeds in and out of the hull, photo by Wikipedia

<u>Chenopodium – 1,785 BCE - from sowing to cooking:</u> Early crops, like chenopodium, were fairly simple to plant. In springtime, the soil was hoed to remove weeds, soften the earth, and allow in air. Seeds were tossed into the soil and then covered. Since these plants were well adapted to that environment, they needed only rainwater, and a little weeding. Shoots and new leaves were harvested for salads only a month after planting. Older leaves were used as a boiled vegetable. At the end of the growing season, when the remaining leaves turned brown, the tiny seeds were ready for harvest. They were collected by running a hand across the tall seed heads and collecting the seeds in a basket.

The seeds of chenopodium did not require extensive processing (like peeling, soaking, or grinding), but they did have one major drawback. They taste just like soap. *Yeck*. These seeds (just like their modern cousin, quinoa [keen-wah]) are covered with a thin soapy layer. This awful flavor is a great defense against herbivores. Deer and birds won't touch chenopodium. To make it tasty for humans, the seeds must be thoroughly washed before they're boiled or pounded into grain. When cooked, quinoa's texture is fluffier than brown rice with a bit of a nutty taste.

CHAPTER SIX

AGRICULTURAL TECHNOLOGY

Chenopodium was a central food crop, but it became less important after corn was adopted. Why? Corn plants produce more grain than chenopodium, so it's a more efficient crop to grow. Unfortunately, corn does not have edible leaves or edible flowers. It also has fewer digestible proteins than chenopodium. When these early farmers dedicated more and more farmland to corn, they planted less and less chenopodium.

Interesting Fact: Like corn, chenopodium can be popped. Why? Both of these seeds have a thin waterproof shell. When they are heated, the moisture inside turns to steam, and the shells burst open, much lighter now without their water weight.

ACTIVITY – WHICH CROP WOULD YOU CHOOSE?:

BACKGROUND: The Timucua and their ancestors had access to a variety of grain species. How did they decide which ones to plant? The species that produced the most grain per plant were prime choices. In this activity, you will weigh a variety of seeds (modern versions of the species available to Florida natives) and compare their value as food plants. Before you begin, make an educated guess about which plant species you think will provide the best seed yield per plant. Your options include bean, corn, pumpkin, quinoa, and sunflower.
Write your choice below.

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INSTRUCTIONS: Use a scale which reads in milligrams to weigh each kind of seed. Be sure to measure at least three of each species so that you can get an average weight. Use your data to fill in the column titled "Average Seed Weight in Milligrams." (For seeds too light to get a reading, try weighing 10 or 50 at a time, then divide this weight by the total number of seeds you used.)

The column titled "Yield per Plant in Milligrams" describes the weight of seeds provided by each plant. Multiply Average Seed Weight x Number of Seeds per Plant to fill in this column. Be sure to provide values for the lower and upper ranges for these weights.

The final column, "Yield per Plant in Pounds," will make it easier to compare these values, since modern Floridians are more familiar with pounds than with milligrams or kilograms. To convert mg to pounds, multiply milligrams by 2.20462262 × 10-6. Round your answer in pounds to the nearest hundredth.

CHAPTER SIX

AGRICULTURAL TECHNOLOGY

ACTIVITY – WHICH CROP WOULD YOU CHOOSE? continued:

YIELD FOR MODERN VERSIONS OF PLANTS AVAILABLE TO THE TIMUCUA PEOPLE

Name of Seed	Average Seed Weight in Milligrams	Number of Seeds per Plant	Yield per Plant in Milligrams	Yield per Plant in Pounds
Quinoa Grain (Chenopodium quinoa)		28,000 - 56,000		
Kidney Bean (6-7 pods per plant)		100 - 200		
Corn Kernel (2 ears per plant)		1000 - 2400		
Sunflower Seed (1 flower per plant)		800 - 2000		
Pumpkin Seed (2 pumpkins per vine)		200 - 1400		

Based on your calculations, which crop produces the highest yield of seed per plant? Does this agree with your educated guess at the top of the page? ______________________

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CHAPTER SIX
AGRICULTURAL TECHNOLOGY

THE AGRICULTURAL LATECOMERS

Tobacco,
photo by Wikipedia

Tobacco makes an entrance. Archeologists begin to find evidence of tobacco cultivation (preserved seeds) around 300 CE. Tobacco was domesticated in Mexico, so it may have travelled across the continent along with corn. Dried tobacco leaves were smoked at ceremonial functions and used in herbal remedies. Obviously, the native people did not know this plant was carcinogenic. By the mid 1600s, the native tobacco, *Nicotiana rustica*, was replaced by a "better-tasting" hybrid tobacco called *Nicotiana tabacum*.

The photo above shows teosinte to the left, corn to the right, and a hybrid in the middle.

Courtesy of Wikipedia

The history of corn. Corn arrived from Mexico, already domesticated. The original "corn" is called teosinte, and the early Mexican Indians began the domestication process around 4,300 BCE. The original teosinte didn't look much like corn. It actually looked like wheat. It had no cob, tiny hard seeds instead of kernels, and no husk around the cob. Teosinte looks so different that, originally, scientists thought it couldn't be the progenitor (parent) of modern corn.

When the genetics of corn and teosinte were studied, scientists learned that these two plants differ in only five genes. A very few genetic changes made a very big difference in the corn. It turns out that the original teosinte had LOTS of genetic variation, meaning that some plants naturally produced plumper seeds, while others produced fewer stalks. The native peoples living in Mesoamerica preferred the plumper seeds over the tiny, hard, nut-like ones. As with sunflower, native peoples selected the larger teosinte seeds. A few thousand years of this artificial selection moved the crop towards a larger size kernel.

The cob and husk were also selected by corn cultivators. Why? They both function to keep the seeds on the stalk. Wild grain plants disperse their seeds by dropping them after they are ripe. Some blow away, while others germinate near the parent. But if you are growing grain as a food crop, you don't want the seeds blowing away or falling on the ground. You want them on the stalk where they're easy to collect and eat. Both the cob and the husk hold the kernels on the stem until harvest. Corn was traded all across North America to many different native groups. Because each community of planters selected for slightly different traits, a variety of corn types were created. These variations made it to the East Coast of North America by 200 CE. Over the next 600-1000 years, it was adopted up the East Coast to Canada and down to Georgia and western Florida. It wasn't until 1,450 CE, just before the arrival of the Europeans, that evidence of corn cultivation is found at pre-Timucua sites.

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Interesting Fact: It's been suggested that the kernels in teosinte were too small and hard to be used as an efficient food source. On the other hand, they do pop like popcorn. So the whole corn revolution may have started because somebody loved popcorn!

Another Interesting Fact: Did you know that modern corn stalks produce only two ears of corn? That's more than two meters (over six feet) in stalk height to produce just two ears of corn! Early corn plants produced six smaller ears. Modern farmers have selected for fewer ears so the plant will put all of its energy into producing a couple of big juicy ears instead of several scrawny ears.

<u>Corn – the big question:</u> If corn made it to the East Coast of North America by 200 CE, why did it take another 1,250 years for it to be cultivated in northeast Florida? For one thing, corn requires a lot more effort than other crops. The soil around corn seedlings must be weeded regularly. Otherwise, the weeds will out-compete the corn, stealing minerals, water, and sunlight needed by the baby corn plants. Weedier crop species, like chenopodium, required far less back-breaking garden work.

Also, corn requires a lot more effort to make it edible. Unless it was eaten fresh off the stalk, corn had to be dried, then soaked in lye, then washed thoroughly, then cracked, then ground up, then boiled, baked into bread, or cooked in some other way. In other words, corn is REALLY labor-intensive. Who wants all of that extra work? Archaeologists tell us that many native groups north of Florida were growing corn by 800 CE. But they only grew a small amount, not nearly enough to feed the whole village. Perhaps the corn was used only for special, ceremonial purposes, since it took so much effort to produce.

Eventually, despite all the effort required, corn did become an important crop. Archaeologists think this change was due to a combination of two factors: ease of harvest and yumminess (okay, that's not really a word). Why was corn easy to harvest? The cob and the husk keep all of the kernels on the stalk in a nice, neat little package. All you have to do is twist off the corn ear and toss it into a basket on your back. One historical record describes the harvest of an entire village's corn fields as a ten-day group effort. Archaeologists estimate that harvest of enough chenopodium to feed an entire village would take more than three times that long.

Another advantage of a corn husk is that kernels don't just fall off when an animal bumps the plant or a stiff wind blows through. Chenopodium loses its grains pretty easily in those cases. Once the grains are on the ground, there's no way to effectively harvest them.

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So, what about the yumminess factor? One kind of native corn was called "sweet corn." When it's very young, sweet corn is full of sugars that will later be converted to carbohydrates. These sugars provided a sweet taste the older grains just couldn't provide. In addition, the older grains could only be prepared in two ways: boiled (to be eaten in stews) or parched (toasted so the grains crack open to make a very chewy snack). Corn allowed MUCH MORE variety. It could be eaten raw or boiled. It could be roasted (i.e. grilled), parched, popped, cooked as hominy, ground into grits, baked into corn bread, mixed into stews, and prepared into plenty of other tasty recipes.

Corn had three major strikes against it. 1) It had less nutritional value. 2) It was harder to grow. 3) It was harder to process and cook. But boy, it tasted great.

Bean vine, photo by Wikipedia

Pumpkins, beans, and amaranth: Like corn, these three crops were domesticated in Mexico and gradually made their way to the East Coast. Pumpkins may have arrived around the same time as corn. Beans and amaranth arrived substantially later, around 1,200 CE.

Domesticated beans produced larger seeds than wild bean plants. In addition, they didn't drop their seeds when ripe. Many wild beans explode when they dry out, flinging their seeds in all directions. Domesticated bean pods do not split. They hold their seeds safely inside the pod until harvest.

Pumpkins, photo by Wikipedia

And what is amaranth? It's a lot like chenopodium, with edible seeds, flowers, and leaves. Archaeological records show that wild amaranth seeds were being collected and eaten in Florida as early as 2000 BCE. However, Florida's early Archaic peoples never domesticated the plant. A totally different amaranth species was domesticated in Mexico and traded east.

Amaranth, photo by Wikipedia

Why didn't the French and Spanish explorers write about amaranth and chenopodium the way they wrote about corn? Many of them did write about tiny "peaze." Historians now think they were talking about amaranth and chenopodium.

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ACTIVITY – WHY DID THE OLD GRAINS FALL OUT OF FAVOR?:

BACKGROUND: Older crops like chenopodium were gradually planted less and less. Why? It may have been the result of crop yields. Crops that produce the most grain and require the least work are most desirable. The Timucua adopted newer crop technologies just like we do today.

INSTRUCTIONS: In this activity, you will compare crop yields from modern chenopodium (quinoa) and modern popcorn. This will function as a model for the change in grain yields observed by Timucua farmers when corn was first introduced to Florida.

Ears of popcorn, photo by Wikipedia

The earliest popcorn discovered dates back to 3,600 BCE. It was found in a cave in New Mexico, and its cobs were tiny - only 1.3 to 5.1 cm long (½"-2"). Florida's earliest corn plants probably measured somewhere between these prehistoric minis and our own modern popcorn, which has 10 cm (4") cobs.

For the purposes of this activity, we'll use data from a popcorn stalk that has 2 ears of corn. Each ear has 500 kernels. Each kernel weighs approximately 0.043 ounces. (For the questions below, round your answer to the nearest tenth.)

1. How much grain (in ounces) is produced by one popcorn plant? ______________________

Work Space:

2. 16 ounces = 1 pound. How many pounds of grain will one popcorn plant produce? ________

Work Space:

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ACTIVITY – WHY DID THE OLD GRAINS FALL OUT OF FAVOR? continued:

3. Chenopodium farmers tell us that it takes about 10 plants to produce one pound of grain (that's only 1.6 ounces of grain per plant). How many chenopodium plants will it take to produce the same amount of grain as a single popcorn plant? ______________

Quinoa grain, larger than life, photo by Wikipedia

Work Space:

4. If you were a Timucua farmer, you would have been faced with a tough decision. Corn produces more seed, but does not produce edible leaves or flowers. Would you have continued growing lots of chenopodium, or would you have focused more on growing corn? Explain your choice.

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WHAT TECHNOLOGIES DID THE TIMUCUA USE TO CULTIVATE THEIR FIELDS?

They began by using prescribed fire to clear the fields of weed growth and last year's crop stems. This also returned ashy nutrients to the soil.
<u>Technology:</u> Fire

A Theodore de Bry engraving of the Timucua planting their fields. Despite the MANY errors, these engravings can be a useful learning resource.

Timucua men did the back-breaking work of hoeing up the soil. Loosening the top layer of dirt disrupted weed growth and allowed oxygen into the soil. The tiny germinating crop roots also moved more easily through the loosened dirt.
<u>Technologies:</u> Division of Labor and Agricultural Science

Timucua hoeing tools had shell, bone, or stone blades hafted onto wooden handles. (Notice that the hoes in the pictures are not accurate.) The women and children probably handled the majority of the planting and weeding throughout the growing season. They used wooden digging sticks to poke holes for seeds which they carried in woven baskets.
<u>Technologies:</u> Division of Labor and Tool-Making

Despite what you see in the French engraving, Timucua fields were not tilled in rows. Planting in rows did not start until people began using animal-drawn plows which worked best when dragged in a straight line. Instead, the Timucua men hoed dirt into hills about four feet wide. (You can see this practice at the bottom of the picture.) The women probably planted four corn seeds, 2 bean seeds, and 2 squash or pumpkin seeds in each hill. Why hills? They help retain water near the roots of the growing plants. The elevation also makes it easier to tell the difference between seedlings and weeds. You don't want to be ripping out your newly sprouted corn.
<u>Technologies:</u> Division of Labor and Agricultural Science

<u>Corn, beans, and squash were called the "Three Sisters" because they were always planted together.</u> Why? Corn plants demand a lot of nitrogen from the soil. This can deplete the soil quickly so that crops grow poorly in following years. Modern farmers add fertilizers to replenish the soil. Five hundred years ago, the Timucua solved this problem by planting beans. Bean plants have a symbiotic relationship with soil bacteria. In this relationship, the bacteria help bean plants stick nitrogen onto their roots, and the bean plants supply the bacteria with carbon. It's good for the beans, good for the bacteria – and good for the Timucua. Much of the nitrogen affixed to the beans' roots stays in the soil after the harvest. This provides the nutrients for next year's corn. Sustainable agriculture at its best!
<u>Technologies:</u> Biological Science

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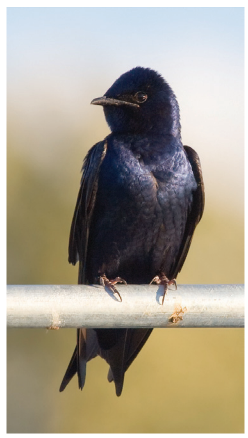
But it doesn't end there. Beans are a climbing vine. They need to reach up to sunlight to produce their largest, healthiest beans. Lucky for them, corn stalks grow straight and tall, providing a perfect ladder for the beans to climb. Squash also grows as a vine, but instead of climbing, it crawls along the ground. Its large leaves cover the soil, forming a kind of living mulch. Mulch traps moisture in the soil, preventing evaporation. It also blocks sunlight so any weed seeds below the leaves don't germinate. This cuts down on competition for water and soil minerals. Finally, squash plants have rough, spiny leaves and stems. These scratchy leaves discourage herbivores from roaming the fields for a snack. It seems that the Three Sisters and the native farmers had developed a symbiotic relationship of their own.
Technologies: **Agricultural Science**

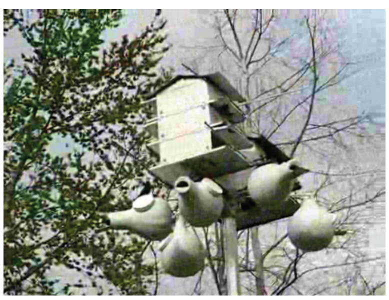
Bottle gourd,
photo by Wikipedia

The Timucua did not clear cut their cropland. Instead, they left some fruit and nut trees standing. These trees provided shade for resting planters as well as roosting space for birds. In fact, the Timucua hung gourd birdhouses in the trees to encourage Purple Martins to move in. Why? Martins are insectivores (bug-eaters). Without modern pesticides, the Timucua depended on biological pest management. The birds ate crop-munching bugs (protecting the Timucua crops) and the Timucua provided the birds with homes and a steady source of food. Another symbiotic relationship. **Technologies:** **Agricultural Science, Tool-Making**

What about the other crops? Bottle gourds were planted, probably along one edge of the field. Tobacco was planted as well. Sunflowers were often grown along the northern rim of the field so they didn't shade the other growing plants. Those big, tasty sunflower seeds would have attracted seed-eating birds from far and wide. So, how did the Timucua prevent the seed-predators from taking their crop? They built guard huts along the edges of the fields. These were manned by older members of the village. If a flock of birds settled on the crops, the guard would frighten them off. (And if an enemy village decided to attack, these field guards could provide early warning.) Giving elders the responsibility for guarding the crops allowed them to contribute to the community's survival and maintain their own self-respect.
Technologies: **Division of Labor, Structures**



Purple Martin,
photo by Wikipedia



Martin house with gourds,
photo by Wikipedia

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Florida has a long growing season, so corn was planted twice. The first variety of corn (called "early corn") was planted in March. It matured quickly and could be harvested after only two months. This corn was often fire-roasted in the husk. Several times during the growing season, women hoed the planting hills to prevent weeds from taking the nutrients needed by the corn. "Late corn" was planted in June. This was actually a different variety of corn. It matured more slowly, with kernels that were not soft enough or sweet enough to eat fresh. When the corn ripened, the Timucua twisted the ears downward on the stalk (to ensure that rainwater did not cause rot), and the ears were left there to dry.
Technologies: Agricultural Science

After the women and children harvested the ears of late corn, they stripped the husks away and rubbed the kernels off the cobs. These hard kernels were inedible without further processing. Soaking the kernels in a lye solution softened them up for pounding. (The lye also broke down corn proteins, changing the vitamin niacin into a digestible form. Niacin is important in the diet because it prevents the disease pellagra.)

The softened corn kernels were cracked using a wooden mortar (deep bowl) and pestle (wooden striking pole). After the women had cracked the corn, they used a loose-weave basket to sift it, separating the cracked outer peels from the corn seed inside. The bits of cracked corn could be made into a porridge, like grits. They could also be pounded into fine corn flour. Fire ashes were added as a leavening agent to help corn breads rise.
Technologies: Fire, Tool-Making, Health Science

The kidney beans grown by the Timucua were not meant to be eaten whole right after picking. They were left to dry on the vine until they rattled in the dry pods. After the pods were picked from the vines, the Timucua shelled them and used wind and sifting baskets to remove the chaff and bits of non-bean material. Dried beans, like dried corn and corn flour, had to be stored out of the elements to ensure that it would last the winter.
Technologies: Tool-Making

Tobacco leaves, bottle gourds, and thin slices of squash were sun dried to preserve them for later use. They too required storage space. And what about the sunflowers? They could be allowed to dry on the stalk. Of course, some seeds would be lost to birds and to the ground. Alternatively, the flower heads could be cut and hung indoors to dry. But this might have required more indoor space than the Timucua had. Once the flower heads were dry, simply rubbing a hand across the seeds would dislodge them. Next, native peoples removed the hulls. Then they added the seeds to breads and soups, boiled them to make sunflower oil, or ate them raw. Like the other crops, plenty of space was needed for

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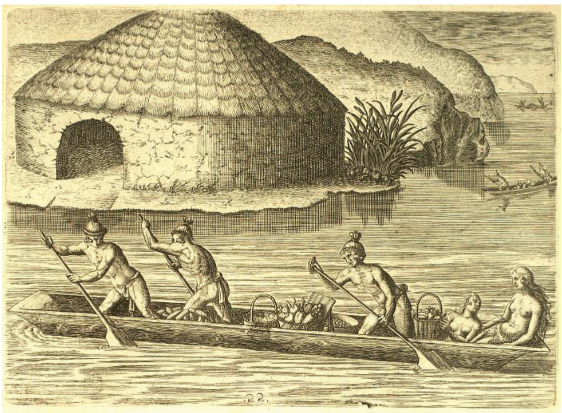
This de Bry engraving shows the Timucua transporting produce to a storehouse. In addition to storage huts within the community, larger storehouses like this one were also used. Why? The chief levied a tax on all of the plant foods produced. These foods were stored away to redistribute when food ran low. They were also used as status gifts to other chiefs and European explorers. (**Archaeological Note:** The hut in this engraving should not have mud walls. Palm thatching should cover the entire structure.)
Technologies: Agricultural Science, Structures



De Bry engraving of Timucua taking food to the storehouses

How healthy was Timucua food? Their diet was mainly nuts, fruits and vegetables, grains, lean meat, and lots of fish and shellfish. Because gummy vitamins hadn't been invented yet, every bit of nutrition had to come from their food. The use of lye enabled the Timucua to digest niacin when they ate grits or cornbread. However, corn still lacks two important proteins (lysine and tryptophan). Beans provide both of these proteins, so corn and beans were often cooked together in soups.

Interesting Fact: The older grains, amaranth and chenopodium, included a full complement of proteins. Eaten alone, they were nutritionally complete. For that reason, modern Floridians are expressing renewed interest these old grains.
Technologies: Nutritional Science

What crops did the Spanish introduce? By the 1600s, Spanish soldiers, missionaries, and townspeople from St. Augustine were in regular contact with the Timucua. They introduced new crops and new ideas. Many villages, particularly those with a mission church, began to cultivate these exotic crops. Archaeologists have found evidence that watermelons, peaches, figs, hazelnuts, garbanzo beans, and oranges were grown at some Timucua villages. Spanish crops and metal tools were adopted by the Timucua. However, native style homes, pottery, and canoes remained unchanged.

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WERE THE TIMUCUA PRACTICING MODERN SCIENCE?

The Timucua had always been observers of their environment, with a clear understanding of how living and non-living things interact. Careful observation is the basis of collecting empirical data, the beginnings of science. When the Timucua started to grow crops, they also started to make the transition towards the use of modern science. How? They weren't just observing; they were making educated guesses, controlling variables (like seed size), and actually testing their ideas. They used the results of these experiments to improve their agricultural technologies. How might native peoples have applied the basic scientific method?

Question: If I plant the biggest seeds, will the next generation have bigger seeds too?
Hypothesis: I think planting bigger seeds will cause the next generation seeds to be bigger.
Method: I'll separate the biggest and smallest seeds from the crops. Then I'll plant them in different parts of the field. At harvest, I'll check to see if there's a size difference in seeds produced in these two sections of the field.
Conclusion: The plants grown from bigger seeds also produced bigger seeds.
New Technology: Next year, we'll save the biggest seeds for planting and use the rest for food.

Asking questions and then setting up experiments to find the answers is at the heart of scientific discovery. Did the Timucua actually follow the modern scientific method (as in the example above)? There's no way to be sure. The Europeans recorded what they observed the Timucua doing. But they had to make educated guesses about the thought processes behind Timucua actions. Read this description of a Timucua planting ceremony.

"Every year, a little before their spring (at the end of February, in fact), the chief Outina's subjects take the skin, complete with antlers of the biggest stag they have been able to catch. They stuff it with all kinds of the choicest plants that their land produces, sew it up again, and deck the horns, the throat, and the rest of the body with their more special fruits made up into wreaths or long garlands. Thus decorated, it is carried away to the music of pipes and singing into a very wide and beautiful plain, and there it is placed on a very tall tree trunk, with its head and chest turned towards the sunrise, prayers bring repeatedly uttered to the sun that he should cause to grow again in their kingdom good things similar to those offered to him."

The de Bry engraving to the right shows a planting ceremony that took place each spring. The Timucua processed a deer hide so that it still held the shape of the living animal, then stuffed it full of fruits and grains. While chanting and celebrating, they raised the stuffed deer hide on a pole - as an offering to the Sun. This ceremony was an attempt to ensure a good harvest. This historical data suggests that the big questions in Timucua life were answered by religion, not by science.

De Bry engraving of Timucua planting ritual

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AGRICULTURAL SCIENCE IN MODERN FLORIDA

For modern Floridians, science explains how the world functions. Droughts and illnesses are explained through meteorology and germ theory, not as actions of a sun spirit or an angry shaman. Our lives are very different from those of the people who lived here 500 years ago. We eat animals that are raised in feed lots instead of hunting them from the wild. We eat crops that are genetically modified to resist herbicides. In fact, we eat food that has no food value at all: no carbs, no fat, no calories. The Timucua would have been baffled.

Why create food that has no food in it? Five hundred years ago, agriculture was about producing food crops, shooing rabbits out of the fields, and keeping the weeds under control. The Timucua understood weeds. They spent a great deal of time hoeing the hills to keep competing weeds away from their crops. Even so, they would have been amazed at the weed problems modern man has created.

Palmer's Amaranth, photo by Wikipedia

The Southeast's most aggressive weed species is called Palmer's Amaranth *(Amaranthus palmeri)*. Another of these super weeds is called Lamb's Quarter *(Chenopodium album)*. Do these names sound familiar? They're related to the same early plants cultivated by native peoples across North and Central America. Amaranth and chenopodium were good survivors then, and they're still good survivors. Palmer's Amaranth grows so quickly, that even during a drought, it can grow an inch a day. It reaches 2.1 meters (7') in height. This is tall enough to shade out cotton plants so they don't get enough sunlight to produce cotton. Each female amaranth plant produces more than 500,000 seeds a season. This combination of fast growth, high reproductive rate, and the ability to shade out other plants makes Palmer's Amaranth a very successful weed. These qualities also made it an excellent choice for early native gardens.

Today, Palmer's Amaranth has an even greater advantage. It has developed resistance to the herbicide, glyphosate. *Resistance to what?* Glyphosate is better known as Roundup, a weed killer developed by Monsanto Corporation. At one time, the use of Roundup to kill weeds in cotton fields was highly beneficial. It reduced the amount of tilling (hoeing) needed to prevent weed growth. Less tilling meant less erosion and less disruption to soil organisms. That's a good thing. In addition, farmers no longer needed to apply chemical herbicides over and over. Decreased chemical use was also better for the environment. So…what's the problem with Roundup?

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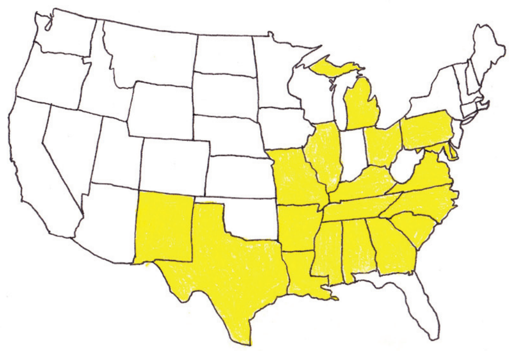
The problem is that Roundup kills all grass-type plants, not just weeds. So, if it was sprayed after the crop had sprouted leaves, the crop would die along with the weeds. Roundup could only be sprayed before the crops germinated. Monsanto Corporation addressed this problem by genetically engineering soy, cotton, and corn plants to resist Roundup. Now, if you bought Monsanto's engineered seeds, you could apply Roundup herbicide throughout the growing season. And it worked great…for a while. Unfortunately, a few of the weeds weren't killed by the Roundup. They were still susceptible…if farmers sprayed them before they were 8 cm (3") tall. But after that, no matter how much Roundup a farmer sprays, Palmer's Amaranth keeps on growing. Whole fields in Georgia have been abandoned because this weed has taken over. Some of these fields are actually in old Timucua territory. Fortunately, this weed hasn't taken hold in Florida. Look at the map below to see which states are fighting the battle against glyphosate-resistant Amaranth.

The Timucua might have suggested harvesting the edible leaves, flowers, and seeds instead of treating amaranth like a weed. Sounds reasonable, right? Here's the problem. Amaranth is excellent at absorbing nitrogen from the soil. Because we apply so much nitrogen fertilizers to our crop soils, Amaranth absorbs a tremendous amount of nitrogen. In fact, it absorbs so much that it becomes toxic to animals and people. Our use of genetically modified seed, coupled with heavy herbicide use, has created a weed that is almost impossible to control. Our excessive use of fertilizers has made this weed useless as a food source.



States Affected by Roundup-Resistant Palmer's Amaranth in mid 2011

Modern farmers are taking aggressive measures to stop Palmer's Amaranth. What measures? For one thing, they're going back to the days of mechanical weed control - hoeing up the soil to prevent weed growth. They're also returning to repeated application of different herbicides. That kills most of the amaranth. But one surviving female plant means 500,000 more seeds. That's a challenge.

Like any technology, GMOs (genetically modified organisms) can provide benefits as well as problems. These plants can resist diseases, handle drought, and fight off insects – all of which lead to much bigger crop yields. It's hard for farmers to say "no" to this kind of technology. The Timucua faced the same quandary when they were introduced to corn, beans, and pumpkins.

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Interesting Fact: In a sense, all food crops have been genetically modified. Plant domestication occurs when man selects for certain traits that show up in the plant's offspring (so, the genes in the offspring are different now, modified by man). This kind of artificial selection has been happening in Mexico since teosinte seeds began their journey towards becoming corn. And it's happening today, when scientists enhance the genes of certain crops. GMOs differ from traditional methods because now, instead of the slow process of crossing different plant breeds to get better ones, scientists can take the speedy route - inserting genes from other plants or bacteria into the genome of the crop.

In the late 1990s, scientists engineered corn to produce a chemical that would stop European Corn Borers. This moth caterpillar was doing serious damage to the corn crop. The engineered corn was tested for safety, and the corn seeds were planted. As the corn matured, its pollen blew onto nearby milkweed plants. Monarch caterpillars ate the pollen-covered milkweed, and guess what? The chemical designed to kill one caterpillar is good at killing other caterpillars.

Since monarch caterpillars don't eat corn, no one expected them to be exposed to the chemical. Of course, milkweed is a common weed in corn fields…but no one can control for every variable in the environment. Nature's simply too complex. It's impossible to accurately predict whether the negatives will outweigh the positives for a particular GMO crop.

Some GMO grains, for example, are being altered to grow in desert regions where people face starvation on a daily basis. In these cases, the crop's genetic modifications (like resistance to drought and increased nutritional value) could be life-saving. GMOs, like all scientific issues, have many pros and cons. What would the Timucua have thought about GMOs?

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ACTIVITY – GROWING YOUR OWN CROPS:

BACKGROUND: Today, because virtually all foods can be purchased at local grocery stores, restaurants, or on the internet, many modern Floridians go their whole lives without ever growing their own food. Whether you produce a successful crop and eat your own produce - or cultivate a field of weeds and caterpillar food - gardening is a worthwhile experience. Because your ability to eat this winter isn't dependent on your gardening success, it can be an enjoyable activity, rather than a tough job.

INSTRUCTIONS, Part I: Your teacher will decide how many of each plant species your class will grow. These instructions assume that each student will start one pot of each species. Species to be planted include popcorn, kidney beans, quinoa (chenopodium), pumpkin, and sunflower. Plant each species according to instructions. Label your pots with your name, the species planted, and the date.

The seeds should be started indoors in late February. Use cleaned yogurt cups as pots. The Timucua reused everything they possibly could, including crates and other containers that washed up from Spanish shipwrecks. We'll follow their example by re-using the plastic cups as pots. Fill the pot with potting soil. Water it lightly, until it is damp, not muddy. Place the pots in a bright window. You can create a simple greenhouse by placing the pots inside the kind of plastic box you buy spinach in at the grocery store. This speeds germination by increasing warmth and preventing the escape of evaporating water.

After the last frost, the seedlings can be planted outside in soil that has been hoed and mixed with compost or manure. As they grow, you'll need to thin them, pulling out the less successful plants, to allow the remaining ones adequate access to water and minerals.

Popcorn: Plant 2 seeds per pot at ½" deep. They will germinate in 10-12 days. Corn is wind-pollinated. This means that when you plant them outside, you need to arrange them in a block (rather than a long line) so the pollen will blow to all of the plants. Time to harvest is 85-120 days. The ears of corn should dry completely on the stalk before harvest. To pop them, strip the husk, and put the ear of corn in a paper bag. Fold down the top and put in the microwave like store-bought popcorn.

Kidney Beans: Soak beans in water overnight. Plant 1 seed in each pot, ½" deep. Water well, but do not make the dirt into mud. Seeds germinate in 2-3 days. These are not the kind of bean sprouts you can eat. They contain a chemical called phytohemagglutinin and are toxic. DO NOT

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ACTIVITY – GROWING YOUR OWN CROPS continued:

EAT THE SPROUTS. These beans grow on a bush. Put a stake in the ground next to each seedling soon after you plant it outside. This will support the bush as it grows. Beans need lots of watering. Harvest occurs in 90 days. The beans contain the same toxin as the sprouts. They must be boiled for a MINIMUM of 10 minutes to destroy the toxins.

Quinoa (chenopodium): Plant a few seeds ¼" deep. The seed will germinate in 3-4 days. Quinoa doesn't really like temperatures over 32°C (90° F), so it needs to be planted as early as possible in Florida. It prefers well-drained soils, so don't overwater. It ripens in 90 days. Because the seed coat of quinoa contains saponins, harvested seeds need to be thoroughly rinsed before cooking.

Pumpkin: Soak seeds for 1-2 hours. Do not use giant species of pumpkin because the seed-coats are extra thick, making germination difficult. Plant 2 seeds per pot, at 1-2" deep. Orient them on their side or with the pointed end down. They germinate in 4-6 days. Water every other day to prevent over-soaking them. Give them as much direct sunlight as possible. When you transplant them outside, bury the stems to just below the bottom set of leaves. Harvest after 120 days.

Sunflowers: Soak seeds for 1-2 hours. Do not use mammoth sunflower seeds. You'll end up spending lots of time staking the plants to prevent them from leaning and collapsing under the weight of the large flower heads. Grow a smaller species. Plant 2 seeds 1- 1.5" deep. They germinate in 11 days. These plants require lots of nitrogen fertilizer to be successful. (You can buy it at the store. The Timucua got it by alternating the locations they planted sunflowers with locations they planted nitrogen-fixing beans each year.) As they grow, they will need staking. The Timucua varieties produced smaller flowers, so they may not have required staking. They tolerate drought very well. They're in full bloom in 60 days. Wait until the flower heads droop and the petals fall off before you harvest.

INSTRUCTIONS, Part II: Keep a log of plant growth, beginning when you plant the seeds. Record how many seeds of each species were planted, whether they're in a "greenhouse," and whether they are in direct sunlight, indirect sunlight, or a growth lamp. Spritz with water each day. Do not pour water into the pot unless the surface of the soil is dry to the touch. Record any signs of germination. Record when the first set of leaves appears.

If you plant the seeds outside, record what kind of soil amendments (compost, manure, fertilizer) were used. Use hill agriculture (instead of rows) like the Timucua did. In each hill, plant 1 corn

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AGRICULTURAL TECHNOLOGY

ACTIVITY – GROWING YOUR OWN CROPS continued:

plant (by gently removing its soil from the pot), one bean, and one pumpkin. This forms the Three Sisters Trio that worked so successfully for the Timucua. Plant the sunflowers at the north end of the garden in hills so they won't shade out the other crops. You can plant a bean next to each sunflower if desired. The quinoa can be planted in hills by itself.

Record the spacing between hills and what was planted in each hill. Each hill should have a label stake which notes what was planted there. Sketch the layout of the garden. Rotate responsibilities for watering the crops to ensure it is done regularly. Until the plants are at least 6" tall, be aggressive about pulling weeds. Taller crops will shade out the weeds, so weeding will be less necessary later. Why are weeds bad? They compete for the water and minerals your crops need to survive. Do your crops need to be thinned? If so, record this information. The thinned seedlings can be replanted in new hills.

Observe the garden for ten minutes each week, taking digital photos of each species. Record observations, including the date, the height of each plant species, development of flowers and seeds, evidence of predation (by caterpillars, birds, rabbits, deer), evidence of disease, etc.

INSTRUCTIONS, Part III: Time to harvest your crops. Record descriptions of the harvest process. Take digital photos of students engaged in this task. Before you prepare any as food, you need to collect seeds to plant next year. The corn, bean, sunflower, and quinoa seeds should be mostly dry at harvest. Spreading them on a screen inside for a few days is a good way to make sure they're dry enough to last until next spring. The Timucua had to ensure the safe storage of seeds or there would be no garden and no food crop the following year. This included keeping them dry and protecting them from rodents.

Harvesting pumpkin seeds is a little messier. Use your hands to strip the big hunks of stringy goo away from the seeds. Then spread the sticky, stringy seeds on a screen or on newspapers where they can dry in the sun. Once completely dry, the strings will just rub off, and the dry seeds can be stored for next planting season.

Note: Today, most of the seeds you buy are hybrids. Hybrid seeds combine useful traits from two parent plants, for example, disease resistance and drought tolerance. That's good for this year's crop. However, next year's crop will be a genetic mix of the plants in your garden. Some will have both traits. Some will just have drought resistance. Others will only have disease resistance. As a result, modern gardeners buy new seed each year if they are using hybrid species.

AGRICULTURAL TECHNOLOGY

ACTIVITY – GROWING YOUR OWN CROPS continued:

INSTRUCTIONS, Part IV: Finally, you can prepare your harvested seeds according the safety guidelines provided by your teacher. You can also harvest the flesh of the pumpkins. Go ahead. Taste the fruits of your labor. It only took 120 days. Record your sensory observations (taste, texture, smell, etc.) and take digital photos of the seeds and pumpkins you cook.

INSTRUCTIONS, Part V: The harvest is over. The garden hills are full of tall corn and sunflower stalks, dried bean bushes, pumpkin vines, and quinoa bushes. When removing bean bushes, be sure to leave the roots in the soil. The roots have fixed plenty of atmospheric nitrogen to their surfaces. As they decompose, that nitrogen will return to the soil, enriching next year's crop. If you pull the bush out by the roots, all of that nitrogen will be lost.

Now, the top of the bean bush and the rest of the stalks should be removed, shredded, and added to a compost pile. After the leaves and stems rot into compost, they can be returned to the soil to enrich next year's planting. Any unused pumpkin flesh can also be composted. Instead of composting, the Timucua burned their fields. The fire reduced last year's stems to ash, returning the nutrients directly to the soil. Record your experiences closing down the garden for the season and creating a compost pile. Photograph each step.

INSTRUCTIONS, Part VI: Record any final observation, thoughts on agriculture in general, and impressions of the Timucua agricultural experience. Use your records, observations, and digital photos to create a PowerPoint presentation. It should explain the gardening process as though speaking to upper elementary students (4th-6th grades), and compare modern processes to processes used by the Timucua. Deliver your presentation to the target audience.

CHAPTER 7

CHAPTER SEVEN

BUILDING TECHNOLOGY

STUDENTS LEARN HOW FLORIDA'S EARLY PEOPLE BUILT STRUCTURES, LIKE HUTS AND FISHING WEIRS, AS WELL AS EARTHWORKS, LIKE MIDDENS AND BURIAL MOUNDS.

WHAT IS BUILDING TECHNOLOGY?

Timucua building technology satisfied two basic purposes. The first was practical, including the need for shelter, access to food, and the ability to store supplies. Modern Floridians must satisfy these same basic needs. Renters and home buyers ask…

1) Does the air conditioner work well?
2) How close is the nearest grocery store?
3) How much closet space will we have?
4) How many times a week is trash collected? Is recycling collected too?

In Timucua times, these concerns were phrased a bit differently.

1) How can we build homes that keep the rain and bugs out, but let the breeze in?
2) Is there a good location nearby to build a fishing weir (permanent fish trap)?
3) How can we store corn and other produce to last all winter?
4) Where do we locate our midden, and can we use these shell trash piles to elevate our homes?

For the Timucua, building technology also served another, very different, purpose - a spiritual one. The world of the spirit had a much wider reach among the Timucua. It affected not only ethical matters, but also burial methods, healthcare, and community solidarity.

When modern Floridians consider these issues, they might ask…

1) Is there an appropriate church (synagogue, mosque, etc.) nearby?
2) What end-of-life options are available (burial, cremation, organ donation)?
3) Where are the closest hospitals and urgent care centers?
4) How can I bring up a matter before City Council?

When the Timucua considered these issues, their concerns included…

1) How do we become ritually pure? (Sweat lodges, seclusion / birthing huts)
2) Where should we build the charnel house and burial mound, and how will we care for the dead?
3) How and where do we care for our sick (particularly as European epidemics swept through Florida)?
4) How many "citizens" can be called on to help construct a council house? How impressive/intimidating will this structure appear to visiting chiefs and Europeans who may wish to attack us in the future?

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In modern Florida, religious, business, and civic organizations provide answers to these questions. The Timucua had to provide these services for themselves. Their building technology satisfied both spiritual and practical needs – at least until the introduction of European warfare and disease.

How can building technology solve problems? Building technologies allowed the Timucua to construct watertight roofs and food storage structures. The construction of fishing weirs provided year-round access to animal protein. The building of smaller huts, including women's seclusion huts and possibly sweat lodges helped the Timucua to practice purity rituals. The building of giant council houses and the construction of sand burial mounds helped to advertise and solidify the power of chiefs and shamans (doctor/minister). The construction of charnel houses to care for and process the dead – as well as their final interment in burial mounds – helped the Timucua balance love for the deceased with the impurity associated with handling the dead. And what about health care? The sick were traditionally treated within their own homes. However, the Timucua belief in lighting a separate fire when caring for the sick may have been tied to the need to isolate the sick person. Moving them out of the family hut and into another "care center" (one with a newly lit fire) would have helped prevent the spread of contagion, like smallpox.

How do historians know that building technology was important to Timucua spirituality? Spanish priests asked questions to see how often the Christian Timucua practiced their own cultural beliefs (instead of newly-learned Christian beliefs). The following five questions show that buildings were still an important part of Timucua spiritual life.

QUESTION 1 - Houses and Hunting Luck: The priests asked, "Have you said that the bones of what was hunted: do not throw them out, otherwise more will not enter the trap, hang them by the ankles or put them in the thatching of the house?"

QUESTION 2 - Storehouses and Protecting Against Famine: The priests asked, "Without prayers by the sorcerer [shaman] have you said that no one should open or go up to the storehouse?"

QUESTION 3 - Houses and Heath Care: The priests asked, "For someone who is sick, have you made a separate light or fire?"

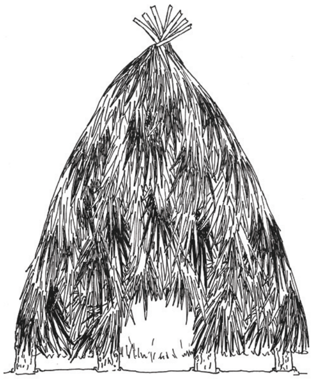
QUESTION 4 - Council House and Political Power: The priests asked, "Having become a chief, have you ordered a new fire to be made for six days in the community house?"

QUESTION 5 - Houses and a Chief's Death Rituals: The priests asked, "Being sick, have you made a new house, saying here I will remain and die?"

These questions were recorded in a book called the Confessionario, written by a Spanish priest who worked closely with the Timucua. His writings provide a link between the Timucua's physical world (which we study at archaeological sites) and their spiritual beliefs (which leave no mark in the archaeological record). Who would have guessed that hunting success, food storage, health care, politics, and end-of-life decisions were all so strongly tied to BOTH buildings and spirituality?

CHAPTER SEVEN
BUILDING TECHNOLOGY

LET'S TALK BUILDINGS



Palm Hut, courtesy of the University Press of Florida

Even after learning to build Spanish-style structures for the missionaries, the Timucua continued building their own homes using natural materials and traditional methods. Let's take a look at traditional hut building.

<u>Making the Supports:</u> First, they needed 8-10 pine trees about 15-30 cm (6-12") in diameter . Fire and shell axes were used to fell these trees and remove the branches. Shell scraping tools were used to strip away the bark. This minimized future damage from insects that live just below the bark layer. Steam and fire were used to bend the narrow ends of the trunks a bit so they would naturally come together to a point.

Replica of a Timucua Hut in Progress

<u>Digging Postholes:</u> With the trees converted into posts, the next step was to dig postholes, not the easiest task when using a shell shovel instead of a posthole digger. Archaeologists have discovered postholes at a St. Augustine archaeological site that extend 13-20 cm (5-8") deep . After the first two posts were set in their holes, the pole tops were bound together with cordage. Then the Timucua continued adding posts a bit less than a meter (3') apart, until a total of 8-10 posts were planted in a circle and tied together at the top. This created a hut about 8.5 meters (25') in diameter. Some of these huts had an interior circle of support posts as well.

<u>Weaving a Lattice:</u> The Timucua wove thin pines and grapevines over and under the posts to form a lattice all the way around the structure. This lattice probably started a meter above the ground and went up to about a half meter from the top. How close together were the grapevine weavers? Perhaps a half meter (1.5'). These weavers provided the lattice used to thatch a roof. They needed to be close enough together to provide thick coverage by palm fronds, but far enough apart to allow the long palm stems to be bent over and under between them. A low space, about one meter from the ground, was left open. This became the entrance to the hut. Why was the doorway so short? A tall door would have caused problems with wood smoke. Normally, the smoke from the fire would rise up through the smoke hole. But if there were also a high door, the smoke would be pulled in both directions (up and sideways) filling the structure with smoke instead of channeling the noxious gases towards the outside.

<u>What Materials Were Used for the Roof?:</u> For this style of hut, the roof begins a half meter from the ground and continues until it reaches a half meter from the top. The very top is unthatched, to provide an escape for smoke. But why don't the thatched palm fronds reach all the way to the ground?

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Water from the soil will wick up into the palm leaves, causing rot. Keeping the palm fronds from touching the ground extends the life of the hut. Because building a hut is hard work, they'd want to get as much life from one as possible. First, they'd spend A LOT of time cutting palm fronds, perhaps 1-2,000 fronds per hut. They looked for wide, mature fronds with long stems. Florida maritime forests have plenty of young palms, with leaves accessible from the ground, but many of these leaves are too small and spindly. Palm frond collection would have been a HUGE effort, especially since the fronds had to be dragged to the site of the new hut (tangling on saw palmetto, greenbriar vine, and grapevines all the way).

Thatching the Hut: Thatching began at the bottom of the hut. Why? This allowed the topmost leaves to channel rainwater off the edge of the hut, instead of channeling it under the top of the next lower frond. Modern roof shingles are laid the same way for the same reason. The Timucua may have used whole, flat palm fronds, fronds folded in half, or fronds rolled into a bundle. We don't know which method they used. Each of these methods has been used by other cultures that build with palms.

After a palm frond was properly folded or bundled, its stem was inserted over the lowest grapevine weaver, then under the next, over the next, under the next, until the base of the frond (where it meets the stem) was snug against that bottom weaver.

Then the next frond stem was woven in beside it, this time starting *under* the lowest weaver, then over, etc. When the entire circumference of the hut (24m or 75') was thatched on that bottom level, the Timucua started thatching one weaver up. Eventually, one circuit at a time, the thatching reached the top of the hut. Palm stems were trimmed so they didn't protrude into the hut's living space. Fronds blocking the smoke hole, as well as any leaves reaching too close to the ground, were also trimmed.

Making it Habitable: The structure was now complete, but it wasn't ready for a family. Low benches, which attached to the inner walls, needed to be installed around the entire periphery of the one-room home. These benches provided sleeping space above, and storage space below. A hearth (fire pit) was dug in the center. Small pits were dug under the benches where dried corn cobs could be burned in smudge fires. These smudge fires created smoke that helped protect the sleeping Timucua from biting insects. Larger pits were dug into the floor and lined with leaves or animal hide. These provided additional "underground" storage.

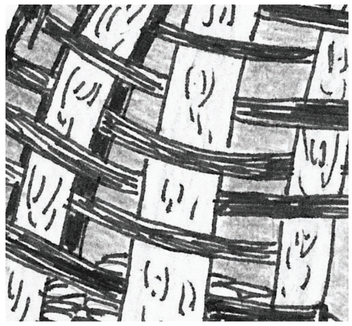
Indoor Plumbing? No such luck. The Timucua had to haul water for drinking and cooking from a nearby creek, lake, or spring. Most native cultures had designated areas – a bit away from the houses - where men and women took care of toilet needs. They may have had a "night basket" as well, for use in the middle of the night. Later, this could be emptied at the latrine areas. Most native cultures also had specific areas at nearby streams or lakes for bathing, washing clothes, and cleaning pots.

CHAPTER SEVEN

BUILDING TECHNOLOGY

ACTIVITY – BUILDING A THATCHED WALL:

BACKGROUND: Students of history often hear the term "wattle and daub." Wattle refers the interweaving of branches and vines to make a lattice. This was common in Timucua territory. Daub refers to a mixture of clay, mud, and plant fibers, which was slathered onto the wattle lattice inside and out. There is no evidence that the Timucua used daub in their construction. Wattle and daub construction was utilized by the mound-building Mississippian cultures further north. One description of the Apalachee council house notes that the inside walls were covered with clay and decorated with paintings. Perhaps the Apalachee adopted some of the artistic and architectural elements of the more complex and powerful chiefdoms they interacted with.



This woven lattice is an example of wattle.

INSTRUCTIONS: You will be using natural materials to build and thatch a small section of wall. See the table below to compare the materials you will use with the actual materials used by the Timucua.

Material You Will Be Using	Material the Timucua Used	Construction Purpose
Bamboo Planting Stakes (1/4"-1" in diameter)	Pine Trees (8" in diameter)	Hut Supports / Uprights
Bamboo Planting Stakes (1/4" in - 1" in diameter)	Grape Vines (1/2" – 2") and Thin Pines (2"-3")	Weavers to create a lattice with the hut supports
Hemp Rope	Woven cord or leather strips	Tying materials
Saw Palmetto Leaves	Sabal Palm Leaves	Large leaves to cover the roof

Note: Bamboo is a bit flexible, like the natural materials the Timucua used, making it an ideal "purchasable" material for this activity. Sabal palm leaves had several distinct advantages over saw palmetto for Timucua thatching. Palm leaves are three or four times larger. The large, sturdy stems make sturdier weavers than the thin palmetto stems which sometimes slip out. Palm stems aren't covered with saw edges either. So why are you using palmetto? It's smaller, so it works better on model 3' sections of wall. It is also easier to collect because it grows low to the ground and is more plentiful than palm leaves. You will need to wear protective gloves while working with saw palmetto.

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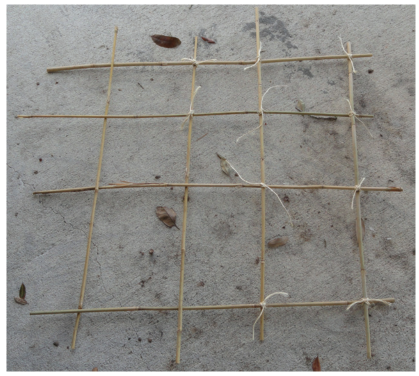
BUILDING TECHNOLOGY

ACTIVITY – BUILDING A THATCHED WALL continued:

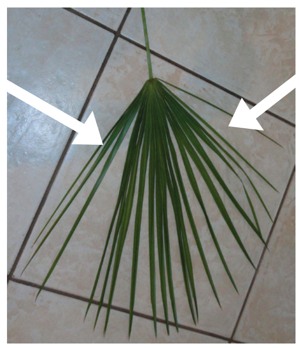
Getting Started: This activity will take some trial and error. Cut the four 6' bamboo stakes in half. Lay out four of these small stakes in a row about 6" apart. One at a time, weave each of the remaining stakes over and under the first four, making a tick-tac-toe shape. The bending of the weavers over and under the uprights should help the frame hold together on its own. But to be sure, your next step is to tie each joint securely. The Timucua were using much larger materials – pines and vines, so it took a lot of effort to bend them over and under each other. The stress of these bends held them in place without any tying required. The Timucua built huts in one piece, with poles dug into the ground, so they were thatching on an upright frame. Since your wall section is not part of a larger structure, you'll be thatching flat on the ground.



Frame made from 8 three-foot-long bamboo stakes and tied with jute twine.

Palmetto fronds: Flat, Folded in Half, and Bundled

Thatching: Fold a palmetto leaf in half at the midrib. Hold your palmetto with the stem pointing away from you, and the straight folded edge facing to the right. Begin weaving at the lower left corner. Weave the long stem of the palmetto leaf over and under until the base of the leaf reaches the second-from-bottom weaver. Tug the top couple of palmetto fingers loose so you can use them to tie the frond to the weaver. (Don't tug too hard; they should still be attached to the frond when you're done tying.) If the frond stem feels snugly bent over the bamboo weavers, there's no need to use twine to tie it to the top weaver. But if it feels loose, use a piece of twine to tie the stem in place at the top too. Continue adding fronds across the bottom, alternating whether you start the palm stem over or under that bottom weaver.



Top Palmetto Fingers

Once you've gotten all the way across your wall (using about 12 fronds), move up to the next weaver and create another line, in exactly the same way. Continue until you reach the right edge of the wall again.

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ACTIVITY – BUILDING A THATCHED WALL continued:

Next, trim the palmetto stems that stick well above the top weaver to about 10 cm (4") above the frame. This just cleans up the area so it's easier to thatch the top.

Start of bottom row of fronds. Each frond is folded in half.

Thatching the Top Weaver: Why is this different? For one thing, you can't weave the palmetto stem over AND under the frame, because there's only one weaver left. Since it's not going over and under, there's no chance it will wedge tightly into place. It will have to be tied at top and bottom. There's another difference too. Because no more thatching will occur above it, this row will only be one palmetto frond thick. The lower rows had two overlapping sets of fronds to keep the water out. To compensate, you will bundle your fronds instead of folding them. Folding just doubles their thickness. Bundling them quadruples the thickness. (See photo.) Once again, separate the 2-3 palm fingers closest to the stem on each side. Don't rip them off; just pull them a bit to separate them from the main frond (as you did earlier). Next, bunch the remaining leaf into a bundle. Use a palmetto strip to tie it together so it will keep the long tube shape. Put the stem under the top weaver, carefully maneuvering it between the many saw-edged stems already there. Use the loosened palm fingers to tie it to the top weaver. Continue to do this all the way across the row. Because the fronds are bunched into long rolls, each one is just as thick as the layered ones below. However, it will take twice as many palm fronds to cover the space, perhaps 20. The bottoms of these fronds will tend to flop away from the wall when you pick it up. To solve this problem, reach underneath, and use palm fingers from the fronds below to tie them in place.

Above: Completed three-foot section of wall. Remember, the Timucua did not build wall sections. They built whole huts (see below for a life-size model). The small sections of wall allow us to practice thatching technology.

Palmetto frond photos courtesy of Ashley Herrera

CHAPTER SEVEN
BUILDING TECHNOLOGY

ACTIVITY – BUILDING A THATCHED WALL continued:

A Visual Check: Before you move your wall, check that the frame is holding together well. The pressure of forcing so many palmetto fronds between them may make the corners and other edges slip free. If any of the bamboo stakes are slipping out, use twine to bind them securely in place. Now you can lift your wall. Before you water-test it, hold it up in the sunlight and look for areas that light peeks through. Patch any significant holes with bunched fronds.

Is it waterproof?: Have one team member hold the wall up so he or she can see the inside of the wall. Another team member will use a gently spraying hose to wet the outside of your wall. Does the water slide off the outside or leak through? If it leaks, why do you think this is happening? What would you do differently next time?

1) In your own words, describe the thatching process.

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2) Did your thatched wall shed all of the water or did some leak inside? If some leaked, why do you think this happened?

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3) If you were assigned another thatching project (or if you were stranded on a deserted island and needed shelter), what would you do differently on your next attempt at thatching?

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CHAPTER SEVEN

BUILDING TECHNOLOGY

HOW WAS A TYPICAL VILLAGE SET UP?

"Typical" is a tough thing to describe. Some Timucua lived at cultural centers which included a council house. Others lived in small villages some distance away. Still others lived in tiny hamlets, with only one or two other families. Particularly on the east coast of Florida, some Timucua spent only the growing seasons (spring, summer, and fall) within a village, and then dispersed to small family camps during winter months. When such a large a group tried to hunt and gather around a single village, resources could run out. Spreading out during the lean season made it easier to find food, firewood, and other necessities.

Archaeologists learn about the set-up of Timucua villages when they excavate postholes. What's a posthole? It is the rotted remains of structural posts that supported native buildings. These organic remains stain the soil a different color. Archaeologists call the stained earth a "posthole." Postholes are one type of "feature" – permanent marks left in the earth by man. By mapping the location of postholes, archaeologists can determine the shape and size of native buildings, how close together they were, and how big the village was as a whole.

Excavation of posthole features at Mission San Luis in Apalachee territory, NW Florida, courtesy of Mission San Luis

The numbers we'll discuss are based on an excavated Timucua village in Alachua County. This site, called the Richardson Site, is one of Chief Potano's villages – one where the Timucua probably met De Soto on his 1593 trip through Florida. This "typical" village had no council house. In fact, archaeologists have yet to find the footprints of any Timucua council houses. This village had 15-20 huts. The huts were about 23 meters (75') apart. Why so far apart? Perhaps this was a strategy to prevent flame from spreading if one hut caught fire. It also provided space in between for hide-tanning racks, smoking racks to preserve meat, communal cooking fires, and other community structures. How big was this village? It was about 182 meters (600 feet) to a side. This gave it an area of a little over eight acres. A professional football field covers 1.32 acres, so a Timucua village was about as big as six football fields. Archaeologists suggest that 200-250 people would have lived in an average village.

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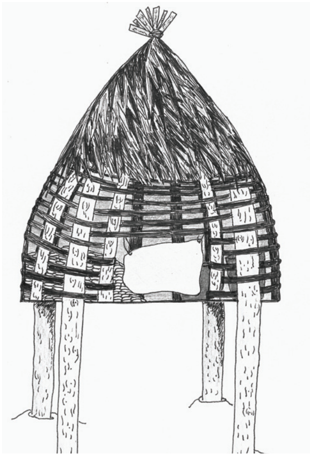
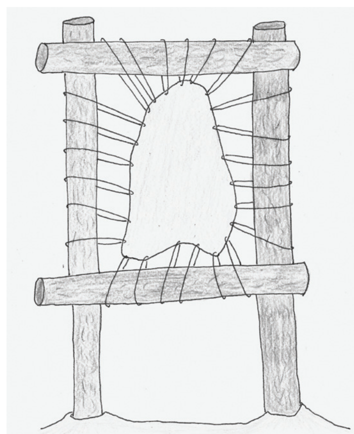


Corn Crib

What other structures were found in Timucua villages? The Timucua built a number of smaller structures. Some were used for storing surplus food. An example would be a corn crib. These cribs, like all Timucua structures, were round. They had smaller support posts, about 7-10 cm (3-4"), and they were only a little over two meters (7') across. The floors of these huts were not at ground level. They were raised several feet off the ground to prevent rodents from getting into the dried corn. The roof of a corn crib was thatched to keep rain off the corn, but the sides were probably unthatched, exposing a loosely woven lattice. The goal was to allow air flow (reducing rot in Florida's humid climate) without providing a 24-hour buffet for the crows. A much larger storehouse held the chief's share of each crop. The chief's share could be used for his own consumption, for gifts to neighboring chiefs, visitors, and Europeans, and for redistribution to the people in times of scarcity. Because several Timucua structures left small postholes, archaeologists can't be sure of the purpose of each small hut they find. Women's seclusion huts (used during menstruation and recovery from childbirth) were common in the southeastern US. Sweat lodges (for sweating out impurities) as well as smoke huts (for concentrating smoke during the preservation of meats) are other possible purposes for these structures.

Archaeologists also find clusters of small postholes. These may represent drying racks for herbal medicines, leaves for weaving, and strips of bark for cordage. They may also have provided space to hang large gill nets for inspection and repair.

Posts about six feet apart could have been hide-tanning racks. These racks would have included a top and bottom spar to make a large square. The stretched hide was attached all the way around with cords.



Hide-tanning rack

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What did a Timucua council house look like? As stated, archaeologists haven't found the postholes for a Timucua council house yet. They have, however, discovered the footprint for a council house made by the Apalachee Indians of northwest Florida. This council house was at Mission San Luis, so the village had its own Spanish mission church. The council house, mission church, and other buildings have been rebuilt, and you can walk inside them the next time you're in the Tallahassee area. Here are some photos of the recreated Apalachee Council House, which holds 2,000 people.

Replica of the Council House at the San Luis Mission in Tallahassee

Outside View of Council House

Interior of Ceiling

Fire Hearth in the Center

Inner Wall with Partitioned Benches, Covered with Woven Mats and Deer Furs

One historical description of a Timucua council house noted that it was 25 meters (81') across. Just as with family huts, a row of benches was built into the inside off the outer wall. These benches were separated by partitions, to create spaces for family groups. Because these buildings were so large, many had a second ring of supports partway between the outer wall and the central fire pit. The description noted that this particular council house had an inner ring of supports that was 15 meters (50') wide. Benches were often attached to this center set of posts as well. The open floor in the center was enormous, and the smoke hole in the roof above may have stretched 8 meters (27'). Public meetings, Black Drink ceremonies, celebrations, and dances were held in this enormous structure. If building a family hut was a major undertaking, constructing a council house was monumental.

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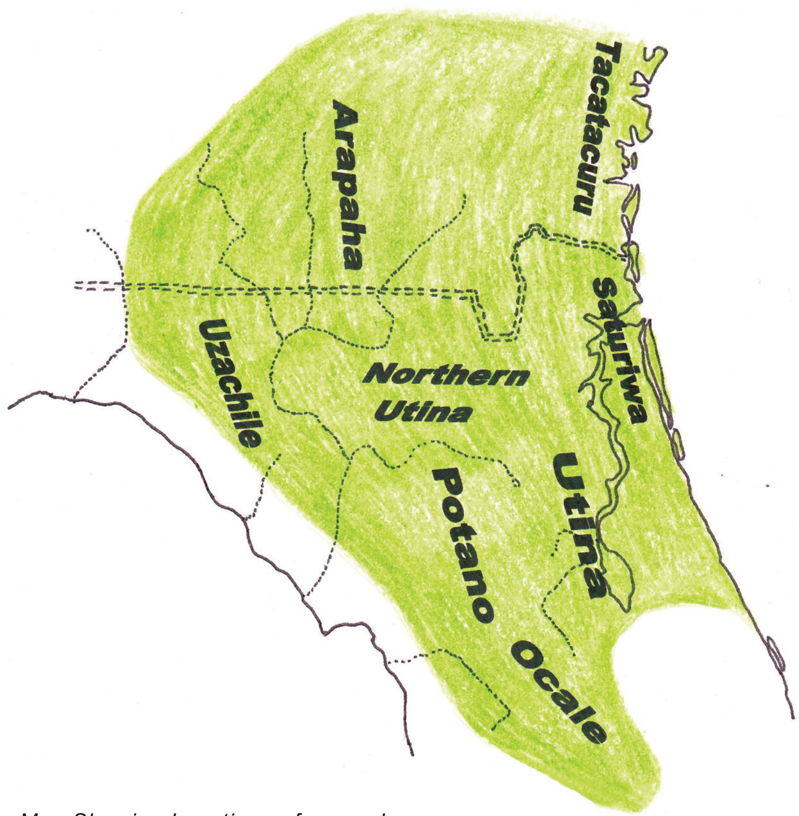
In fact, it WAS monumental. The council house was a monument to the strength of a regional leader. It took the resources of many villages to provide enough large trees, palm fronds, and laborers to complete such a structure. The Spanish reported that some council houses were only large enough to seat 300, while the Apalachee council house could hold 2,000 people. Why such a difference in sizes? The Apalachee were a single nation, united politically. Fifteen hundred people lived at Mission San Luis alone, not to mention the rest of Apalachee territory. The Timucua also had a large territory, but they were never united. Florida's western Timucua, who depended more heavily on farming were divided into three main groups: Potano, Northern Utina, and Uzachile. If each had a council house, it would have served only the Timucua in that region. The eastern Timucua, who depended less on agriculture, were divided into ten groups. The people of each area gave allegiance to a single headchief. So, if fewer people were in a group, a smaller council house would suffice. In any case, when they had to depend on their own human labor to do all of the work, didn't have the resources to build bigger. Look at the map to see where some of the Timucua chiefdoms were located in north Florida and southeast Georgia.



Map Showing Locations of several Timucua Chiefdoms in Georgia and Florida

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WHAT WAS A CHARNEL HOUSE?

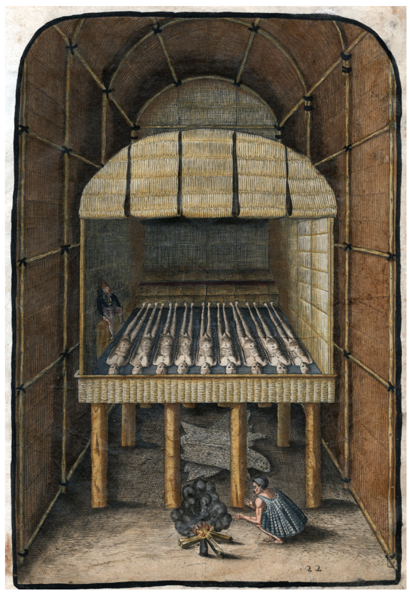
A charnel (kar-nel) house was part of a process that many native cultures used to bury their dead. While some individuals were buried in a mound directly after death, most were processed in a charnel house before burial. A charnel house is a structure where bodies were stored until they decomposed. At a later date, the bones were cleaned, wrapped in a deerskin bundle, and buried in a burial mound. This is called a bundle burial.

Sometimes many bundle burials were buried in the mound at the same time. This may have occurred when the charnel house was full, or perhaps at a seasonal celebration that called for mass transfer of remains to the mound. One Spanish priest wrote that the bones were purified in a fire, then put into boxes and preserved on a platform so that living members of the community could visit with deceased relatives.

This brings us to the question…why process the skeleton at all? Processing skeletons was a way of showing the proper respect for and treatment of the dead. Some native groups had a celebration for the deceased person when it was time to bury him in the mound. This practice gave loved ones a chance to celebrate the person's life anew - when the grief of loss was not so fresh. The use of a charnel house also reinforced the idea of community. Even in death, the deceased were together with the people they knew and loved. Archeologists consider the interment of bundle burials as evidence of charnel house use.

What did a charnel house look like? We don't have much evidence from early Florida, but native groups in Virginia built a raised structure – a bit like a large corn crib. The image to the right depicts a charnel house observed in 1558 in Roanoke, North Carolina. The Timucua, of course, did not build square structures. But the practice of processing the dead was clearly going on all over the continent.

Who painted this picture? John White was an English painter and map maker. The watercolor drawings he made in North Carolina were engraved by Theodore de Bry. Because we have White's original paintings to study, we do know that de Bry didn't compose these engraving himself.



De Bry engraving titled,"The Tombe of their Werovvans or Cheiff Lordes."

Courtesy of the British Museum at www.virtualjamestown.org

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Where were charnel houses located? Spaniards recorded that charnel houses in the Tampa Bay village of Tocobago were located in the forest, some distance from the community. However, the structure was close enough to allow the native people to visit their dead every morning. Guards were posted at the charnel house, to prevent panthers and wolves from dragging off the deceased. Like many other charnel houses, this one was located atop a sand mound. The Spanish described it as temple mound, decorated with elaborate animal carvings.

The actual footprint of a charnel house has only been found in one location, near Tampa Bay. (Perhaps it is the same one described above.) Parrish Mound 2 is about 20 meters (65') in diameter, but only about 1.8 meters (6') high. This mound supported a trapezoid-shaped building that was 7.62 meters (25') wide. The walls were upright logs that had been dug four feet into the earth. There was space in between the logs to allow air flow, and the remains of 34 individuals had been buried in the dirt-floor of this charnel house, some as bundle burials and some as cremations (a rare occurrence in Florida). Seven others were buried atop the mound, but outside the building itself. Unlike the North Carolina charnel house, this one wasn't elevated on stilts. It was elevated by an earthen mound. When the charnel house was no longer in use, it was burned to the ground, an practice seen elsewhere in Florida. European artifacts in the mound show that it was still in use during the Contact Period.

Who was processed in a charnel house? Everyone in the village made their way to the charnel house eventually, except for the chief. Chiefly burials were described by French explorers, Franciscan friars, and St. Augustine Spaniards. They all spoke of an elaborate grieving process. Public lamentation by women occurred daily, sometimes for six months to a year. Men and women also cut their hair short as a tribute to the dead chief.

More about chiefly burials: In some cases, the chief was interred after three days of community fasting. He was buried in a small sand mound apart from the community burial mound. His drinking cup and other grave goods were buried with him. Other descriptions say the chief's body was processed, and the purified bones were stored in a chest so that villagers could pay homage to their lost chief. Still other descriptions describe the chief's house being burned after he died in it. Why such different burial methods? Remember, the Timucua were never a united group. They just happened to speak the same language. Being different groups, they had different practices. (Consider the differences in culture among American English-speakers, British English-speakers, and Australian English-speakers.)

Archaeological Note: To avoid having to destroy the chief's house, another hut was often built, where the chief went to die. Archaeologists discovered evidence of this practice at a pre-Timucua village in Colombia County. Around 400 CE these Weeden Island peoples buried their chief in a shallow grave dug down into the floor of a small house. The house had been built on a sand mound. A cover for the grave was constructed from logs. Finally, the grave, the chief, and house were burned together.

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WHAT ABOUT MOUNDS?

Cahokia – Monk's Mound, in Illinois, 1,400 CE, photo by Wikipedia

Often, a Florida burial mound began as a platform mound-an earthen pyramid with a wide, flat top. Then a charnel house was built on the platform. When human remains were transferred from the charnel house to the soil of the mound, it officially became a burial mound.

Florida mounds aren't as massive as the ones found at Cahokia in Illinois. The largest there (Monk's Mound) is a stunning 291 meters (955') tall. For comparison, the Great Pyramid at Giza is 146 meters (481') tall. Turtle Mound, found in Volusia County, is the largest Florida mound at 23 meters (75') tall.

Why are Florida mounds so much smaller? Most Florida groups were not organized into complex Mississippian-style chiefdoms. The great mound centers that pepper the interior of the US were controlled by powerful central leaders. They weren't just chiefs (or even headchiefs of groups of villages). They were the leaders of confederations made up of many chiefdoms.

Most Florida cultures, like the Timucua, were less politically complex. Agriculture was less intense; social classes were more equal; and populations were smaller. As a result, they lacked the labor force and the powerful centralized government to take on such enormous projects. The closest many groups got to this sort of *monumental* display was their council house.

Two Florida cultures did achieve true chiefdom status, though not at the extreme levels found in the US interior. One of these groups, the Apalachee, prospered through intensive agriculture. (Remember the Council House at San Luis?) The other, the Calusa, achieved Mississippian power through the intensive harvest of marine resources, like fish and shellfish. (They actually built whole islands out of shell middens.)

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Lake Jackson Mound 2
1,000-1,500 CE, Tallahassee,
photo by Wikipedia

The Fort Walton Culture (which later became the Apalachee) built this mound at Lake Jackson. It is 11 meters (36') high. The Caloosahatchee culture (which later became the Calusa) dug an extensive system of canals in southwest Florida. Those canals connected many villages with the Gulf of Mexico and allowed people in the main Calusa village to canoe right up to their huts. These massive earthworks attest to each group's ability to command significant labor forces.

<u>What other mounds are found in Florida?</u>

The Crystal River site in Citrus County included six distinct mounds. Mound G (a burial site) has been radiocarbon dated to several hundred years BCE. At that time, Temple Mound 1 (pictured below) was probably about 9 meters (30') high. This mound complex (city) was occupied continuously from 200 BCE until about 1000 CE. It was a ceremonial center, visited by thousands who wished to trade, participate in ritual activities, and bury their dead. All of those people created a lot of trash. The crescent-shaped trash midden at Crystal River is 400m long, 30m wide, and 1.2m tall. Twelve hundred years' worth of occupation leaves a mark on the environment.

Calusa Canals, Fort Meyers Area,
1,400 CE, Art by Merald Clark.

Courtesy of the Florida
Museum of Natural History

Crystal River Temple Mound 1
Citrus County, West Coast of Florida,
photo by Wikipedia

The earthworks at Crystal River, Lake Jackson, and Caloosahatchee are far from Timucua territory. But we do have a few platform mounds at archaeological sites in our own backyard: Mount Royal, Thursbys, Shields and Grant. While these were not true Mississippian cultures, they were clearly influenced by the complex chiefdoms in the interior of the US. The construction of platform mounds, and the inclusion of exotic ceremonial objects such as grave goods, links them with Mississippian cultures as far away as Oklahoma.

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Let's talk about Mount Royal. Mount Royal (in Putnam County) is located about 40 miles south of St. Augustine in a freshwater environment on the banks of the St. Johns River. Why were these native peoples able to coordinate the labor to build a mound here? It was a combination of things. Their position on the St. Johns River allowed them to intensively harvest freshwater resources. At the same time, they were far enough inland to have good soils for agriculture. And finally, their position near Lake George (close to the start of the St. Johns River) allowed them to control trade routes between East and Central Florida peoples. Added together, these things made them powerful enough to harness the labor of many surrounding villages. Mount Royal reached the peak of its power as a mound center between 1,050 and 1,300 CE. After this time, native peoples continued living there, but Mount Royal had lost its strength as a cultural center. The Timucua living there 200 years later still engaged in trade, but their government was not as centralized, nor did they command the same power.

When the French visited this location in 1565, they found an average Timucua village called Enecape. It had a large platform mound, probably topped by a charnel house. A huge earthen highway led up to the mound. The French also visited Edelano, another Timucua village on the shores of Lake George. They described a similar causeway at Edelano which was 300 paces long and 50 paces wide. In 1765, William Bartram visited another nearby native site, on Drayton Island. He noted seeing a "great avenue or Indian highway" there. The existence of three significant road-building operations in three neighboring communities offers significant evidence that a centralized government was at work.

Archaeologists and historians have worked together to unite these archaeological features with European records about mission churches established at Timucua villages. Their hard work allows us to identify the Mount Royal site as the Timucua village of Enecape.

So, what happened to the once-powerful inhabitants of Mount Royal? In 1595, a Spanish mission was set up there. By 1656, native populations throughout northeast Florida had been so depleted by disease, that the Spanish moved the remaining Timucua at mission San Antonio de Enecape north to another mission, to consolidate survivors. Later, in 1680, a group of Yamassee Indians from Georgia was resettled at Enecape. By the early 1700s, they too, had disappeared.

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ACTIVITY – MAPPING THE MOUNT ROYAL SITE:

BACKGROUND: The Mount Royal site was excavated by C.B. Moore in 1894. This early archaeologist kept thorough records, but modern archaeological practices had not yet been established. This means that many important pieces of information were never even noticed. Excavations occurred so quickly that there was no time to sift the soil for tiny bits like fish bones. Native American graves were disrupted and the grave goods removed with no regard for cultural concerns.

Did you know that modern archaeologists leave part of each site unexcavated, so that future archeologists with better methods can learn more? Once an archaeological site has been excavated, the information we can learn from it has been destroyed. Keeping thorough records is of absolute importance, since the learning process destroys the object being studied. Moore's methods left us with many now-unanswerable questions. But if he hadn't excavated those mounds back in the 1890s, many would have been looted and destroyed with no information recorded at all.

It is much easier to visualize an archaeological site when you plot it on graph paper. However, to plot it on paper, all of the measurements must be expressed in the same units. The original measurements for the Mount Royal features were recorded in paces, yards, feet, miles, and roods. (Yes, roods. A rood is equivalent to one quarter of an acre.) Luckily, modern archaeologists have taken measurements to supplement Moore's work. The combined data are presented below.

INSTRUCTIONS, Part I: In the Table titled, "Mount Royal Features," convert feet and yards into meters.

MOUNT ROYAL FEATURES

Mount RoyalFeatures	Original Data (Without the Paces and Roods)	Size in Meters
Burial Mound (Roughly Circular)	160 feet across	m in diameter
Causeway	820 yards long	m in length
Causeway	Ranging from 12-25 feet across (Use 20' for this activity.)	m in width
Ridge on Each Side of the Causeway	Up to 12 feet wide (use 12')	m in width
Pond width	100 yards wide	m in width
Pond length	150 yards long	m in length

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ACTIVITY – MAPPING THE MOUNT ROYAL SITE continued:

INSTRUCTIONS, Part II: Use the data in the table and the information in the paragraph below to create an accurate sketch of the Mount Royal site on graph paper. Be sure to label all features, title your map, and include a list which describes how many units long or wide each feature is. (For example, "Causeway is X units long." Also include a north arrow on your map.

The three features at Mount Royal (a burial mound, a long highway with raised ridges on each side, and a shallow pond) are oriented on a north-south axis, with the mound farthest south, the pond farthest north, and the highway connecting the two. The burial mound at Mount Royal is just less than 5 meters high, and the ridges alongside the causeways are about 1 meter tall. The existing pond was probably the borrow pit which provided the soil used in mound construction. Archaeologists do not know why these pre-Timucua peoples hauled soil from nearly a half mile away when building this mound.

1) In order to make a proportional sketch, you will have to decide how many meters will fit in each square on your graph paper. Record that information here, and be sure to include it in a key on your sketch.

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2) Create your sketch of the Mount Royal site on a sheet of graph paper, then copy it over on a fresh page for submission to your teacher.

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MOUND BUILDING

How did they actually build mounds? The answer is different for every mound. Some mounds are made of shell. They're basically middens (trash piles) that were shaped on purpose. Other mounds are made completely of sand, with no shell at all (even when shell was available). All mounds do have one thing in common: layers. (These steps describe the construction of Mount Royal.)

Step One: First, the native peoples scraped the ground clean of leafy debris. Sometimes they dug below the surface a bit. Shell hammers, axes, and shovels made good digging and scraping tools.

Step Two: Next, they mixed bits of charred wood with yellow sand from the borrow pit. Then they hauled this mixture, basket by basket, a half-mile to reach the cleaned area. They spread the sand around, creating a blackened layer that marked the base of the mound.

Step Three: Next, they mixed hematite, a red iron-ore, with huge amounts of yellow sand. They spread this light red mixture across the mound in a layer that sometimes reached 2.1 meters (7') thick. That's A LOT of sand. At 1,886 square meters, this mound was bigger than an Olympic-sized swimming pool (1,250 m^2.) The building of this layer alone required them to haul more dirt than it would take to fill that Olympic swimming pool. And they hauled it from a half-mile away.

Step Four: They added another yellow layer, the final preparation before the mound could receive burials. Both kinds of burials, primary (still articulated) and secondary (bundle burials), were set into the yellow layer. Each grave was marked with handfuls of dark red hematite sand. The association of red with burials is common among North American native peoples and prehistoric Europeans.

Step Five: The native peoples buried special items with many of the graves, including whelk shells, shell beads, pottery, copper beads, and copper breastplates. They also scattered stone tools throughout the yellow layer, perhaps as a tribute to the whole group.

Step Six: Next, they covered the skeletons and grave goods with another layer of yellow sand. This ended the physical burial event. (Archaeology cannot teach us how these native people expressed love or grief at such an event, because emotions leave no mark in the archaeological record.)

Step Seven: Eventually, the native people would need to transfer another group from the charnel house to the burial mound. At this time, they built new sand layers atop the existing mound, first, scraping the top of the mound clean of leaves. Next, they hauled a layer of colored sand to make an obvious base for the new burial event. Then, steps 2-6 were repeated.

Step Eight: After a long period of time, the native people stopped using this mound as a burial spot. They mixed a large batch of deep red hematite sand and spread it across the entire top of the mound as a cap.

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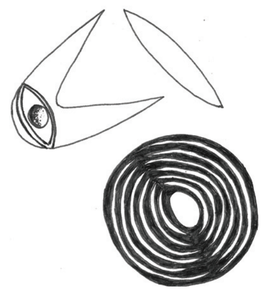
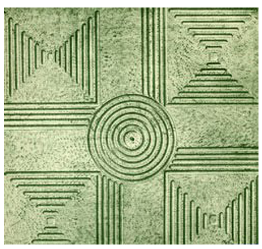
What have archaeologists learned by studying mounds in Timucua territory? Let's look at a few mounds... Mounds in Putnam, Nassau, Duval, and Volusia Counties. Some of these mounds contain shell, but most are primarily sand. Shell mounds preserve bones much better than sand because the calcium in the shells makes the soil alkaline. Sandy soil alone is mildly acidic and eats away at skeletons until they finally disappear entirely. Each of these mounds contains layers, human burials, and grave goods.



Forked eye Motif

Putnam County (Mount Royal): Mount Royal is best known for its copper artifacts, which demonstrate the trading power of these native peoples. One 10 ½" copper breast plate was decorated with the forked eye design so popular in Mississippian cultures to the north. Copper-covered wooden ear spools are another trade item found at Mount Royal.

Replica of a copper-covered ear spool, courtesy of Brian Floyd



Mount Royal copper breastplate, courtesy of C.B. Moore

Dog Adorno - an ornament on a clay pot found in Shields Mound.

Courtesy of Dr. Keith Ashley

Duval County (Shields and Grant Mounds): The Mill Cove Complex includes Shields Mound and Grant Mound. It also includes all of the artifacts and features that pepper the 750-meter space between them. Shields Mound contained drilled bear canine teeth, igneous stone points, and a dog adorno (a small decoration on a clay pot). Less than a mile away, Grant Mound contained an incredible 147 stone celts! These two mounds were traditionally considered to be separate sites. However, recent archaeological studies have confirmed that both mounds were active at the same time, between 900 and1150 CE. They're both built on natural sand hills (to give them added elevation), and they both have long causeways leading up to them. Some mound centers were only used for ceremonial purposes, but the variety of artifacts found between these two mounds shows that the Mill Cove Complex was a thriving town as well.

Nassau County (Walker Mound): Walker Mound on Amelia Island was a small cone-shaped mound topped with a red sand cap. Some of its red-hematite layers contain skeletal fragments, including teeth, finger bones, and bits of skull. These bits may have been collected from the charnel house after the skeletons had been bundled for burial.

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Volusia County (Thursbys Mounds): Thursbys Mound is located at Blue Springs State Park, just a few miles from where the large wooden owl totem was discovered. The mound was 3.7 meters (12') high and 27 meters (90') in diameter, with a shell ramp leading up from the river. This site boasts a huge number of plant and animal effigy pots. Some pots were replicas of acorns, squash, and gourds. Forty-two others effigies are replicas of animals, including fish, turtles, panthers, bears, squirrels, turkeys, and dogs.

WHAT ABOUT MIDDENS AND SHELL RINGS?

Shell middens cover acres of northeast Florida and southeast Georgia. Many middens were first laid down by the Archaic Indians (8,000 BCE – 750 BCE) and are peppered with sherds of thick Orange Period pottery. As these cultures evolved or were replaced by migrants, the artifacts in the middens changed. The new group might have used different pottery styles, but they were still harvesting oysters and dumping them where they had always been dumped. Some Florida middens cover a large area, but are only a few inches thick. They're called sheet middens. The largest midden in Florida is found at the Canaveral National Seashore in Volusia County. Turtle Mound was at least 23 meters (75') high in prehistoric days (only 50' today). It's so tall that it was used as a navigational aid for ships. (For example: "Pull into port near the giant shell hill.") Today, Turtle Mound covers two entire acres, and has a modern boardwalk, so you can hike to the top.

Historical Note: Why are Florida's middens smaller than they once were? Most were harvested for use as fill in road construction projects in the early 1900s.

Archaic Shell Midden, 2,500 BCE Pelotes Island in Duval County. The arrows show where you can see the shell hill through the tree cover.

Close-Up of an Oyster Shell Midden with Eroding Sherds of Pottery

<u>**What is a shell ring?**</u> It's a large ridge of shell shaped like an O, a U, or a C. These intentionally-shaped middens were created by Archaic peoples who lived in Florida long before the Timucua. Three shell rings have been identified in Timucua territory: Oxeye (the earliest), Rollins, and Guana. How

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did the Archaic peoples build these rings? Their villages were probably set up with the houses in a ring and an open plaza in the middle. Shells and other trash were dumped behind the houses, eventually forming a ring around the village. As these ridges grew higher, the Archaic people moved their houses to the ridge tops. (Why elevate their houses? Aside from the better view, elevation protected homes from the extreme high tides associated with hurricanes.) Some of these ridges were nearly 3 meters (9‘) high and very steep, so houses could not have been built on them. The immense amounts of shell suggest that the rings were regional ceremonial sites where lots of feasting took place.

All shell rings were monuments, a show of strength and power. They predate the great mounds of North America by thousands of years. The development of shell rings may be the first evidence that egalitarian societies (where everyone's equal) were becoming more stratified (meaning some people have more status and power than others). After all, someone had to coordinate the oyster dumping to create those extra tall shell rings.

Some of these rings, including the Rollins site, have shell ramps leading up to the top, making it easier to carry up buckets of shell. These rings are built primarily from oyster shell, but other species are included, with some rings having thick sections of coquina shell. Many artifacts are found in the ring middens, particularly pottery and shell and bone tools. Human remains are very rare.

Because sea levels have risen so much over the last few millennia, half of the Oxeye Shell Ring is now under the marsh. When it was created, that area was high and dry. Oxeye and Rollins are only four miles apart, with Rollins materials dating to only a few hundred years after Oxeye. Perhaps the ring-builders moved inland as their shell ring was flooded. Rollins is unique because it has 9 attached ringlets (some of them fairly large, greater than 80m in diameter).

How big are these shell rings? The shapes are very irregular, so you can't get a single diameter for a ring. The diameters of Oxeye, Rollins, and Guana range from 130m to 235m (430-770'). That's the length of four to seven football fields. The plazas in the middle ranged from 65m-140m across (213-459'). And how tall were these rings? Guana is 1.3 meters high; Oxyeye, 2.2 m, and Rollins 3m (all ranging from 4-10 feet high). So, their heights are not very impressive. It's the sheer volume of shell and its intentional arrangement that catch the attention of archaeologists.

Shapes of Shell Rings Found in Timucua Territory:

Rollins Shell Ring,
Duval County
2,460 – 4,150
years ago

Guana Shell Ring,
St. Johns County
2,740 – 3,860 years ago

Oxeye Shell Ring,
Duval County
4,370 - 4,580
years ago

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LET'S TALK ABOUT WEIRS

Weirs are large, semi-permanent fish traps. The Timucua used them to harvest fish and shellfish without actively having to be there to catch them. Building a fishing weir was a community effort. Timucua communities living inland along fresh water rivers probably built their weirs from rivercane, a North American relative of bamboo, which grows to over 9 meters (32') tall. The tough, hollow stems grew to be 7 cm in (3") diameter. They made perfect, ready-to-use poles. All they needed was to be cut to the proper length. Because rivercane does not grow well in salty water, it would not have been as easily available to villages near salt marshes.

Instead, these Timucua used young pine trees to make their poles. Using young pine trees required more labor than using rivercane. Branches had to be stripped away, perhaps the bark too. Next, the poles were cut to size. How long? That depended on the depth of the water. For inland creeks, tidal action did not affect the level of water. Simply observing water levels from season to season would indicate how deep the water would get. In tidal situations, the depth of the water can change radically twice a day because the tide flows in and out twice during each 24-hour period. A weir should allow the fish to pass across it at high tide, but be trapped at low tide.

Archaeology Note I: In 1913, subway builders found the remains of several 2,000 year old fishing weirs buried beneath Boston, MA, in an area that was once a salt marsh. These ancient fences were probably 30-46 meters (100-150') long. They were made of poles that were 5 cm (2") in diameter and about a meter (3-4') long.

Archaeology Note II: In many parts of the world, permanent weirs were created by piling up stones to make the walls. Some of these ancient weirs are still in existence today. Other weirs were "earthen," with the walls made of piled up dirt. An incredibly large earthen weir cuts across 500 square kilometers of seasonally flooded wetlands in Bolivia. This huge archaeological feature can be seen from the air when flying over the Amazon.

Archaeology Note III: In February 2011, a team of University College Dublin archaeologists spent every minute of each day's 2-hour low tide studying a 700-year-old fishing weir. They were hoping to learn as much as they could before funding - and the weir - disappeared forever. The weir had been buried in the marsh mud for centuries. Tidal action exposed the posts that made up this ancient fence, exposing them to the destructive power of oxygen, marine animals, and moving water.

Historical Note: In the 1560s, the French explorer, Jean Ribault, wrote that the Timucua created weirs that were "built in the water with great reeds, so well and cunningly set together after the fashion of a labyrinth, with many turns and crooks." Similarly, Rene de Laudonnière described them as "inclosures, made of reeds, and framed in the fashion of a labyrinth, or maze...."

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ACTIVITY – WEIR BUILDING:

BACKGROUND: The chart below tracks the tidal changes along northeast Florida's St. Johns River. Some of the lows are negative because they drop below the mean low tide level expected at those sites. To figure out how deep the water will actually be at high or low tide, you need to know the value of Mean Low at the site your weir will be built.

The Timucua didn't have printed tide tables. Instead, they had an intense awareness of tidal changes developed through daily observation. The older members of the community remembered the low lows as well as the hurricane-driven super-high tides. They probably measured water depth using their bodies as a gauge, in lieu of modern tools like rulers. For example, low tide is at my knees; high tide is at my hips. Instead of storing tide-charts on the internet, village elders passed this information on to younger members of the village.

For this activity, assume the following:

1) You are building a weir in a tidal marsh or river.
2) To keep it simple, mean low water depth at all of the proposed weir sites will be 1'.
   (Mean Low Water is how deep you expect the water to be at low tide on an average day.)
3) You will need 2' at the bottom of the pole to pound down into the marsh/river mud.
4) Your weir should be able to block the fishes' paths at mid-tide, halfway between high and low.

INSTRUCTIONS, Part I: Use the information presented above to complete the table titled, "Tide Charts and Weir Building." (Use a separate piece of scratch paper if needed.)

TIDE CHARTS AND WEIR BUILDING

Location of Weir	Low Tide	High Tide	Change in Water Elevation	Half of this Change	Mean Low Depth	Depth pole is buried in the mud	Length of Poles Needed
Mayport	-1.1'	5.1'	6.2'	3.1'	add 1'	add 2'	6.1'
Clapboard Creek	-0.8'	3.7'			add 1'	add 2'	
Downtown Jacksonville	-0.1'	2.1'			add 1'	add 2'	
Palatka	-0.2'	1.1'			add 1'	add 2'	
Green Cove Springs	-0.3'	0.8'			add 1'	add 2'	
Welaka	0.0'	0.5'			add 1'	add 2'	

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ACTIVITY – WEIR BUILDING continued:

INSTRUCTIONS, Part II: Based on your reading of the completed table, answer the following questions.

1) In this table, the weir locations are organized according to distance from the ocean. Mayport is closest to the Atlantic Ocean, while Welaka is far to the south, near Lake George, close to the start of the St. Johns River. Write a sentence describing how tidal changes differ as you move further and further from the ocean. Why do you think this occurs?

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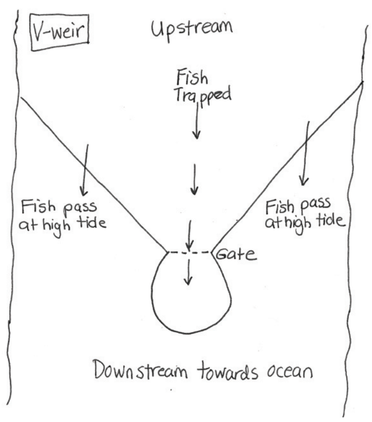
INSTRUCTIONS, Part III: Prepare your work space by adding a one-inch layer of sand to the bottom of a tray. This substrate will give you something to press your weir "poles" into. Your goal is to construct a weir that will funnel fish towards a trap located at the tail end of the weir. You may construct one of three basic weir types.

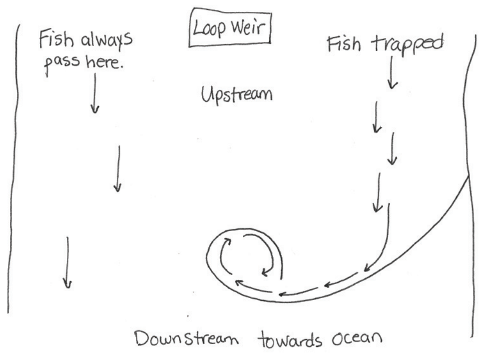
1) A V-weir was usually placed in a creek or small river in order to catch fish moving downstream. This can be used in both tidal and non-tidal situations. The wide end of the V is pointed upstream, nice and open for the fish to swim into. The V narrows as the fish move downstream until it funnels them into an enclosure at the end. These enclosures could be made with gates that formed a pen, allowing the Timucua to return and collect the fish days later if desired. If a pen was used, the walls of the pen had to be taller than the high tide level, or the fish could just swim out. If you build this kind of weir, the funnel walls should be short enough to allow fish to pass freely across at high tides, but tall enough to block them at low tide.



CHAPTER SEVEN BUILDING TECHNOLOGY

ACTIVITY – WEIR BUILDING continued:

2) A loop-weir, instead of spanning an entire large river, extends from one bank out into the middle. These fences probably started in the marsh grasses at the edge, and curved out towards the middle in a downstream direction. Then they curved all the way around to create an almost-closed loop at the end which contained the fish. Many fish species will become disoriented and continue to swim loops even if the trap is not gated.



3) The labyrinth-weir described by Ribault and Laudonnière is a variation on a loop-weir. Instead of the gently curving loop trap at the end, the Timucua may have added several twists and turns, so that fish became disoriented and got stuck at the dead ends in the maze.

Getting Started: Think about which weir you plan to build and the shape that your weir will take. You can create a V-shaped fence with an enclosure, a curved loop-weir, or a more complex labyrinth-weir of your own design. Draw a sketch of your weir plan. Be sure to label the direction of the tidal flow, noting upstream (inland) and downstream (towards the ocean). Using your fingers, break popsicle sticks into appropriate lengths and press the sticks into the sand. When you start inserting the sticks, they should not actually be touching. Water needs to flow freely through the weir - or the pressure of the tidal flow will eventually damage the structure. Add water to an approximate depth of one inch above the sand level. You can use a dry Cheerio to represent a fish. To simulate the fish swimming with the tide, nudge the Cheerio along with a pencil.

Testing Your Weir: Start with a fresh Cheerio. Set it afloat and nudge it along downstream. Does the weir trap the fish as planned? If not, what's wrong? Is the water level too high or low? Change it. (In real life, this would mean building a taller or shorter weir, since you can't actually alter the levels of the tides.) With this change, does your weir function better? Did your fish get caught between the slats of your weir? Alter the stick placement to fix the problem. Could the fish too easily escape the loop-style weir? How can you alter your plan to fix the problem? Did the labyrinth-style weir capture fish effectively? Does it work any better than the simpler loop-weirs made by classmates?

BUILDING TECHNOLOGY

ACTIVITY – WEIR BUILDING continued:

Results: Your weir is meant to be a work-in-progress with continual changes until you are happy with the way it is working. Native peoples did not invent this technology overnight. It was tested and modified over thousands of years until it became a well-perfected fishing technology. On the lines below, describe your weir. Explain problems encountered during the weir-building process and how you overcame them. In the box, draw a line sketch of your weir. Use arrows to show how fish can be trapped in this weir, and how they can pass safely. (Catching every fish would destroy the fish population you depend on for food.) Be sure to label your weir as a v-weir, loop-weir, or labyrinth-weir. Note which direction is upstream and which is downstream.

CHAPTER 8

CHAPTER EIGHT

ARCHAEOLOGICAL TECHNOLOGY

STUDENTS LEARN HOW MODERN ARCHAEOLOGISTS UTILIZE EXCAVATION, CARBON-DATING, CURATION, AND PUBLICATION TO DEVELOP OUR UNDERSTANDING OF FLORIDA'S EARLY PEOPLE.

WHAT IS ARCHAEOLOGY?

Excavations in Florida shell middens, photos courtesy of the Florida Public Archaeology Network, NE Region

Archaeology and history both study man's past, however, they do it in very different ways. Archaeology studies early cultures by finding and interpreting MATERIALS they left behind, like pottery, burned seeds, shell middens, or wooden sculptures. These artifacts show <u>what people were DOING</u> (making pots, cooking, eating shellfish, and carving).

History studies early cultures by reviewing WRITINGS made by members of that culture, or by visitors to that culture. These writings might include descriptions of travels, letters home, lists of the people living in a town, or an obituary describing a death. These written documents show <u>what people were THINKING</u> (i.e. about exploration, family, population growth, or grief and religion).

A natural divide between archaeology and history occurs when a culture begins to read and write. Literacy (the ability to read and write) allowed people to record their histories. Before cultures became literate, they could not record their "stories." As a result, modern historians cannot directly study these pre-literate societies. Archaeologists can study them directly because they rely on artifacts (not words) for clues to early lifestyles and technologies.

Archaeology Note: Many archaeologists also study literate cultures. NASA's archaeologists study sites important to the history of aviation and space flight (like crash sites). Garbologists are archaeologists who study modern landfills to learn about eating patterns and recycling behaviors of modern people.

<u>Back to Literacy:</u> Different cultures learned to read and write at different times. For example, the Egyptians began writing around 3300 BCE, the Chinese around 1200 BCE, and the Mesoamericans in 600 BCE. For each of these cultures, recorded history began at these dates. The Timucua were not a

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literate culture when the Europeans arrived. However, according to the Spanish priests, they learned to read and write very quickly. One or two letters written by Timucua chiefs are still in existence today. These letters fall under the study of history – as do the written records of Spanish, French, and English explorers who visited the Timucua.

Except for these documents, everything we know about Florida's early people comes from archaeologists, through the study of things, not written words. The presence of burned corn cobs tells us that a group cultivated corn. Bundle burials suggest that the deceased were processed in a charnel house. (See the unit on Building Technologies.) Wooden carvings (via analysis of the carved parts) demonstrate the different kinds of woodworking tools that a culture used. The presence of glass beads indicates interaction with European explorers.

So, where do archaeology and history meet? In Florida, they bump into each other around 1513, when Ponce de Leon first lands near Cape Canaveral. When he sails around to the west side of Florida, he clashes with the Calusa Indians. Amazingly, one speaks a little Spanish. (Had this Calusa person visited the Spanish on the island of Cuba to the south? Had he learned the language from Spaniards whose ships had wrecked in southwest Florida? Or had the Spanish been making unofficial trips to Florida before Ponce de Leon's famous journey? Historians are still searching for an answer.) It's only after Ponce de Leon records his unpleasant encounter with the Calusa, that historians finally have written documents to work with.

European documentation about Florida's Indians began in 1513. The last Timucua evacuated to Cuba with the Spanish in 1763. During this time (1513-1763) both archaeologists and historians have plenty of material to study. Archaeologists focus on what they can prove through artifacts. When talking about the people living in northeast Florida during the Spanish mission period, they call them "San Pedro" and "San Marcos" cultures. Historians focus on the records of Spanish priests and administrators. They call the native people who lived at Spanish missions "Timucua." San Pedro and San Marcos cultures ARE the Timucua. They are Timucua speakers living in a particular place and producing a particular kind of pottery. So, the archaeological terminology provides more detailed knowledge about technology and way of life, while the historical terminology (i.e. Timucua) gives a rough location and the language spoken.

Do archaeologists and historians ever work together? This kind of collaboration is happening more and more every day. By working together, archaeologists and historians have identified the Mount Royal archaeological site (near the base of the St. Johns River) as the Timucua village Enecape. They believe a Spanish mission called San Antonio de Enecape existed there as well.

Archaeologists have also located Spanish artifacts at several native villages along the southwest coast, interior, and northwest of Florida. These include bells, mirrors, beads, and scissors. They date to around 1539, when Hernando De Soto was marching through Florida.

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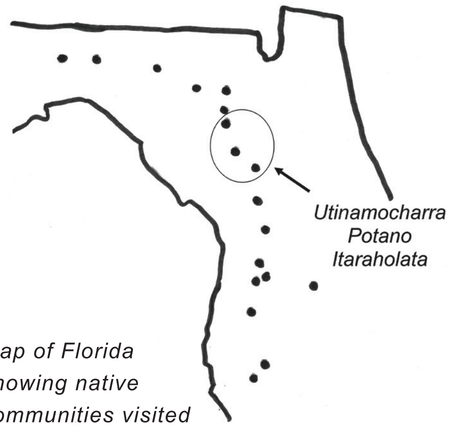
By working with historians, archaeologists have matched these excavated sites with the Timucua villages mentioned in records of Hernando de Soto's travels. Some of these sites are close to modern Florida towns. *Utinamochara* was just west of Gainesville. *Potano* was located at the town of Evinston. And *Itaraholata* was located southwest of Ocala. As archaeologists collect more data, and historians locate new documents, they'll both continue to work towards creating a more complete understanding of Florida's early people.



Map of Florida showing native communities visited by De Soto in 1539

A word about CONTEXT: What is context? Context is probably the most important concept in archaeology. It describes everything about where an artifact was found. (For example, a whelk shell bowl was discovered at Dent Mound, site 8DU68 on Pelotes Island in Duval County, Florida). But that's just the beginning. It also describes the site where this artifact was found. (The whelk bowl was discovered in an oyster shell midden that was eroding into Clapboard Creek.) Context also describes the other artifacts found near the whelk bowl. (A large number of Orange Period fiber-tempered pottery sherds were also eroding out of the midden, along with a few Archaic period chert projectile points. Some pottery sherds from later periods include St. Johns chalky and sand-tempered.)

The context for this piece tells us a lot. The bowl was found with Archaic period pottery and projectile points, so it was probably made by Archaic peoples in Florida. The few later artifacts suggest that later cultures visited the site. Because the shell midden is washing away into the creek, many later artifacts may have already been washed away, collected by treasure hunters, or relocated when the area was mined to create materials for road fill.

Knowing that it came from an eroding site is important. You don't have nearly as much context information at this kind of disturbed site as you would have at an excavation. When strata are carefully removed, you know exactly which artifacts came from above the shell bowl (younger artifacts) and which artifacts came from below the shell bowl (older artifacts). Archaeologists preserve context information by scraping away the dirt in careful 10 cm levels, so they can retrieve as much data as possible.

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ARCHAEOLOGICAL TECHNOLOGY

LAB – CREATING A MODEL MIDDEN:

BACKGROUND: Archaeologists often rely on the excavation of middens (trash piles) to provide the information needed to learn about ancient cultures. Many Timucua middens are composed mostly of shell with a little dirt and a few artifacts and biofacts mixed in. (A biofact is a shell, seed, or bone which has not been modified by man, but does give us clues about the past.)

The materials found in most middens were not laid out with any foresight or planning. Native peoples just dumped their trash. While some archaeologists study midden "deposition" (how the trash was dumped), most archaeologists focus specifically on the artifacts they find. In this activity, you will be constructing a midden for classmates to excavate. While building it, think about how trash is actually dumped. If you had just shucked a bunch of oysters, you'd probably dump the basketful of leftover shells in a pile. If you had just finished knapping some stone points, you might shake out the deer hide you work over, scattering the debitage over a small area. If a pot broke, the pieces would probably be dumped together. Also, remember that middens weren't used for only one day. If shellfish were shucked five times in a week, there might be five different piles of shell trash (for each family in the village). Would the piles be right on top of each other? Or would they be spread thinly across the area in the form of a sheet midden? You'll need to decide these things before you start constructing your midden. **Remember**: The Timucua did NOT "construct" middens. They simply threw away trash. Your purpose in constructing this midden is to create a realistic midden model for classmates to excavate.

You'll be creating strata (layers) in your midden. Stratigraphy (*stra-ti-gra-fee*) is the study of strata, the layers of cultural materials discovered during excavation. This science is based on the fact that long ago, the surface of the ground was lower than it is today. As leaves fell onto this ground and dust blew in, more soil was created above that ancient surface. Prehistoric peoples moved to the site and dug holes into the soil to set posts for their homes. They also deposited leftover shells, broken stone points, and chipped pottery across the top of the soil. This debris raised the level of the ground a bit more. When later historic peoples lived on the same site, they also dug postholes for their huts and dumped shell trash, broken iron tools, and charred seeds. This raised the level of the ground even further. Much later, when a family of modern Floridians moves to the same site, they might accidentally drop trash like coke cans and plastic grocery bags.

Look again at this excavation. The left side shows a feature. This is believed to be part of the first fort at St. Augustine. Did you know there were nine forts, including the one built from coquina that still stands today?

CHAPTER EIGHT ARCHAEOLOGICAL TECHNOLOGY

LAB – CREATING A MODEL MIDDEN continued:

The foundation of their house may be dug down through the older strata below. Stratigraphy tells us that younger materials will usually be found at higher levels of an excavation, while older materials will be found at the lower levels. If a site has been disturbed, by digging animals, an uprooted tree, or human treasure-hunting, the strata can be mixed, producing confusing data.

Archaeology Note 1: Objects made by man are classified as "artifacts." Postholes, building foundations, and ditches are classified separately as "features." Features are parts of structures or buildings made by man.

Archaeology Note 2: The stratigraphy principal which states that older artifacts will be deeper is called "superposition."

INSTRUCTIONS:

1) **Design a midden plan which will answer the following questions.** (You will be required to describe your plan, the locations of artifacts, and the methods used to deposit them, so consider carefully and take good notes.) You will be designing two midden strata, one BEFORE contact with Europeans (the lower one) and one AFTER first contact with Europeans. Remember, you do not need to include every single artifact and biofact available to you. Be selective. For the Contact Period midden, do not add many European artifacts (perhaps only one). These are rare finds. If agriculture was not important at this village site, add only a few seeds or none at all. (Usually, only charred seeds survive in the archaeological record.) If agriculture was important at this site, add more. If more than one seed type is available to you, did your group cultivate both? What about the collection of wild seeds like acorns?

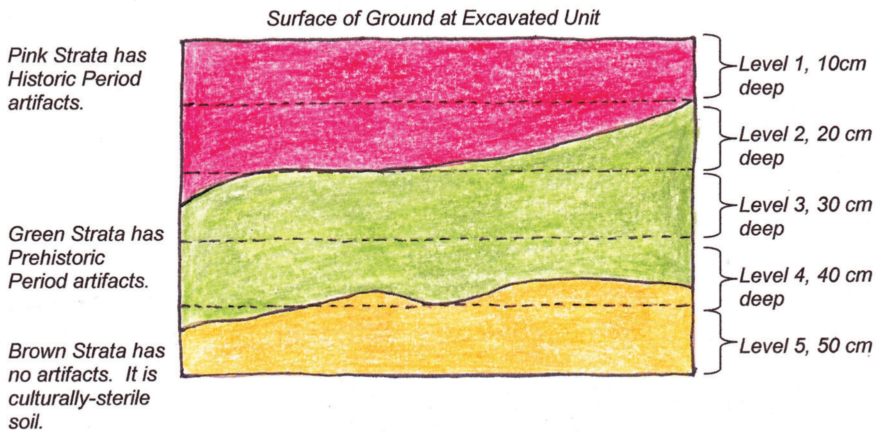
   Questions to consider:

   a. Will this midden be mostly prehistoric, mostly historic (Contact Period) or an even split between the two?
   b. What artifacts and biofacts will be present in both levels?
   c. Which materials are only in one level and why?
   d. What amounts of each artifact will you deposit, and what does that indicate? For example, lots of shell means lots of shellfish eaten. A large number of iron artifacts probably indicates a mission village, since there was regular, long-term contact at these sites.
   e. What seeds were used in each period? Contact Period only: corn, bean, and pumpkin. Cultivated by both Prehistoric and Contact Period cultures: sunflower, squash, quinoa, and gourd. If your midden includes lots of charred corn, quinoa, or sunflower seeds, that suggests intensive cultivation.

LAB – CREATING A MODEL MIDDEN continued:

f. Will materials be deposited in piles or as a sheet midden? Will this vary according to the type of material being deposited?

g. Will the division between strata be flat? On an incline? Hill-shaped?



The materials you have for midden construction will vary. Some examples include: pieces of shell or bone (you can modify some of these into tools by sharpening them on concrete), broken pottery, stone debitage, seeds, glass beads (Spanish), and copper (prehistoric, but usually found in burial mounds, not middens), nails (Spanish nails were iron, not steel, and they were square), moist yellow sand, moist gray soil, and moist brown soil.

2) **Starting Construction:** Sprinkle a thin, but solid strata (<1/2 cm) of plain sand across the base of your container. This represents the culturally-sterile sand which was deposited at a time before the site was occupied by humans. ["Culturally-sterile" means no sign of humans.] When culturally-sterile sand is reached, excavation normally goes no deeper. Remember, many Timucua middens are 99% shell, with little sand.

3) For the next 2-4 cm, you will be adding a strata of midden with damp gray soil. (Different colored soils are used to indicate a different time period during which the midden was created. They would normally be slight variations on the area's natural soil color.) Sprinkle in some soil, then begin depositing your artifacts and biofacts (including plenty of shell), adding more soil along the way. Make a list of the materials you add, plus a clear sketch of the locations of these materials. If you deposit all of the artifacts and biofacts in a single layer (filling the rest of the 2-4 cm strata with plain dirt) this indicates that the area was occupied for a while, then unoccupied. If you deposit a few artifacts, then dirt and shell, then more artifacts and more dirt and shell (so the artifacts are dispersed vertically through the strata) this indicates that the

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LAB – CREATING A MODEL MIDDEN continued:

site was continuously occupied for a long period of time. If you are dividing your time periods evenly, this layer should be 2.5 cm (or 1") thick. When you have completed the layer, use your fingers to press down on the surface. This will compress the soil, making it easier to excavate later. (Lower layers at actual sites have been compressed by the weight of shell and soil above them.) Start sprinkling brown soil and shell atop the previous strata. Make it just thick enough so that you can't see the lower strata through it. Deposit the artifacts and biofacts appropriate for this time period, adding soil along the way. Record your list of midden materials, and sketch their locations. Leave at least two centimeters of space at the top of your midden to prevent overflow. Use your fingers to press down on the entire surface of the midden to compress the soils. On the outside of your container, name your midden using the team members' last names. For example: Jones-Davidson Site.

4) **Recording your Method:** On a separate piece of paper, put your notes into the following format.

Prehistoric Midden Record:

a. List the materials you will include and the amounts (i.e. 2 shell tools, 1 copper breastplate, about 20 chenopodium seeds, handfuls of coquina shell).
b. Explain the reasons you made these choices and what it should tell archaeologists about this culture.
c. Describe the method of deposition: trash piles or sheet midden and why.
d. If you included any artifacts like pottery or shell or bone tools, describe and include their locations.
e. How many centimeters thick is this strata? Was this site used longer by prehistoric or historic peoples?
f. Sketch the locations of different materials. If shell is located throughout, note this in the description. If different shell species are used, record this information as well.

European Contact Period Midden Record:

a. List the materials you will include and the amounts (i.e. 2 nails, 4 stone debitage chips, 3 corn kernels, handfuls of crushed oyster shell).
b. Explain the reasons you made these choices and what it should tell archaeologists about this culture.
c. Describe the method of deposition: piles or sheet midden and why.

Spanish glass beads, courtesy Mission San Luis

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LAB – EXCAVATING A MODEL MIDDEN:

d. If you included any artifacts like pottery, nails, glass beads, or bone tools, describe and include their locations.
e. How many centimeters thick is this strata? Was this site used longer by prehistoric or historic peoples?
f. Sketch the locations of different materials. If shell is located throughout, note this in the description. If different shell species are used, record this information as well.

BACKGROUND: Excavation is not about moving dirt as quickly as possible. It's about noticing details. What color is the soil? Does the soil color change? Is it an abrupt change, or does it occur gradually? Is the soil sandy or slick and clay-like? Is it mostly shell with a little dirt OR mostly dirt with very few shells? Each of these details is important to interpreting the past. Archaeologists record all of these details. They excavate carefully, removing soil and artifacts, in an organized fashion using scientific tools and methods. Excavation is a systematic process which involves "scraping away" the dirt to uncover the past. In this activity, you will be excavating a midden created by your classmates. Because you will be using the materials you excavate for the Screening and Flotation labs, you will bag the contents of each 2 cm level in labeled containers. (In an actual excavation, the levels are 10 cm deep, and the material is screened immediately. Only the artifacts are bagged.) You will not be excavating the entire site. Archaeologists are ethically-bound to leave a portion of each site undisturbed for future archaeologists to study. (One exception is when a site is going to be bulldozed for construction.) In addition, archaeologists never have the funding or manpower to excavate an entire site. They must carefully plan where they will excavate, to make the most of their time and money.

Archaeology Note: When planning an excavation, the following costs must be considered when seeking funding.

- **The archaeologists' salary while in the field**
- **Equipment cost or rental** for screens, shovels, trowels, backhoes, trucks, cameras, safety equipment, walkie talkies, batteries, pumps and hoses (for wet-sites), artifact storage bags, flotation equipment, and more.
- **The archaeologist's salary for time spent analyzing the artifacts and for researching and writing reports.**
- **Proper storage (curation) of the artifacts.**
- **Additional considerations:**
  Sometimes this funding also pays for the creation of educational displays in museums and parks, as well as archaeologist's salaries for delivering lectures about the excavation.

ARCHAEOLOGICAL TECHNOLOGY

LAB – EXCAVATING A MODEL MIDDEN continued:

INSTRUCTIONS:

1) **Focus your research.** What information do you want to learn about this midden – or about the people who created this midden? *(When we say "people," we're referring to native cultures- as though this were a real midden – not your classmates who actually constructed the model.)* The research question you ask should be specific and unique to your interests. It should also be a question that can be answered in this model excavation. For example, "Did pottery styles change from prehistoric to Contact Period times at this site?" would not be useful if your class only used one type of pottery during midden construction. Likewise, you may be interested to know whether many of the Timucua suffered from malnutrition, but that cannot be answered from a midden excavation, only from a burial study. Research questions must be carefully tailored to the site in question.

   Use your experiences in midden-construction to help you design your question. Then rephrase it as a hypothesis. **For example:** The question, "Did pottery styles change from prehistoric to Contact Period times at this site?" becomes "The artifacts discovered at this midden site will reflect the use of different pottery styles by prehistoric and historic native peoples."

   When doing your analysis, you will report whether your findings "support" or "fail to support" your hypothesis. For example, "Yes, the findings support a change in pottery type between time periods," or "No, the findings fail to support a change in pottery styles."

2) **Plan your excavation.** The surface area of your midden site is probably about 200 cm2. Your funding will allow you to excavate 2 units down to culturally sterile soil. Each unit will be 7 cm x 7 cm and cover a surface area of 49 cm^2. Together, the two units will cover just over a third of the site. Where will you place these units? Touching each other or far apart? Along the edges or in the middle? Will they be oriented with the edges of the midden or will they be diagonal? Be sure to note why you are making these choices. Make a sketch of your excavation plan.

3) **Have your storage system ready.** As you excavate, you will remove 2 cm of material for each level. The material excavated from each level needs its own labeled bag, for example: Unit 1, Level 1, X cm. (X cm is the depth at which the top of the level begins. Measure this depth from the top of the container. How? Tape a piece of string from one corner to another. Measure straight down from the string to the surface. The point you measure from is called a "datum." Mark the location of your datum on the string. You will measure the starting depth of each successive layer from this point.) Each time you start excavating a new level, start a new bag.

CHAPTER EIGHT

ARCHAEOLOGICAL TECHNOLOGY

LAB – EXCAVATING A MODEL MIDDEN continued:

4) **Set up your units**. Use toothpicks to mark the corners of your 7x7 cm2 unit. A toothpick is about 6.5 cm long, so you should be able to push it all the way to the bottom of the midden container. If shell blocks the path of the toothpick, insert it as far as possible, and be careful not to dislodge it during excavation. Some archaeologists leave a small triangle of soil unexcavated in each corner to ensure that they don't dislodge the corner markers.

5) **Begin excavation.** Your excavation tool will be a putty knife. (At an actual dig, tools would include flat-blade shovels and flat trowels. You're working in miniature here.) Making the sides and bottom of your unit straight and smooth is a difficult skill to master. It takes patience. You're working in a shell-filled substrate, so shells will certainly block your line of excavation and stick halfway into the unit. Excavate patiently. Try not to make the unit any bigger than the square. If you need a guide, tape a string across the top of the container in line with the edge of the unit you're excavating. Use that string as a guide to cut a line in the soil with your putty knife. Repeat as you excavate deeper. It is important for the walls to be smooth so archaeologists can see the stratigraphy - the levels which indicate transitions from a younger culture to an older one. Smooth sides also make the excavation scientifically accurate.

6) **Excavate in levels.** Remember, YOU ARE NOT DIGGING WILDLY. Use your tools to scrape down to the appropriate depth. Keep your ruler handy, and measure your depth frequently. DO NOT GET IN A RUSH and excavate deeper than one level at a time. There's no way to go back and undo a mistake. Bag and label the materials excavated for Unit 1, Level 1.

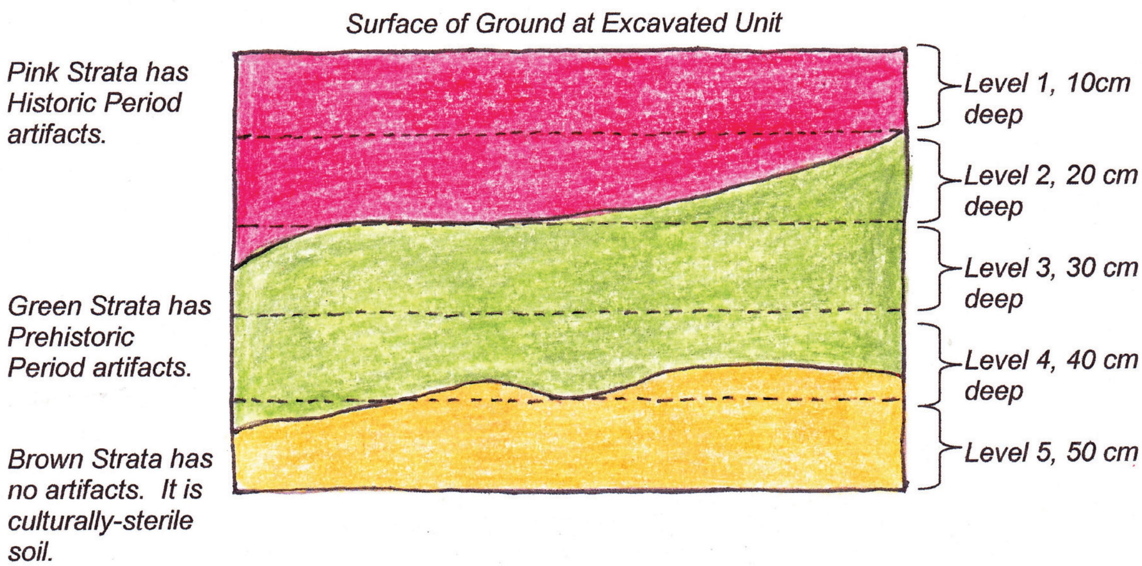
If you notice a change in soil color in the middle of a level, STOP excavating. When you begin again, you will carefully remove the upper soil color all the way across the unit. Do not dig into the new color until the upper layer has been completely excavated. The material from one soil color goes in one bag. When you proceed to excavate the rest of the level, put the materials from this new strata in a new bag.

You have reached an earlier time period, and these materials will need to be stored separately for analysis. Label the new bag, "Unit 1, Level 1, X cm," so you will know how deep you were when the new strata started. (X tells us the depth of the top of the new soil color. Take this measurement from the top of the container. This is your datum point. If the color change is on a slant, be sure to sketch the angle, including measurements of a high point and low point. This stratigraphy should show up clearly in the side of your unit after you are through excavating. If possible, take a digital photo of the strata visible after excavation. Be sure to

LAB – EXCAVATING A MODEL MIDDEN continued:

record detailed observations as you go. Anything could be important during later analysis.

Remember, LEVEL depths are constant – and predetermined by your research goals. STRATA are layers of cultural materials that were laid down in the natural course of living. Levels and strata rarely match up. In the sketch below, the soil colors are bold and different. In a real excavation, soil colors are usually varieties of brown and gray, much more difficult to pinpoint.



This sketch shows the stratigraphy of an excavation that includes historic and prehistoric artifacts. Level 1 is entirely Historic (one bag for artifacts). Level 2 includes two cultural strata, so two bags are needed to separate artifacts. Level 3 includes two cultural strata, so two bags are needed. Level 4 includes the prehistoric strata and culturally-sterile sand (one bag needed). Level 5 includes a tiny bit of prehistoric material. One bag needed.

Because each model midden is about 5.5 cm deep, you should be able to excavate 3 levels, with the bottom level being shallower because you will reach culturally-sterile sand and stop excavating.

Repeat this process for Unit 2. What happens if an artifact is half in and half out of the side of the unit? Work around the artifact without removing it from the wall. When your excavation is complete, you may carefully remove the artifact from the wall of the unit. Record the exact depth where it occurred, and be sure it is included in the appropriate bag. If possible, take a digital photo of the artifact in situ (in place) before you remove it from the wall of the unit.

CHAPTER EIGHT ARCHAEOLOGICAL TECHNOLOGY

LAB – EXCAVATING A MODEL MIDDEN continued:

7) **Stratigraphy.** As noted earlier, after you complete each unit, you should take a look at the strata visible in the side (profile) of the excavated unit. Measure the depth of each strata. If the line between strata is on a curve (instead of being precisely horizontal), measure it at several points so that you can plot the points and draw a clear sketch of the strata. Repeat for Unit 2. If you have access to a digital camera, photograph the strata for inclusion in your final report.

Note the strata of shell midden and soil in the stratigraphy of this excavation. St. Johns County, FL, courtesy of the NE Region Florida Public Archaeology Network

8) **Record your observations.** This will be included in your final report. On a separate piece of paper, note any differences observed between the units (i.e. amount of shell, thickness of strata, artifacts observed). What parts of the excavation were challenging? Include depths of cultural strata and sketches of strata as well as a sketch of the locations of your units in relation to the entire midden.

9) You will be analyzing the artifacts and doing flotation studies on the soil (matrix) in a later activity.

DIFFERENT KINDS OF ARCHAEOLOGY

The first thing an archaeologist needs is a Research Question. There's no sense wasting time, money, and sweat digging up the ground unless they have a purpose in mind. For example, archaeologists studying the change from prehistoric Alachua cultures into historic Potano Indians might ask the following question. "How do the artifacts found at pre-mission Alachua sites compare with artifacts found at mission-period Potano villages?" This question has a 1) a specific goal – changes in Alachua tool-use as influenced by Spanish missions, and 2) a specific location – in this case, the Richardson Site. This study required excavation of native sites. *(Archaeologist: Jerald T. Milanich)*

Archaeologists searching for sources of spiculate clay used in making St. Johns pottery would ask entirely different questions: "Where in northeast Florida did St. Johns potters find clays with naturally-high levels of sponge spicules?" This question has 1) a very specific goal – to discover a specific natural clay source and 2) a specific location (northeast Florida). This study did not require the excavation of native sites. *(Archaeologists: Vicki Rolland and Paulette Bond)* [See the unit on Tool Making Technology for descriptions of sponge spicules and pottery manufacture.]

CHAPTER EIGHT

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Other archaeologists work to develop or clarify regional timelines. What are these timelines used for? Archaeologists establish that a certain style of pottery was made at a certain time, so if they find that pottery type at another site, they can make a good guess at the date of that site. One study focused on the following question: "Will a careful review of archaeological reports show that coastal peoples in northeast Florida had their own unique pottery and lifestyle?" This question has 1) a specific goal – interpreting existing data (along with new date information) – to see if the timelines for northeast Florida cultures can be applied to the coastal peoples too. This study also focuses on 2) a specific location – the coastal northeast Florida and Georgia villages. This study does not excavate or collect samples. It combines the data from earlier digs with new date information about the previously excavated artifacts. *(Archaeologist: Dr. Keith Ashley)*

These three examples demonstrate that archaeology can take many forms. Excavation, environmental sampling, and data analysis are only a few of the methods utilized by archaeologists. Whichever method they employ, one thing is certain. For every hour spent in the field, AT LEAST three hours are spent in the lab. Archaeology has come a long way since C.B. Moore demolished his way through

A CASE STUDY: WET SITE ARCHAEOLOGY AT HONTOON ISLAND

On the following pages, we'll take a look at the processes archaeologists used when studying Hontoon Island – an underwater archaeological site. Hontoon Island is just south of Timucua territory, in the land of the Mayaca. The Mayaca first encountered the Spanish in the 1560s. Pedro Menendez was traveling south on the St. Johns River, and the Mayaca refused to allow him to pass. When he ignored their decree and rowed on, his ship found the river blocked with a fence of stakes. Menendez had his men break through the barrier and proceed. Soon, at a narrow part of the river, the Mayaca were waiting with archers, and forced Menendez to retreat. That takes guts. It's also a historian's view of the people living in this region. Archaeologists depend on artifacts, not stories. They've discovered Spanish olive jars and other European artifacts nearby. This suggests that (much later) a mission was located in the area, perhaps San Salvador de Mayaca, noted in Spanish records.

Spanish Olive Jar, courtesy of Daniel Frank Sedwick, LLC at http:/wwwsedwickcoins.com

The native people living at Hontoon Island produced the giant wooden owl totem as well as the smaller pelican and otter carvings. (See the Tool Technologies unit.) Because these artifacts were submerged in water, they were protected from the ravages of oxygen. At dry sites, archaeologists find plenty of shell and shell tools, bits of bone, stone tools, and pottery sherds. However, these represent only about 10% of the artifacts made by early peoples. How do we know this? Samples of the other 90%

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have been found at Florida's wet sites, like Key Marco and Hontoon Island. In addition to carvings, archaeologists have recovered fishing nets, wooden mortars and pestles, atlatls, bowls, wedges, canoe paddles, toys, and more. The excavation at Hontoon Island also produced over eighty species of seeds and other plant parts. At dry sites, seeds rarely survive in the archaeological record, unless they've been charred. So, finding 80 different kinds of seeds is truly amazing. Wet sites are unique both because of the wealth of information they provide AND for the challenges they pose. Most excavation in Florida is dry excavation, in which units, perhaps one meter square and a meter deep, are excavated with perfectly smooth vertical walls.

Getting dirty at Hontoon Island: When she started her third excavation at Hontoon Island, archaeologist Barbara Purdy had many research questions. For one, she wanted to utilize wooden artifacts and debitage to study what kinds of wood-working tools were used by this St. Johns culture. She was in the right place. But getting those wooden bits out of the protective muck was no easy chore. She had a permit to excavate a trench 2m wide x 26m long, with a 6m additional trench alongside it. The land sloped down gradually into a lagoon, with five of the 14 units actually in the muck. Things would be getting dirty.

Studying strata (stratigraphy) is a bit more challenging at wet sites. When excavating in wet areas, one muddy cave-in can destroy the stratigraphy because what was on top has tumbled down to mix with lower artifacts. The key to stopping cave-ins is controlling the water, removing it when possible, and preventing it from washing away the walls of your units. That requires multiple pumps and hoses, along with constant problem-solving to prevent water and hoses from collapsing your hard work.

The team started with the dry units first. They created 2x2m squares, cordoned off in a line to form a trench. Often, archaeologists orient trenches North-South. However, in this case, the trench ran from the lagoon area towards the midden. This shell midden, like so many others, had been mined to produce material for road fill in the 1930s. Purdy's team oriented their trench to take advantage of the largest stretch of undamaged midden.

Dry excavation: So, the units are laid out. Excavation at the dry units begins with flat-bladed shovels and flat trowels. Why flat? The sides and bottom of an archaeological unit must be perfectly straight and smooth. Curved digging and scraping tools can't produce that. Excavators began by removing the 2-5 cm of root mass. Then they continued down until they reached 25 centimeters (the depth of all levels in this study). Each 25-cm level holds a cubic meter of shell, soil, and artifacts. That's enough to fill 45 five-gallon buckets. Did we mention that fieldwork is hard on the back? The excavation continued down, level by level, until the water table had been reached. (This is when water starts seeping into the unit from underground.) The dry materials excavated from these midden units were sifted through screens. Then, the initial measuring and study of artifacts began in the field. Drawings of the strata in each unit were carefully recorded. Later, these soil would be backfilled into these upland units.

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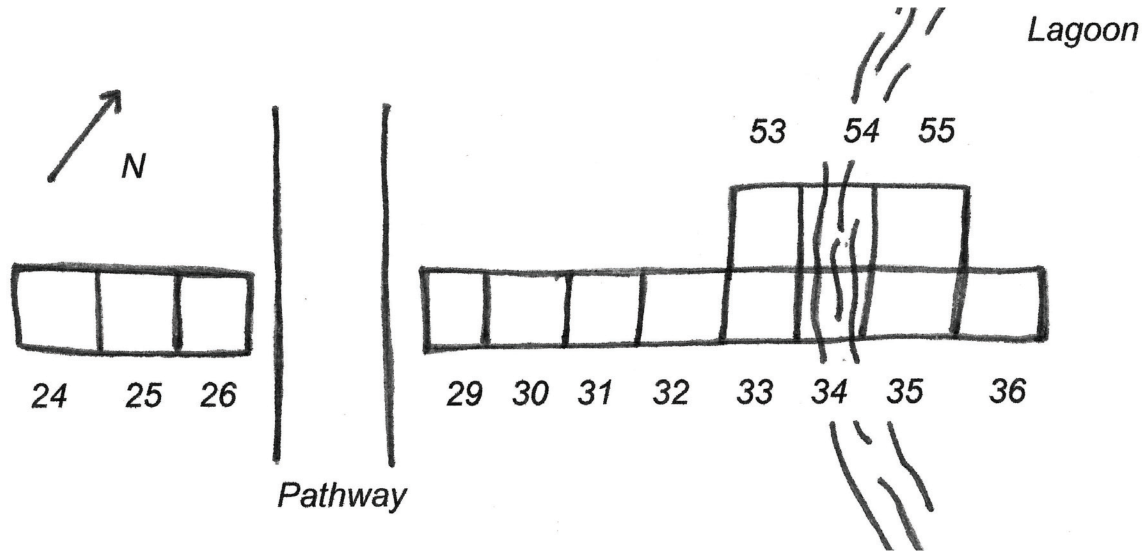
Dr. Barbara Purdy's 1984 trench at Hontoon Island, Florida



Wet excavation: Now the fun begins. The seven remaining units would be excavated below the water table. Even the ones that were dry up top became a soggy, boggy mess below. How could they excavate careful strata when they couldn't even see through the muddy water? Well, they tried to remove the water. This worked well enough, but there were constant problems. Hoses that were used to pump out water started dragging along the edges of other units, causing cave-ins. And where did archaeologists put all of the water they're pumping out of those units? They can't just spew it back into the lagoon. Tiny artifacts might be floating in that water. (Each hose had a piece of fine screen covering the intake hole, but some tiny artifacts might have gotten through anyway.) Even if you weren't worried about losing those tiny artifacts, you can't risk those artifacts contaminating another unit – or additional archaeological sites deep under water. So what did the archaeologists do? They used Unit 33 as a holding area for the pumped water. That was a temporary fix, but with the pumps running constantly, Unit 33 was going to fill up fast. They had to empty it continually too.

Pumps: The team used three different pumps. They also invented a variety of homemade gadgets to support hoses and guide the flow of water, eliminating some of its destructive power. The biggest pump pulled water out of the unit that was being excavated, and channelled it into Unit 33, the most upland of the wet units. It had already been excavated, so it could serve as a holding area for water. A smaller pump was used to draw mucky sediment out of this unit when it began to clog. A third pump pulled water out of Unit 33 and sent it to the screening area. The water was poured through fine screens, and any artifacts were collected.

After screening, this water was pumped over to a nearby area of midden which had been damaged by shell mining long ago. Depositing the water onto a disturbed archaeological site helped to preserve the integrity of the pristine archaeological sites still underwater.

With the water removed, excavation continued. Because artifacts and bits of saturated wood are very fragile, one scrape with a trowel could mean destruction. A process called "water excavation" was required. They used a hose to gently spray water at the base of the unit, collecting the resulting mud in a pan. Any visible artifacts were removed, and the mud went into a mesh-bottom bucket. The liquid that leaked out of those buckets was collected, and the water went back into unit 33. The draining buckets full of mud and artifacts were screened twice, first through mesh with holes 0.625 cm, the second with holes 0.3125 cm. Needless to say, the archaeologists were finding every teeny-tiny thing in this muck. Stratigraphy was recorded for the wet units as well, but they were not backfilled at the conclusion of the project. During drought years (when water levels drop) these excavated units are still visible.

One year later: Because of drought conditions, the water table had dropped even lower than it had been during the 1984 excavation. The team received permits to excavate two more units, a bit further out into the marsh.

Why bother? If it sounds like a major headache dealing with wet sites, it is. You may wonder why these archaeologists were so intent on excavating below the water table. It's because wooden artifacts are only preserved in areas that have been completely submerged ever since the items were deposited. If the mud had dried out even once, the wooden artifacts in the mud would have warped and decomposed. Archaeologists have to get wet and muddy, or they have no chance of finding these amazing wooden artifacts.

So, the work was finally completed…right? Not by a long shot. Sure, the excavating was complete. The screening and initial sorting had been accomplished. But much more needed to be done before the data could be organized, analyzed, and published for use by other archaeologists.

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LAB – SCREENING FOR ARTIFACTS:

***Above:** Archaeologist screening artifacts, courtesy of the Florida Public Archaeology Network, West Central Region*

***Below:** Archaeologists screening artifacts with water, courtesy of the Florida Public Archaeology Network, Northeast Region*

BACKGROUND: After artifacts and their matrix have been carefully excavated, they are put through screens to ensure that every bit of available evidence is found. The screens allow dirt to pass through while the artifacts, seeds, and bones remain on top of the screen. Screens with larger openings can allow some of the smaller artifacts to slip through. Archaeologists choose an appropriate screen size based on the conditions at each archaeological site. Common screen sizes have holes that are 1/2", 1/4", and 1/8" in diameter.You will be screening the materials you excavated earlier. In addition to locating the artifacts and biofacts, you will be testing to see which size screen is required at this site.

Testing for appropriate screen size:

INSTRUCTIONS:
You will be testing three screen mesh sizes: 1/2", 1/4", and 1/8". The goal is to find the largest holes you can use without losing artifacts. Why don't archaeologists automatically use the smallest hole-size to ensure that all artifacts are found? The smaller mesh screens clog up more easily as you are working the dirt through them. If the screens are constantly clogging, it will take much longer to screen the material.

<u>So, how do they decide which size to use?</u> First, they put the excavated material through the largest screen (1/2") and record what they found. Next, they screen the same material with the 1/4" middle-sized screen. If nothing new is found, just more of the same artifacts (only smaller), you can stick with the largest screen size. It's showing you everything at the site.

However, if any new materials are discovered (like tiny beads or seeds that weren't found before), you'll need to record your finds and proceed to screen the remaining material with an even smaller

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LAB – SCREENING FOR ARTIFACTS continued:

screen (1/8"). Record your findings. If nothing new is found, just more of the same artifacts (only smaller), you can use the middle-sized screen. However, if anything new is found, like a tiny fish bone, then you'll need to use the smallest screen to ensure that you're not missing important info.

In Review: After screening samples through each size, compare the artifacts found. If nothing new is being collected by the smaller screen sizes, you can stick with the largest one for the rest of your excavation. However, if new (meaning different) materials are being found by a smaller screen size, you'll need to use that smaller screen size to screen the rest of your excavated materials.

Starting the Screen-Size Test: Spread foil, wax paper, or newspaper across your work area. This will catch materials that fall through the screen. Start with the bag titled, Unit 1, Level 1. (If this bag has no artifacts in it, choose another bag that does have artifacts.) Empty just enough material to cover the bottom of the 1/2" screen. Use your fingers to gently stir the material. After the soil falls through, collect the artifacts, and transfer them to a bag labeled Unit 1, Level 1, X cm deep, 1/2" screen. (X cm is the depth at which you started excavating that level. For the uppermost level in a unit, X = the distance from the top of the container to the surface of the soil.) Repeat for any remaining material from the original bag. Save the matrix material (dirt) that falls through the screen to be used in the next stage of the test.

Put the saved material through the 1/4" screen. Store any artifacts and biofacts you find in this screen in a bag titled Unit 1, Level 1, X cm deep, 1/4" screen. Transfer any matrix material that falls through the ¼" screen into the 1/8" screen. Repeat the process, labeling artifacts or biofacts recovered as "Unit 1, Level 1, X cm deep, 1/8" screen. Put any soil or artifacts that fall through the smallest screen into a bag labeled "Unit 1, Level 1, X cm, for flotation."

Analysis: Record the artifacts and biofacts found in each bag, carefully returning the contents to their properly labeled bag. A list might include 1 shell tool, 1 iron nail, 2 corn kernels, and crushed shell. Compare the lists for each bag. Was anything found in the ¼" screen bag that wasn't found in the 1/2"? Was anything found in the 1/8" screen that wasn't found in the others? If nothing new was found in the smaller screens, you may continue your screening using 1/2" screen. If new items, like stone debitage, were found at the 1/4" level, you will use the 1/4" screen for the rest of the screening. However, if something tiny, like a glass bead is found only with the 1/8" screen, you will need to use this screen for the entire site. Record your choice for screen size. This completes the screen-size test. Now you may continue screening the rest of the site.

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LAB – SCREENING FOR ARTIFACTS continued:

Screening: Start with the next bag. Perhaps it is Unit 1, Level 2, X cm (X = the depth where you start excavating that level, measured from the top of the container). Proceed with screening the contents in the appropriately-sized screen. After screening the contents of a bag, you can reuse the labeled bag for the artifacts and biofacts you've found. Save the material that goes through the screen (dirt and tiny artifacts and shell) and bag it with the label "Unit 1, Level 2, X cm, for flotation.)

Repeat this process with your third level, bagging the artifacts and saving the remaining marix materials for the flotation lab.

Now it's time to start on Unit 2. Screen the materials as you excavate, storing any artifacts and biofacts in a baggy labeled Unit 2, Level 1, X cm. (When you start excavating a unit, X will always equal the distance from the top of the container to the soil surface.) You do not need to save the soil for flotation. Archaeologists do flotations on only a small percentage of the materials they excavate from each level. Be sure to sketch/photograph the strata visible in your completed unit. *Did you have any idea that archaeology required so much tedious bagging and record-keeping?*

Analysis: Okay, you've collected the artifacts. Now it's time to see what you can learn from them. First, create a master list of artifacts and biofacts found in each CULTURAL STRATA. We're not looking at levels anymore. We're looking at strata.

What did the Contact Period culture (the top one because it's more recent) deposit? What did the prehistoric culture (lower strata) deposit? Once you have your lists, compare them. How are they similar? How are they different? Were they deposited differently (piles vs. sheet midden)? Did they provide answers to any of the following questions?

a. How did native pottery and tools differ from one culture to the next?
b. How did agriculture differ?
c. How did hunting and gathering differ?
d. What evidence of European contact was found in the upper strata?
e. What evidence of trade was found in the lower strata (copper)?
f. Did the evidence support or fail to support your personal Research Question?

On another sheet of paper, record the answers to these questions. Include a description of the two cultures (prehistoric and Contact Period) based on what you learned from your excavation.

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LAB – SCREENING FOR ARTIFACTS continued:

Follow-up: The team who constructed your midden recorded a list of all the artifacts and biofacts they included. Because you were only able to excavate 360 cm3 (6x6x5cm) out of a total 1000 cm3 (12x10x5 cm), you obviously missed some artifacts. Compare your list of artifacts with the list provided by the construction team. What interesting artifacts or biofacts did you miss? Would these have changed your interpretation of the site? In real life, archaeologists have no way of knowing what they missed, of what incredible artifact may have been buried only centimeters away from their last unit. Record your comparison of your excavation and the total midden.

Collect all of your labeled baggies and place them in a storage box. Write your midden's name on your storage box. (This name is located on the container of your model midden.) Also, write the full names of both excavators and the date. Proper storage of artifacts is called "curation."

Flotation – Collecting Tiny Artifacts and Biofacts:

Flotation: Even when using very fine screens, there is always the possibility that some useful bit of information will be lost. To address this concern, some samples of muck are returned to the lab to undergo flotation. How does flotation work? The muck is added to water and stirred. The fine mud particles stay suspended in the water. The seeds, charcoal, roots, and nuts float to the top. These floating materials are called the "light fraction," and they are poured through a fine screen so that they can be collected separately. Meanwhile, the bits of bone, chert, and glass beads have sunk to the bottom. When the muddy water is poured off, this "heavy fraction" remains at the bottom, coated in mud. The muck sample may go through flotation several times to ensure that all of the bits have been recovered. The Hontoon Island team also used "chemical flotation." For example, the light fraction bits can be stirred into a chemical that has a different density from water. This affects what will float and what will sink. If researchers wished to separate the seeds from the charcoal, they would use a chemical which allows charcoal to float, while the seeds sink.

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LAB – FIELD FLOTATION:

BACKGROUND: In addition to field flotations, special laboratory equipment has been created that bubbles air through the water. The bubbles help lift the light fraction to the top. Extra funding must be allotted for use of this equipment. Why is flotation so important? Charred seeds easily slip through 1/8" screens. Because they're the same color as the soil, they go unnoticed at most excavations. In fact, many sites were believed to have no plant remains at all - until flotation was invented in the 1970s. It is important because it opened up a whole new area of study for archaeologists: seeds.

INSTRUCTIONS: Observe a flotation performed by your teacher. Then float your own sample. Pour your first bag of flotation matrix into a container. Fill halfway with water and stir. Gently pour any floating material off the top into your sieve (net) as it rests over a bowl. Any artifacts or biofacts you recover in the net become your "light fraction." Pour off as much of the muddy water as you can without losing any of the "heavy fraction" sludge at the bottom.

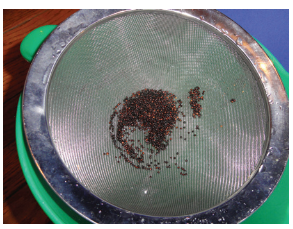
Add more water to the remaining material; stir; and decant (pour off) the floating material at least three more times. Archaeologists can perform up to 6 total flotations on any sample. After you've rinsed the light fraction in the net, empty it onto a paper towel to dry. Using tape, attach a baggy labeled "Unit 1, Level 1, X cm, light fraction, your name," to the paper towel so you'll be ready to bag it when it's dry.

PHOTOS OF THE FLOTATION PROCESS

Sample before flotation

Charred Seeds Float, Flotation #1

Fewer seeds float, Flotation #2



"Light Fraction" - total seeds recovered in 4 flotations

"Heavy Fraction" - glass beads and mud at the bottom of the Bowl after 4 flotations

Heavy Fraction" – glass beads sieved and washed

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LAB – FIELD FLOTATION continued:

What do we do with the heavy fraction? Add a bit of water to the mix of sludge and artifacts at the bottom of your container. Slosh it around, then pour the material into your net sieve. Rinse with a water sprayer if available. Place on a paper towel to dry. Attach a baggy labeled "Unit 1, Level 1, X cm, heavy fraction." Bag it later when dry.

What if you don't find any artifacts? That means that you were catching everything with your screens. Repeat these steps with the other 2-3 bags of flotation materials you recovered from Unit 1, bagging them and labeling them appropriately.

Choose one light fraction that includes plant materials (if any) and one heavy fraction that includes artifacts (if any) and use a pencil tip to carefully count each seed or bead. Add this information to your final report.

Analysis: Identify the materials in your light fractions and heavy fractions. Make a list of both for each Cultural Layer, prehistoric and Contact Period, (not for each level). How do the light and heavy fractions differ between prehistoric and Contact Period? Did you find anything you hadn't found before? Compare your findings with the construction record for this midden. What (if anything) have you learned from the flotation that you did not learn from the screening? How has this changed your interpretation of the midden? Does it support or fail to support your Research Question?

HOW OLD ARE THESE ARTIFACTS?

Radiocarbon Dating: Discovering the age of artifacts is a primary goal of most excavations. What materials can be carbon-dated? Anything that was once alive (any plant or animal material) can be carbon-dated. How does this work? It measures a radioactive form of carbon, C-14. This atom doesn't emit enough radiation to harm anyone, but it does eventually decay into a stable form of nitrogen. Only one in one-trillion carbon atoms is a radioactive C-14.

Living organisms constantly exchange carbon with the environment, through photosynthesis, eating, and breathing. C-14 is absorbed at a constant rate, and exhaled at a constant rate…until the organism dies. Once the eating and photosynthesizing stops, no more C-14 can be absorbed. However, C-14 does continue its slow rate of radioactive decay. Its half life is 5,730 years. So, after 5,730 years, half of the organism's C-14 will be gone. After another 5,730 years, half of that will be gone. And so on. By comparing the amount of C-14 in an ancient bone with the amount that should be in a living bone, archaeologists can estimate how old the bone actually is. This form of dating works well for items as

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old as 50,000 years. But the system has its flaws. The amount of C-14 in the atmosphere today is very different than it was 10,000 years ago.

Why? For one thing, today, C-14 is being created at a slightly higher rate than it is decaying. (This means that it's being produced faster than it's disappearing.) In the past, the rate of C-14 production was less than its rate of decay. (It was disappearing faster than new C-14 was being produced). How is C-14 created?

- The sun's rays create neutrons in the upper atmosphere.
- These neutrons smack into a nitrogen (N-14) atom.
- Voila, C-14 is created.

This natural change in the rate of C-14 production influences the amount of C-14 in the air. Humans have made significant changes too. Since the Industrial Revolution, humans have been burning fossil fuels at an ever-increasing rate. The combustion process expels huge amounts of STABLE carbon into the atmosphere, decreasing the ratio of C-14 to far LESS than 1/trillion atoms. So, the Industrial Revolution decreased the ration of C-14 in the air. That all changed in the 1950s when nuclear weapons testing began. The release of nuclear radiation tipped the balance so that C-14 levels nearly doubled.

These kinds of changes wreak havoc with attempts to use C-14 as a dating tool. The C-14 raw data must be carefully calibrated to compensate for these changes, or your date could be up to 1,000 years off. A calibrated radiocarbon date will be expressed as "cal 1525 CE."

How have scientists determined the amount of C-14 in the atmosphere in 1525 CE? Dendrologists (studiers of tree-rings) have measured the C-14 in ancient trees to use as a baseline for comparison.

Thermoluminescence Dating: This test is usually performed to confirm a site's radiocarbon date, or to provide a primary date if there were no organic remains to be carbon dated. Thermoluminescence can date anything with a crystalline structure, including chert and pottery. How does it work? Well crystalline structures are never perfect. They always have tiny imperfections. These imperfections can capture electrons created by background radiation (cosmic rays and radioactive minerals like uranium). As soon as a quartz crystal is formed, it begins collecting radiation. This collected radiation, however, can be wiped clean by exposure to very bright light or intense heat (at least 350°C).

In the Pyrotechnology unit, we learned that Florida's fire-treated chert is heated to 350°C, and that fired pottery must reach 760°C. When humans fire chert or clay (both crystalline), they remove all of the accumulated radiation. This "zeroes" the radiation amount. Eventually, after the stone point or pot is no longer in use, it finds its way into the soil - interred in a burial mound, tossed into a midden, or simply lost. Once it is buried, it is no longer subject to heat (pots being cooked) or intense sunlight, which might wipe out the radiation again. It just collects radiation at its normal slow pace.

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When an archaeologist runs a thermoluminescence scan, she subjects the artifact to heat greater than 400°C and measures the amount of light released by the artifact. The brighter the light, the more electrons are being released. More electrons mean the artifact has been lying there soaking up radiation longer. It's older. Like radiocarbon dating, thermoluminescence requires calibration to account for variation in the amount of cosmic rays or nearby radioactive minerals that the artifact has been exposed to.

NOW YOU'VE GOT THE ARTIFACTS. WHAT DO YOU DO WITH THEM?

Curation: This is the long-term storage and maintenance of both artifacts and the primary research documents that go with them. For example, suppose you find a dried up lake in Alachua County with 100 exposed native canoes. Where would you store them all? In the year 2000, this actually happened. Because the canoes were in too poor a state to be moved, the task of curation did not come into play. But even a single well-preserved canoe presents serious storage issues. Left in the air, even for a short time, the wood will warp and crack. It will need to be submerged in a vat of PEG solution for one to three years. Most archaeologists don't have space for a canoe-sized vat in their offices…if they even have offices.

Curating the smaller objects can also be a challenge. The single 3x3 m unit excavated at Hontoon Island in 1980 produced 5,777 pieces of bone, 3,624 pieces of wood, and 3,265 sherds of pottery. Where do you store it all? Before the digging starts, archaeologists must plan for storage of the materials they excavate. This isn't just storage for a week or even a year. It's storage *forever.* And the storage facility needs to catalog where each collection is located so it can be retrieved for future study. In the past, most storage facilities charged a one-time fee "in perpetuity." During 1998 in the southeastern states, it cost between $68 and $200 to curate one cubic foot of material. That gets expensive fast. And who pays for this? The archaeologist? A university? A museum? The government? These questions must be addressed prior to ever setting foot in the field. To complicate matters, many storage facilities are now charging a price per 5, 10, or 15 years of storage. So the question of "who pays" will come up again and again.

Preservation: So, you've got a place to store what you find. You also need a plan for making it last. Pottery and stone tools stand up fairly well on their own, but perishable items, like bone and wood dry, crack, and warp after being submerged. Wood in particular requires intensive preservation.

When wood is under water for long periods of time, bacterial processes break down the cellulose that makes up the hard parts of the wood. The wooden artifact then soaks up water like a sponge, filling all of the spaces once filled with cellulose. The water inside the wood cells helps the artifact to hold its shape. However, once the artifact is removed from its watery environment, the water in all of those internal spaces begins to evaporate. Without water to support the artifact, it cracks and warps fairly quickly. Many of the wooden artifacts discovered at Key Marco in 1896 were lost to just this kind of warping.

Keeping wooden objects submerged after discovery is a good short-term solution. But something more permanent (and lighter than vats of water) is needed for permanent storage. Currently, the best answer is PEG - polyethylene glycol. PEG is a synthetic substance with a consistency something like waxy Vaseline. The goal is to replace all of the water in the waterlogged artifact with PEG. The PEG inside the wood will provide support, so the artifact won't warp. The PEG on the outside of the artifact provides a protective barrier to prevent cracking. Sound simple? It's not.

The artifact starts out submerged in heated water. Bit by bit, small amounts of PEG are added to the water. (A bit of fungicide to prevent slime growth is tossed in too.) Eventually, when about 70% of the water in the artifact has been replaced by PEG, the artifact is ready to come out of the vat. After it cools, excess waxy PEG is removed. The artifact may be darker than it was before, but it won't collapse, shrink, or warp. The process can take from several months up to three years, depending on the condition of the artifact.

If the artifact being treated is a 5.6 meter (18') native canoe, that's an expensive and space-consumptive process. How expensive? In 1997, using PEG to preserve a wooden artifact that was 6' x 1' would cost $3,500. This included the price of a vat, heaters and pumps, and an actual ton of PEG to be used in the restoration process. Today, when canoes are discovered submerged in water, they are generally left there, where the natural environment can handle the preservation on its own.

WHAT YOU'VE LEARNED AND HOW YOU TELL OTHERS

Analysis and Publication: You've completed your excavation; preservation is underway; and storage for materials is arranged. You've got an incredible amount of data to sift through. The radiocarbon and thermoluminescence dates you got back don't really mesh with the historical context you were trying to prove. Next, you've got to figure out what it all means. Fortunately, in any scientific study, there are no wrong answers. If the data does not support your hypothesis, then it helps you and other researchers pose new questions for study. In fact, many archaeological reports end with a section that includes suggestions for further study.

What happens to these reports? Archaeologists are ethically bound to publish their work. Why? It's because excavations destroy the archaeological resource they're studying. Once excavated, that particular unit can never be excavated again. The excavation process is destructive by its very nature. Modern archaeologists collect incredible amounts of data AND they leave part of the site unexcavated, but at the end of the day, much of the site has still been destroyed

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When they publish their findings, it helps to compensate for the loss of the original resource. Other archaeologists can't excavate the original unit, but they can review the data collected for use in their own studies. Because of time and funding restrictions, many reports take years to complete and publish. Some are never made public. In these cases, individuals can ask for permission to review the unpublished data, by requesting it from the land owner, project leader, or the lead archaeologist.

Where do archaeology reports get published? There are a variety of scholarly journals, but if you are researching Florida archaeology, the place to start is *The Florida Anthropologist*, a publication first produced by the Florida Anthropological Society (FAS) in 1948. All of the back-issues are available online at http://ufdc.ufl.edu/?s=flant. This is another form of curation. By digitizing all of the past issues, the FAS is ensuring that other researchers can access these reports. If you are interested in learning more about Florida archaeology, this website is a great resource. However, you can't just go to their main page and type "spiculate clays" hoping for a response. It will tell you that it can't find those words. The best way to access this online resource is to use a search engine like Google to find which issue of The Florida Anthropologist you want. By typing "Florida spiculate clay" into Google, the second hit is "Florida Anthropologist, Vol. 25, No. 2." Click that link, and you will go to a virtual copy of the publication you want. NOW, you if you type "spiculate clays," the search function can search that specific volume. It will offer you a list of each page where this phrase occurs. There's a wealth of information there. It just takes a bit of *digging* to reach it.

Some archaeologists produce books about their research, written in layman's terms, so that anyone can enjoy and learn from them. Dr. Jerald T. Milanich has published a number of books on the Timucua, Florida's prehistory, and the Spanish missions. Dr. Barbara Purdy has produced several books on wet-site excavation and artifacts as well as prehistoric stone tools. These, and the publications of other archaeologists, are available at most Florida libraries. Check them out.

CHAPTER 9

CHAPTER NINE

ARCHAEOLOGY - BEYOND EXCAVATION

STUDENTS LEARN HOW THE GENOGRAPHIC PROJECT, BIOARCHAEOLOGY, AND EXPERIMENTAL ARCHAEOLOGY TEACH US ABOUT EARLY NATIVE PEOPLES.

STUDYING ANCIENT POPULATIONS THROUGH MODERN GENETICS

GENETICS is a branch of science. It investigates what we inherit from our parents (like brown eyes or wavy hair), how we inherit these traits (through our genes), and the variation or differences among all living things. Scientists study genetics to understand how genes function in a healthy body, how genes contribute to disease, and what genes can tell us about the history of all living things. When genetics is applied to human history, it studies populations (or groups of humans) not individual people.

GENEALOGY is a branch of history. It investigates a person's family history by researching documents (like birth certificates) and family stories that have been handed down for generations. Since the 1990s, genealogical research has expanded to include genetic testing, which can suggest a genetic relationship between two people (or groups of people) even when no documents exist to support that conclusion. Genealogy focuses on individuals and families (not whole populations).

What is the *Human Genome Project*? This is **GENETIC** research – a project which has mapped about 92% of the 30,000 base pairs in human DNA. This information is used in studying the variation within human populations and in searching for cures for genetic diseases.

What is the *Genographic Project*? This is **GENETIC** research funded by the National Geographic Society to track migration patterns of humans out of Africa. This project is not-for-profit. No medical research is included. It is focused only on learning about migration in human history.

What is *FamilySearch*? This is **GENEALOGICAL** research – a vast website which helps individuals track their family histories at no cost. You can input a person's first and last name, the state where they lived, and the dates they lived. The website shows you any documents relating to that person. For example, my grandmother's name brought up the handwritten 1945 census for Dade County, Florida. In the census listing, my grandmother was 34, and my mother was only two-years-old.

What is *Family Tree DNA*? This is just one of many **GENEALOGICAL** companies that uses genetics as a tool to identify recent ancestors for clients. For a fee, they can identify the mutations in your Y-chromosome (if you're male) or on your mitochondrial DNA (if you're female). They advertise specific services to adoptees hoping to find birth parents, to those searching for Jewish, African American, or Native American ancestry, and to people just looking to learn more about their family tree. These services can provide clues to ancestry, but they cannot prove genetic relationships.

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GENETICS AND THE STORY OF HUMAN MIGRATION

The human genome includes all of the genetic information needed to create a human being. This information is stored in the DNA in our cells. Scientists have discovered about 25,000 distinct genes (which are only a small part of the total human genome). These genes provide instructions for making proteins - the building blocks of human bodies. The rest of our DNA is called "junk DNA" because it does not code for any specific protein. This junk DNA is still copied along with the useful parts of our DNA and is included in everyone's genetic code.

Every so often, tiny errors occur when genes are being copied. If these errors – called mutations – occur in the somatic (body) cells, they are not passed on to the next generation. If instead, the mutations occur in the gametes (egg and sperm cells), the tiny changes can be passed on.

Some mutations are harmful. In these cases, due to natural selection, the individual may not survive to pass the mutation on to future generations. A few mutations are beneficial. In these cases, the individual may be more successful and have more chances to pass the mutation on to the next generation.

Most mutations occur in the junk DNA. As a result, they don't affect the organism's ability to survive at all. Natural selection does not act on these mutations, so they get passed on like nothing ever happened. Scientists who are studying human migration patterns focus on our "junk DNA." Two kinds of mutations are tracked: STRs (short repeated segments) and SNPs (changes in a single nucleotide).

A LOOK AT STRS (REPEATS)

An STR occurs when a short section of DNA gets repeated. They're often studied on the Y-chromosome. One section of the Y-chromosome is called DYS-454. This section of chromosome contains the DNA sequence "AAAT." Roughly 96% of men have 11 repeats of the section "AAAT." 3% have 10 repeats, and 2% have 12 repeats.

For example, 96% of men have:

AAAT –	AAAT –	AAAT –	AAAT –	AAAT –	AAAT –	AAAT –	AAAT –	AAAT –	AAAT –	AAAT
1	2	3	4	5	6	7	8	9	10	11

What exactly does this mean? When a mutation occurs, it can cause one repeat to be added OR one repeat to be deleted. If you have 12 repeats, you are more closely related to a man with 11 repeats than you are to a man with 10 repeats. This can be used in paternity testing (to see how closely a baby is related to a potential father). Police also use STRs to create a "genetic fingerprint" for identifying crime suspects.

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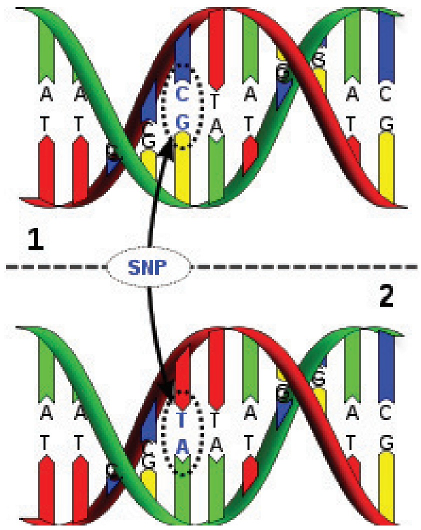
Some genealogical tests check 67 different STRs on the Y-chromosome. The more similar you are to another man across the 67 repeats, the more closely you are related. Y-STR studies are only available for men because only males have Y-chromosomes. Y-STRs (as well as repeats on autosomal [non-sex] chromosomes) are often used for genealogical research, matching relatives within the last 200 years.

A LOOK AT SNPS (SINGLE CHANGES)

An SNP is a change that occurs at a single nucleotide (one base pair). So, one C might become an A. Or one T becomes a C. It's just one small change. These changes are often tracked when studying mitochondrial DNA (mtDNA).

What is mitochondrial DNA? Mitochondria are the tiny energy-making organelles inside our cells. They exist outside a cell's nucleus and have their own DNA. When an egg and sperm join, mitochondrial DNA is contributed from the egg, but not from the sperm. So, mtDNA tracks mutations through your female ancestors. Y-chromosome SNPs track mutations through your male ancestors.



This illustration shows an SNP, in which a single base pair has changed. What used to be a cytosine-guanine pair, is now a tyrosine-adenine pair.

Illustration by Wikipedia

HOW CAN MUTATIONS TRACK HUMAN MIGRATION?

Mutations (mistakes in copying DNA) do not happen very often. But they do seem to occur at a constant rate. Some STR mutations occur once every 500 generations. This means that two mutations would occur after 1,000 generations. Three mutations would occur after 1,500 generations, and so on. How long is a generation? A generation is the length of time between the birth of a parent and the birth of her child. Twenty-five years is sometimes used as an estimate.

STRs and SNPs on the X and Y chromosomes are used for tracking changes across ancient populations of humans (more than 5,000 years ago). This information shows that all humans originated in Africa and started moving out into the rest of the world about 65,000 years ago.

Africans have more genetic variation than any other population on the planet. When groups of humans left Africa, their cells only carried a small part of the genetic variation of the entire African population. Later mutations in the genome of the migrating group made it even more distinct from the parent population. By comparing genetic differences among populations, geneticists can show which groups left Africa earlier or later, and where they travelled afterwards. You can go to the Genographic Project website at https://genographic.nationalgeographic.com/genographic/lan/en/atlas.html to see an interactive map showing human migration across the globe.

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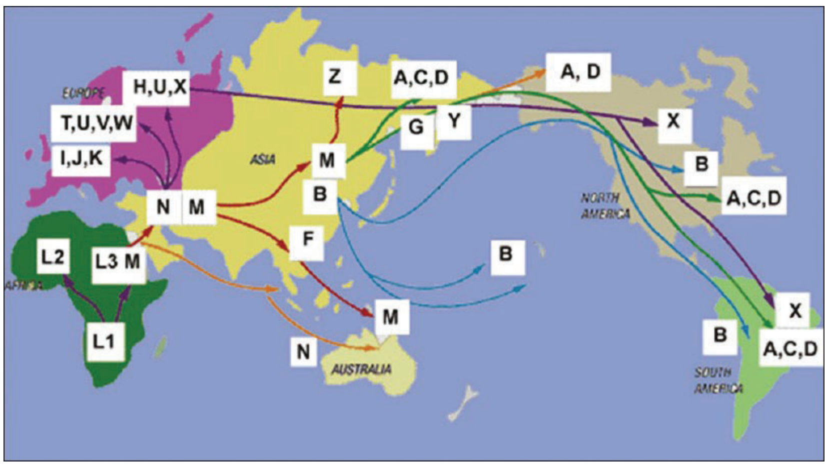
By 30,000 BCE, humans had travelled into India, Asia, Australia, and Europe. By 25,000 BCE, people were crossing the Bering Land Bridge between Asia and North America. By 15,000 BCE, humans had populated North and South America. These dates can be established using traditional archaeology, but the Genographic Project provides information about which path humans followed to get to these places.

REMINDER: When discussing the distant past, scientists generally use BCE (Before the Common Era) instead of BC (Before Christ). BCE and BC mean exactly the same thing. Instead of AD, scientists use CE (Common Era). So, an event that occurred 15,000 years BCE (or BC) could also be described as occurring at 17,000 years ago. [15,000 + roughly 2,000 years = 17,000 years ago]

WHAT IS A HAPLOGROUP?

When geneticists began tracking the movements of early humans across the globe, they needed to name each group that possessed a new set of mutations. These major groups are called Haplogroups, and are described by a letter. The original African haplogroup (when tracing the female line) is called "L". "M" was the first group to leave Africa. Native Americans are often included in the following haplogroups: A, B, C, D, X. Having any one of these mutations does not prove Native American ancestry, as they can be found in other populations around the world. However, having many of them is a good indicator of Native American ancestry.



This is a map showing where different haplogroups are common.

Native Americans often (though not always) have the following genetic markers: A, B, C, D, X.

Illustration by Wikipedia

This lettering system is for mutations found on mtDNA. There is a different naming system for mutations on the Y-chromosome. Geneticists are also studying repeats on autosomal (non-sex) chromosomes. Chromosome Number-9 has a repeating section which is common in Native American populations. Scientists have compared this STR in populations of Native Americans, Asians, Europeans, and people living in Berengia (the area where the Bering Land Bridge connected Asia and North America during the last Ice Age).

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The 9-allele mutation is common in all Native American populations. It is NOT found in Asian or European populations. It IS found in the populations living in Berengia. This shows that Native American peoples all came from the same place – Berengia. They probably crossed the Bering Land Bridge in three separate migrations over thousands of years. But they didn't start their migration from Europe or Australia or the Orient. They'd been living in Berengia for quite some time.

Genealogy companies will, for a price, check the DNA of a person wishing to clarify his ancestry (whether it is Native American, African, or anything else). If a person's haplotype (specific section of a haplogroup) includes several of these mutations (A, B, C, D, X, and the 9-allele repeat), they are considered to be genetically Native American. Currently, this information is not recognized by the US government or by tribal leaders as proof that a person is Native American.

NOTE: Genetic studies are concerned with populations – groups of people. Some individuals in a Native American population might have A, B, and X mutations, while others have D and the 9-allele repeat. It's the population as a whole that includes all of these mutations. What does this mean? It means that there is NO way to genetically identify a person's race. There's no genetic code for a Native American or an African American or a Mexican American. There are just genetic tags that suggest ancestry. None of these mutations has any affect on a person's appearance or on their mental or physical qualities.

ACTIVITY – TAKE A LOOK AT A HAPLOGROUP MAP:

INSTRUCTIONS: Use the Haplogroup Map and the regional color lists below to answer the following questions.

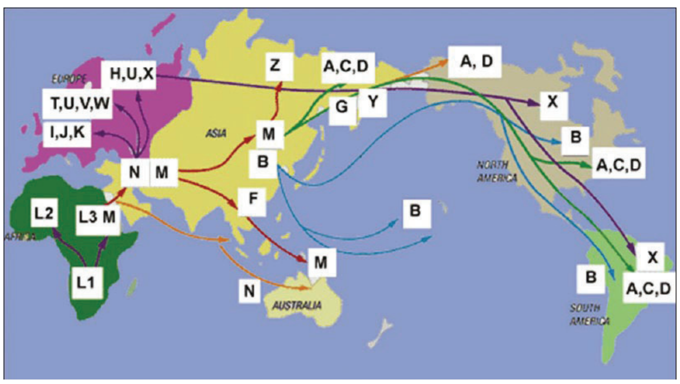
Pink: Northern Europe, Western Europe

Dark Green: Northwest Africa, Northeast Africa, Southern Africa

Yellow: Middle East, Eastern Asia, Siberia, Berengia, Australia

Tan: Alaska, Eastern North America

Light Green: Western South America, Eastern South America



Haplogroup Map, illustration by Wikipedia

CHAPTER NINE ARCHAEOLOGY - BEYOND EXCAVATION

ACTIVITY – TAKE A LOOK AT A HAPLOGROUP MAP continued:

1) A man learns that he has an "A" marker. Which geographic areas are linked with this marker?

____

2) A young woman discovers that she has a "U" genetic marker. Which geographic areas are linked with the marker U?

____

3) A grandfather working on his family tree learns that he possesses a "C" marker. Which geographic areas are linked with the marker C?

____

4) A woman participating in the Genographic Project learns that he possesses an "N" marker. Which geographic areas are linked with the marker N?

____

5) A man who was adopted is trying to learn more about his birth parents. He has an "L" marker. Which geographic areas are linked with the marker L?

____

6) Three middle school students volunteer to participate in a local genealogy project. Daniel has the genetic marker D. Marissa has M. And Jeff has J. Which student belongs to the lineage that is most similar to the original African population? Which is the most different?

____

____

____

____

CHAPTER NINE
ARCHAEOLOGY - BEYOND EXCAVATION

STUDYING ANCIENT POPULATIONS THROUGH ISOTOPES, CAVITIES, AND SKELETAL STRESS

The study of human genes is only one method of looking inside human beings for clues to the past. Human skeletons can also be studied to look for signs left by the foods they ate, the diseases they battled, and the kinds of physical stress they endured. To research these topics, archaeologists need access to the skeletons of early Native Americans. Most of the skeletal remains of native people are protected by a piece of legislation called NAGPRA.

What is NAGPRA? Today, most archaeologists study artifacts found in **middens**, not in **burial mounds**. And they rarely study skeletal remains at all. Why? The Native American Graves Protection and Repatriation Act (NAGPRA) is a powerful piece of legislation that protects Native American graves, including skeletons and the artifacts associated with them. ("Repatriation" means to return someone to the place they came from.) Throughout American history, Native American graves have been pillaged for "treasures." These Native Americans were not buried in formal graveyards, so their gravesites were not protected by the laws that protect other burials.

Native American burial practices are closely intertwined with religious beliefs. The freedom to practice religion is protected by the First Amendment of the Constitution. NAGRPA regulations seek to protect both the integrity of the native graves and the religious freedoms of past and present Native Americans.

Since 1990, when this legislation came about, the skeletons of 32,000 Native Americans have been repatriated (returned to the tribe they were most closely related to). These skeletons had been housed in museums and federal facilities for years. In addition to the skeletal remains, 793,500 burial or sacred artifacts have been returned to native peoples.

How does NAGPRA affect archaeology? It gives modern native groups the power to protect any human remains excavated on government-owned lands. If a modern native group can prove kinship with the deceased, they have the right to approve or deny any tests the archaeologists wish to perform. They may also demand immediate reburial of their ancestor and associated grave goods. Many native groups believe it is disrespectful to unearth the dead or to perform invasive tests on them. As a result, archaeologists are rarely permitted to study skeletal remains.

The Timucua and almost all of Florida's historic Indians disappeared by the 1760s. They have no descendants who actually consider themselves "Timucua." Because no one can claim a genetic connection with these early Floridians. Their remains are considered "culturally unaffiliated." Archaeologists can request to study the skeletal remains of these "culturally unaffiliated" native remains by contacting the museums that curate them.

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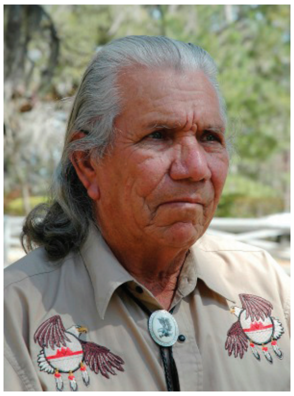

Chief Gilmer Bennett of the Apalachee, 2009, photo by Wikipedia

Why can't the Seminole claim these early remains? The Seminole's ancestors migrated into Florida from Georgia and other areas in the early 1700s. As a result, they and the Timucua are from completely different cultural groups.

Are any of Florida's historic native peoples affiliated with a modern group? Just one: the Apalachee. In 1704, the Spanish withdrew from Apalachee province (the Tallahassee area) after attacks and slave raids by the British and their native allies. To regain Spanish protection, many of the remaining Apalachee moved towards St. Augustine. There, they blended with other refugee groups, including the Timucua.

However, one group of 800 native peoples – mostly Apalachee – headed west instead. First, they settled in Mobile, Alabama, where the French described them as being "good Catholics." On September 6, 1704, records show that an Apalachee was baptized there, leaving a clear historical paper trail of the Apalachee exodus. In 1763, eighty Apalachee people moved on and settled in Rapides Parrish in central Louisiana. Catholic Church records describe priests visiting an Apalachee village in Rapides in 1769, a village with a large wooden cross built adjacent to their hilltop home. About 300 Apalachee live there today. They are known as the Talimali Band of the Apalachee and are led by Chief Gilmer Bennett.

WHAT IS BIOARCHAEOLOGY?

Bioarchaeology is the study of ancient human remains. Through studying these skeletons, archaeologists hope to learn how humans adapted to stresses in their environment. What kinds of stress leave marks on a person's skeleton? Malnutrition (specifically lack of iron) can cause rippled, spongy-looking marks on the skull. If a person regularly carries heavy loads (especially during adolescence), his bones thicken to handle the weight. When a person is subject to an extremely heavy workload, the stresses actually degrade his joints. This is called osteoarthritis. Scientists can even determine whether a person ate mostly fish or mostly corn by looking at the levels of carbon and nitrogen isotopes in their bones.

Florida and Georgia map showing three Contact Period Cultures

One bioarchaeology study analyzed the skeletal remains of Timucua, Apalachee, and Guale people. (See map to right.) Some of the skeletons represented people living before the Spanish set up missions. Others represent people who actually lived in mission villages. Archaeologist were looking for evidence of cultural changes introduced by the Spanish missions.

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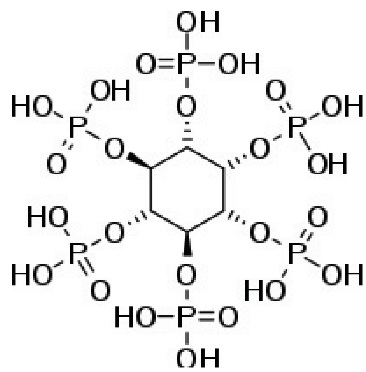
Let's talk about iron. Every multivitamin includes iron. It is the building block for red blood cells which carry oxygen throughout our bodies. Lack of iron, a condition called anemia, causes fatigue, shortness of breath, inability to focus, and poor general health. The body responds to chronic (long-term) anemia by producing more red blood cells (RBCs). These cells are normally manufactured in the long bones. In cases of chronic anemia, the body induces skull bones (both the flat bones across the top and the eye orbits) to go into RBC production. This causes the skull and orbits show the same porous ripped appearance as bone marrow. Researchers recorded the percentages of skulls which showed these signs of iron deficiency. The results for juveniles (under 16) showed the clearest trends. Only 6.1% of the kids living just before the mission period experienced chronic iron deficiency. After the establishment of missions, 73.7% of the kids living well showed iron deficiency. What could cause such a huge decrease in dietary iron? In a word: corn.

Corn contains the chemical phytate, which bonds to iron, preventing its absorption by the small intestine. As a result, iron deficiency often suggests high rates of corn consumption. Why were the Timucua suddenly eating so much corn? Missions were established in villages that were growing enough corn to supply the priests with food. As St. Augustine demanded more and more corn from each village, corn production AND corn consumption increased. Interestingly, when corn is eaten together with fish, iron absorption increases by up to 50%. Scientists still haven't figured out why, but this "meat effect" is actually prescribed to improve iron deficiencies in communities world-wide.



A phytate molecule. All of the P's are chemically bound phosphorous atoms.

Image by Wikipedia

Biological Note: Phytate is a natural chemical that grain plants create to store phosphorus. Neither humans nor pigs can digest this chemical because we lack the necessary digestive enzyme. Cows can digest phytate because the microbes living in their many-chambered stomachs produce the necessary enzyme.

Genetically Modified Crops: Researchers at the University of Colorado have engineered a new strain of corn that has 95% less phytate than normal. A study of Guatemalan men showed that iron absorption increased by 50% when eating low-phytate corn. This corn has tremendous positive potential for the environment too. Pigs and chickens are fed diets of corn, but they can only digest 15% of the phosphorus in their feed because it's all locked up in non-digestible phytate. What isn't digested comes out the other end as waste. This produces whole lagoons of pig and chicken poop full of phosphorus, a potent fertilizer. In the environment, excess fertilizer can cause toxic algae blooms in lakes. So, low-phytate corn, by decreasing the fertilizer-content of farm waste, protects the environment. Over the past ten years, low-phytate varieties of rice, barley, and soybean have been engineered, in addition to corn.

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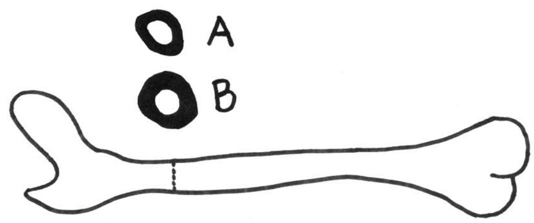
Let's talk cavities. The teeth of these Florida and Georgia peoples were also assessed for cavities. Because corn is a carbohydrate (a complex sugar), it contributes to cavities. Native people living before corn agriculture had cavities in only 1.2% of their teeth. Those living after the beginning of corn agriculture (both before and during the mission period) showed an increase in cavities. Now, 7.6 - 9.6% of teeth were afflicted with cavities. During the late mission period, when maize agriculture had really stepped up, 19.6% (or one in five) teeth had cavities. That's pretty convincing archaeological evidence that matches the historical descriptions of increased corn agriculture.

Let's talk skeletal stress. Repetitive tasks, which cause long-term wear and tear on the joints, can lead to bone degradation – or osteoarthritis. Two interesting trends were discovered when archaeologists studied the joints of these early peoples. First, osteoarthritis decreased from the early prehistoric period (0-1000 CE) to the late prehistoric period (1000-1550 CE). Was there something about the switch to growing corn that was easier on the back? Growing and processing corn is hard work. But harvesting and processing wild plants may have been even harder. The unit on Wild Plants details the effort required to process plants like cattail, acorns, and coontie. Compared to that, corn may have called for less pounding and grinding.

The second trend was a radical increase in osteoarthritis for the late mission period (1680-1700 CE). During this time, St. Augustine set up labor draft. Each native village was required to send men to St. Augustine to work on fort construction and other projects. The men had to walk all the way there while carrying all of the food they would need. (They usually weren't paid for their labor either.) The increase in osteoarthritis provides archaeological evidence of how this labor draft impacted mission Indians. The percentages of osteoarthritis found in each time period are Early Prehistoric: 26%, Late Prehistoric: 16.4%, and Late Mission: 68.3%.

Let's talk adaptation. The human body doesn't just respond to stress with disease. It can also adapt, making the person stronger and more able to handle the stress. How? Bones actually get thicker so that they can handle greater stresses. In this illustration, you can see the thickness of the femur (upper leg bone) measured at two different points. Note the thicker bones in mission-period Indians.



The circles are cross-sections from femurs (upper leg bones). The upper circle (A) is from a Prehistoric native person in the Florida / Georgia region. The lower circle (B) is from a Mission-period native. Note the thicker bone in sample B.

Let's talk isotopes. Not the radioactive kind this time. Carbon and nitrogen both have stable isotopes, each with an extra neutron. This extra neutron makes each atom a bit heavier. The slight weight difference means that Carbon-13 is absorbed at a different rate during photosynthesis than C-12. For every 1000 carbon atoms in the world, 989 will be C-12, while only 11 will be C-13. When people eat lots of corn, their bodies end up with more C-13 than what's found in the surrounding environment.

ARCHAEOLOGY - BEYOND EXCAVATION

Heavy nitrogen (N-15) is more common in marine environments. It also becomes more concentrated the higher up you go in the food chain. So eating a shark will give you more N-15 than eating a mullet. And eating a mullet will give you more N-15 than eating a raccoon. For every 1000 nitrogen atoms, 996 will be N-14, with only 4 being N-15. So, a person eating lots of seafood will have greater than four N-15 atoms per 1000 nitrogen atoms.

Data shows that the amount of C-13 increases in skeletal samples during the mission period. This corresponds to an increase in the eating of corn. At the same time, the amount of N-15 decreases. Why? Eating marine fish gives the highest levels of N-15, followed by freshwater fish, then by land animals, and finally by corn and beans. When the N-15 levels at missions sites drop, it indicates that the native people were relying less on fishing and more on farming, with some hunting. Interestingly, the coastal villages had higher levels of N-15 than the inland villages. They may have been fishing less than in the olden days, but the isotope data shows they were still eating plenty of fish.

Archaeology Note: There has been a lot of controversy about when corn was first grown in Florida. The French and Spanish left plenty of documents describing the fields of native corn they found (and plundered) during the mid-1500s. But when did the Timucua actually start growing corn? Plant materials normally decompose over time, so there aren't many corn cobs or corn kernels found at archaeological sites. Instead, archaeologists look for other evidence that might pinpoint the dates of corn cultivation. They look for corn pollen in human coprolites (petrified poop) and for pottery that is cob-marked (impressed with corn cobs before the firing process).

They also look at human bone isotope levels. These studies show that before 1,450 CE, bones found in pre-Timucua burial sites had a fairly consistent level of C-13. After 1,450 CE, the levels of C-13 increase a lot. This suggests that the Timucua first started growing corn around 1,450 CE, only 100 years before European contact. The evidence was surprising, because corn pollen collected near Lake Okeechobee had suggested that corn was cultivated as early as 450 BCE. New technologies like isotope analysis have allowed archaeologists to establish that corn cultivation actually began much later.

STUDYING ANCIENT PEOPLES THROUGH TRIAL AND ERROR

No matter how much we look through a microscope, no matter how many interesting artifacts we excavate, there are some things that can only be learned through trial and error. If you really want to figure out how native peoples carved a canoe, wove a fishing net, fashioned shell tools, or built a hut, there's no substitute for trying it yourself. One modern Floridian, Dr. Robin C. Brown did just that. He practiced experimental archaeology for five years while doing research for his book, *Florida's First People*. He taught himself the following Timucua technologies, using only native materials (no power saws allowed).

1) Starting a fire with a self-made bow drill
2) Knapping stone tools using heat-treating technologies
3) Coiling pottery and firing it
4) Weaving cord, rope, baskets, mats, cloth, and fishing nets using a variety of plant fibers
5) Creating tools like shell axes and sharks tooth knives
6) Tanning deer hides
7) Making wooden tools, like a mortar and pestle
8) Processing and cooking nuts, acorns, cattails, coontie, and corn for consumption
9) Collecting and cooking shellfish, including whelk and coquina
10) Processing Yaupon holly and making the Black Drink

His research goal was to develop a feel for the skills that Florida's native peoples needed to survive. The book has provided modern Floridians with a better understanding of the life skills of native peoples. It has also aided primitive technologists, the people who create realistic replicas of native tools for nature centers and museums. After many requests, Robin Brown wrote a version of his book for younger readers. It's called *The Crafts of Florida's First People*.

WHAT IS EXPERIMENTAL ARCHAEOLOGY?

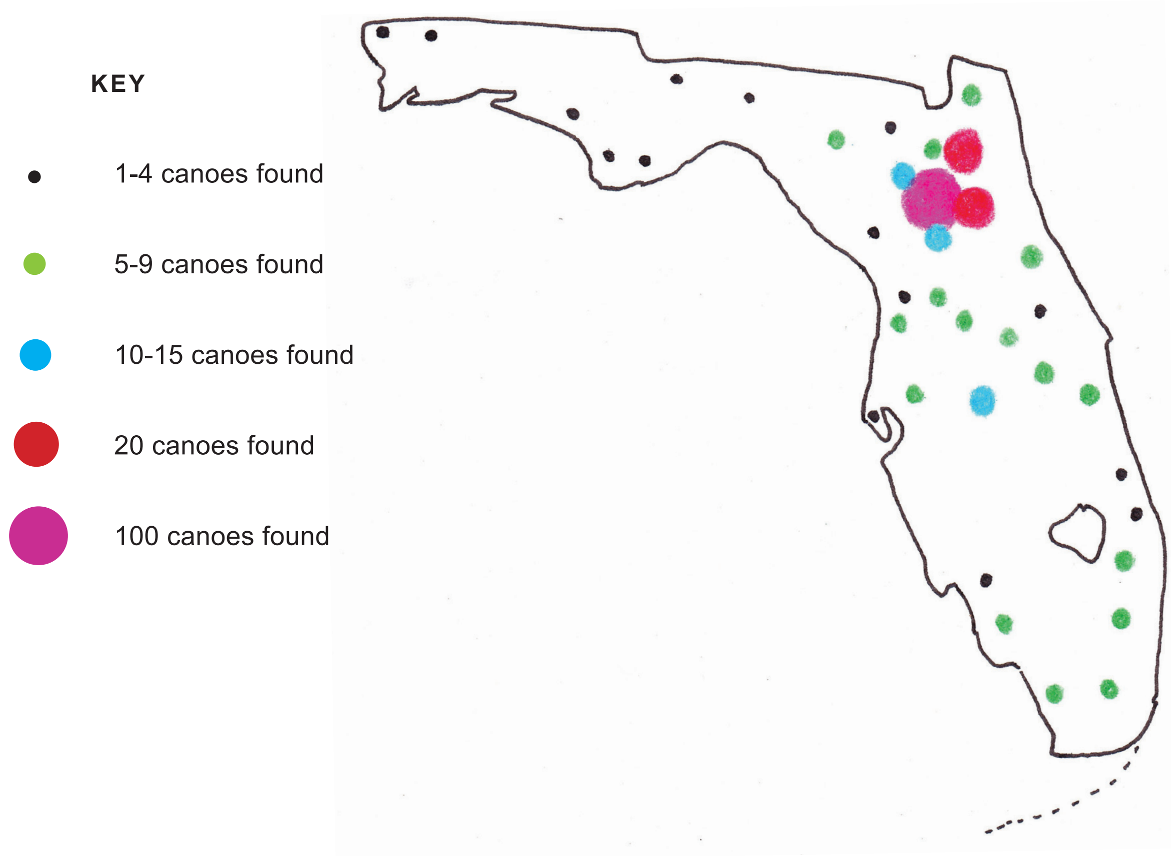
Experimental archaeologists follow two basic methods. Both take place after plenty of research. The first is the "jump in and just figure out how they did it" method. Robin Brown worked this way. He kept trying different ways of making a shell hoe until something worked.

The other method involves painstaking (and often tedious) analysis of wear patterns on ancient and modern replica tools. They want to identify which tasks create which types of wear on the tools. For example, if you use a shell chisel to make a canoe, all that chipping will create cracks and scars on the chisel. A chipping tool develops different wear marks than a tool used for pounding or cutting. Once an archaeologist can recognize the wear pattern on modern replica tools, he can study actual artifacts to look for the same use-wear patterns. This helps archaeologists to figure out how ancient artifacts were used as tools.

One of the most popular experimental archaeology projects seems to be constructing dugout canoes. Several colleges and other groups have attempted this with varying degrees of realism. Some use chainsaws to cut down the tree needed for canoe-making. Others make a separate experiment of using fire and shell axes to fell the tree. Some cut the initial canoe shape with modern tools, while others stick to native tools for the whole job. One group even made the many shell tools needed for the task. These experimental archaeologists learn by trial and error how to control the fire used to char and soften the interior of the canoe. Many give up part way through and resort to using modern tools to finish the project. Others stick with native technologies until they see that canoe float. Regardless of individual successes and failures, every one of these studies provides us with a greater understanding of native life.

You may be wondering, why we need to make modern dugouts? Aren't there hundreds of old dugouts being found around the state? As a matter of fact, there are. In the year 2000, droughts had really lowered the water levels at Lake Newnan in the Gainesville area. An AP Environmental Sciences class from a local high school discovered some ancient dugouts while on a fieldtrip. Archaeologists surveyed the site, finding a total of 101 canoes. These dugouts ranged in age from 500 to 5,000 years old. Most were made of pine, with a few cypress mixed in. The wood had degraded so much (some of it was the texture of wet cardboard) that the canoes could not be moved or preserved. Samples were taken for study, and the canoes were left in situ.

This map shows the locations of native canoes preserved in wet sites around Florida. The original maps were created by L.A. Newsom in 1982 and R. M. McGee in 1987.



CHAPTER NINE

ARCHAEOLOGY - BEYOND EXCAVATION

These recovered canoes and paddles are exhibit at the Florida Museum of Natural History in Gainesville.

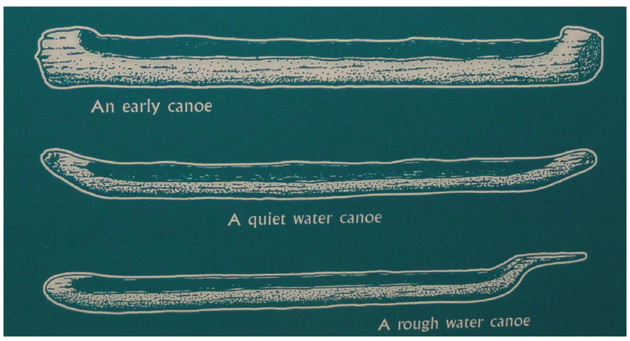
Above right: *Toy Canoes, found in Volusia and Putnam Counties (in or near pre-Timucua territory.)*

Above Left and Below: *500-year-old pine canoe, made by the Timucua.*

Type 1

Type 2

Type 3



This artist's rendering at the Florida Museum of Natural History depicts an archaic canoe (1.) which was used prior to 500 BCE. The two lower canoes were made by both prehistoric and historic peoples (2. & 3.) from 500 BCE to the 1700s CE. Contact Period canoes differ mainly in the use or iron tools during construction.

Right: *Florida canoe paddles and poles ranging from 260 BCE to 1420 CE.*

CHAPTER NINE
ARCHAEOLOGY - BEYOND EXCAVATION

ACTIVITY – IDENTIFYING FLORIDA CANOE TYPES:

INSTRUCTIONS: Compare the canoes in these photos to the Type 1, Type 2, and Type 3 canoes in the illustration. Use both the images and their accompanying text to make an educated guess about which type of Florida canoe each represents.

Ancient canoes preserved in peat or marsh mud are usually quite degraded. They're flattened because of the weight of the muck pressing down on them, and they're often missing one or both ends.

The canoe to the right is 1,100-years-old. It was found in 2011 in Tampa's salt marsh flats. The 11.6 meter (38') canoe was missing one end. It was cut into 3 meter (10') sections to make it easier to transport and then soak in a preservation bath. After about 2 years, it will be reassembled and displayed at Weedon Island State Park. (This is outside Timucua territory.)

A. This canoe is probably Type _______ ,because ____

____

The replica canoes in the photo below were created as a part of an experimental archaeology project at Crystal River State Archaeological Site. (This is outside Timucua territory.)

Courtesy of www. EpicRoadTrips.us

C. These canoes are probably Type _______ ,because ____

____

ARCHAEOLOGY - BEYOND EXCAVATION

ACTIVITY – IDENTIFYING FLORIDA CANOE TYPES continued:

This Florida canoe is on display at the Ft. Caroline National Memorial in Jacksonville, FL. It was discovered near Gainesville (40 miles from the Gulf Coast). It has been tentatively dated to 500 years ago. (This is within Timucua Territory.)

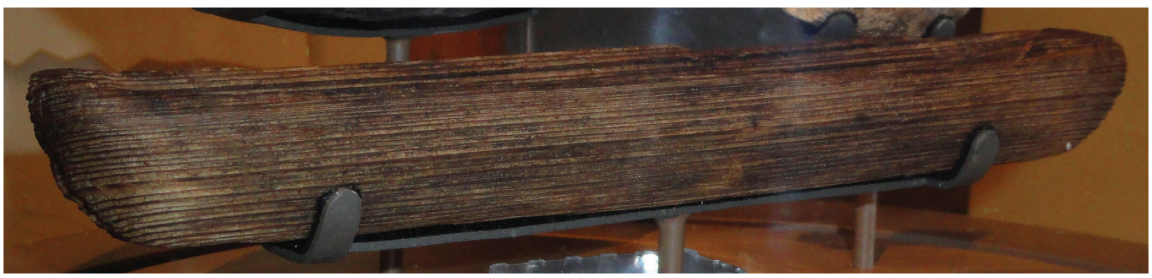
C. This canoe is probably Type _______ ,because ____

____

This canoe is on display at the Florida Museum of Natural history in Gainesville. It was found in Florahome, FL, Putnam County (about 30 miles from the Atlantic Coast). It is dated to 400 years ago. (This is within Timucua Territory.)

D. This canoe is probably Type _______ ,because ____

____



This toy canoe is on display at the Florida Museum of Natural History. It was found in Satsuma, FL and has been dated to 480 BCE. (Satsuma is in Putnam County, within Timucua Territory.)

E. This canoe is probably Type _______ ,because ____

____

CHAPTER NINE
ARCHAEOLOGY - BEYOND EXCAVATION

EXPERIMENTAL ARCHAEOLOGY – CANOES

Incredible finds, like the mass of canoes at Newnan's Lake, often raise more questions than they answer. Why were so many canoes found there? Why did most of the discovered dugouts date to around 700-950 CE? Why are most made of pine, with only a few made from cypress?

Hydrology (the study of how water moves across land) may provide an answer to the first question. At times of high water in Florida history, isolated lakes were connected into flowing rivers, making canoe highways across the state. During times of low water (droughts) the connecting river highway disappears, and even the lakes dry up into mud-filled holes. When many canoes are discovered together, archaeologists think they might have been abandoned due to low water levels. Another theory notes that some cultures sunk canoes on purpose to protect them from weathering or theft while the owners were away. We can only guess why they never returned for their canoes.

Both geology (the study of processes that shape the earth) and hydrology offer insights about the age of the discovered dugouts. The canoes were found in mucky peat at the bottom of lakebeds. These peat deposits started forming 6,000 years ago, so it makes sense that the oldest canoes are in the 5,000-year range. Many of these ancient canoes may have been destroyed when water levels dropped and exposed the canoes to oxygen. Only a few survived from these times. Because so many canoes date from 700-950 CE, archaeologists believe the pond has been consistently full of water since that time. (The drought that exposed them, allowing their discovery, may represent the lowest water level in 1,300 years). But why aren't we finding more recent canoes, from the Contact Period, for example? Only further study can tell.

The final question, about the use of pine vs. cypress, is one that can be addressed by experimental archaeology. Here are some of the conclusions drawn by participants in several different canoe projects.

1) **First, our answer about wood type:** Pine is easier to work than cypress. Why? Its pitchy sap helps it burn more easily. Then charred wood can be scraped out instead of chopped out.
2) Chopping unburned wood with stone and shell tools leaves permanent chips and gouges in the tool blades. This damage is very specific, so actual artifacts can be studied to see if they show the kinds of use-wear marks left by woodworking.
3) You needed a big tree to start with, perhaps 20' long x 3' in diameter.
4) Felling a tree with fire takes up to 18 hours. Felling a large tree using only stone tools takes about 30 hours. Perhaps native peoples girdled good canoe trees earlier in the season to weaken them. (Girdling is cutting through the bark all the way around the tree to prevent the transport of water and minerals up the tree.)

ARCHAEOLOGY - BEYOND EXCAVATION

5) While charring the wood, wet clay should be slathered across any wood you don't want burned, including depressions that might burn through. The fire's heat hardens and cracks the clay, so it must be replaced with fresh, wet clay after each burning event.
6) A wooden scoop to remove hot coals is helpful to prevent burned fingers.
7) If the pine log is sufficiently charred, wooden tools work just as well as stone for scraping away the charred layer.
8) The wood debitage created by canoe-making is made up of long, narrow strips. These strips are exactly as wide as the blade on the shell tool used to chip them.
9) You shouldn't allow the felled tree to dry before starting canoe manufacture. It causes cracks to develop.
10) Elevating canoe logs on stands allows wood workers to reach all sides of the log and is easier on the back.
11) If you burn a canoe log for 2-3 hours a day, it will take you 17 days to complete the canoe (using native tools and methods). A one-inch layer of wood is removed per day.
12) Burning the base of the canoe from the bottom, with the heat billowing up into the canoe base, is too uncontrolled. Native peoples probably rolled the canoe so its base faced upwards. The base could be burned and worked in a more controlled (if slower) manner.
13) The inside of the canoe must be scoured with sand and an abrading tool to make it smooth enough to sit in.

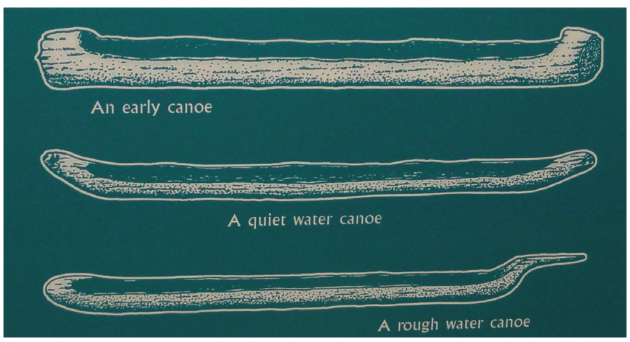
ACTIVITY – TESTING CANOE STYLES:

BACKGROUND: In Florida, archaeologists have observed three basic canoe styles.
Type I canoes date from the Archaic Period (2,500–500 BCE). They are very basic structures. The bottoms of these canoes are not angled up in the front and back. In fact, the ends are identical, so there's not actually a front or a back. The chipping work on the outside is often incomplete, even leaving the bark on in some spots.

Type 1

Type 2

Type 3



Three styles of Florida Canoe

An illustration from the Florida Museum of Natural History

ARCHAEOLOGY - BEYOND EXCAVATION

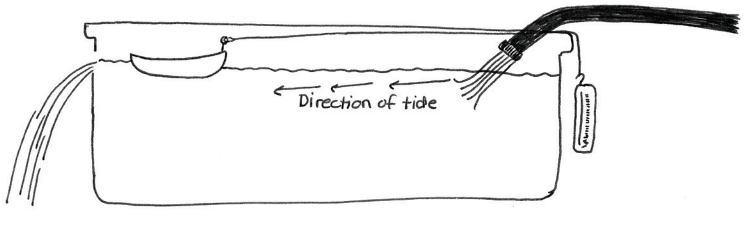
ACTIVITY – TESTING CANOE STYLES continued:

Type 2 canoes date from the early prehistoric into the historic periods (500 BCE – 1700s CE). The bottoms of these canoes are angled up in the front and back. The front of the canoe has a gentler angle, allowing water to flow around the canoe more smoothly. It's more hydrodynamic than the back. The outside of a Type 2 canoe is smooth and free of bark.

Type 3 canoes were also used from 500 BCE to the 1700s CE. The back of the canoe angles up a bit, but not as sharply as Type 2. The real difference is the front, which has a long, wide prow. The prow created buoyancy for cresting over waves and rough water. The front is also much more V-shaped. This helped it to cut through water at high speeds. This canoe was designed to go offshore, while Type 2 was used in rivers, lakes, and smooth tidal flats.

INSTRUCTIONS: You will be using miniature canoes carved from foam to test the effectiveness of Type 1, Type 2, and Type 3 canoes. Each canoe will be tested in three water environments: tidal marsh, rough intracoastal waters, and calm lakes. Your goal is to determine which of the three canoe shapes works best in each environment. Before you begin, formulate a hypothesis rating the various canoe types for each environment.

Station A - Tidal Marsh: Paddling against the tide takes a huge amount of effort. A canoe that moves more easily through the water (creating less friction) is said to by "hydrodynamic." Hydrodynamics is the study of how fluids move around objects. In this lab, you'll be measuring the force required to propel each canoe type through the water. The flow of the tide will be simulated by running a garden hose into the tub. The weight of the spring scale will pull the canoe forwards.



In a tidal marsh, the most hydrodynamic canoe is the one that requires the least force to propel it through the tide. You can measure this force with a spring scale attached to the canoe with fishing line. The fishing line should be long enough to reach the entire length of the tub (or gutter, whichever your class is using) PLUS enough to dangle over the rim of the tub and support the hanging spring scale. How long will your line be? ________________________________

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ACTIVITY – TESTING CANOE STYLES continued:

Attach one end of the fishing line to an eye screw on the front end of your canoe. The other end attaches to the spring scale. Set the canoe into the water at the far end of your tub. Hold the spring scale and walk around to the opposite end of the tub, stretching the line so that it rests on the upper lip of the tub edge. A teammate will turn on the hose, to a pre-determined (and constant) flow, for example, 6 turns of the spigot. He will place the running hose into the water opposite the canoe, to simulate the force of the tide. Release the spring scale so it dangles, allowing it to read the number of Newtons (force) required to move the canoe against the tide. As the boat struggles against the flow, read the spring scale and record the force in Newtons. You will probably be rotating through stations, so you may need to wait until your next rotation arrives to test the next canoe type. The canoe requiring the least amount of force is the most efficient in a tidal environment.

Type 1 requires ____________ Newtons.   The best canoe type for a tidal environment

Type 2 requires ____________ Newtons.   is ____________________________.

Type 3 requires ____________ Newtons.

Station B – Smooth Lake or River: You'll use a different method to test hydrodynamics in still water. Attach one end of your line to an eye screw in the canoe you're testing. Attach the other end to a fishing weight. Set the canoe at the far end of the tub. Then stretch the line across the length of the tub so that it rests on the upper lip of the tub. A teammate should be standing by with a stopwatch. When he says, "go," release the weight. As gravity pulls it downward, the string will pull the boat forward through the still water. When the canoe touches the close end of the tub, stop the stopwatch. Record the length of time it takes for the weight to pull this canoe through the water. Repeat the experiment with the other two canoes as the rotation permits. The canoe that covers the distance fastest is most hydrodynamic. It would be the most valuable canoe type for Timucua living in a still water environment.

Type 1 took ____________ seconds.   The best canoe type for still water

Type 2 took ____________ seconds.   is ____________________________.

Type 3 took ____________ seconds.

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ACTIVITY – TESTING CANOE STYLES continued:

Station C – Rough Open Water: Paddling through waves adds another element – the possibility of waves swamping your canoe. Developing a canoe that would maintain its buoyancy even in rough water would be essential in a maritime environment. This process is similar to Station B. Attach one end of your line to an eye screw in the canoe you're testing. Attach the other end to a fishing weight. Set the canoe at the far end of your tub, and gently stretch the line across the length of the tub so that it rests across the tub's rim. Before releasing the weight, one teammate should agitate the water to create waves. Another teammate should be standing by with a stopwatch. When he says, "go," release the weight. Gravity will pull the weight downward, tugging the canoe forward through the choppy water. When the canoe touches the close end of the tub, stop the stopwatch. Record the time it takes for the weight to pull this canoe through the water. Repeat the experiment with the other two canoes as the rotation permits. For consistency, have the same teammate agitate the water during each trial, using the same motions. The canoe that covers this distance the fastest is most hydrodynamic. It would be the most valuable to the Timucua in a rough water environment.

Type 1 took ____________ seconds.

Type 2 took ____________ seconds.

Type 3 took ____________ seconds.

The best canoe type for still water is ______________________________.

Record your observations and your conclusions on the lines below.

____

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____

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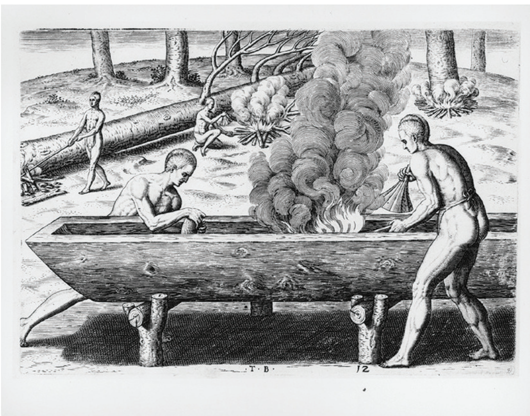
CHAPTER NINE
ARCHAEOLOGY - BEYOND EXCAVATION

CANOE MANUFACTURING CENTERS

With so many canoes found at Lake Newnan, doesn't it seem likely that a canoe-making center was located nearby? No such place has been found in the southeast. In fact only one has been found on the East Coast of North America, way up in Massachusetts. What would a native person have looked for when choosing a spot to manufacture canoes? They'd want nearby access to large trees – or at least a way to float the logs to the manufacture site. They'd also need fuel for the fires that must burn for several days. Access to clay and water would have been important for fire control. And finally, they'd need a way to launch new canoes into the water to test them.

What would an archaeologist look for if she were searching for a canoe-manufacture site? The site would have lots of charcoal, ash, wood debitage, and broken or worn out shell tools. She might also look for postholes left by canoe support frames.



This de Bry Engraving shows the Algonquin people of North Carolina using fire in the canoe making process. The entire process is illustrated here.

Upper right, a tree is being felled using a fire burning at its base. Upper far left, a man is using fire to "cut" the log to the proper canoe length. Upper middle, a man is using fire to remove large branches. In front, the men are using fire to char the interior of the canoe so they can scrape out the wood. Notice that the canoe is resting on supports.

Courtesy of the British Museum

THE DETAILED SIDE OF EXPERIMENTAL ARCHAEOLOGY

Many experimental archaeology studies have been performed on STONE tools. These archaeologists start by making their own stone tools (like stone axes), then use the tools (chop wood), and record the use-wear patterns that show up on the stone (chips and cracks on the axe blade).

In the 1980s, a few experimental archaeologists adapted these stone use-wear studies to the SHELL tools found in Florida. What is "use-wear"? It is the damage done to the working surfaces and edges of a tool through everyday use. Archaeologists were looking for areas on the shell tools that were broken, cracked, scratched, or rubbed to a shiny polish. They learned that shells used as axes took on one kind of damage, while shells used to pound nuts were damaged in a completely different way. This information helps archaeologists identify the purpose of ancient tools, which rarely look like a chisel, axe, or hammer. They just look like...old shells. The list below reviews some of their use-wear conclusions.

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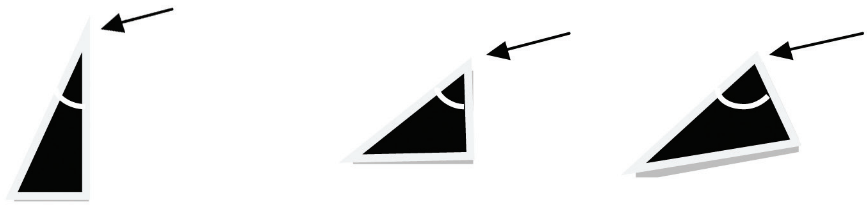
1) If an item was hafted (mounted on a handle), it will probably have holes or notches cut through the outer whorl where the handle was inserted.

2) Old shells are the largest, but they're too brittle to make large chopping and pounding tools like axes and hammers. When archaeologists study the use-wear on large shell artifacts, they do find wear marks (like scratches and polishing), but not cracks. This suggests that large shell tools were used for a purpose other than chopping or pounding.

3) The angle of the shell's working edge is directly related to the amount of damage on the shell. Smaller angles (28-41°) showed the most impact damage and were designated as chopping tools. Medium angles (45-59°) showed less impact damage and were designated as cutting tools. Larger angles (60-70°) showed very little impact damage and were categorized as scrapers. In the image below, the arrows show the cutting edge of the tool.



28-41° angle, narrow cutting edge of a shell axe

45-59° angle, wider edge of a shell knife

60-70° angle, very wide edge of a shell scraper

4) The shells with the smallest angle blades were woodworking tools called celts (pronounced: selts). The many impact scars were big enough to be seen with the naked eye. If the working edge had become dull through use, and someone kept using the shell anyway, it showed layers of tiny fractures. This was only visible through a 100-power microscope.

5) Organic plant residues were found imbedded in the impact scars and cracks on many of the tools. When viewed under a stronger microscope (200-power), these residues looked glossy. When viewed under 400-power, the glossy areas were filled with tiny striations (lines) that were all in one direction. The shell tool had been repeatedly rubbed or struck in a particular direction, leaving these lines.

Figure a. If the striations were parallel to the working edge, the tool was used for sawing, which is a back and forth motion along the same axis as the blade. Think about using a modern saw.

a.

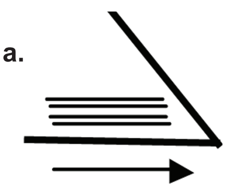


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Figure b. Some striations that were perpendicular to the working edge indicated tools used for cutting or slicing. Slicing a carrot, for example, you press the knife down through the carrot. Any lines scratched into the knife (by the material being sliced) would also be up and down, perpendicular to the blade.

b. & c.

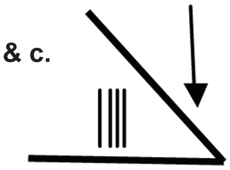

Figure c. Other times, striations at that same 90° angle indicated use as a carving or whittling tool. Imagine the movement of someone's hands while they're whittling wood with a pocket knife, and you can see how the striations would also be perpendicular to the blade.

EXPERIMENT – USE-WEAR STUDIES ON WOODEN TOOLS:

BACKGROUND: Throughout history, wooden tools have been used for a variety of purposes, including digging sticks, pestles for pounding, and tool handles. In this activity, you will start by using wooden tools to build up a wear pattern. Then you will inspect the wooden tool for signs of wear that indicate use.

INSTRUCTIONS, Part I: Your class will be presented with several wooden tools made from modified dowels. You will move from station to station, using the tool as directed so that it can develop a wear pattern. For digging sticks, you will push the sharpened end into the soil, as though you are trying to dig up an edible root. For pestles, you will pound the flat end of the dowel into dried corn or acorns, crushing them against a hard surface. (A concrete surface is okay). For tool handles, you might have a shell hoe, perhaps a whelk or clam shell attached to a dowel handle. You can use any binding material (even packing tape) as long as the shell is tightly bound. Use this shell hoe for hoeing up the dirt in preparation for planting. The force of the shell against the wooden handle should leave identifiable stress marks. Each tool's working edge should be photographed before use and again after the first use and after the final use.

Before you try each of the three tools, examine the tool for damage. Repeat this observation after you use the tool. Record your observations below.

1a. Digging Tool: Pre: ____

Post: ____

1b. Pounding Tool: Pre: ____

Post: ____

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EXPERIMENT – USE-WEAR STUDIES ON WOODEN TOOLS continued:

1c. Handle: Pre: ______________________________

Post: ______________________________

INSTRUCTIONS, Part II: Your class will return inside. The shell will be removed from the wooden handles of the hoes. Your teacher will photograph the use-wear on these handles. Students will visit each station and examine all three tool types - both with the naked eye and with a magnifying glass. In the space below, record any signs of wear. Which signs show up only with magnification?

2a. Digging Tool: Naked Eye: ______________________________

Magnifying Glass Only: ______________________________

2b. Pounding Tool: Naked Eye: ______________________________

Magnifying Glass Only: ______________________________

2c. Handle: Naked Eye: ______________________________

Magnifying Glass Only: ______________________________

INSTRUCTIONS, Part III: Your teacher will shuffle the tools so that you will not know which kind you are examining. You will examine three different tools. You may have one of each tool type, or three of the same tool type. Apply your observations about tool wear to try to figure out what each tool was used for.

3a. How was your first tool used? ______________________________

What is your evidence for this conclusion? ______________________________

3b. How was your second tool used? ______________________________

What is your evidence for this conclusion? ______________________________

3c. How was your third tool used? ______________________________

What is your evidence for this conclusion? ______________________________

ARCHAEOLOGY - BEYOND EXCAVATION

EXPERIMENT – USE-WEAR STUDIES ON WOODEN TOOLS continued:

4. Write a short paragraph, for inclusion in an archaeology text book, describing how to identify wooden tools through wear analysis. Remember, it's the obligation of every archaeologist to record detailed observations (take notes) and to publish his findings (share his conclusions).

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ARCHAEOLOGY - BEYOND EXCAVATION

ACTIVITY – EXAMINATION OF DEBITAGE:

BACKGROUND: Native tool makers used shell axes to chisel wood out of canoe logs. Each axe produced chips of exactly the same width as the working surface (blade) on the shell tool. After the Timucua got metal tools from the Spanish, canoe construction began to produce unique iron axe debitage. Comparing the debitage found at native sites tells archaeologists a lot, even in the absence of actual artifacts.

When you created a soap caving in the Tool Technology unit, your teacher collected a sample of soap debitage created with wooden tools. She also carved a sculpture of her own, using a metal knife. This produced a completely different kind of debitage.

INSTRUCTIONS: Use a ruler and magnifying glass to observe both groups of debitage. Are the sizes of the chips in each group uniform? Or did each tool produce chips of varying sizes? Is the debitage produced by one tool consistently smaller, thinner, or distinctively shaped when compared with the other?

Measure 5 pieces of debitage (length, width, and if possible thickness) in millimeters. Take an average for each dimension. Record your date here.

Five Lengths: ____ Average: ________

Five Widths: ____ Average: ________

Five Thicknesses: ____________________________________ Average: ________

Write a statement to be included in an archaeology handbook regarding the differences in debitage created by wooden tools vs. metal tools. Data describing metal-created debitage can help archaeologists demonstrate contact with Europeans even if no European artifacts are found in the excavation.

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CHAPTER 10

CHAPTER TEN

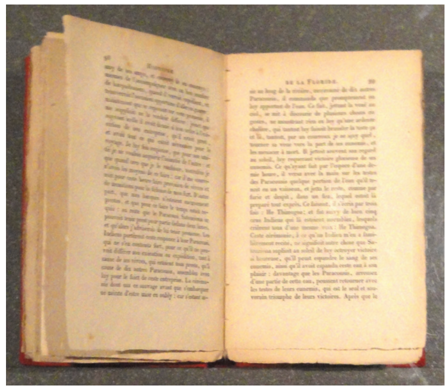
HISTORY AND THE TIMUCUA

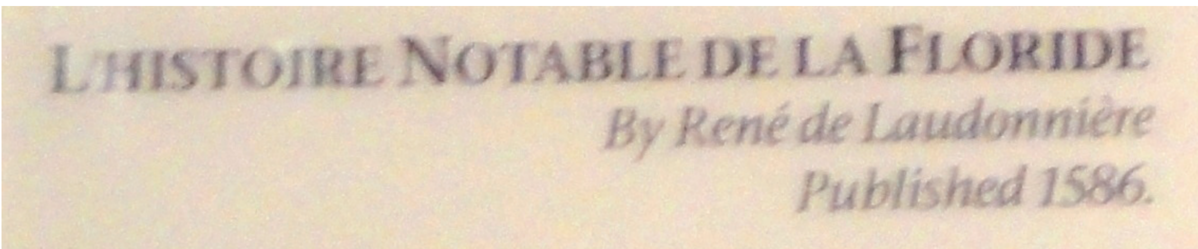
STUDENTS LEARN HOW HISTORICAL RESOURCES TEACH US ABOUT THE TIMUCUA PEOPLE AND THEIR TECHNOLOGY.

LET'S TALK ABOUT HISTORICAL DOCUMENTS

In the unit titled "Theodore de Bry's Timucua Engravings – Fact or Fiction?" we spent plenty of time analyzing the authenticity of his work. Other historical documents provide more reliable information about the Timucua. The earliest were the memoirs of French and Spanish explorers.

French explorer, René Laudonnière (Low-don-**YARE**): He wrote an account of his experiences in Florida from 1562 – 1565. This account seems to have been written as an administrative report, to be read by King Charles IV or Admiral Coligny. Laudonnière never submitted it for general publication, though several other people had published their own memoirs. Because he was not publishing for profit, he had less reason to wildly embellish what he observed about the Timucua. When we read crazy things in his text – like the time he met a 250-year-old Timucua man whose own father was still alive – we can chalk that up to miscommunication or misunderstanding – not outright fabrication.





It's Laudonnière's account that explains how the Timucua got their name. When Europeans asked the Timucua "what is the name of your people?" the Timucua responded with "we are us" or "this is our land." Since they couldn't call every native group, "we are us," the French and Spanish usually referred to each village by the name of its leader. Headchief Saturiwa resided in the village Saturiwa. His enemy, Outina, lived near modern day Green Cove Springs, in a village named…you guessed it, Outina. Even further west, near Gainesville, lived an enemy to both of these headchiefs: Potano. Laudonnière's text makes it clear that these chiefs were never united politically. So why are all of these villages lumped under the same name - Timucua? It's because they all spoke variations of the same language. And we call this language "Timucua."

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HISTORY AND THE TIMUCUA

Laudonnière records: *"I asked him where he got the slab of silver which he had given me. To this he made a quick response which I could not comprehend. He noticed that I could not understand and showed me by signs that it came from a place far up the river and several days distant from the river, and that all they had of it they took by force of arms from the people of that place called by them 'Thimogona.' He strongly asserted that these were their most ancient and natural enemies."*

According to Laudonnière, the word, *Thimogona*, was another word for enemy. Because it was applied to another native chief, and perhaps his village, Europeans gradually came to use this name for all the villages in that area. Later, the term grew to include all speakers of the Timucua language.

Could we have learned the origins of the Timucua name from an archaeological dig? No way. That's the benefit of historical documents. If we can sift through the writings that don't ring true (i.e. the 250-year-old great-great-grandfather), huge amounts of worthwhile information is there for the picking.

De Bry engraving of the Ribault Monument

In this de Bry engraving, Chief Atore (Saturiwa's nephew) is showing Laudonnière how much respect his people show to the French monument. [**Note**: The Timucua were not giants, though they look like it here. This engraving prompts us to compare a 5'5" French explorer with a possibly 6-foot-tall chief whose his hair is decorated and tied atop his head. De Bry wants you to think the Timucua are giants. It makes for better book sales.]

Interesting Fact: A study published in 2004 measured skeletons of Europeans that lived during the 1600s. At this time, the height of the average European was just under 5'6". Unfortunately, there's no data available on the average height of the Timucua.

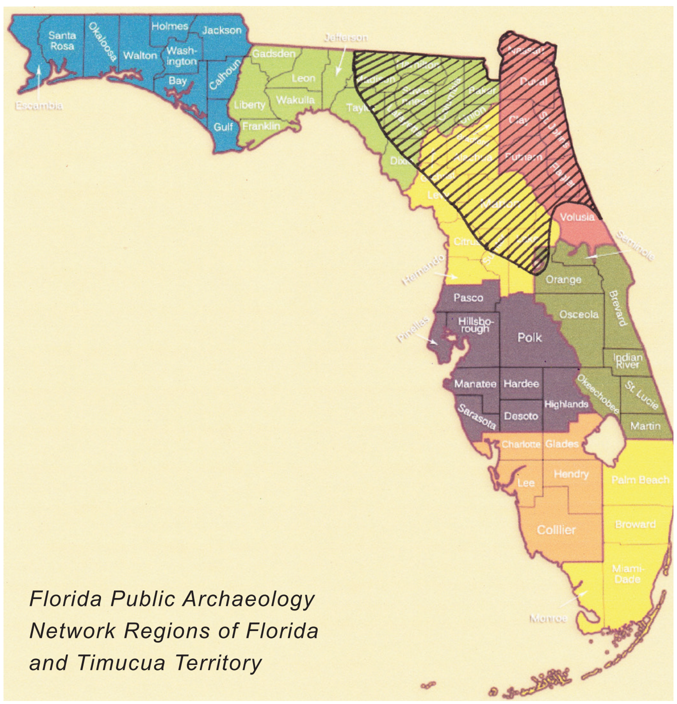
CHAPTER TEN
HISTORY AND THE TIMUCUA

ACTIVITY – WHICH FPAN REGIONS INCLUDE TIMUCUA TERRITORY?:

BACKGROUND: The locations of Timucua villages are discussed in a variety of historical documents, including the memoirs of French explorers, letters written by Spanish priests, and reports written by St. Augustine personnel. Archaeological excavations have also pinpointed several village sites that contain artifacts from the European Contact Period. These artifacts include iron tools, domestic animal bones, and glass beads. Christian burials have also been discovered. By combining all of these sources, a basic map has been created that shows the territory used by Timucua-speakers. Because these native peoples were never united, there was no "Timucua capital." Instead, regional headchiefs controlled areas within this large block of space.

The Florida Public Archaeology Network (FPAN) is an organization that works to protect, study, and teach about Florida's archaeological resources. It is divided into eight regions, each of which focuses on the unique cultural resources in its area.

INSTRUCTIONS: A variety of native groups, each with distinct languages and cultural beliefs thrived in early Florida. Archaeologists at FPAN try to focus their educational programs on the native cultures that flourished in their own region. In this map, each color represents a different FPAN region. Blue = Northwest. Light Green = North Central. Red = Northeast. Yellow = Central. Dark Green = East Central. Purple = West Central. Peach = Southwest. Light Yellow = Southeast. The crosshatched area marks Timucua territory in Florida. (Don't forget that Timucua-speakers lived in Georgia as well.) On the lines below, record the names of the FPAN regions that include some part of Timucua Territory.



Florida Public Archaeology Network Regions of Florida and Timucua Territory

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CHAPTER TEN
HISTORY AND THE TIMUCUA

THE CONFESSIONARIO – A GUIDE TO TIMUCUA TECHNOLOGIES FOR HEALTH CARE, AGRICULTURE, AND HUNTING SUCCESS

Health care and environmental practices are cultural beliefs that leave little evidence in the archaeological record. So how can modern Floridians learn about these aspects of Timucua life? One Spanish priest provided some useful hints.

This priest, Francisco Pareja, arrived in Florida on September 23, 1573. He spent 33 years among the Timucua people teaching them about Christianity. During that time, he learned the Timucua language, documenting ten different dialects across NE Florida and SE Georgia. Many of Pareja's fellow priests did not speak Timucua. This made it nearly impossible for them to listen to the confessions of the Catholic Timucua. To solve this problem, Francisco Pareja wrote down a list of questions the priests should ask the Timucua during confession. Each sentence was written in both Spanish and Timucua. By studying this 1613 document, called the *Confessionario*, historianshave learned enough about the Timucua language to produce a small dictionary. They've also learned about the Timucua lifestyle.

When modern Floridians read the *Confessionario*, they should remember that Francisco Pareja's observations were colored by his experiences as a Spanish Catholic. The Timucua culture was so different from his own that he sometimes misinterpreted the reasons for the Timucua behaviors he was observing. In many cases, his writings tell us more about the Spanish culture than they do about the Timucua.

How can we get past this bias about the Timucua? We should start, oddly enough, by focusing on the Spanish. Spanish priests were teaching the Timucua about Catholic rules and beliefs. They were also trying to stop the Timucua from practicing aspects of their own native culture. The questions in the *Confessionario* show us which Timucua behaviors the priests considered inappropriate. Reviewing these questions gives modern Floridians a glimpse of Timucua everyday life.

At first glance, many Timucua practices and beliefs might look like "superstition." But consider these modern beliefs: "Walking under a ladder or opening an umbrella inside brings bad luck." If you look at these ideas literally, they do seem a bit ridiculous. No actions actually cause good or bad luck. But if you look more closely at the consequences of those particular actions, you see the value behind the belief. Ladders can fall on your head. Umbrellas opened indoors can poke eyes. Either one would be pretty unlucky.

With some thought, many of the Timucua beliefs make good sense. They are accurate descriptions of the real world. What's more, many of them function as behavior guides for the people. Some served to improve health, while many more worked towards preserving the environment around them. Why were the Timucua such environmentalists? For subsistence cultures, it's not an option. If you don't protect the environment, it will not be able to provide you with the food and other resources you need to survive.

HISTORY AND THE TIMUCUA

In the following discussion, the questions from the *Confessionario* are in **bold italics**. The modern interpretation is in plain text below each question. Only a small portion of Pareja's text is included here.

TIMUCUA BELIEFS THAT IMPROVE HEALTH

"For someone who is sick, have you made a separate light or fire?"

Diseases like smallpox and measles were passed from person to person. Raging epidemics sometimes wiped out half a village. If a Timucua person were sick, moving them to another hut would help prevent the spread of the illness to the rest of their family. Caregivers would light a new fire at the isolated hut in order to provide care at that location.

If "…you have sneezed, and having come to the house, you have taken a bath with water of the herb, and not doing this, have you believed for sure that you will die, have you believed this?"

As discussed in the unit on Wild Plants, many Florida plants have medicinal uses. It made sense for the Timucua to use herbal remedies when they were sick. Today, people take herbal supplements like Echinacea or Vitamin C to improve their health.

TIMUCUA BELIEFS THAT IMPROVE SUCCESSES IN PLANT GATHERING AND HARVESTING

"When collecting acorns or other fruits, did you consider it a sin to eat the first fruits that were cut?"

With as many as 200 people living in a village, the land nearby would be aggressively harvested. The people could easily collect and eat every acorn, blueberry, plum, and grape in the area. There would be nothing left for the animals to eat and no seeds left to grow new plants for the following year. Perhaps by throwing the first fruits back into the woods, the Timucua were planting the next generation. This ensured that native plant species would never die out.

"Have you considered it a sin to eat the first maize from a new clearing?"

Some kernels had to be saved as seed corn for the following year. In times of hunger, the people might be tempted to eat all of the corn, leaving nothing to plant next year. The refusal to eat this corn made sure the Timucua people would never consume it all. They would always have crops in the future because there would be enough seeds for spring planting.

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"…have you not wanted to eat that which was sowed in an old field?"

Planting a field several seasons in a row depletes the minerals in the soil. (This happens even when the Three Sister crops are planted together.) To deal with this problem, the Timucua stopped using this field for a few years, letting it lie fallow, so the minerals could gradually return. Planting in an old field would produce a poor crop and make the soil even worse. So, it made sense to refuse to eat from (and plant in) an old field. It ensured that some fields would always be ready for future plantings.

"For the beginning of the sowing, have you fixed a pot of gacha, and that six old men eat from it?"

The older members of the village had the most wisdom about planting, hunting, and everything else. Providing these senior citizens with a ceremonial meal helped them feel like valued members of the community. Their willing advice led to a more successful harvest.

TIMUCUA BELIEFS THAT IMPROVE HUNTING SUCCESS

"The first fish that enters the new fish traps, have you said not to put them in hot water, otherwise no more would be caught?"

They're probably talking about fishing weirs. Releasing the first fish trapped ensured that there would always be some fish left to breed and have more baby fish.

"When the winter comes, have you held it to be a sin to eat the small chicken?"

This question was probably referring to quail. By refusing to hunt immature quail, the Timucua gave these birds a chance to grow up and reproduce. This practice ensured that there would be more quail to hunt in the future.

"The broth of the deer or the wild chicken, have you said not to spill it, otherwise the snare will not catch another?"

Broth is the water that meat and vegetables have been cooked in. It's full of vitamins and is a very healthy food. This belief reminded people not to waste it. Modern Floridians have a similar saying: "Waste not; want not." This saying doesn't mean that if you do waste, you'll definitely run out of resources. It just says that you might. If the Timucua wasted food and had to hunt more animals to feed themselves, there might not be enough deer or quail left in the local population to hunt the next year.

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"Have you said that the bones of what was hunted: do not throw them out, otherwise more will not enter the trap, hang them by the ankles or put them in the thatching of the house?"

Bones can serve many useful purposes. They can become structural parts of the hut. They can be cracked and boiled to get the marrow out for nutritious food. They can be used to make knives, needles, awls, and other tools. So it makes good sense to save them and not throw them away. If the Timucua did throw bones away, and then had to hunt more animals to get bones for tools, there might not be enough animals in the local population to hunt next year.

"To hunt some deer, have you taken the antlers of another deer, have you prayed to them the ceremony of the Devil?"

This is describing the deer hide disguises that the Timucua used so effectively to hunt deer. And what does the "ceremony of the Devil part" mean? Historians believe that the Timucua spoke simple charms as part of nearly every activity, especially those that dealt with finding food. They probably spoke these charms as automatically as modern Floridians say "Bless you" when someone sneezes. It is unlikely that these charms had anything to do with the devil, since the Timucua had no concept of a devil before learning about it from the Spanish priests.

"The ceremony of the laurel that is made to the Devil, have you made it?"

The ceremony of the laurel is probably the Black Drink Ceremony, made with yaupon holly. The leaves were roasted, and then boiled, to make a caffeinated drink called Cassina. Cassina was drunk by adult male hunters when going on a big hunt or battle. It gave them an extra caffeine boost. (Again, this was not a ceremony to the devil. The priests just perceived it that way.) By using the Black Drink, the Timucua utilized botanical technology to improve their chances of a successful hunt or battle.

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ACTIVITY – DECIPHERING A MODERN *CONFESSIONARIO*:

BACKGROUND: If an alien anthropologist visited Earth today, he'd misunderstand the reasoning behind many everyday behaviors. In the same way, Francisco Pareja misconstrued the purpose of several Timucua practices.

INSTRUCTIONS: The questions below show how an alien anthropologist might perceive several modern behaviors as pure superstition. On the lines provided, explain how each of these behaviors is more than just superstition, how it actually makes sense – if you know enough about modern human cultures.

1) ***If "…you have sneezed, have you covered your face, and not doing this, have you believed that others will become ill?"***

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2) ***"When tending your crops, did you dust the plants with ceremonial powders, and not doing this, have you believed that insects would attack your crop?"***

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3) ***"When going to the store, have you written an incantation, believing you must do this or you will not find the things you need?"***

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HISTORY AND THE TIMUCUA

ACTIVITY – DECIPHERING A MODERN *CONFESSIONARIO* continued:

4) ***"On a cloudy day, have you said you must bring an umbrella, otherwise the rain will come?"***

5) ***"To win at a sport, have you worn your lucky socks inside out?"***

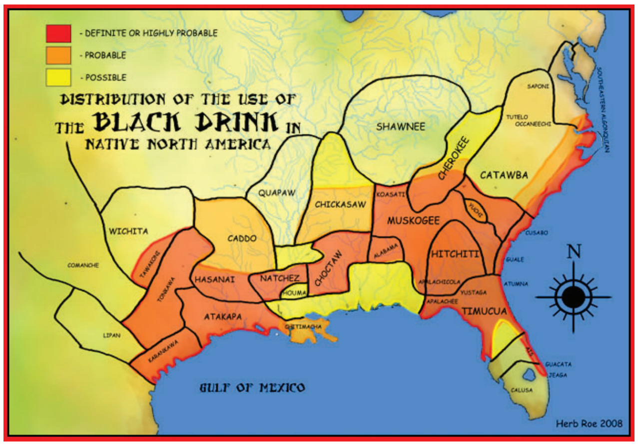
6) ***"Have you believed that perfuming your skin with herbs, the person of your choice will be attracted to you?"***

CHAPTER TEN

HISTORY AND THE TIMUCUA

THE BLACK DRINK – BOTANICAL TECHNOLOGY

The Black Drink (also called Cassina) was an herbal tea made from the leaves of the Yaupon Holly. Several European documents describe the widespread consumption of this beverage. Yaupon grows best in coastal areas and was common throughout Timucua territory.



The red areas on this map show native groups that used in the Black Drink, image by Wikipedia

Its leaves contain caffeine, which led to its use by native peoples. Why would a plant have caffeine? Caffeine is toxic to insects and fungi. Studies have proven that young plant leaves have more caffeine than older ones because they are softer and more susceptible to attack by insects.

The Timucua had no way of directly measuring caffeine content or absorption. But even without scientific equipment, the Timucua's grasp of plant technology allowed them to find and utilize the only plant in North America that produces caffeine.

Yaupon Holly, photo by Wikipedia

1) **The Timucua preferred to use young holly leaves when making the Black Drink.** Young leaves contain more caffeine.
2) **They roasted the leaves before making the Black Drink.** Roasting increases the solubility of caffeine, so more can be dissolved into the water. Coffee beans are roasted for the same reason today.
3) **They boiled these roasted leaves and served the Black Drink very hot.** Modern lab techniques show that boiling water absorbs 30 times more caffeine than water at room temperature.

How much caffeine do modern Yaupon holly plants produce? The table below compares it to three commonly used caffeinated drinks: coffee, tea, and hot chocolate.

HISTORY AND THE TIMUCUA

COMPARISON OF CAFFEINATED BEVERAGES

Type of Beverage	Scientific Name of Plant	Part of the Plant Used	% Caffeine in the Plant
Black Drink	*Ilex vomitoria*	Leaves	0.2%
Coffee	*Coffea arabica*	Seeds	1.2%
Tea	*Camellia sinensis L.*	Leaves	3.0%
Hot Chocolate	*Theobroma cacao*	Seeds	0.2%

Caffeine also has medicinal uses. It is a natural diuretic, something that makes you sweat and urinate a lot. Yaupon holly was made into a medicinal tea that was helpful in treating kidney and bladder problems.

Caffeine is also a natural stimulant and appetite depressant. Laudonnière described the use of Cassina as follows. (Do your best with this Old English translation from the French.)

"Afterward he commaundeth Cassine to be brewed, which is a drinke made of the leaues of a certaine tree: They drinke this Cassine very hotte: he drinketh first, then he causeth to be giuen thereof to all of them one after another in the same boule, which holdeth well a quart measure of Paris. They make so great account of this drinke, that no man may taste thereof in this assembly, vnlesse hee hath made proof of his valure in the warre. Moreouer this drinke hath such a vertue, that assoone as they haue drunke it, they become all in a sweate, which sweate, being past, it taketh away hunger and thirst for foure and twenty houres after."

The Timucua had keyed in on the fact that the Black Drink's caffeine stimulates two different parts of the human nervous system: parasympathetic and sympathetic.

The Parasympathetic Nervous System is referred to as "rest and digest." It controls the normal everyday processes like digestion, tear production, and elimination. (This triggers the plant's medicinal function, since caffeine promotes urination.)

The Sympathetic Nervous System is referred to as "fight or flight." It handles high-stress situations by stopping digestion, increasing heart-rate, dilating lung passages, and increasing sweating. (That's why you get sweaty palms when you're nervous.) It also causes the body to convert stored fat into useful energy and release it into the bloodstream. (That's why the Timucua could go without food.) All of these fight-or-flight responses were triggered by caffeine.

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Wow. Big impact...for one drink. But wait; European documents also describe cassina as an everyday morning beverage. Certainly the Spanish used it that way, just as modern Floridians use coffee. They weren't having a fight-or-flight reflex every morning. That's because it takes a fair amount of caffeine to kick-start that reflex. After 3 cups of coffee (that's 500 mg of caffeine) you'd be feeling significant effects. To get that much caffeine from a modern brew of Cassina, you would have to drink 50 cups (at 9mg of caffeine per cup). When Timucua men drank a cup of Cassina at morning gatherings, it was actually just…tea. The large scale consumption before a battle or hunt was a different matter.

Only men who had proven themselves in battle were permitted to join in the Black Drink Ceremony. The Cassina was served in whelk shell bowls in the council house. The French documented its use and told of vomiting that occurred after drinking it. There's nothing in yaupon holly leaves to cause vomiting, but chugging 50 cups of a hot liquid might do the trick. Also, they may have altered the Cassina recipe to induce vomiting. Salt water is a known emetic, and for communities living near a marsh, salt water was a plentiful resource. Many southeastern native cultures used vomiting as a form of ritual purification. It is likely that vomiting after the ceremony was a standard part of their preparation for battle. (Salty tea, anyone?)

Historical Note: The Black Drink was never used as a social drug. The Timucua drank it for both religious and practical purposes. The vomiting aspect provided ritual purification, which satisfied Timucua religious needs. The caffeinated aspect improved successes in hunts and battles, satisfying a practical need. The Black Drink was never used for a quick energy boost.

The de Bry engraving below depicts the Black Drink Ceremony. You can see several Timucua vomiting in the background. In this image, the women are preparing the Cassina, but only the men are drinking it. Note that the drinking cups are portrayed as chambered nautilus shells, not whelk shells. Also, European memoirs say that this ceremony took place in the council house, not outside.

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ACTIVITY – TIMUCUA TIMELINE:

BACKGROUND: Timelines establish an order of events throughout history. They can be analyzed to look for comparative data, trends, and causality. Comparative data includes simple comparisons between what was going on in different parts of the world at any particular period in time. Trends involve patterns of change that can be seen in a timeline. Causality looks for evidence of cause and effect in timeline events.

INSTRUCTIONS: Review the two timelines below. Both provide information about the development (and destruction) of the Timucua culture. The first begins when Paleoindians reach Florida and ends just before European contact. The second begins with European contact and ends with the death of the last Timucua person. As you review these timelines, look for interesting bits of comparative data, trends showing change, and evidence of cause and effect. Then read the questions below each timeline and write your answers on the lines provided.

PRE-COLUMBIAN TIMELINE

(Pre-Timucua Events – Black) (World Events – Blue)

10,000 BCE	Mammoths hunted by Paleoindians in Florida
10,000 BCE	Pottery used by the Jamon people in Japan
4300 BCE	Teosinte domesticated in Mesoamerica
3300 BCE	Writing developed in Egypt
3100 BCE	First evidence of canoe use in Florida
2560 BCE	Great Pyramid at Giza is built
2500 BCE	Fiber-tempered pottery invented by Archaic Indians in NE Florida
2000 BCE	Squashes domesticated in Eastern North America
800 BCE	Turkeys domesticates by Aztecs in Mesoamerica
600 BCE	Writing invented in Mesoamerica
500 BCE	St. Johns sponge spicule pottery invented in NE Florida
312 BCE	Romans built aqueducts to supply cities with water
800 CE	Bow and arrow is first used in southeastern North America
820 CE	Algebra is invented by an Arabic scholar

CHAPTER TEN

HISTORY AND THE TIMUCUA

ACTIVITY – TIMUCUA TIMELINE continued:

1200 CE	Corn grown by the Ft .Walton culture (pre-Apalachee) in NW FL
1300 CE	Mount Royal, a pre-Timucua society, is a powerful mound center
1300 CE	Giant owl totem carved just south of Timucua territory
1400 CE	Cahokia Mound Center in Illinois is a supremely powerful and heavily agricultural Mississippian culture
1400 CE	Massive canal building by the Caloosahatchee culture in SW Florida
1450 CE	Corn first grown in Timucua territory
1500 CE	Agricultural terraces are built by Incas in South America

1) This timeline is broken up into bracketed segments. Why do you think the author chose this format?

2) Review each bracketed section. What comparative conclusions can you draw about Florida's early cultures and the rest of the world?

3) The final bracket spans only 250 years. It is filled with powerful cultural centers, the introduction of agriculture, mound and canal building, and a massive example of woodworking. Discuss possible relationships or causality associated with the events in this bracket.

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ACTIVITY – TIMUCUA TIMELINE continued:

CONTACT-PERIOD TIMELINE

1492 CE	Columbus "discovered" the New World
1492 CE	An estimated 200,000 Timucua live in Florida and Georgia
1513 CE	Ponce de Leon battles the Calusa
1539 CE	De Soto travels through Florida, battles western Timucua
1539-1540 CE	Evidence of an epidemic in one western Timucua village: 70 primary burials were interred in a burial mound together
1562 CE	Fort Caroline is established among NE Timucua
1565 CE	St. Augustine is founded among NE Timucua
1591 CE	De Bry publishes his engravings of the Timucua
1595 CE	Spanish missions begin to Christianize the Timucua
1595 CE	Epidemics strike coastal missions
1612-1616 CE	Epidemics strike inland missions
1613 CE	Francisco Pareja writes the *Confessionario*
1650 CE	Epidemics rage through St. Augustine
1655 CE	Smallpox epidemic sweeps through Timucua and Guale villages
1656 CE	Timucua Rebellion, Timucua write letters in their own language
1659 CE	10,000 native people die in a measles epidemic
1704	British and native allies attack Florida Indians in slave raids
1704 CE	Remaining Apalachee people head west, eventually settling in Louisiana
1750 CE	Half a million people in Europe are dying of smallpox each year
1763 CE	Spain cedes Florida to the British. The remaining Christian Indians evacuate to Cuba with the Spanish.
1767 CE	Juan Alonso Cabale, the last Timucua person, dies in Cuba.

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ACTIVITY – TIMUCUA TIMELINE continued:

4) This timeline is broken up into bracketed segments. Examine each bracket and describe what the main focus is in each.

5) Consider any trends, relationships, or causality regarding the data on epidemics. Record your conclusions on the lines below. (**NOTE**: As early as 1300 CE, before the beginning of the Contact Period timeline, smallpox epidemics were raging through Germany. They were introduced by the Crusades.)

6) In addition to epidemics, what other forces led to the destruction of this early Florida culture?

CHAPTER TEN
HISTORY AND THE TIMUCUA

THE TIMUCUA LANGUAGE

The disappearance of the Timucua was mirrored across the southeast, as culture after culture faded away. Modern historians are fortunate that the Europeans created so many documents about the Timucua. Many of Florida's lost cultures remain truly lost because modern students have no way to study them. No record of the Calusa language exists. And for the Apalachee language, only a handful of words are known. Thanks to the work of Francisco Pareja, linguist Julian Granberry was able to create a Timucua dictionary of 1,485 words.

The dictionary project was a massive undertaking, one which required painstaking review of over 2000 pages of text written by Spanish priests. It also involved translation of these materials from Spanish to English and analysis of word meanings and pronunciation. The Timucua-speakers had disappeared 225 years before Granberry started his work, so he could not ask anyone if his conclusions were correct. His primary sources were written by Spanish priests who had learned Timucua as a second language. As a result, their knowledge of the language was not as strong as that of a native-speaker. Even knowing that Granberry's dictionary must include errors, it is a valuable source for historians interested in this ancient language.

Granberry's dictionary is a "**secondary source**" because its author did not have access to the people or events he was studying. When creating a secondary source, researchers study and analyze "**primary sources**." Francisco Pareja's text is a primary source, because he was actually there making first-hand observations. Laudonnière's descriptions of the Timucua are a "**primary source**" as well. Primary sources are considered more reliable, because there's less chance that a later researcher has introduced errors while translating or interpreting the material.

That doesn't mean that primary sources are completely trustworthy. First-hand observers can make mistakes. After all, Laudonnière thought he met a 250-year-old man. Then he recorded it as fact.

Because the average Floridian may not be able to read the primary sources in French or Spanish, historians, like Dr. John Hann, have worked to make these documents accessible to everyone. Dr. Hann sifted through thousands of old Spanish documents to create secondary source books, like A History of the Timucua Indians and Missions.

Another kind of primary source is an archaeological report. These reports, once written, become a historical resource. Their data tables report the pottery, stone points, shell tools, animal bones, seeds, and European artifacts excavated. They note features, geology, environmental data, and anything else that might be pertinent to the excavation. These reports also include the archaeologists' interpretation of the data relating to their research purpose.

HISTORY AND THE TIMUCUA

Reading and understanding these reports requires knowledge of archaeological terminology, processes, and pottery-types. This can be a little daunting to the modern reader. To provide easier access to this information, some archaeologists, like Dr. Jerald Milanich, produce both primary and secondary sources. Dr. Milanich's primary sources are archaeological reports based on his personal research. He creates secondary sources, like his book titled *The Timucuas*, by collecting interesting facts from archaeology reports and historical documents, and presenting them in an easy-to-understand format. In this way, he makes archaeological information available to everyone.

ACTIVITY – TRY YOUR HAND AT TRANSLATION:

BACKGROUND: When French and Spanish explorers, and later, Spanish priests, tried to communicate with the Timucua, they ran headlong into a language barrier. The structure of the Timucua language is completely different from French and Spanish. It's also totally different from other native languages in Florida, including Apalachee in NW Florida and Calusa in SW Florida. (We don't know much about these languages, but the first-hand records left by Europeans in Florida tell us that the cultures spoke very different languages.)

Timucua speakers added meaning to words by adding suffixes. A suffix is a letter (or letters) that are added to the end of a word. English uses many suffixes to add meaning. For example, adding "-s" or "-es" to the end of a word indicates a plural or "many." (dog ⟶ dogs) Timucua-speakers did this to a much greater degree. As a result, single words often included 5 or 6 syllables. English speakers are usually comfortable saying words with up to four or five syllables (like dic-tion-a-ry). Anything longer is referred to as a "tongue twister." The Spanish priests undoubtedly felt this way about learning to speak Timucua.

INSTRUCTIONS: Use the grammar rules and vocabulary list below to translate phrases and sentences into Timucua. Write your answers on the lines provided. Afterwards, as a class you will try your hand at pronouncing the tongue twisters you've created.

10 SIMPLIFIED TIMUCUA GRAMMAR RULES

1) To say "the," add "-ma" to the end of a word.
   rabbit = quelo (keh-low), the rabbit = quelo-ma (keh-low-ma)

2) To say "his" or "her," add "-si" to the end of a word.
   rabbit = quelo, her rabbit = quelo-si (keh-low-see)

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ACTIVITY – TRY YOUR HAND AT TRANSLATION continued:

3) To make a word plural, add "-care" to the end of the word.
rabbit = quelo, rabbits = quelo-care (keh-low-ka-reh)

4) If you are including more than one suffix, use the plural first, then another suffix.
Plural: rabbits = quelo-care. Additional Suffix at the end: the rabbits = quelo-care-ma

5) To say "your," add "-ye" to the end of a word.
rabbit = quelo, your rabbit = quelo-ye (keh-low-yeh)

6) To say "my" add "-na" to the end of a word.
rabbit = quelo, my rabbit = quelo-na (keh-low-na)

7) To say "all," add " –tooma" to the end of a word.
rabbit = quelo, all rabbits = quelo-tooma (keh-low-too-ma)

8) To say "it is," you add "-no" to the end of a word.
my rabbit = quelo-na, It is my rabbit. = Quelo-na-no. (keh-low-nah)

9) To say "I am," you use a stand-alone word: hontala (hone-ta-la)
hunter = bali, (ba-lee) I am a hunter. = Hontala bali.

10) Compound nouns are similar in English and Timucua.
bird = chulufi (chew-loo-fee), house = paha (pa-ha), bird house = chulufi paha

CHAPTER TEN
HISTORY AND THE TIMUCUA

ACTIVITY – TRY YOUR HAND AT TRANSLATION continued:

A SAMPLE OF TIMUCUA WORDS

Nouns	Adjectives	Verbs and Conjunctions
Plural Noun= -care (cah-reh)	all of the = -tooma (too-ma)	and = acu (ah-coo)
alligator = itori (ee-tor-ee)	disrespectful = iquibi (ee-kee-bee)	I am = hontala (hone-ta-la)
arrow = atulu (ah-too-loo)	faithful = boho (bo-ho)	It is = -no (no)
bone = yabi (yah-bee)	far away = huri (hoo-ree)	
bow = colo (co-lo)	fearless = nayuchami (na-you-cha-me)	
deer = honoso (ho-no-so)	filthy = baya (ba-ya)	
dog = efa (eh-fah)	finished = atime (ah-tee-meh)	
family = hasomi (ha-so-me)	great = yayi (ya-yee)	
fish = cuyu (coo-yoo)	happy = isaco (ee-sa-ko)	
game = hapu (ha-poo)	his / her = -si (see)	
grape = bihi (bee-hee)	hungry = hono (ho-no)	
house = paha (pa-ha)	innocent = qichi (kee-chee)	
hunt / hunter = bali (ba-lee)	mad = mahereba (ma-heh-reh-bah)	
huricane = huque (hoo-keh)	my = -na (nah)	
oyster = sicale (see-ka-leh)	pretty/handsome = tera (te-rah)	
rabbit = quelo (keh-low)	rich = talaca (ta-la-ka)	
sister = amita (ah-me-tah)	the = -ma (ma)	
teacher = quachi (kwah-chee)	your = -ye (yeh)	
trap = uqe (oo-keh)		
weir = acatala (ah-ka-ta-la)		

CHAPTER TEN
HISTORY AND THE TIMUCUA

ACTIVITY – TRY YOUR HAND AT TRANSLATION continued:

1. alligators __________
2. the weir __________
3. your dog __________
4. my fish __________
5. arrows __________
6. bow and arrows __________
7. deer hunt __________
8. fish bones __________
9. rabbit traps __________
10. women('s) house __________
11. all of the grapes __________
12. I am hungry. __________
13. I am his sister. __________
14. I am fearless and handsome. __________
15. I am your teacher. __________
16. It is a hurricane. __________
17. It is far away. __________
18. Create your own phrase. __________
19. Create your own sentence. __________
20. Translate this phrase into English: "*Mahereba chuluficare*" __________

Historical Note: Some of the priests began teaching the Spanish alphabet to Timucua villagers. In less than six months, Timucua adults learned to read and write. Why were they such motivated learners? Literacy is an incredible technology. It allows your exact words to be carried to places you cannot (or will not) go. Almost immediately, the Timucua began writing letters (in their own language) to other chiefs, Spanish governors, and even the Spanish king. They intercepted Spanish communications during the Timucua Rebellion, read the intelligence, and used this information in planning their tactics against the Spanish. Literacy isn't just technology. It's power.

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