Florida’s Ancient Oceans

An intermediate and middle school grade level unit
created by

Lisa Jap-Tjong and Sandy Small
Florida Industrial and Phosphate Research Institute
Polk County, FL
DISCLAIMER

The contents of this teaching unit are reproduced herein as received from the teachers who authored the unit. The unit has been peer-reviewed and edited in compliance with the FIPR Institute Education Program lesson plan style.

Mention of company names or products does not constitute endorsement by the Florida Industrial and Phosphate Research Institute.
Unit Summary

Dear Teachers,

This unit is designed to complement the *Kids Dig It!* traveling library fossil kit that is loaned to classroom teachers in grades 4-8 and the *Florida’s Ancient Oceans* role-play that FIPR staff facilitates in the classroom. It is recommended that teachers lead students through the pre-visit Lesson Plan 3 (on page 29), Prehistoric Portfolio Research, before FIPR staff bring materials to the classroom. Each student will be asked to share with the class a fact about a researched animal *before* FIPR staff distribute puppets to students for the role-play.

*Florida’s Ancient Oceans* is a brain-based, integrated thematic unit that can be presented over six weeks. It focuses on the changes to Florida’s sea level and habitats over 24 million years and the geological processes related to those changes. The unit also includes details about wildlife that lived during each epoch. The unit corrects a misconception of many students that dinosaurs once lived in Florida.

The unit makes it easier for students to understand geologic time and Florida’s prehistory by having the class walk beside a geologic timeline rope as a narrator reads a script describing how Florida has changed. The timeline script describes changes in climate, sea levels, habitats, and wildlife. The narrator also explains the development of phosphate, a mineral essential for life; much of this mineral was formed underwater in Florida during the Miocene Epoch.

The lesson plans in this unit are filled with engaging activities that call on students to use all their senses and higher-order thinking as they conduct and apply research in many different learning settings. All the lesson plans in the unit reflect the same kind of creativity, engaging as many learning styles and integrating as many subject areas as possible.

The *Kids Dig It!* traveling library offers ideal reinforcement for the other activities and has been very popular with Florida students and teachers for a decade. *Kids Dig It!* simulates a fossil dig, in smaller scale, with authentic fossils and matrix organized by epoch. Materials may be borrowed for up to three weeks. Materials are designed for use by six cooperative learning groups, ideally of four students per group. Each student works as a paleontologist, using scientific procedures to research and identify fossils.

Florida Industrial and Phosphate Research Institute
1855 West Main Street
Bartow, FL  33830
(863) 534-7160

©Florida Industrial and Phosphate Research Institute
Perspective

Picture a central Florida phosphate mine in the late nineteenth century. As one man holds a giant water hose and wets the side of a mine cut, other workers use pickaxes to dig out matrix and haul it away in wheelbarrows to the processing plant. During this intensive work, miners uncover impressive fossils such as entire mastodon skeletons with distinctive long, curved tusks. Over the past 130 years such finds have taught paleontologists and geologists a great deal about Florida’s prehistoric past.

Much phosphate, a mineral essential to all plant and animal life, was formed underwater in Florida during the Miocene Epoch. Phosphate cannot be reproduced in a laboratory. It must be mined and processed into a soluble form that plants and animals need. People access phosphate through food—the plants and animals we eat. Industries process phosphate primarily into agricultural products such as fertilizer and animal feed, as well as thousands of household products we use every day.

The unit Florida’s Ancient Oceans should benefit any teacher exploring Florida’s natural and geologic history since phosphate relates directly to the geological processes that shaped Florida. The marine and terrestrial fossils found in Florida tell the story of how Florida’s habitats and wildlife changed over time. Shark teeth and dugong ribs are fossils of early marine animals; camel teeth and alligator scutes are fossils of prehistoric land dwellers. All have been found in or near phosphate mines, and all bear witness to Florida’s richly diverse geologic past.

The content of the unit offers an opportunity to spiral the information across the grade levels, beginning with the 4th grade curriculum, with its focus on the state of Florida. There are opportunities for learners of all abilities and learning styles to grasp the concept of geologic time and changes over time with this brain-based, integrated, thematic approach that calls on students to use their own creativity and higher-order thinking through research and dramatic play.

FIPR’s Education Coordinator, Lisa Jap-Tjong, and Training Specialist, Dr. Sandy Small, began to develop this unit in 2003. They looked at more than 50 different shapes Florida took over 24 million years and then selected several to represent Florida’s footprint in four different epochs for the role-play Florida’s Ancient Oceans.

The script, canvas “stage,” geology presentation, and geologic timeline were reviewed for scientific accuracy by Dr. Stanley R. Riggs, Professor of Geology at East Carolina University. Florida’s Ancient Oceans has been performed at non-classroom venues, including conferences of the Florida Association of Science Teachers (FAST) and the League of Environmental Educators in Florida (LEEF), Earth Day at the Historic Bok Sanctuary, Lake Wales, as well as in classrooms throughout Florida’s Polk and Hillsborough Counties.

The unit will challenge any teacher to take students’ interaction with content to a higher level of understanding and excitement as students gain knowledge and skills that the State of Florida expects them to master.
Table of Contents

Concept Map.................................................................................................................................................. 6

Next Generation Sunshine State Standards................................................................................................. 7

Specific Objectives.......................................................................................................................................... 12

List of Activities............................................................................................................................................ 13

Unit Vocabulary.............................................................................................................................................. 14

Unit Vocabulary Definitions............................................................................................................................ 15

Lesson Plans
  1. Florida’s Changing Shape ...................................................................................................................... 18
  2. Geological Timeline Rope ..................................................................................................................... 22
  3. Prehistoric Portfolio Research............................................................................................................... 29

Cloze Sentences Activity ................................................................................................................................ 70

Prehistoric Trading Cards ............................................................................................................................ 73

List of Materials............................................................................................................................................ 75
Concept Map

Directions: Develop the web below with your students as you progress through this unit. Show it on an overhead or draw it on chart paper. Students will want to refer to it as you build on their knowledge base. Completing a concept map is an effective way to show students how much they have learned.
Next Generation Sunshine State Standards

Language Arts Benchmarks

LA.4.4.2.2 The student will record information (e.g., observations, notes, lists, charts, map labels, legends) related to a topic, including visual aids as appropriate;

LA.4.4.2.3 The student will write informational/expository essays that contain introductory, body and concluding paragraphs.

LA.4.5.2.1 The student will listen to information presented orally and show an understanding of key points.

LA.4.5.2.2 The student will plan, organize, and give an oral presentation and use appropriate voice, eye contact and body movement for the topic, audience, and occasion.

LA.4.5.2.5 The student will make formal and informal presentations for a variety of purposes, audiences, and occasions demonstrating appropriate language choices, body language, eye contact gestures, and appropriate use of available technologies.

LA.4.6.1.1 The student will read informational text and text features (e.g., format, graphics, legends, illustrations, diagrams) or organize information for different purposes (e.g., being informed, following multi-step directions, creating a report, conducting interviews, preparing to take a test, performing a task).

LA.5.2.2.3 The student will organize information to show understanding (e.g., representing main ideas within text through charting, mapping, paraphrasing, or summarizing).

LA.5.4.2.1 The student will write in a variety of informational/expository forms (e.g., summaries, procedure, instructions, experiments, rubrics, how-to manuals, assembly instructions).

LA.5.4.2.2 The student will record information (e.g., observations, notes, lists, charts, map labels, legends) related to a topic, including visual aids to organize and record information on charts, data tables, maps and graphs, as appropriate.

LA.5.4.2.3 The student will write informational/expository essays that state a thesis with a narrow focus, containing introductory, body and concluding paragraphs.

LA.5.5.1.1 The student will demonstrate fluent and legible cursive writing skills.

LA.5.5.2.1 The student will listen and speak to gain and share information for a variety of purposes, including personal interviews, dramatic and poetic recitations, and formal presentations.
LA.5.5.2.2  The student will make formal oral presentations for a variety of purposes and occasions, demonstrating appropriate language choices, body language, eye contact and the use of gestures, the use of supporting graphics (charts, illustrations, images, props), and available technologies.

LA.5.6.2.1  The student will select a topic for inquiry, formulate a search plan, and apply evaluative criteria (e.g., usefulness, validity, currentness, objectivity) to select and use appropriate resources.

LA.5.6.2.2  The student will read and record information systematically, evaluating the validity and reliability of information in text by examining several sources of information.

LA.5.6.3.2  The student will use a variety of reliable media sources to gather information effectively and to transmit information to specific audiences.

LA.5.6.4.1  The student will select and use appropriate available technologies to enhance communication and achieve a purpose (e.g., video, presentations).

LA.5.6.4.2  The student will determine and use the appropriate digital tools (e.g., word processing, multimedia authoring, web tools, graphic organizers) for publishing and presenting a topic.

LA.6.2.2.3  The student will organize information to show understanding (e.g., representing main ideas within text through charting, mapping, paraphrasing, summarizing, or comparing/contrasting).

LA.6.4.2.1  The student will write in a variety of information/expository forms (e.g., summaries, procedures, instructions, experiments, rubrics, how-to manuals, assembly instructions).

LA.6.4.2.2  The student will record information (e.g., observations, notes, lists, charts, legends) related to a topic, including visual aids to organize and record information and include a list of sources used.

LA.6.4.2.3  The student will write informational/expository essays (e.g., process, description, explanation, comparison/contrast, problem/solution) that include a thesis statement, supporting details, and introductory, body and concluding paragraphs.

LA.6.5.1.1  The student will use fluent and legible handwriting skills.

LA.6.5.2.1  The student will listen and gain information for variety of purposes, (e.g., clarifying, elaborating, summarizing main ideas and supporting details).
LA.6.5.2.2 The student will deliver narrative and informative presentations, including oral responses to literature, and adjust oral language, body language, eye contact, gestures, technology and supporting graphics appropriate to the situation.

LA.6.6.2.1 The student will select a topic for inquiry, formulate a search plan, and apply evaluative criteria (e.g., relevance, accuracy, organization, validity, currentness) to select and use appropriate resources.

LA.6.6.2.2 The student will collect, evaluate and summarize information using a variety of techniques from multiple sources (e.g., encyclopedias, websites, experts) that includes paraphrasing to convey ideas and details from the source, main idea(s) and relevant details.

LA.6.6.4.2 The student will determine and apply digital tools (e.g., word processing, multimedia authoring, web tools, graphic organizers) to publications and presentations.

LA.7.2.2.3 The student will organize information to show understanding (e.g., representing main ideas within text through charting, mapping, paraphrasing, summarizing, or comparing/contrasting).

LA.7.4.2.1 The student will write in a variety of informational/expository forms (e.g., summaries, procedures, instructions, experiments, rubrics, how-to manuals, assembly instructions).

LA.7.4.2.2 The student will record information (e.g., observations, notes, lists, charts, legends) related to a topic, including visual aids to organize and record information, as appropriate, and attribute source of information.

LA.7.4.2.3 The student will write specialized informational/expository essays (process, description, explanation, comparison/contrast, problem/solution) that include a thesis statement, supporting details, an organizational structure particular to its type, and introductory, body and concluding paragraphs.

LA.7.5.1.1 The student will use fluent and legible handwriting skills.

LA.7.5.2.3 The student will organize and effectively deliver speeches to entertain, inform and persuade, demonstrating appropriate language choices, body language, eye contact, gestures, and the use of supporting graphics and technology.

LA.7.6.2.1 The student will select a topic, develop a prioritized search plan, and apply evaluative criteria (e.g., relevance, objectivity, scope of content in print and online sources) to select appropriate resources for research.
LA.7.6.4.2 The student will evaluate and apply digital tools (e.g., word processing, multimedia authoring, web tools, graphic organizers) to publications and presentations.

LA.8.4.2.1 The student will write in a variety of informational/expository forms (e.g., summaries, procedures, instructions, experiments, rubrics, how-to manuals, assembly instructions).

LA.8.4.2.3 The student will write specialized informational/expository essays (process, description, explanation, comparison/contrast, problem/solution) that include a thesis statement, supporting details, an organizational structure particular to its type, and introductory, body and concluding paragraphs.

LA.8.5.2.1 The student will demonstrate effective listening skills and behaviors for a variety of purposes, and demonstrate understanding by paraphrasing and/or summarizing.

LA.8.6.2.2 The student will assess, organize, synthesize, and evaluate the validity and reliability of information in text, using a variety of techniques by examining several sources of information, including both primary and secondary sources.

Science Benchmarks

SC.4.E.6.3 Recognize that humans need resources found on Earth and that these are either renewable or nonrenewable.

SC.4.E.6.5 Investigate how technology and tools help to extend the ability of humans to observe very small things and very large things.

SC.4.E.6.6 Identify resources available in Florida (water, phosphate, oil, limestone, silicon, wind and solar energy).

SC.4.L.16.2 Explain that although characteristics of plants and animals are inherited, some characteristics can be affected by the environment.

SC.4.L.16.3 Recognize that animal behaviors may be shaped by heredity and learning.

SC.4.N.2.1 Explain that science focuses solely on the natural world.

SC.4.N.3.1 Explain that models can be three dimensional, two dimensional, an explanation in your mind, or a computer model.

SC.5.L.15.1 Describe how, when the environment changes, differences between individuals allow some plants and animals to survive and reproduce while others die or move to new locations.

SC.5.L.17.1 Compare and contrast adaptations displayed by animals and plants that enable them to survive in different environments such as life cycles variations, animal
behaviors and physical characteristics.

SC.6.E.6.1 Describe and give examples of ways in which Earth’s surface is built up and torn down by physical and chemical weathering, erosion, and deposition.

SC.6.E.6.2 Recognize that there are a variety of different landforms on Earth’s surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida.

SC.6.N.3.1 Recognize and explain that a scientific theory is a well-supported and widely accepted explanation of nature and is not simply a claim posed by an individual. Thus, the use of the term theory in science is very different than how it is used in everyday life.

SC.6.N.3.4 Identify the role of models in the context of sixth-grade benchmarks.

SC.7.E.6.4 Explain and give examples of how physical evidence supports scientific theories that Earth has evolved over geologic time due to natural processes.

SC.7.L.15.1 Recognize that fossil evidence is consistent with the scientific theory of evolution that living things evolved from earlier species.

SC.7.L.15.2 Explore the scientific theory of evolution by recognizing and explaining ways in which genetic variation and environmental factors contribute to natural selection and diversity of organisms.

SC.7.L.15.3 Explore the scientific theory of evolution by relating how the inability of species to adapt within a changing environment may contribute to the extinction of that species.

Social Studies Benchmarks
SS.4.A.9.1 Utilize timelines to sequence key events in Florida history.

SS.4.G.1.1 Identify physical features of Florida.

SS.4.G.1.3 Explain how weather impacts Florida.

SS.5.G.1.4 Construct maps, charts, and graphs to display geographic information.

SS.6.W.1.1 Use timelines to identify chronological order of historical events.

SS.6.W.1.2 Identify terms (decade, century, epoch, era, millennium, BC/BCE, AD/CE) and designations of time periods.
Specific Objectives

The students will...

1. Recognize changes in Florida’s land mass.
2. Understand that changes occurred over millions of years.
3. Know the natural forces that affected change.
4. Understand the concept of geologic time.
5. Explain Florida in relation to the geologic timescale.
6. Describe, in writing, changes in Florida over geologic time.
7. Research a prehistoric (or modern) animal and record their findings.
8. Record their sources of information for research of animal.
9. Compare information from several research sources and assess which information is credible and relevant.
10. Give an oral presentation about the animal they researched.
11. Participate in the *Florida’s Ancient Oceans* role-play by acting the part of their animal in the correct epoch and using actions to reflect their research into the animal’s habitat and behavior.
12. Participate in a simulated fossil dig.
List of Activities

Lesson 1: Florida’s Changing Shape
   Changes in Florida Over Time ................................................................. 19
   *Mini Make and Take* model ................................................................. 21

Lesson 2: Geological Timeline Rope
   Venn Diagram Comparing two Epochs in the Cenozoic Era ................. 24
   Script for Walking the Timeline ......................................................... 26

Lesson 3: Prehistoric Portfolio Research
   Research a Prehistoric Animal ............................................................ 33
   *Animal Research Record* Worksheet .................................................. 35
   List of Animals for Research ............................................................... 36
   Information Sheets on each Animal ..................................................... 37

Optional Activities – FIPR Institute Traveling Library
   *Florida’s Ancient Oceans* Role-Play .................................................... 31
   *Kids Dig It!* Fossil Dig .................................................................. 31

Cloze Sentences Activity ................................................................. 70
   Cloze Sentences Activity Key ............................................................. 72

Prehistoric Trading Cards ................................................................. 73
## Unit Vocabulary

<table>
<thead>
<tr>
<th>Term</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ancestor</td>
<td>Holocene Epoch</td>
</tr>
<tr>
<td>Appearance</td>
<td>Ice Age</td>
</tr>
<tr>
<td>Behavior</td>
<td>Jurassic Period</td>
</tr>
<tr>
<td>Carnivore</td>
<td>Miocene Epoch</td>
</tr>
<tr>
<td>Cretaceous Period</td>
<td>Oligocene Epoch</td>
</tr>
<tr>
<td>Eocene Epoch</td>
<td>Omnivore</td>
</tr>
<tr>
<td>Epoch</td>
<td>Paleocene Epoch</td>
</tr>
<tr>
<td>Era</td>
<td>Paleontologist</td>
</tr>
<tr>
<td>Erosion</td>
<td>Period</td>
</tr>
<tr>
<td>Evidence</td>
<td>Peninsula</td>
</tr>
<tr>
<td>Extinct</td>
<td>Phosphate</td>
</tr>
<tr>
<td>Florida Platform</td>
<td>Pleistocene Epoch</td>
</tr>
<tr>
<td>Fossils</td>
<td>Pliocene Epoch</td>
</tr>
<tr>
<td>Geologist</td>
<td>Relatives</td>
</tr>
<tr>
<td>Glaciers</td>
<td>Sediment</td>
</tr>
<tr>
<td>Global cycles</td>
<td>Theory</td>
</tr>
<tr>
<td>Gulf Trough</td>
<td>Timeline</td>
</tr>
<tr>
<td>Habitat</td>
<td>Upwelling</td>
</tr>
<tr>
<td>Herbivore</td>
<td></td>
</tr>
</tbody>
</table>
Unit Vocabulary Definitions

Ancestor: An animal or plant linked genetically to a later-living animal or plant in a line of direct descent. (Usually, an ancestor is a forebears more than two generations removed, i.e., more remote in time than a grandparent.)

Appearance: Visible characteristics of an organism or object.

Behavior: An organism’s actions and reactions within its environment in response to stimuli.

Cretaceous Period: The third and last period of the Mesozoic Era of geological time from 141 to 65 million years ago.

Carnivore: An organism that consumes other consumers.

Eocene Epoch: The second epoch of the Paleogene Period of geological time lasting from 54 to 38 million years ago. The Eocene Epoch marked the appearance of modern mammals.

Epoch: The smallest division of geologic time, a subdivision of the Tertiary or Quaternary periods only. (Examples include the Miocene, Pliocene, Pleistocene, and Holocene Epochs.)

Era: A major division of geological time (shorter than an eon, longer than a period) that lasts several hundred million years.

Erosion: The wearing away of weathered Earth’s surface by the breakdown and transportation of rock and soil.

Evidence: That which tends to prove or disprove something; ground for belief; proof.

Extinct: No longer living; describing a species that has died out without leaving any living offspring.

Florida Platform: The base on which the Florida land mass rests. The platform is composed of limestone, formed of the calcium carbonate deposited by shelled marine animals. The platform is congruent with Florida’s east coast but extends farther into the Gulf of Mexico than Florida’s current west coast.

Fossils: A whole or part of an organism that has been preserved in sedimentary rock. The most common types of fossils are bones, teeth, molds, casts, petrified wood, and carbon films.

Geologist: A scientist who studies Earth’s origin, history, and structure, including the rocks and minerals found in Earth’s crust.

Glaciers: A huge mass of ice slowly flowing over a land mass, formed from compacted snow in an area where snow accumulation exceeds melting and
sublimation.

**Global cycles:** The periodic warming and cooling of the Earth on a global scale that happens naturally over long periods of subtle change (also known as Climatic Cycles.)

**Gulf trough:** The elongated sedimentary depression that separated the Florida Platform from early Tertiary North America. *Synonym:* Ditch.

**Habitat:** A place in an ecosystem where an organism normally lives.

**Herbivore:** An organism that consumes producers.

**Holocene Epoch:** The current epoch of geological time, lasting from 10,000 years ago to the present.

**Ice Age:** Long periods of climatic cooling during which ice sheets cover large areas of the earth's surface.

**Jurassic Period:** A period of the Mesozoic Epoch, occurring from 190 to 140 million years ago and characterized by an abundance of dinosaurs and the advent of birds and mammals.

**Miocene Epoch:** The fourth epoch in the Cenozoic era of geological time, lasting from approximately 24 to 5 million years ago.

**Oligocene Epoch:** The third epoch in the Cenozoic era of geological time, lasting from 38 to 24 million years ago.

**Omnivore:** An organism that eats a variety of other organisms, including animals and plants. Eats both producers and consumers.

**Paleocene Epoch:** The first epoch in the Cenozoic era of geological time, lasting from 65 to 54 million years ago.

**Paleontologist:** A scientist who studies prehistoric life. The science of paleontology includes the study of fossils and geochemical evidence to try to explain life from its beginnings on the Earth.

**Peninsula:** An area of land almost completely surrounded by water, except for an isthmus connecting it with the mainland.

**Period:** A subdivision of a geologic era.

**Phosphate:** A class of mineral that is the only known source of the element phosphorus. Phosphate is a nutrient that all living things need to survive and grow. Phosphate rock, which cannot be dissolved in water, is mined to be used as a raw material in fertilizers and animal feeds. The resulting final product is a form of phosphate that is water-soluble and usable by plants and animals.
Pleistocene Epoch: The sixth epoch of the Cenozoic era in geological time lasting from approximately 1.8 million to 10,000 years ago; characterized by glacial events.

Pliocene Epoch: The fifth epoch of the Cenozoic era in geological time lasting form approximately 5 to 1.8 million years.

Relative: An organism connected to another organism genetically. A relative may be an ancestor, a descendant (inheriting genes from an ancestor), or a brother, sister, or cousin (sharing kinship through a common ancestor).

Sediment: Fragments that result from the breaking of rocks, minerals, and organic matter.

Theory: A set of statements or principles devised to explain a group of facts or phenomena, especially one that has been repeatedly tested or is widely accepted and can be used to make predictions about natural phenomena.

Timeline: A chart or table presenting dates and events in chronological order. A timeline may include illustrations and summaries.

Upwelling: A process in which cold, often nutrient-rich waters from the ocean depths rise to the surface. In the Miocene Epoch, upwelling contributed to the formation of phosphate.
Lesson 1: Florida’s Changing Shape
Author: Lisa Jap-Tjong

Introduction:
For much of its history, Florida was underwater. At first, Florida consisted solely of the Florida Platform, a limestone base formed from the calcium carbonate remains of shelled marine animals. Though the Appalachian Mountains began to erode 65 million to 24 million years ago, and rivers carried this debris south, at first it could not be deposited because of swift currents in the Gulf Trough that separated the platform from the rest of North America. Later, currents changed and sediment filled the trough. By the late Oligocene Epoch, Florida emerged as a small peninsula atop the platform.

The Miocene Epoch lasted for 19 million years, from 24 million to 5 million years ago. It was notable for several reasons. Florida in the Miocene Epoch was home to both marine and land animals; in fact, a greater variety of animals lived on land in the Miocene than at any other time. This epoch was also notable for the formation of large amounts of phosphate in the oceans. There were many shifts in sea level, in response to polar freezes and thaws. When sea levels were high, organic material settled on the ocean floor and was moved toward the surface by upwelling currents. Marine animals in shallower water ate these wastes and added to them; the new waste material was deposited on top of underwater plateaus in the shallows. When seawater could no longer hold this compound in solution, it precipitated out. When sea levels were low, this material was reworked through weathering. Carbon was washed away; what remained was fluorapatite, or the phosphate rock that is mined today.

During the Pliocene Epoch, from 5 million to 1.8 million years ago, Florida was often submerged in shallow seas. At times Florida consisted of a few islands. At other times, Florida was a peninsula that extended as far south as today’s Bradenton. Most, but not all, of the Pliocene fossils that are found in Florida are of marine animals.

The Pleistocene Epoch, which lasted from 1.8 million years ago to 10,000 years ago, is sometimes called the “Ice Age,” though this epoch featured a variation in climates, also. When glaciers melted, sea levels rose and the Florida climate became more humid. During dry periods, sediments that had been carried by ocean currents and deposited to form islands, became sand ridges, such as the Lake Wales Ridge. During cooling cycles, as glaciers advanced, sea levels fell and at times Florida expanded to roughly twice its current width. Expansion of Earth’s land mass made it easier for many large land animals to migrate into Florida from the north (over the Bering Land Bridge from Asia) and from Central and South America.

This activity will show how Florida changed over time, from the Oligocene Epoch to the present, and assumed its current location and shape.

As the Pleistocene ended and the Holocene Epoch began, the climate grew warmer, sea levels rose, and Florida began to take its current shape.
Activity:
Students will listen as the teacher reads a story describing changes in Florida over time. As the story is being read, whenever a change is indicated, students will place paper cut-outs of the different shapes of Florida on a piece of blue construction paper (the ocean base).

Estimated Time:
One 45-minute class period

Grade Level:
Grades: 4-8

Standards:
LA.4.4.2.3 LA.4.5.2.1 SC.4.E.6.3 SC.4.E.6.5 SC.4.E.6.6 SS.4.A.9.1
SS.4.G.1.1 SS.4.G.1.3
LA.5.4.2.1 LA.5.4.2.3 LA.5.5.1.1 SS.5.G.1.4
LA.6.2.2.3 LA.6.4.2.1 LA.6.4.2.3 LA.6.5.1.1 LA.6.5.2.1 LA.5.2.2.3
LA.7.2.2.3 LA.7.4.2.1 LA.7.4.2.3 LA.7.5.1.1 SC.7.E.6.4 SC.7.L.15.1
LA.8.4.2.1 LA.8.4.2.3 LA.8.5.2.1

Objectives:
The students will...
1. Recognize changes in Florida’s land mass.
2. Understand that changes occurred over time.
3. Know natural forces that affected change.

Vocabulary:
epoch era
sediment peninsula
Florida platform erosion
upwelling phosphate
glaciers Ice Age
habitat fossils

Materials:
Double-stick tape
Scissors
Blue construction paper
*Mini Make & Take, #01-B template*

Procedure:
1. Before presenting the story, the teacher distributes the *Mini Make & Take* template and allows students time to cut out all the shapes and place tape on the back side of each piece. (Regular one-sided tape may be rolled in half, to substitute for double-stick tape.)
2. The teacher will move the pieces onto or on the base as they narrate the story of how Florida
changed over time.
3. The teacher will demonstrate the placement of the “Florida” shapes first and then have the students place the shapes as the teacher narrates the script the second time.
4. The teacher holds up the ocean base and explains, “For most of its history, Florida was covered by sea water.”
5. The teacher will attach the north Florida fringe only. The teacher continues, “Gradually, sediments that eroded from the Appalachian Mountains settled in North Florida. In time, these sediments extended southward to form a small peninsula.”
6. The teacher will attach the island cutout (the north Florida fringe is still on the base). The teacher continues, “Later, when polar ice melted and seas were high, Florida consisted of islands at the center of the state and a fringe of land in north Florida. At this time, an important mineral, phosphate, was formed underwater, in the shallows of oceans covering part of the peninsula.”
7. The teacher will remove the north Florida fringe and island cutouts and attach the “wide Florida” cutout to the ocean base. The teacher notes, “When glaciers advanced and sea levels were low, during the Pleistocene Epoch, known as the Ice Age, much more land was exposed. At times, during dry years, Florida extended much farther into the Gulf of Mexico, and was twice as wide as it is today. It was a shorter trip for animals from South and Central America and western north America to reach this wider Florida peninsula.”
8. The teacher removes the “wide Florida” cutout and attach the “modern-day Florida” cutout. The teacher notes, “As the climate grew warmer and the glaciers melted, sea levels rose, and Florida took the shape it has today, in the Holocene (or Modern) Epoch.
9. Now as the teacher reads the script for the second time, the students are instructed to arrange pieces on the ocean base in the correct sequence, starting with Step 4. The teacher should make sure students demonstrate understanding by displaying the ocean base alone or correct shape or shapes on the base at each point in the story.

Analysis/Conclusion:
1. Students correctly choose the Florida shape to match text being read by the teacher.
2. Have students write a short essay describing how Florida changed over time. The essay should also include information about changes in sea levels and climate as Florida’s coastal shape changed.

Extension:
In their own words and using their own materials (Florida shapes cutouts and ocean base), students tell the story to their parents.

Teacher Notes:
Make one copy per student of the Mini Make & Take, #01-B template
Prepare one example of the model for demonstration purposes
Mini-Make and Take, #01-B
Florida’s Changing Shape:
Florida templates

Cut out these shapes for placing on the blue 8 1/2 x 11” poster board. Place Velcro on the base and on the green shapes as the lesson plan directs.

“Wide” Florida (during the Pleistocene Epoch)

©FLORIDA INDUSTRIAL AND PHOSPHATE RESEARCH INSTITUTE
Introduction:
Earth is estimated to be over 400 million years old. Life on the planet evolved from early stages in the Paleozoic Era (when invertebrates were the life form), through the Mesozoic “middle life” Era, to the emergence of humans and other mammals during the Cenozoic Era. Scientists divide Earth’s past into distinct periods, according to the types of fossils and rocks characteristic of each. A chronological list of these different time spans is known as the geologic time scale.

Eras are divided into periods, and periods are divided into epochs; epochs are divided into stages. Some of these time spans lasted for millions of years. Scientists can estimate dates by measuring the quantity of radioactivity that remains in rocks. In order to describe our own time, we would say we live in the Phanerozoic Eon, the Cenozoic Era, Quaternary Period, and Holocene Epoch.

During the Paleocene Epoch, the supercontinent Pangaea was breaking up and its seven constituent continents began the shift toward their current positions. Some land broke from Africa and migrated north and west to a point south of today’s state of Georgia. It took the form of an underwater structure called the Florida Platform, built up from limestone formed of calcium carbonate (shell material, from marine organisms). Late in the Oligocene Epoch, the Gulf Trough that separated this underwater platform from North America filled with sediment from the eroding Appalachian Mountains. Eventually, when climates were dry, the Florida land mass appeared above sea level, sometimes as islands, sometimes as a small peninsula.

When the climate warmed in the Miocene Epoch, sea levels rose. A combination of upwelling currents, uneven underwater topography, low-oxygenated seawater, and an abundance of decaying sea life provided ideal conditions for the formation of phosphate. When seawater could no longer hold all the wastes in solution, phosphorus ions were precipitated out in the form of francolite. Ocean currents washed away carbon; today, on dry land, miners dig 30 or more feet down to reach the phosphate that was laid down during the Miocene Epoch.

During the Pliocene Epoch, from 5 million to 1.8 million years ago, Florida was often completely submerged in shallow oceans. At other times, when sea levels fell, Florida was a peninsula that reached as far south as today’s Bradenton.

The Pleistocene Epoch, 1.8 million to 10,000 years ago, was a time of extreme climate changes. There were four major glaciations, during which glaciers advanced, many rivers froze, and sea levels declined significantly. At times, Florida became twice as wide as it is today. Animals crossed from Asia to North America over a land bridge in the Bering Straits, and it also became easier for animals to migrate from Central and South America to a wider Florida. The Pleistocene Epoch was the time of large land animals, such as the mammoth and giant sloth, as well as the coming of paleo-man to the Florida peninsula.

For the past 10,000 years, Earth has experienced warmer climates and higher sea levels. In the Holocene Epoch Florida provided habitat to small mammals, such as rabbits and raccoons. This epoch has also seen the development of diverse human cultures by paleo-man’s descendant, modern man.
Students will understand the concept of geologic time and Florida’s correlation to the geologic time scale from the Jurassic Period to the Holocene Epoch, and through the rise and fall of sea levels that resulted from global cycles of melting and freezing.

Students should be familiar with the concept of time and chronological order. The previous lesson introduced them to the concept that Florida has changed over time.

Activity:
Students will walk beside a 100-foot rope that is marked to represent geologic time from the Jurassic Period to the Holocene Epoch. Students will stop at different points along the rope to hear the teacher narrate how Florida changed during each epoch. This activity will show how Florida changed over time, from the Oligocene Epoch to the present, and assumed its current location and shape.

Estimated Time:
One 45-minute class period

Grade Level:
4-8

Standards:
SS.4.A.9.1
LA.5.2.2.3 LA.5.5.1.1
LA.6.5.1.1 SC.6.N.3.4 SS.6.W.1.1 SS.6.W.1.2
LA.7.5.1.1 SC.7.E.6.4

Objectives:
The students will..
1. Understand the concept of geologic time.
2. Explain where Florida is positioned on the geologic timescale.
3. Describe, in writing, changes in Florida over time.

Vocabulary:
geologist              timeline
glacier                global cycles
Gulf trough            paleontologist
era                    period
epoch                  extinct
Jurassic Period        Cretaceous Period
Paleocene Epoch        Eocene Epoch
Oligocene Epoch        Pliocene Epoch
Miocene Epoch          Pleistocene Epoch
Holocene Epoch
Materials:
One 100-foot rope
Masking tape to mark time divisions
Markers
Florida shapes from Lesson 2 (Mini Make & Take, #01-B template)
Four sheets of blue construction paper

Procedure:
1. In a hallway or another lengthy space, such as a schoolyard or an unused parking lot or athletic field, unroll the entire timeline rope so that it lies flat. (If the only space available for this activity is square, such as a portion of the school cafeteria, arrange the rope in several turns so that the class will be able to “walk” the timeline’s entire length.)
2. Distribute signs/cutouts/blank blue sheets to 18 students or classroom volunteers, as follows:
   a. Nine students will receive one period or epoch sign each; Jurassic Period, Cretaceous Period, Paleocene Epoch, Eocene Epoch, Oligocene Epoch, Miocene Epoch, Pliocene Epoch, Pleistocene Epoch, Holocene Epoch.
   b. Four students will receive one of the Florida shape cutouts from Lesson 1.
   c. Five students will each receive a blank sheet of blue construction paper to indicate times when Florida was underwater.
3. Instruct sign-holders that when the class reaches each marked point on the timeline rope, one of them will come to the marked point and hold up a card while the teacher reads the script describing that point in geologic time. After their part has been read, each card-holder will place the card beside the timeline along with any illustrations.
4. All students will proceed single file to each point in the timeline. At each marked point, the teacher reads the label/time caption aloud and then asks the student holding the shape representing Florida in that epoch, or the blue ocean sheet, to come to the front of the line and display that graphic as a portion of the script is read.
5. Continue this process until the class has walked the entire timeline. Invite the class to look at representations of all the changes in Florida in just the past 200 million years. Ask students to compare those changes to the changes Earth went through in 450 million years.
6. To put the timeline rope in perspective, stress that to simplify the activity, we have started in the Jurassic period. In order to understand Earth’s entire history, they would have to stretch 24 ropes before this one to represent Earth’s history prior to the Jurassic Period!

Analysis/Conclusion:
Quiz the students by calling out an epoch or geological time and have them hold up the “Florida Shape” that corresponds. Or hold up the shape and have the students tell you the epoch or corresponding geological time.

Extension:
Create a Venn Diagram comparing two of the epochs of the Cenozoic Era.

Teacher Notes:
Make one sign naming each period or epoch listed below (eight signs)
Photocopy the geologic timeline and distribute one copy to each student.
Timeline rope:
At a scale of one foot = 2 million years, prepare a 100-foot rope to represent 200 million years, the span of time on Earth from the beginning of the Jurassic Period to the present. Mark each point on the rope as indicated below and label each point with tape.

Mark the first end of the rope: Jurassic Period, began 195 to 208 million years ago

Mark the other end of the rope: Holocene Epoch—Present to 10,000 years ago

Measure 28 feet from the Jurassic Period end of the rope: Cretaceous Period begins, 141 million years ago

Measure 33 feet from the Holocene Epoch end of the rope: Paleocene Period begins, 66 million years ago

Measure 29 feet from the Holocene Epoch end of the rope: Eocene Period begins, 57 million years ago

Measure 18 feet from the Holocene Epoch end of rope: Oligocene Epoch begins, 36.6 million years ago

Measure 12 feet from the Holocene Epoch end of rope: Miocene Epoch begins, 24 million years ago

Measure 2 feet, 6 inches from the Holocene Epoch end of rope: Pliocene Epoch begins, 5 million years ago

Measure 11 inches from second end of rope: Pleistocene Epoch begins, 1.8 million years ago

Note: In order to show the breakup of Pangaea and the movement of continents during the Paleocene Epoch, the teacher may wish to enlarge the picture given on the geologic timeline sheet and glue it to a sheet of blue construction paper.

Sources:
http://www.dinosaurisle.com/timeline.aspx
Script for Timeline Rope Markers
Author: Lisa Jap-Tjong

1. Have a student with a piece of blue construction paper and the student with the Jurassic Period sign hold them high so that everyone in the class can see them. Say, “To represent the geologic time before this point, imagine 24 additional ropes laid in front of this rope, to represent all of Earth’s 460 million-year history. We begin our journey through geologic time at the Jurassic Period. The supercontinent, Pangaea, was breaking up into the seven continents we know today.” Ask students to name the continents. You should get these responses: Africa, Antarctica, Asia, Australia, Europe, North America, and South America. Have the students lay down their sheets of paper at the beginning of the timeline rope. The class will walk single file beside the timeline rope to the next marker.

2. Have another student with a piece of blue construction paper and the student with the Cretaceous Period sign hold them high so that everyone in the class can see them. Say, “During the Cretaceous Period, the land that would become Florida was still a part of the continent of Africa. The end of the Cretaceous Period marked the extinction of the dinosaurs and many other land animals.” Have the student lay the blue sheet by the timeline rope. The class continues to the next marker on the timeline.

3. Have another student with a piece of blue construction paper and the student with the Paleocene Epoch sign hold them high so that everyone in the class can see them. Say, “During the Paleocene Epoch, the land that would become Florida broke away from the continent of Africa but lay underwater. After the breakup of Pangaea the continents were slowly moving toward their current locations.” Have the student lay the blue sheet by the timeline rope. The class continues to the next marker on the timeline.

4. Have another student with a piece of blue construction paper and the student with the Eocene Epoch sign hold them up high so that everyone in the class can see them. Say, “In the Eocene Epoch, the continents reached the locations they are in today. Florida took shape as a limestone platform made from calcium carbonate, the shells left by marine organisms. The Florida Platform was under water.” The students lay down their signs and the class walks to the next marker on the timeline.

5. At this point, the students with the Northern Florida Fringe shape and the Oligocene Epoch sign will hold them up high so everyone in the class can see them. Say, “During the Oligocene Epoch, Florida was a limestone embankment. The Appalachian Mountains were eroding, but a strong current across the Gulf Trough prevented these sediments from being deposited. Florida began to emerge in the late Oligocene Epoch and the early Miocene Epoch when the Gulf Trough filled with sand, silt, and clay from the Appalachians, and a peninsula developed.” The class continues to the next marker on the timeline.

6. Have the students with the Florida Islands shape and the Miocene Epoch sign hold them up high so everyone in the class can see them. Say, “During the Miocene Epoch, 24 million to 5 million years ago, animals such as the three-toed horse and rhinoceros lived on the Florida plains. In the oceans swam the megalodon shark and dugong. Seventeen to 15 million years ago, as the climate warmed, sea levels rose. Much of central Florida was underwater. Upwelling currents, low-oxygenated water, and an abundance of decaying sea life all contributed to the formation of vast deposits of phosphate, formed when wastes precipitated out of seawater. Today this phosphate is mined in Florida and is used to manufacture fertilizer that improves plant growth.” The class walks to the next marker.
7. The last student with the blue construction paper and the student with the Pliocene Epoch sign hold them up high so everyone in the class can see them. Say, “During the Pliocene Epoch, from 5 million to 1.8 million years ago, Florida was often completely covered by shallow water. The spiny jewel box, star coral, sand dollar and oyster thrived in this environment. The huge megalodon still swam in Florida waters.” The students places their blue sheet and epoch sign beside the rope, and the class continues to walk to the next point on the timeline.

8. Have the students with the “wide” Florida shape and the one with the Pleistocene Epoch sign hold them up high so everyone in the class can see them. Say, “The Pleistocene Epoch, sometimes called the ‘Ice Age,’ took place between 1.8 million and 10,000 years ago. When Earth cooled, glaciers expanded, and some rivers that once fed into the oceans froze, dramatically lowering sea levels and exposing much more land. A Bering land bridge linked Asia with North America. Florida expanded to twice its current width. Mammoths, mastodons, giant sloths, bison and other large land animals found ample habitat in Florida. So did another newcomer, paleo-man.” The students lay down their “wide Florida” cutout and epoch sign. Students walk to the final marker.

9. The students with the “modern” Florida shape and the Holocene Epoch sign hold them up high so everyone in the class can see them. Say, “After the last big chill of the Pleistocene Epoch, the climate warmed and sea levels rose. As oceans encroached on their habitat, many large land animals died out. We have now reached our own time, the Holocene or modern Epoch, characterized by rising sea levels, small mammals, and the dominant presence of modern man, an organism so adaptable he can help shape his environment.”
Florida and Geological Time

Florida’s Ancient Oceans
Introduction:
Florida has been part of the continent of North America for only 200 million years. During the Miocene Epoch, many species of animals lived in Florida habitats. Land animals included the three-toed horse and rhinoceros. In oceans swam the megalodon shark, mako shark, gavialosuchus (a large marine crocodile), and stingray. In the shallows swam the dugong, a mammal related to today’s manatee. Gradually, climate changes late in the Miocene Epoch forced the extinction of many land animals. Cold and drought destroyed forests. Animals that did not adapt or move to other habitats died out. As the climate cooled, sea levels fell.

This freeze continued into the Pliocene Epoch. At this point, Florida was a bit smaller than the current perimeter of the state. During the Pliocene Epoch, 5 million to 1.8 million years ago, Florida was often underwater. Sea creatures that flourished in the Pliocene Epoch included the sand dollar, scallop, spiny jewel box, and star coral. At times during the Pliocene, seas receded and there was room on the peninsula for such animals as the six-horned pronghorn, which resembled today’s antelope, and a large walrus that thrived on scallops in Lake Okeechobee, then an inland sea. Later, the climate again grew much warmer. Toward the end of the Pliocene Epoch, the Earth cooled and changed the habitat of marine animals.

During the Pleistocene Epoch, from 1.8 million years ago to 10,000 years ago, Florida underwent many changes. Sometimes sea levels were high, the climate was humid, and the only land was a group of islands. Sometimes sea levels were low and the climate turned much drier. The Pleistocene Epoch is sometimes called the Ice Age because of its four great glacial periods. When glaciers advanced, rivers froze over, sea levels fell, and Florida expanded to roughly twice its current width. Around 10,000 years ago, man came to the peninsula. Then the climate grew warmer. Glaciers melted, sea levels rose, and Florida became more humid. The large land animals became extinct. Several explanations have been offered for this extinction, including man’s skill at hunting, changes in climate and habitat, and exposure to new diseases. Paleo-man was what scientists call “modern.” He was able to adapt to changes in the environment and did not become extinct.

During the Holocene or Modern Epoch, sea levels have been rising. One reason is the natural cycle, independent of man, in which polar ice caps and glaciers melt and sea levels rise. Another reason for rising sea levels is the increase in global temperature that has resulted since mankind began burning more fossil fuels, with an impact on Earth’s atmosphere.

This lesson introduces the wide variety of wildlife that lived in Florida during the past 24 million years as global climate cycles caused fluctuations in sea levels that in turn changed habitats.

Activity:
Each student will research an animal that lived in the Miocene, Pliocene, Pleistocene, or Holocene Epoch and will present information orally to the class. During role-play using tarps, movement, and puppets, students re-enact how Florida has changed over 24 million years. Students should be familiar with reference books and note-taking strategies and be able to read text for main idea and supporting details.
Estimated Time:
Six 50-minute class periods

Grade Level:
4-8

Standards:
LA.4.4.2.2 LA.4.5.2.1 LA.4.5.2.2 LA.4.5.2.5 LA.4.6.1.1 SC.4.L.16.2
SC.4.L.16.3
LA.5.4.2.2 LA.5.5.1.1 LA.5.5.2.1 LA.5.5.2.2 LA.5.6.2.1 LA.5.6.2.2
LA.5.6.3.2 LA.5.6.4.1 LA.5.6.4.2 SC.5.L.15.1 SC.5.L.17.1
LA.6.2.2.3 LA.6.4.2.2 LA.6.5.1.1 LA.6.5.2.2 LA.6.6.2.1 LA.6.6.2.2
LA.6.6.4.2 SC.6.N.3.1 SC.6.N.3.4 SS.6.W.1.2
LA.7.2.2.3 LA.7.4.2.2 LA.7.5.1.1 LA.7.5.2.3 LA.7.6.2.1 LA.7.6.4.2
SC.7.L.15.1 SC.7.L.15.2 SC.7.L.15.3
LA.8.6.6.2

Objectives:
The students will…
1. Research a prehistoric animal and record their findings and sources of information.
2. Compare information from several research sources and assess which information is credible and relevant.
3. Give a five-minute oral presentation about the animals they researched.
4. Participate in the Florida’s Ancient Oceans role-play by acting the part of the researched animal in the correct epoch, using appropriate actions that reflect research into animal habitat and behavior.
5. Participate in Kids Dig It!, a simulated fossil dig.

Vocabulary:
appearance habitat
behavior timeline
time line evidence
ancestor relatives
phosphate omnivore
carnivore herbivore

Materials:
Paper
Pencils
Reference books
Animal Research Record worksheets
Student Project Directions sheet
Animal Facts sheets
Manila file folders (optional)
Crayons  
Stapler  
Map of Florida  
Internet access  
Old newspapers

**Procedure:**

**Days 1-2**

1. Inform students that Florida did not always look like it does now. It has had many habitats and different animals. Show the map of Florida and point out key features, such as the Lake Wales Ridge and Lake Okeechobee. Explain that these were major habitats in prehistoric Florida for unique wildlife that inhabited Florida for only a limited period of time.

2. Tell students they will be learning about prehistoric (and some modern) animals through their own research. Assign (or allow each student to choose) an animal to research. (The role-play features 32 animals representing the four epochs.)

3. Each student will need the *Student Project Directions*, an *Animal Research Record* worksheet, and a manila file folder. Have students staple their record sheet inside the manila folder.

4. Discuss the expectations listed on the student *Animal Research Record* worksheet. Review the record worksheet and make sure students understand what information they are expected to record in each section.

5. Have the students write the terms associated with their animal in the box located on the top left hand side of the worksheet.

6. The class visits the library, where students research their animal. Be sure students are recording information on their record sheets.

7. Have students also find a picture of their animal. On the top page of the manila folder have students staple a picture of the animal that they have found or have drawn.

**Days 3-4**

1. Give each student the *Animal Facts* sheet that corresponds with their animal so they can add additional data.

2. Have students take turns presenting information about animals to the class.

**Day 5 (Optional)**

Have a FIPR staff member come to your school to present *Florida’s Ancient Oceans* to your class. For the role-play, have each student exchange his/her folder for their corresponding puppet; at the conclusion of the play, each student exchanges the puppet back for his/her own folder.

**Day 6 (Optional)**

Request to borrow the *Kids Dig It!* kits for a fossil dig. Each kit includes a drawer representing the Pleistocene, Pliocene, and Miocene Epochs.

**Analysis/Conclusion:**

1. Students’ completion of the research record sheet for their animal and the oral presentation to the class.
2. Have students complete the *Cloze Sentences Activity* on pages 70-71.

**Extension:**
1. Tape a picture of one animal on each student’s back and have classmates ask each other questions to identify the animals.
2. Have students write a narrative about how the animal they researched was affected by changes in habitat and sea level. Was the animal able to adapt to changes in habitat? Did it become extinct?

**Teacher Notes:**
Make one copy for each student of the *Animal Research Record* worksheet and the *Student Project Directions*
Make copies of each of the *Animal Facts* sheet
Schedule time for the class to work in the media center
Call FIPR and make arrangements for a staff member to come in and present *Florida’s Ancient Oceans* and drop off the *Kids Dig It!* kits—phone (863) 534-7160
Prehistoric Portfolio Research  
Student Project Directions

Soon, you will play a role in the activity “Florida’s Ancient Oceans” with materials in a traveling library from the Florida Industrial and Phosphate Research Institute. Using tarps, movement, and puppets, you will tell the story of how Florida changed during 24 million years. Some of you will move the “ocean” and place “islands.” Some of you will guide a puppet to show how animals lived in a habitat. Gather facts beforehand and share them with your classmates in an oral presentation so you will be able to perform a role in the play with confidence and skill. Here are the steps for the prehistoric animal portfolio.

Research a topic:
Choose a topic from the list provided and gather your portfolio materials.
• Use a variety of resources such as books or internet sites during computer lab or on your own.
• Record the information on the data sheets provided. Be sure to define the listed words plus any new words that help you understand your topic. Use these words in your class presentation.
• List the resources you used to find information for your topic. Serious researchers share sources.
• You may use the picture to illustrate behavior or write a key statement about the topic.

Validate the Information:
Ask questions as you read the information to check your understanding.
• Do I understand this and does it make sense? Is the information accurate? How do I tell?
• Does the new information match other facts I have found? If not, can I explain the difference?
• Compare information in different sources until a complete story of the animal is constructed.
• Color in your picture and add details that reflect its description, behavior and habitat.

Explore further a fun fact, something very unusual, or an explanation not all experts agree on.
• For example, experts may have different theories about why a certain animal became extinct, or have different ideas on what the scientific name of an animal should be.
• Add new information that helps you understand how your animal lived and died. Be creative.
• Study the information sheet provided by your teacher and double check your information.

Oral Presentation:
• You will have 5 minutes to share what you know about your prehistoric or modern animal.
• Review the information you have gathered and decide what is important for others to know.
• Outline what you will say and decide what pictures or diagrams you will show the class.
• Share facts from each section of the data sheet. Use the vocabulary words in your talk.
Role Play:

- Bring your folder with you the day of the performance to exchange for a puppet or props.
- Listen for cues in the narrated script for when you need to enter the Florida stage to perform.
- When your animal’s epoch is shown, come out onto the stage and move your puppet in its habitat.
- Interact with the other animals on the land and in the sea in ways that reflect what you learned.
Animal Research Record

<table>
<thead>
<tr>
<th>Appearance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat</td>
<td></td>
</tr>
<tr>
<td>Behavior</td>
<td></td>
</tr>
<tr>
<td>Epoch/Timeline</td>
<td></td>
</tr>
<tr>
<td>Theory/Evidence</td>
<td></td>
</tr>
<tr>
<td>Ancestors/Relatives</td>
<td></td>
</tr>
<tr>
<td>Unusual Facts</td>
<td></td>
</tr>
<tr>
<td>&quot;I didn't know that!&quot;</td>
<td></td>
</tr>
<tr>
<td>Ideas for Role-Play</td>
<td></td>
</tr>
</tbody>
</table>

Define the following terms and use them in your oral presentation to the class.

List the sources used in your research.
### List of Animals to Research and their Terms

<table>
<thead>
<tr>
<th>Animal</th>
<th>Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alligator</td>
<td>(terms: reptile and scute)</td>
</tr>
<tr>
<td>Armadillo</td>
<td>(terms: xenarthran and nocturnal)</td>
</tr>
<tr>
<td><em>Bison antiquus</em></td>
<td>(terms: herbivore and ungulate)</td>
</tr>
<tr>
<td><em>Bison bison</em></td>
<td>(terms: herbivore and ungulate)</td>
</tr>
<tr>
<td>Bluegill</td>
<td>(terms: hatchery and gills)</td>
</tr>
<tr>
<td>Camel</td>
<td>(terms: camilid and quadrupeds)</td>
</tr>
<tr>
<td>Dire Wolf</td>
<td>(terms: carnivore and scavenger)</td>
</tr>
<tr>
<td>Dugong</td>
<td>(terms: sirenian and mammal)</td>
</tr>
<tr>
<td><em>Eastern Cottontail</em></td>
<td>(terms: nocturnal and herbivore)</td>
</tr>
<tr>
<td>Gavialosuchus</td>
<td>(terms: crocodylidae and scute)</td>
</tr>
<tr>
<td>Giant Sloth</td>
<td>(terms: herbivore and diurnal)</td>
</tr>
<tr>
<td>Glyptodont</td>
<td>(terms: edentata and osteoderm)</td>
</tr>
<tr>
<td>Gopher Tortoise</td>
<td>(terms: carapace and plastron)</td>
</tr>
<tr>
<td>Horseshoe Crab</td>
<td>(terms: arthropod and telson)</td>
</tr>
<tr>
<td>Mammoth</td>
<td>(terms: conical and index fossil)</td>
</tr>
<tr>
<td>Mastodon</td>
<td>(terms: proboscids and herbivore)</td>
</tr>
<tr>
<td>Megalodon</td>
<td>(terms: cartilage and poikilothermic)</td>
</tr>
<tr>
<td>Modern Man</td>
<td>(terms: biped and omnivore)</td>
</tr>
<tr>
<td>Opossum</td>
<td>(terms: marsupial and prehensile)</td>
</tr>
<tr>
<td>Paleo-Man</td>
<td>(terms: primate and artifacts)</td>
</tr>
<tr>
<td>Prehistoric Mako Shark</td>
<td>(Isurus hastalis and cartilage)</td>
</tr>
<tr>
<td>Prehistoric Walrus</td>
<td>(terms: humeri and pinniped)</td>
</tr>
<tr>
<td>Prehistoric Oyster</td>
<td>(terms: brackish and nacre)</td>
</tr>
<tr>
<td>Raccoon</td>
<td>(terms: mammal and quadruped)</td>
</tr>
<tr>
<td>Rhinoceros</td>
<td>(terms: perissodactyl and grazer)</td>
</tr>
<tr>
<td>Saber-Toothed Cat</td>
<td>(terms: canine and carnivore)</td>
</tr>
<tr>
<td>Sand Dollar</td>
<td>(terms: echinoderms and aboral)</td>
</tr>
<tr>
<td>Scallop</td>
<td>(terms: mollusk and bivalve)</td>
</tr>
<tr>
<td>Six-Horned Pronghorn</td>
<td>(terms: artiodactyla and horn)</td>
</tr>
<tr>
<td>Spiny Jewel Box</td>
<td>(terms: ligament and mollusk)</td>
</tr>
<tr>
<td>Star Coral</td>
<td>(terms: polyp and exoskeleton)</td>
</tr>
<tr>
<td>Stingray</td>
<td>(terms: vertebrate and barb)</td>
</tr>
<tr>
<td>Three-Toed Horse</td>
<td>(terms: metacarpals and browse)</td>
</tr>
</tbody>
</table>
The Alligator
Compiled by: Dr. Sandy Small

DESCRIPTION: The American alligator (Alligator mississippiensis) is a reptile that lives in fresh or brackish (a mixture of salty and fresh) water.

APPEARANCE: The animal has four short legs, ending in heavy claws. It has a broad, rounded snout. There are six raised ridges on its back, which merge into two ridges on top of its tapering tail. The animal has thick skin; its back is protected by bony plates, called scutes. Color ranges from black to gray, with a white to yellow underbelly.

SIZE: Adults measure from six to twelve feet and may weigh 600 pounds or more.

HABITAT: The alligator lives in ponds, swamps, rivers, freshwater and brackish marshes, and canals. Only rarely are alligators found in the ocean.

BEHAVIOR: Docile unless surprised near the nest. Can run over short distances. In cool months, the alligator hibernates by burrowing in mud. Below temperatures of 80 degrees, alligators stop feeding; they draw on their reserves of energy during the winter. During droughts, the alligator deepens pools (“alligator holes”) and thus preserves aquatic habitats for other animals. For this reason, some ecologists consider alligators a “keystone species.”

DIET: The alligator is a carnivore. It eats snails, frogs, insects, small fish, turtles, waterfowl, small mammals, even smaller alligators.

OFFSPRING: Adults mate in April. Females build nests in marshes and along the shoreline and lay 40-50 eggs in June-July. In August-September, eggs hatch. Hatchlings stay in groups called pods for several years, though the mother moves on in the next mating season.

LIFE STORY: Alligators live from 35-50 years in the wild, even longer in captivity.

RELATIVES: Although alligators and crocodiles look similar, they belong to different families and are slightly different in appearance. The modern crocodile (Crocodylus acutus) has a long, narrow snout, while the alligator’s snout is broader and squared. Crocs inhabit saltwater ponds and marshes, even open ocean. They have a salt-extracting gland that allows them to survive in salt water for long periods of time (alligators do not have this gland). The American crocodile has a very limited habitat range, from the Florida Keys to the southern tip of the Everglades and Florida Bay. The American alligator, in contrast, is found as far as far north as the Carolinas, as far south as the Florida Keys, and as far west as Louisiana and Texas. Adult male crocodiles have a low, weak growl, and adult female crocs are usually silent. Adult alligators, in contrast, make more noise! Adult male alligators bellow or roar; females roar (more softly) and also grunt.

EPOCH: Holocene, 10,000 years ago to the present.

For the past 10,000 years, since the end of the Pleistocene Epoch, earth’s climate has grown warmer. One reason for this warming trend (but not the only reason) is humans’ burning of fossil fuels. Glaciers are shrinking, and sea levels have risen. During the Holocene Epoch, humans have competed for habitat with other land animals.

ROLE IN PLAY: Feed at night. Chase after prey. (You can run fast over short distances.) Open and close your powerful bottom jaw to eat. Swallow your food whole (your conical teeth hold food but aren’t equipped for cutting it). Enjoy your habitat, ponds or marshes or at the water’s edge.
The Armadillo
Compiled by: Dr. Sandy Small

DESCRIPTION: The nine-banded armadillo (Dasypus novemcinctus) is the only armadillo found in the United States thus far in the Holocene Epoch. It has expanded its range since first crossing the Rio Grande in the 1850s. Today, it lives in Texas and Florida (excluding the Keys) and other southeastern states.

APPEARANCE: This mammal is brown or gray. It has a soft belly, peg-like teeth and four short legs that end in curved claws. Its name means “little armored one.” The armadillo is the only mammal now alive with a body protected by bony plates covered in overlapping scales called scutes.

SIZE: An adult is 15 to 17 inches long, not counting its 14-to-16-inch tail, and weighs 8 to 17 pounds, the size of an average housecat. Males are heavier than females.

HABITAT: The animal likes bushy or forested areas in a warm, moist habitat where at least 15 inches of rain falls each year. Armadillos can’t tolerate cold winters.

BEHAVIOR: Each armadillo builds several burrows, each 20 inches to 12 feet underground. A burrow’s tunnels can be as long as 23 feet. The animal can swim. It can also hold its breath for 6 minutes. The armadillo is solitary or may travel with another armadillo of the same sex. Males prefer to share their burrow with males, females with females.

Animals rarely stray far from the area where they were born, unless crowding forces them to seek a home elsewhere.

Armadillos are primarily nocturnal. By day, they sleep in their burrows. They prefer to burrow or run away from danger.

DIET: Armadillos eat insects, small animals, roots and fruits, and may eat the shoots of plants or road kill. They eat daily; they do not hibernate.

OFFSPRING: Armadillo females bear young in the spring. An average litter contains four pups, all of the same sex.

LIFE STORY: Lifespan averages 4 to 7 years in the wild, longer in captivity. The armadillo has few natural enemies. Urban and suburban sprawl has reduced the threat from wolves, coyotes, bears, and wildcats. Now dogs and humans are the armadillo’s major predators.

RELATIVES: Today’s armadillo is a xenarthran, related to the glyptodonts and giant armadillos of the Pleistocene Epoch.

EPOCH: Holocene, 10,000 years ago to the present.

For the past 10,000 years, since the end of the Pleistocene Epoch and the onset of the Holocene, Earth’s climate has grown warmer. One reason for this warming trend (but not the only reason) is humans’ burning of fossil fuels. Glaciers are shrinking, and sea levels have risen. During the Holocene Epoch, humans have competed for habitat with other land animals.

ROLE IN PLAY: Use your strong sense of smell to dig in the dirt for food. Dig a burrow with your strong front claws and use your hind legs to kick away the dirt you dig up. If forced to confront a predator, use your sharp claws or startling your predator by jumping and squealing. Enjoy your habitat.
The Bison bison
Compiled by: Dr. Sandy Small

DESCRIPTION: Bison bison, the modern bison, lived in Florida and other parts of eastern North America in the Holocene Epoch. Since the 19th century, it has lived in the Great Plains of North America. This mammal is an herbivore (a plant-eater) and an ungulate (a hoofed animal). Bison are classified in the order Artiodactyla (hoofed animals with an even number of toes). The bison bears weight on two large digits per foot. Both males and females have curved horns smaller than the horns of Bison antiquus. It is incorrect to call this animal a “buffalo.”

APPEARANCE: The modern bison has long, shaggy brown fur, a mane and chin hairs, and a long tail. There are short, curled black horns on its head. Its shoulders are humped.

SIZE: Bison bison is the largest land animal in North America. Adult males (bulls) stand 6 feet at the shoulder and weigh as much as 2,400 pounds; adult females stand 5 feet at the shoulder and weigh 800 to 1,000 pounds. At birth calves weigh 30-40 pounds.

HABITAT: Plains, prairies, river valleys.

BEHAVIOR: The Bison bison is most active in early morning and late afternoon. It feeds, rests, or wallows in dirt. The animal has never been domesticated and will attack humans when provoked. It can run fast (30-40 mph), jump a 30-foot fence, and even swim. Having more body hair than cattle do, bison better withstand cold weather. On open rangeland they travel dozens of miles a day and do not overgraze. Bison travel in herds, except for non-dominant bulls, which travel solo or in small groups.

DIET: Bison bison is an herbivore, eating many types of grasses and occasionally berries and lichen. As a ruminant, the bison eats reprocessed, partially digested food (a cud) by bringing it back up the digestive tract and chewing it again. Ruminant animals can eat food in one location, then move to a safer spot to finish digesting the meal.

LIFE STORY: Bison bison first appeared in Florida 4,500 years ago. European explorers wrote about encountering the animal here. The animal moved west in the 1700s. On the Great Plains, the bison was highly valued by Native Americans for its hides, sinews, horns, fur, meat, and even fuel (dried bison dung or “buffalo chips”). Once Native Americans began to trade extensively with whites, they killed more bison for the fur trade than they could store or transport. Bison were even more extensively hunted by European-Americans in the 1870s and 1880s. Whites killed the animals for their hides and to remove obstacles to permanent settlement of the plains. By 1900 only a few hundred bison survived; today Bison bison number several thousand. Today they live on federally-protected land (such as Yellowstone National Park) and in private herds. Ranchers raise them as a source of high-protein, low-fat meat. In recognition of the species’ early presence in Florida, the Bison bison is one of the animals featured at Payne’s Prairie Preserve State Park, near Gainesville.

RELATIVES: The wisent (“vee-sent”) of Europe is a distant relative.

EPOCH: Holocene, from 10,000 years ago to the present.

For the past 10,000 years, since the end of the Pleistocene Epoch, Earth’s climate has grown warmer. One reason for this warming trend (but not the only reason) is humans’ burning of fossil fuels. Glaciers are shrinking and sea levels have risen. As human settlement expands, humans have come into closer contact with wild animals; there is intense competition among land animals for habitat.

ROLE IN PLAY: Appear on the Florida canvas on cue 10 minutes after the Holocene Epoch begins (=4,500 years ago).

Act out grazing. Enjoy your habitat. On cue, two minutes before the end of the activity (=300+ years ago), move north and west of Florida because the habitat here can no longer sustain you.
The Bison antiquus  
Compiled by: Dr. Sandy Small  

DESCRIPTION: Bison antiquus was one of two species of bison that lived in eastern North America, including Florida, in the Pleistocene Epoch. The larger animal, Bison latifrons, arrived during the middle of the epoch. Bison antiquus ("buy zun an tee cuss"), somewhat smaller, lived in the late Pleistocene, from 22,000 years ago to 10,000 years ago. It was an herbivore (a plant-eater) and an ungulate (a hoofed animal). Bison are classified in the order Artiodactyla (hoofed animals with an even number of toes). The Bison antiquus bore its weight on two large digits per foot.

It is incorrect to use the term “buffalo” for either prehistoric bison species, or for the modern species Bison bison.

APPEARANCE: Bison antiquus was a large land animal with fur over most of its body. Both males and females had horns.

SIZE: Though fossil teeth of the Bison latifrons and the Bison antiquus look the same, we can distinguish between the species by examining horn cores. Horns of the Bison latifrons measured six feet in length. The Bison antiquus had shorter horns. (Horns of the modern bison are shorter still, and curved.) Horns are partially bone; some horns fossilized.

HABITAT: The range of Bison antiquus was from Alaska south to Nicaragua, from eastern North America to California.

BEHAVIOR: This animal could run fast, jump, and swim. Its thick fur protected it in winter.

DIET: Bison antiquus was an herbivore that ate grasses and sedge. Like the cow, the bison was a ruminant, with multiple stomachs; it reprocessed partially digested food (a cud) by bringing it back up the digestive tract and chewing it again. Ruminant animals can eat food in one location, then move to a safer spot to finish digesting the meal.

LIFE STORY: The Pleistocene bison of Florida came to North America via the Bering Land Bridge. Large herds may have grazed in central Florida. Scientists debate reasons for the disappearance of large land animals late in the Pleistocene. Some believe paleo-man over-hunted them.

RELATIVES: The wisent ("vee-sent") of Europe is a distant relative. Another relative (descended from a common ancestor) is the Bison bison, now the largest land animal in North America. Bison bison lived in Florida from 4,500 years ago to as recently as the 1700s but now they live on the Great Plains.

TIMELINE: During the Pleistocene Epoch, there were many abrupt changes in Earth’s climate and sea level. The Ice Age included periods when glaciers spread over much of the Earth. When glaciers expanded, the climate was cool and dry and more dry land was available as habitat for large animals. When glaciers melted, the climate was warm and humid and land animals’ habitat shrank. Some animals adapted, some found a new habitat, but others became extinct (died without living offspring).

FOSSIL RECORD: Fossil hunters have found bison teeth and leg bones in shell pits. A partial skull, with part of a chert spear point imbedded in it, was found in Florida’s Wicassa River; carbon dating determined it was over 11,000 years old. Bison fossils have been found in the Aucilla and Suwannee Rivers and near Tampa Bay. Telling bison material apart from cow skull fragments and lower jaw teeth is difficult. Paleontologists look for large portions of the jaw, for a bison jawbone is significantly larger than a cow jawbone.

ROLE IN PLAY: Act out grazing and seeking water. Run from predators. Enjoy your habitat. When the Pleistocene Epoch ends, you become extinct.
The Bluegill
Compiled by: Dr. Sandy Small

DESCRIPTION: Bluegill (Lepomis macrochirus) is a freshwater fish found throughout the United States. Another name for bluegill is bream (pronounced “brim”).

APPEARANCE: Color varies, from yellow to dark blue. The fish has black gill flaps and a long, pointed pectoral fin under its body.

SIZE: The fish is small- to medium-sized. The typical adult weighs 12 ounces and is six to nine inches in length; very long ones reach a foot in length.

HABITAT: Ponds, lakes, some slow-flowing rivers throughout the United States. The native range for this fish is from Minnesota in the north to Arkansas and Georgia in the southeast, but because this is a popular sport and eating fish, it has been stocked in lakes all over the country, including Florida. Bluegill often travel in schools of 20 to 30 fish.

DIET: The bluegill is a carnivore. It eats insects, worms, snails, and smaller fish. Large bluegill eat freshwater shrimp, small crayfish and snails.

OFFSPRING: In breeding season, the male builds a nest in sand and gravel, two feet below the waterline. The female lays 2,000 to 67,000 eggs, and the male guards the nest.

LIFE STORY: The lifespan of a bluegill has been reported as five to six years or eleven years.

We know that modern humans have had significant impacts on the environment.

Not all human influence has been negative. Humans have extended the range of bluegill by raising this fish in hatcheries and introducing bluegill into (“stocking”) lakes and ponds throughout the country.

EPOCH: Holocene, 10,000 years ago to the present.

For the past 10,000 years, since the end of the Pleistocene Epoch, Earth’s climate has grown warmer. One reason for this warming trend (but not the only reason) is humans’ burning of fossil fuels. Glaciers are melting, and sea levels have risen.

ROLE IN PLAY: Swim in a Florida lake or river (not the ocean). Eat insects, snails, or shrimp. Enjoy your habitat.
The Camel
Compiled by: Dr. Sandy Small

DESCRIPTION: The camels that inhabited Florida in the Pleistocene were large quadrupeds (four-legged animals). Like the llama, which has been domesticated in South America, North America’s camel has been classified in the camelid family (Camelidae). Camels are Artiodactyls, that is, they have an even number of toes on each foot.

APPEARANCE: Scientists believe Florida’s prehistoric camels lacked the hump we see on Asian camels. For this reason, some specialists call Florida’s Pleistocene camels lamines or llamines. Camel teeth were selenodont, with crescent (moon)-shaped cusps. Unlike other ungulates, camels have foot bones (metapodia) that are fused into one single bone, the cannon bone, though in late Pleistocene camelids, the cannon bone may be split.

SIZE: The size range of camelids is from three to seventeen feet tall at the head. A long-legged camelid skeleton, assembled and on display in Gainesville, is the Hemiauchenia macrocephala, which stands two meters high at the shoulder (an adult male has to stretch to reach its lower jawbone).

HABITAT: Dry savanna. For some camelids, Florida was not dry enough; they migrated west.

BEHAVIOR: Unknown. Two modern camelids, llamas and alpacas, have been domesticated, but others, guanacos and vicunas, remain wild.

DIET: The camelids were herbivores (plant-eaters) and grazers (eating grasses from the ground instead of browsing for twigs or leaves).

LIFE STORY: After crossing the Bering Land Bridge from Asia five million years ago, camels had a long history in North America. Small camelids lived in Florida in the Miocene. Late in the epoch, large giraffe-like camels lived here. A very large species of camel, the Megatylopus, lived in the Bone Valley region in the early Pliocene Epoch. These species became extinct.

Two camel species lived in Florida in the Pleistocene: the Paleolama, an animal with stocky legs, and the Hemiauchenia, which had more slender legs. Around 11,000 years ago, all camels had become extinct in Florida.

To date, there have been no reports of camel fossils found in or near sites used by Paleo-man. This suggests that the “Overkill” theory (of human overhunting) does not apply to camelids.

RELATIVES: The Paleolama was most closely related to the llama that lives today in South America.

EPOCH: Pleistocene (“plies-toe-seen”), 1.8 million to 10,000 years ago

In the Pleistocene Epoch, there were many abrupt changes in earth’s climate and sea level. The Ice Age included many periods when glaciers spread over much of the earth. When glaciers expanded, Florida’s climate was cool and dry and more dry land was available as habitat for large animals. Climate changes forced some animals to find a new habitat; if they did not, some became extinct (died without living offspring).

FOSSIL RECORD: Paleontologists study camelid teeth, jaws, and leg bones. Camel bones dating from the Pleistocene have been found at the Love site near Gainesville and the Leisey Shell Pit in Hillsborough County; camel teeth dating from the Pleistocene have been found in Pinellas and Alachua Counties. In the 1980s an amateur paleontologist discovered a late Pleistocene skeleton of Hemiauchenia macrocephala (a large-headed camelid) in Citrus County. This skeleton, more than 95% complete, was donated to the Florida Museum of Natural History. A cast of the skull may be seen in the Hall of Florida Fossils, Gainesville.

ROLE IN PLAY: Act out grazing. Enjoy your habitat. When the Pleistocene Epoch ends, you become extinct in North America.
The Dire Wolf
Compiled by: Dr. Sandy Small

DESCRIPTION: The dire wolf (Canis diris) was a large, carnivorous animal.

APPEARANCE: It had a smaller brain and shorter legs than the modern wolf. With less agility and stamina, the dire wolf was at a disadvantage in chasing prey. The animal had a smaller brain case than its modern counterpart.

SIZE: Once, scientists believed the dire wolf was much larger than the modern gray wolf. Now most agree it was around the same size. Adults were 5 feet (1.5 meters) in length and weighed around 110 pounds (50 kg).

HABITAT: Its range was throughout North America, coast to coast, and from Canada to South America.

BEHAVIOR: Scientists think dire wolves hunted in packs (because so many fossils of this animal have been found at the La Brea Tar Pits in California).

DIET: The animal had large teeth capable of crushing bone; experts believe it compensated for its lack of speed by scavenging, tearing apart animals that other animals had killed. The dire wolf also hunted slow-moving prey such as bison, mammoths, and small horses.

LIFE STORY: The dire wolf probably originated in South America; it reached North America around 100,000 years ago.

The dire wolf became extinct 16,000-10,000 years ago. Some experts believe the chief cause was a warming climate, which changed the habitat of the large herbivores this animal fed on. Others believe the cause was Paleo-man’s efficiency at killing. The gray wolf, better equipped than the dire wolf to chase quick-moving prey, survived.

EPOCH: Pleistocene (“plies-toe-seen”), 1.8 million to 10,000 years ago.

In the Pleistocene Epoch, there were many abrupt changes in earth’s climate and sea level. The Ice Age included many periods when glaciers spread over much of the earth. When glaciers expanded, Florida’s climate was cool and dry and more land was available as habitat for large animals. Later, when glaciers melted, the climate was warm and humid and land animals’ habitat shrank. Some fauna adapted, others found a new habitat, but others became extinct (died without offspring).

FOSSIL RECORD: Dire wolf fossilized skeletons and teeth have been found. The crowns of dire wolf teeth show lots of wear, evidence of bone crushing. Fossil bones show scars and fractures typical of animals that hunted large prey.

The first dire wolf fossil was discovered in Indiana in 1854. Since 1910, fossils from more than 3,000 dire wolves have been recovered from the La Brea Tar Pits near Los Angeles, California. Fossils of dire wolf adults and pups have been found in the Cutler Hammock sinkhole near Miami.

ROLE IN PLAY: Act out scavenging on large animal carcasses or chasing slow-moving animals. Enjoy your habitat.
You become extinct before the end of the Pleistocene Epoch.
**The Dugong**
Compiled by: Dr. Sandy Small

**DESCRIPTION:** The Dugong was an aquatic mammal belonging to a class called sirenians. Most dugongs were marine (lived in salt water). All dugongs that lived in Florida during the Miocene became extinct; however, in the Holocene Epoch, dugongs lived elsewhere in the world in very warm waters.

**APPEARANCE:** The animal was fleshy and large. It propelled itself through the water using paddle-like front limbs. It had no hind limbs but had a divided tail with pointed horizontal branches. It had one-pair of tusk-like teeth below a bristled snout. Like whales, dugongs were descended from land-dwelling mammals.

**SIZE:** Two to three meters in length, like modern dugongs.

**HABITAT:** The dugong swam in the shallows near the shoreline and balanced itself on its tail to nibble plants that grew at the water’s edge.

**BEHAVIOR:** As a mammal, the dugong had no gills. It surfaced, supporting itself on its tail (“tail-standing”) to breathe. The dugong swam in deeper waters by day but moved at night to shallows to feed. It used its front limbs to feed itself (and females used the limbs to hold young). The animals usually traveled alone or in small groups. Males were not involved in rearing young.

**DIET:** The dugong was an herbivore.

**OFFSPRING:** If it was like modern sirenians, the prehistoric dugong gave birth to a calf every three to five years. At birth, a dugong calf weighed 60 to 100 pounds and was able to swim. It stayed near its mother for two years, swimming beside her or resting on her back.

**LIFE STORY:** Dugongs disappeared from Florida at the end of the Miocene. We do not know precisely why they became extinct.

**RELATIVES:** Dugongs resemble modern manatees, which also belong to the Sirenian order. Because of this resemblance, it can be tricky to distinguish between dugong fossils and manatee remains. Fossil hunters hope to find bones near, or attached to, a skull. Dugongs had no more than four or five cheek teeth at any time; modern manatees have seven teeth.

**EPOCH:** Miocene (“my-oh-seen”), 24 million to 5 million years ago

During this epoch, land first emerged in Florida from ancient oceans, creating a peninsula that extended southward to Bradenton. In this epoch, much of the phosphate we dig out of the ground today was formed. Wastes and skeletons of tiny sea creatures drifted to the sea floor. Seawater reworked this material, reacting it with calcium carbonate on the ocean floor. Later, the material precipitated out of seawater to form phosphate, which became part of the sediment. When ancient oceans receded, the phosphate was landlocked; today, miners dig through dry land to mine the phosphate, which is used to make fertilizer and other products.

**FOSSIL RECORD:** Florida fossil-hunters have found dugong bones (especially the large, dense, banana-shaped rib bones and backbones) and even entire skeletons. A dugong skeleton from Bone Valley can be found at the Mulberry (Florida) Phosphate Museum.

**ROLE IN PLAY:** Act out swimming in the shallows, coming up to breathe, caring for young and eating small plants; enjoy your marine habitat. When the Miocene Epoch ends, at least one of you leaves Florida, swimming southward to try out habitats in central America. Any dugongs remaining in Florida at the end of the epoch become extinct.
The Eastern Cottontail
Compiled by: Dr. Sandy Small

DESCRIPTION: The Eastern cottontail (Sylvilagus floridanus) is one of several types of rabbit native to Florida during the Holocene Epoch. Its range includes most of the state.

APPEARANCE: This mammal has grayish-brown fur, a white belly and tail.

SIZE: Adults are 14 to 17 inches long, with ears as long as 2½ inches. Adult Eastern cottontails weigh two to four pounds.

HABITAT: The animal’s habitat includes fields, the edges of woods, thickets (dense growths of shrubs and trees), and gardens. The Eastern cottontail generally prefers upland areas, though some have been spotted in swamps.

BEHAVIOR: Rabbits are “homebodies”; they may never travel farther than one acre from their “form” (a nest, made in grass). The home range of a rabbit is almost always less than 10 acres. These animals are nocturnal, most active in late afternoon through the next morning. They feed at night. Hind legs are heavily muscled. The Eastern cottontail runs faster than Florida’s marsh rabbit. It can run 15 miles an hour and also jump 15 feet.

DIET: Eastern cottontails are herbivores. They eat a variety of plants, including garden crops, grasses, buds, berries, tree and shrub bark. Their diet in spring features more leafy plants and sprouts; in winter, more twigs and bramble bark; when other food is in short supply, they may even eat their own scat (droppings).

OFFSPRING: These rabbits bear several litters a year—more in warm climates. Females (or does) give birth to four or five young in each litter. Bunnies are born blind, with little fur.

LIFE STORY: The Eastern cottontail’s predators include foxes, bobcats, hawks, owls, weasels, and man. Because their predators are efficient hunters, the average rabbit in the wild lives less than one year. Only their rate of reproduction—up to 35 bunnies a year—has kept the species from dying out thus far.

EPOCH: Holocene, 10,000 years ago to the present.

For the past 10,000 years, since the end of the Pleistocene Epoch, Earth’s climate has grown warmer. One reason for this warming trend (but not the only reason) is humans’ burning of fossil fuels. Glaciers are shrinking, and sea levels have risen. During the Holocene epoch, humans have competed for habitat with other land animals.

ROLE IN PLAY: Hop through the grass, looking for food (is a garden nearby?). Flee predators. Jump. Run in a zigzag pattern. Enjoy your habitat.
The Giant Sloth
Compiled by: Dr. Sandy Small

DESCRIPTION: This was the largest land animal ever to live in Florida. It was a quadruped (four-legged animal) that could stand erect to strip leaves and bark from tall trees. Like prehistoric and modern armadillos, the giant sloth was a xenarthran; it is classified with other placental mammals that have extra surfaces on their vertebrae. The word xenarthra means “strange joints.”

APPEARANCE: The sloth was tall and bear-like. It had five sharp claws, the longest one foot in length, used to uproot food plants.

SIZE: One giant sloth, the megatherium, was the size of a modern elephant, weighing five tons and reaching 17 to 20 feet in height when standing on its hind legs, with the support of its broad, muscular tail. A smaller sloth was the Mylodon. Jefferson’s and Harlan’s ground sloths were the size of oxen. The length of a ground sloth has been estimated as 20 feet, from nose to tail, and weight has been estimated as 3 tons.

HABITAT: The giant sloth walked on the ground. It may have been solitary.

BEHAVIOR: The giant sloth walked on four legs, but its claws were so curved that the animal had to walk on the sides of its feet. The giant sloth was probably diurnal (active in the daytime) since it had few enemies and no Pleistocene land animal was big enough or strong enough to challenge it.

Much of the modern sloth’s body weight comes from the food it consumes. The modern animal takes up to a month to digest food. It has a slow metabolic rate and low body temperature. Understandably, the word sloth (for the animal and also for laziness) is derived from a Middle English word “slowth” which means “slow.”

DIET: The giant sloth was probably an herbivore, gnawing on live oak, magnolia, and sweet gum trees. Sloth teeth are blunt and small, ideal for grinding a diet of leaves. Some scientists theorize that the animal may have eaten meat, also. A short olecranon bone (in the arm, below the elbow) indicates the sloth could have used its claws as daggers. If hungry, a giant sloth might have claimed an animal killed by a saber-cat, or even flipped a glyptodont onto its back to kill and consume it. (No other Pleistocene animal was strong enough to do this.)

LIFE STORY: The giant sloth migrated from South America across the Panamanian land bridge. It became extinct 11,000-10,000 years ago. Some scientists say the key factor was climate/habitat change. Others say paleo-man hunted the giant sloth to extinction.

RELATIVES: Modern relatives include two-toed and three-toed sloths, which are much smaller and live in trees.

EPOCH: Pleistocene ("plies-toe-seen"), 1.8 million to 10,000 years ago.

In the Pleistocene Epoch, there were many abrupt changes in Earth’s climate and sea level. The Ice Age included periods when glaciers spread over much of the Earth. When glaciers expanded, Florida’s climate was cool and dry and more dry land was available as habitat for large animals. When glaciers melted, the climate was warm and humid and land animals’ habitat shrank. Some fauna adapted, some found a new habitat, but others became extinct (died without offspring).

FOSSIL RECORD: Fossil hunters have found many sloth bones and several articulated skeletons. One outstanding discovery, made by a geology student, was a skeleton found in 1986 in a limestone quarry near Gainesville, Florida.

ROLE IN PLAY: Act out browsing for food or water. Enjoy your habitat. Other than man, you have no real predators. When the Pleistocene Epoch ends you become extinct.
The Gavialosuchus
Compiled by: Dr. Sandy Small

DESCRIPTION: The Gavialosuchus americanus was a large marine (sea-dwelling) crocodile. Pronounce its name “gah vee al oh suke us,” stressing the “suke” syllable.

APPEARANCE: It had a long, slender snout with narrower teeth than other crocodilians had. Its skin was protected by large, scale-like plates called scutes or osteoderms. (The word scute comes from the Latin word for shield.)

SIZE: The Gavialosuchus was 30 feet long or longer (imagine five or six adults lying down, head to foot).

HABITAT: The warm sea water surrounding Florida in the Miocene Epoch. There was lots of sea water; when the Florida landmass emerged from the oceans during this epoch, the peninsula reached only as far south as Bradenton.

BEHAVIOR: The gavialosuchus used its tail in swimming. With eyes and nostrils placed at the top of its head, the croc was able to see and breathe underwater. The gavialosuchus was an ambush hunter, waiting for fish to swim nearby, then attacking.

DIET: Fish, reptiles, mammals, smaller crocodiles, and possibly mollusks and crustaceans.

LIFE STORY: The gavialosuchus lived during the Miocene Epoch only. We do not know precisely why it became extinct.

RELATIVES: Members of the family Crocodylidae (including all crocodiles but not alligators) have lived on Earth for over 200 million years. Most modern crocs live in shallow freshwater environments, though some in Australia and Southeast Asia are ocean-dwellers. The word crocodile comes from krokodilos, Greek for “stone worm,” because the Ancient Greeks saw crocodiles sunning themselves on the gravel-covered banks of the Nile River.

Crocodiles and alligators belong to two different families and are slightly different in appearance. Crocodiles generally have V-shaped heads with longer, narrower snouts. When a crocodile’s mouth is closed, the fourth tooth on each side of its mouth sticks up on the outside (does not fit into the upper jaw). In contrast, alligators generally have U-shaped snouts. The alligator’s lower teeth do fit into its upper jaw.

EPOCH: Miocene (“my-oh-seen”), 24 million to 5 million years ago.

During this epoch, land first emerged in Florida from ancient oceans, creating a peninsula that extended southward to Bradenton. In this epoch, much of the phosphate we dig out of the ground today was formed. Wastes and skeletons of tiny sea creatures drifted to the sea floor. Seawater reworked this material, reacting it with calcium carbonate on the ocean floor. Later, the material precipitated out of seawater to form phosphate, which became part of the sediment. When ancient oceans receded, the phosphate was landlocked; today, miners dig through dry land to mine the phosphate, which is used to make fertilizer and other products.

FOSSIL RECORD: Fossil-hunters have found skeletal remains of the gavialosuchus, including teeth, skulls, flat scutes, and bones. One of the most complete discoveries was of a 52-inch-long skull with teeth found in 1990 at a phosphate mine in Polk County, Florida. From the size of this skull, scientists estimate that the croc’s body measured 32 feet (15.8 meters) in length.

ROLE IN PLAY: Act out swimming in the ocean and finding smaller sea creatures to eat. Enjoy your habitat. At the end of the Miocene Epoch, you become extinct.
The Glyptodont
Compiled by: Dr. Sandy Small

DESCRIPTION: This was a very large xenarthran, member of a group of placental mammals that includes anteaters, sloths, and armadillos. The word xenarthra means “strange joints” and refers to extra surfaces on vertebrae. A glyptodont is any animal belonging to the family Glyptodontidae. One genus in that family was the glyptodon. (All glyptodons are glyptodonts, but not all glyptodonts are glyptodons!)

APPEARANCE: The animal was outfitted with over 1,000 armored plates called scutes (also known as osteoderms) that covered its back. The scutes were one inch (5 cm) thick, and were arranged differently on each species. The glyptodont’s tail and head were protected by bony plates. This was useful, for the glyptodont could not pull its head under its shell.

SIZE: Adult glyptodonts were the size of a Volkswagen beetle auto or an ox. The adult weighed over 1-2 tons (1,000 kg) and was around 5 feet (2 meters) in length.

HABITAT: The glyptodont grazed by rivers and small bodies of water.

BEHAVIOR: The animal moved slowly, just one or two miles per hour, on powerful, short legs. It didn’t need to hurry; few predators posed any danger to this massive animal. Scientists think saber-cats may have eaten glyptodonts but do not know how the cats could flip such a heavy creature onto its back in order to reach the glyptodont’s unprotected stomach.

DIET: It was an herbivore. Though the order it belongs to—Edentata—means “no teeth,” the glyptodont did have small teeth, far back in its jaw. These teeth were well adapted to grinding the animal’s diet of grasses. The name glyptodont means “grooved or carved tooth.” Large muscles powered the lower jaw in chewing fibrous river plants.

LIFE STORY: Glyptodonts originated in South America and spread into southeastern North America. The species Glyptotherium floridanum lived in Florida. The glyptodont arrived in the late Pleistocene and became extinct 10,000 years ago. Some scientists say climate/habitat change caused extinction. Some say humans killed off 32 species of Pleistocene animals, including glyptodonts, in just 1,500 years. Other scientists blame diseases that spread rapidly to species never before exposed to them. (These three theories about the causes of extinction are described as “overchill,” “overkill,” and “over-ill.”)

RELATIVES: Glyptodonts are related to, but not ancestors of, giant armadillos (which themselves became extinct 9,000 years ago). Glyptodonts are also related to modern armadillos, anteaters, and both giant and modern sloths.

EPOCH: Pleistocene (“plies-toe-seen”), 1.8 million to 10,000 years ago.

In the Pleistocene Epoch, there were many abrupt changes in Earth’s climate and sea level. The Ice Age included periods when glaciers spread over much of the Earth. When glaciers expanded, Florida’s climate was cool and dry and more dry land was available as habitat for large animals. When glaciers melted, the climate was warm and humid and land animals’ habitat shrank. Some animals adapted, some found a new habitat, but others became extinct (died without offspring).

FOSSIL RECORD: Fossil hunters have found many glyptodont scutes, in the Peace River and elsewhere, from Florida to Texas. The Florida Natural History Museum displays a glyptodont skeleton.

ROLE IN PLAY: Act out browsing along a riverbank for plants to eat. Watch out for saber-cats! (You have few other enemies, since few Pleistocene land animals are as large as you.) Beware, though, of paleo-man; armed with weapons and fire, man may have sought your shell as a shield or shelter. Enjoy your habitat. When the Pleistocene Epoch ends you become extinct.
The Gopher Tortoise
Compiled by: Dr. Sandy Small

DESCRIPTION: The gopher tortoise (Gopherus polyphemus) is a reptile found in the southeastern U.S.

APPEARANCE: This tortoise has an oval, domed carapace (top shell) that is gray, brown, or tan, with scutes (protective plates) lying inside five-sided grooved rings. The plastron (underside of shell) is yellowish. Forelegs are flattened and hind legs are round. Legs end in strong claws.

SIZE: The adult is typically 12 inches long.

HABITAT: Dry uplands throughout Florida and north-central Georgia. The “gopher” needs well-drained, sandy soil in which to dig its burrow and depends on ample sunlight for building burrows and nests for eggs, and to grow the plants it eats. Formerly, frequent fires cleared woodlands of brush and hardwoods with dense canopies, but humans have interfered with this cycle. When forests become overgrown, light is scarce, and food sources are shaded out, gopher tortoises are forced to seek new homes.

BEHAVIOR: Digging with their front feet, gopher tortoises excavate burrows that range in size from 3 feet to more than 50 feet long and 6 to 22 feet deep. (Look for a mound of loose sand, called an apron, at the entrance.) The burrow insulates this cold-blooded animal from extremes of heat, cold, humidity, or dryness. It also offers a temporary home to over 300 other animal species (this sharing of habitat is called commensalism, from the Latin words for “together” and “table”). Because its burrow is important to so many other animals, the gopher tortoise is considered a keystone species in its habitat.

DIET: This herbivore eats grass, clover, gopher apple, and saw palmetto berries.

OFFSPRING: Females nest in spring and summer. Eggs hatch in 80-100 days. At birth, young measure 31.5 to 2 inches (3-5 cm) and have soft shells. They grow less than one inch per year.

LIFE STORY: This animal matures in 10 to 20 years. After maturity, the female may not lay eggs every year; some years she may lay only five or six. There is intense competition with humans for land. Both humans and tortoises prefer to establish homes on land that is high and dry, and Florida’s human population boom since the 1950s has shrunk the tortoise’s habitat. Man continues to prey on these animals, sometimes burying them in their burrows. Gopher tortoises are vulnerable to viral diseases. Automobiles kill many of the animals, and roadways isolate many more, separating populations. Raccoons, indigo snakes, and hawks prey on the young; dogs and raccoons eat adult tortoises. Even though the animal’s lifespan is 40 to 60 years—or even more than 100 years in captivity—the gopher tortoise remains a “species of special concern” to ecological authorities in Florida. People planning mining or construction in the animals’ territory are encouraged to relocate gopher tortoises to a new habitat.

RELATIVES: The gopher tortoise descended from a land tortoise that lived in North America nearly 60 million years ago and migrated to the southeast millions of years ago, when Florida was dry grassland. Of the four land tortoise species that survived, only one species lives in Florida.

EPOCH: Holocene, 10,000 years ago to the present.

ROLE IN PLAY: Dig your burrow and spend 90% of your time there. Occasionally emerge and look for food. Enjoy your habitat. If you “beat the odds,” you may live to the age of 40-60 years!
The Horseshoe Crab
Compiled by: Dr. Sandy Small

DESCRIPTION: The horseshoe crab (Limulus polyphemus) is an arthropod, a segmented animal lacking a backbone and having jointed legs. It is not a true crab; it lacks the crab’s two pairs of antennae and a pair of jaws, and it has two more pairs of legs and two more eyes than the true crab.

APPEARANCE: Odd indeed! The scientific name means “odd one-eyed giant.” The common name comes from the crab’s shape, an elongated half-circle. The animal has seven pairs of legs (five pairs end in claws). On the underside, overlapping plates function as gills (exchanging waste gases for oxygen from seawater) and help the crab paddle through the ocean. The animal has a telson (a long, spiny tail) which it uses to turn itself over, back to stomach or stomach to back.

HABITAT: The horseshoe crab lives in oceans and on beaches from Maine to the Yucatan peninsula, and in estuaries, such as Florida’s Indian River Lagoon.

BEHAVIOR: The animal spends most of its life in the subtidal zone but visits the beach to spawn.

DIET: Clams, worms. The animal grabs food with its legs, crushes it, then moves it to its mouth.

OFFSPRING: Mating occurs in spring and summer, during high tides. The female scoops out a nest on a beach and deposits tens of thousands of eggs, each one 1/16 inch in diameter. If not eaten by loggerhead turtles, shorebirds, alligators, and fish, the eggs hatch in two weeks. Young can swim from birth and mature in nine or ten years.

LIFE STORY: Horseshoe crabs probably lived in Florida oceans in the Pliocene Epoch, but the shells (made of chitin, not calcium carbonate) are fragile, and no fossils have been found locally. Fossils of horseshoe crabs found in Germany date from the Jurassic Epoch, when dinosaurs roamed the Earth!

Spanish explorers named Cockroach Bay on Florida’s Gulf coast for this animal.

The horseshoe crab has eyes with long optic nerves that scientists study to understand the human eye. The horseshoe crab has blood that drug companies use in research because the blood clots when infections are present. Scientists harvest blood carefully and return the animals to the shore.

As a horseshoe crab ages, other organisms attach themselves to its shell, including algae, worms, anemones, crabs, shrimp, snails, mussels, and barnacles. These “passengers” make it harder for the crab to move and to see.

Humans no longer prize horseshoe crabs as food (too much shell, too little meat), but farmers in coastal regions use them to make fertilizer, and fishermen use them as eel and conch bait. Predators include loggerhead sea turtles, shorebirds, alligators, and fish. Lifespan is undocumented but experts think it may be 20 to 40 years.

RELATIVES: This animal is more closely related to spiders, scorpions, and ticks than to crabs.

It is the closest living relative of the trilobite, an extinct arthropod that lived in the Paleozoic Era. Sometimes the horseshoe crab is called a “living fossil” because it looks a lot like species that lived more than 200 million years ago and are preserved in the fossil record.

EPOCH: Holocene, 10,000 years ago to the present.

For the past 10,000 years, since the end of the Pleistocene Epoch, Earth’s climate has grown warmer. One reason for this warming trend (but not the only reason) is humans’ burning of fossil fuels. Glaciers are shrinking, and sea levels have risen.

ROLE IN PLAY: Swim on your back or crawl on and dig into the sand. Enjoy your habitat.
The Mammoth
Compiled by: Dr. Sandy Small

DESCRIPTION: The mammoth was a large, tusked mammal which lived in North America. There were several types. Woolly mammoths, with dense fur, lived farther north; Columbian mammoths lived in warmer climates. This mammoth arrived in Florida later than the mastodon.

APPEARANCE: Mammoths, which stood 9 to 15 feet tall at the shoulder, were generally larger than mastodons, which stood 7 to 8 feet tall at the shoulder. Mammoth teeth were small, arranged in washboard-like ridges; they were well adapted for chewing prairie grass. Mastodon teeth were large, blunt, and conical, well adapted for grinding and tearing leaves and pine needles in the mastodon’s forest habitat. Mammoth tusks are usually longer and more curved than mastodon tusks. (Both males and females had tusks.) The mammoth had a sloping back.

SIZE: Adult Columbian mammoths stood 13 feet (four meters) tall at the shoulder (smaller than today’s African elephants but larger than mastodons). They weighed as much as 10 tons. The Columbian mammoth’s tusks could reach 14 feet (4.25 meters) in length.

HABITAT: Open savanna (grassland).

DIET: The mammoth was an herbivore, a grass-eater. It may also have eaten large fruits, such as the Osage orange, Kentucky coffee, and honey locust. Experts have studied the food intake of modern African elephants and estimate the Columbian mammoth may have eaten 700 pounds of plant material every day!

LIFE STORY: The mammoth is considered an “index fossil” because it lived only during the Pleistocene Epoch. When paleontologists find mammoth bones or teeth, they can confidently identify other fossils found in the same stratum (layer) of earth as originating in the Pleistocene, because mammoths lived at no other time. Experts still debate why the mammoth became extinct. Some blame man’s prowess as a hunter (the “Overkill” theory). Others insist that changes to climate and habitat were also key factors.

RELATIVES: The modern elephant is closely related to the mammoth. They both have tiny teeth embedded in cement-type material.

EPOCH: Pleistocene (“plies-toe-seen”), 1.8 million to 10,000 years ago.

In the Pleistocene Epoch, there were many abrupt changes in Earth’s climate and sea level. The Ice Age included many periods when glaciers spread over much of the Earth. When glaciers enlarged, Florida’s climate was cool and dry and more land was available as habitat for large animals. Later, when glaciers melted, the climate was warm and humid and land animals’ habitat shrank. Some fauna adapted, some found a new habitat, but others became extinct (died without offspring).

FOSSIL RECORD: Complete fossilized mammoth skeletons, as well as skull, tusk fragments, and teeth, have been found. Cave drawings in France and Spain show early man’s impressions of mammoths.

ROLE IN PLAY: Act out grazing.
Enjoy your habitat.
At the end of the Pleistocene Epoch you become extinct.
**The Mastodon**
Compiled by: Dr. Sandy Small

**DESCRIPTION:** The mastodon (Mammut americanum) was a large, tusked mammal. Adults were the size of today’s African elephants. The name comes from Latin words for “chest tooth.”

**APPEARANCE:** Both mastodons and mammoths were proboscids (they are classified in an order of elephant-like animals). North American mastodons, which stood 7 to 8 feet tall at the shoulder, were generally smaller than mammoths, which stood 13 feet tall at the shoulder. Mastodons had large, blunt, conical teeth well adapted for chewing leaves and pine needles in their forest habitat; mammoth teeth, in contrast, had washboard-like ridges, well adapted for chewing prairie grass. Mastodon tusks are usually straighter; mammoth tusks, usually longer and more curved.

**SIZE:** Adult mastodons weighed from four to six tons.

**HABITAT:** The mastodon lived in forests. (Remember that the mammoth lived on grassland. Some experts say that the mastodon and mammoth partitioned the ecosystem to ensure that both animals would have enough food and habitat.)

**DIET:** The mastodon was a browsing herbivore. It ate leaves, twigs, fruits, nuts, and berries.

**LIFE STORY:** This animal evolved earlier than the mammoth. The mastodon roamed North America 3.7 million to 10,000 years ago. Fossil hunters rarely find its tusks, even though the mastodon lived in Florida 1,000 years after the mammoth became extinct.

Debate continues on why the mastodon and other large Pleistocene animals died out. Some experts believe that changes in climate, which killed off vegetation and completely destroyed the mammoth’s habitat, are as important a factor as man’s ability as a hunter.

**RELATIVES:** A recent tracing of the mastodon’s mitochondrial genome (its genetic material) shows that it was more closely related to the smaller Asian elephant (though it looked more like the African elephant). We know the modern elephant is not a descendant of the mastodon because of a difference in tooth type.

**EPOCH:** Pleistocene (“plies-toe-seen”), 1.8 million to 10,000 years ago.

In the Pleistocene Epoch, there were many abrupt changes in Earth’s climate and sea level. The Ice Age included many periods when glaciers spread over much of the Earth. When glaciers enlarged, Florida’s climate was cool and dry and more land was available as habitat for large animals. Later, when glaciers melted, the climate was warm and humid and land animals’ habitat shrank. Some fauna adapted, some found a new habitat, but others became extinct (died without offspring).

**FOSSIL RECORD:** Fossil hunters have found partial and complete mastodon skeletons. We know about the mastodon’s diet from its fossilized teeth.

**ROLE IN PLAY:** Act out using your trunk and tusks to get food. Try to run from predators. Enjoy your habitat. When the Pleistocene Epoch ends, you become extinct.
The Megalodon
Compiled by: Dr. Sandy Small

DESCRIPTION: This was the largest of the large-toothed sharks. Its name means “big tooth.”

APPEARANCE: Intimidatingly large. Slow-moving, compared to sharks that evolved later.

SIZE: The megalodon was twice the size of the modern great white shark. Adults were 40 to 70 feet in length; at birth, pups were 7 to 10 feet in length, nearly the size of adult dugongs. Though shark cartilage does not preserve well, and we have no megalodon skeletons, experts estimate body length from the width of certain teeth. Cliff Jeremiah’s formula: For every centimeter of width in an upper anterior root, figure 4.5 feet of shark length. Adult megalodons are estimated to have weighed as much as 10,000 pounds.

HABITAT: In contrast to the mako, the megalodon preferred shallower seas.

BEHAVIOR: It swam, it saw, it chomped, it ate.

DIET: Megs ate baleen and sperm whales, large fish, dugongs, seals, sea lions, and giant squid. As cold-blooded animals, sharks eat proportionately less than humans do (only 2% of their body weight per day). Jaws opened extremely wide (the megalodon could have swallowed whole a mammal or a fish the size of the modern great white shark).

LIFE STORY: Because many juvenile megalodon teeth have been found along Florida’s Peace River, paleontologists think that megalodons reared their young there, in a saltwater bay where they were protected from predators. The megalodon became extinct 3 million to 1.6 million years ago (experts disagree on precisely when and why). Food became scarce when sharks that could swim faster outcompeted the meg, and when some whales (the meg’s main diet) became faster swimmers and moved to cooler waters. The emergence of an isthmus in Panama linking North and South America blocked sea routes and changed ocean currents. The megalodon had been able to adapt to changes in ocean salinity and had survived into a second epoch but could not adapt to changes in its food supply.

RELATIVES: Experts disagree about the correct scientific name for this shark and about which modern shark is most closely related to it. Those who think the Miocene animal is closely related to the modern great white shark call it “Megalodon carcharodon.” Those who believe that the mako shark is more closely related to the great white shark (citing similarities in the animals’ teeth) call the meg “Megalodon carcharocles.” Experts continue to study the fossil record and sometimes revise the way they classify species.

EPOCH: Miocene (“my-oh-seen”), 24 million to 5 million years ago.

During this epoch, land first emerged in Florida from ancient oceans, creating a peninsula that extended southward to Bradenton. In this epoch, much of the phosphate we dig out of the ground today was formed. Wastes and skeletons of tiny sea creatures drifted to the sea floor. Seawater reworked this material, reacting it with calcium carbonate on the ocean floor. Later, the material precipitated out of seawater to form phosphate, which became part of the sediment. When ancient oceans receded, the phosphate was landlocked; today, miners dig through dry land to mine the phosphate, which is used to make fertilizer and other products.

FOSSIL RECORD: This animal’s fossil teeth are found worldwide. The megalodon had at least 250 teeth at a time, growing in several rows; when a tooth was lost, another from a row behind replaced it.

ROLE IN PLAY: Act out swimming and finding smaller sea creatures to eat. Enjoy your habitat. Before the mid-Pleistocene, you become extinct.
Modern Man
Compiled by: Dr. Sandy Small

DESCRIPTION: Modern man (Homo sapiens) is a direct descendant of paleo-man, who was a newcomer to Florida 12,000 to 10,000 years ago. Modern man has the largest brain-to-body mass of all animals.

APPEARANCE: Man is a biped, standing upright on two legs. Compared to other mammals, man is covered only minimally with hair.

SIZE: Height and weight depend on diet/nutrition and genetics (human height is 90% heritable). In the U.S., the average height of an adult male is 175.8 cm; an adult female, 162.5 cm.

HABITAT: Modern man lives on dry land, usually in structures he has built of sod, stone, wood, brick, or steel. Man lives on six continents and sojourns (visits for a while) in Antarctica.

BEHAVIOR: Humans are social animals, often found in families and groups of friends. Humans communicate in a variety of ways. It is unknown when human speech developed; written languages are estimated to be only 5,000 years old. Modern humans trade and travel widely and create laws to govern towns and nations. They utilize technology, applying labor-saving tools to improve the speed of transport and produce more crops and manufactured goods. Because technology often depends on large-scale use of fossil fuels, land, water, and minerals, critics in recent decades have urged that development become sustainable, relying more on resources that can be reused or replaced. In developed societies, humans enjoy leisure, time spent on things beyond the basic needs of food and shelter; they express themselves through sports, the arts, philosophy and religion. Modern man studies science (a disciplined search for truth about the natural world), human culture (ways of living taught to subsequent generations), the history of their own, and other species.

DIET: Modern man is an omnivore; he is capable of digesting animal flesh and plant material.

OFFSPRING: Development before birth lasts nine months. At birth, an infant is totally dependent on its parents. Humans usually learn to walk by age 1, to talk by age 2; they reach physical maturity at around 15 years.

LIFE STORY: Improved diet and advances in combating diseases have extended the lifespan in developed countries to around 80 years, slightly longer for women than for men.

RELATIVES: Humans share 95% of their genetic material with other primates and therefore descended from a common ancestor, around 7 to 5 million years ago.

EPOCH: Holocene, 100,000 years ago to the present.

For the past 10,000 years, since the end of the Pleistocene Epoch, Earth’s climate has grown warmer. One reason for this warming trend (but not the only reason) is humans’ burning of fossil fuels. Glaciers are shrinking, and sea levels have risen. During the Holocene Epoch, humans have competed for habitat with other land animals.

ROLE IN PLAY: Build or acquire a home. Earn a living (trade goods and services for other goods and services or for money). Express yourself (talk, read, write, build or make things, travel). Enjoy your habitat.
**The Opossum**  
Compiled by: Dr. Sandy Small

**DESCRIPTION:** The Virginia opossum (Didelphis virginiana) is a mammal and North America’s only native marsupial (animal that raises its young in female’s pouch). Didelphis means double womb (the pouch is thought of as a second womb because the young continue to develop there after birth).

**APPEARANCE:** Body is gray or black. The animal’s face and the tips of its ears are white. There are whiskers on the opossum’s long, pointed face. The pink tail is long and tapered. Each of the animal’s four short legs end in five digits. On each of its hind feet, the opossum has an inner opposable thumb. The opossum has 50 teeth, more than any other land animal in North America.

**SIZE:** The animal is the size of a housecat. Adults average 32 inches in length (including a 15-inch tail).

**HABITAT:** Woods, watersides, farms, and towns, in most of the United States and portions of Canada and Mexico.

**BEHAVIOR:** The opossum is a nocturnal animal (more active at night). It is less active in cold weather. This animal uses its long, wraparound tail to keep itself steady as it crawls on tree trunks; it does not suspend itself from its tail. When the animal is surprised at close range, it may appear to play dead (the origin of the phrase, “play ‘possum”). This is an involuntary reaction to being frightened and unable to flee.

**DIET:** The opossum is an omnivore. It eats fruit, nuts, bird eggs, crickets, cockroaches, beetles, snails, mice, rats, and the flesh of already-killed animals.

**OFFSPRING:** The female gives birth two to three times a year. In each litter there may be from one to fourteen tiny young (in average litter: eight). Babies continue to grow in the mother’s marsupium (pouch) for two months. After leaving the pouch, offspring are carried on the mother’s back whenever they are away from the den, until they are old enough to travel on their own.

**LIFE STORY:** This gentle animal has numerous predators (enemies), including humans, dogs, cats, owls, and larger wildlife.

**RELATIVES:** The opossum is related to other marsupials, such as the kangaroo and the koala.

**EPOCH:** Holocene, 10,000 years ago to the present.

For the past 10,000 years, since the end of the Pleistocene Epoch, Earth’s climate has grown warmer. One reason for this warming trend (but not the only reason) is humans’ burning of fossil fuels. Glaciers are shrinking and sea levels have risen. During the Holocene Epoch, humans have competed for habitat with other land animals.

**ROLE IN PLAY:** Act out climbing a tree, eating, and “freezing” in shock when surprised. Enjoy your habitat.
The Paleo-Man
Compiled by: Dr. Sandy Small

DESCRIPTION: Paleo-man descended from humans who crossed from Asia to North America over the Bering land bridge (Beringia). He arrived in Florida 12,000-10,000 years ago, near the end of the Pleistocene.

APPEARANCE: Paleo-man was one of the less hirsute (hairy) mammals. He was a primate (walked erect on two legs).

SIZE: Fossils indicate Paleo-man was taller than a saber-cat, shorter and much lighter weight than a mammoth.

HABITAT: In Florida, as elsewhere, humans settled in areas well supplied with fresh water and near hunting grounds.

BEHAVIOR: Paleo-man had the largest brain of any mammal and was able to adapt to his environment. He used his opposable thumbs to make tools, such as spear points made from chert, a quartz stone. Many experts blame man’s efficiency as a hunter for the disappearance of large land animals during the late Pleistocene Epoch (the “Overkill” theory).

DIET: Paleo-man was an omnivore (he ate both plants and animals). He hunted and gathered nuts and berries. As the large land animals died out, he relied more on hunting deer and on fishing for mollusks and other shell fish. Shell mounds at sites such as Horr’s Island, in Collier County, are piles of “empties” left by oyster eaters. Late in the Pleistocene, communities developed agriculture. They grew the “three sisters” crops: corn, squash, and beans.

LIFE STORY: Paleo-man did not become extinct. Coastal communities were established by Florida’s Paleo-Indians: the Apalachee, Timucua, Tocobaga, Calusa, Ais, and Tequesta. A cultural milestone 4,000 to 3,000 years ago was the making of fire-glazed pottery, which allowed Paleo-Indians to store food. Robin Brown states that Florida’s Paleo-Indian period lasted 2,000 3,000 years; by then, the great land animals had died out. We do not know when early man developed the power of speech; fossils give us no clues. Societies that depend solely on primitive agriculture for survival usually offer no time for the development of writing. Modern European descendants of Paleo-man first came to Florida in the 1500s. By the 1760s, most descendants of native peoples had died or left Florida.

EPOCH: Paleo-man lived in the Pleistocene, 1.7 million to 10,000 years ago. His descendant, modern man, lives in the Holocene, 10,000 years ago to the present.

During the Pleistocene Epoch, there were many abrupt changes in earth’s climate and sea level. The Ice Age included many periods when glaciers spread over much of the earth. When glaciers expanded, the climate was cool and dry and more dry land was available as habitat for large animals. When glaciers melted, the climate was warm and humid and land animals’ habitat shrunk. Some animals adapted, others found a new habitat, and the rest became extinct (died without living offspring).

For the past 10,000 years, since the end of the Pleistocene Epoch, Earth’s climate has grown warmer. One reason for this warming trend (not the only reason) is humans’ burning of fossil fuels. Glaciers are melting and sea levels have risen. As human settlement expands, there is intense competition among land animals for habitat.

THE RECORD: Human skeletal remains from Little Salt Spring in Sarasota County date from 10,000 years ago. Archaeologists are students of prehistoric people, their dwellings, and artifacts (objects made or modified by man). They dig for clues in middens (pits of household refuse). They have found parts of weapons and animal bones that were butchered, not accidentally broken. In rivers that run through karst deposits, such as the Aucilla River, they have found spear points. Changes in the size and shape of the points show that man adapted to habitat change by using different tools to hunt smaller animals.

ROLE IN PLAY: Gather nuts and berries, make tools, and hunt large animals. Enjoy your habitat. After the Pleistocene Epoch ends, remain in Florida while its land mass shrinks. Hunt deer, fish, and farm. Form communities near the coast. Make pottery. Your successor is modern man.
The Prehistoric Mako Shark
Compiled by: Dr. Sandy Small

**DESCRIPTION:** Miocene species of mako included the *Isurus hastalis*. It was abundant in these two epochs and we find many fossil teeth of this species. Some experts consider the *Isurus hastalis* a “cousin” of the modern great white shark.

**APPEARANCE:** The prehistoric makos had long, thin, triangular, sharp teeth which grew in several rows. Fossil hunters have found teeth measuring from ¼ inch to 2 inches long. Mako teeth, called “narrow form,” are easy to distinguish from megalodon teeth. The mako had a body that was streamlined, lighter-weight and shorter than the body of the megalodon. Modern makos are blue.

**SIZE:** Prehistoric mako sharks were even longer than their modern kin, which can reach 12 feet in length.

**HABITAT:** The mako was a deep-ocean shark that thrived in cold waters.

**BEHAVIOR:** The mako swam fast in pursuit of prey. If the prehistoric animal behaved like its modern kin, it jumped spectacularly high.

**DIET:** All sharks are carnivores. The mako ate squid, sharks, other fish, and marine mammals.

**LIFE STORY:** Like the megalodon, the mako became extinct in the late Pliocene. One theory is that the great white shark, which had evolved by then, was a more efficient predator and removed the old-timers’ food supply.

**RELATIVES:** Some scientists now believe that now-extinct species of mako sharks (and not megalodons) were ancestors of the modern great white shark. They developed this theory by comparing the serrations (jagged edges) on the teeth of several shark species.

Modern makos, descended from the same ancestor as the *Isurus hastalis*, include a longfin species, inhabiting warm waters, and a shortfin species, swimming in cooler seas and known for great speed and amazingly high jumps.

**EPOCH:** Miocene (“my-oh-seen”), 24 million to 5 million years ago.

During this epoch, land first emerged in Florida from ancient oceans, creating a peninsula that extended southward to Bradenton. In this epoch, much of the phosphate we dig out of the ground today was formed. Wastes and skeletons of tiny sea creatures drifted to the sea floor. Seawater reworked this material, reacting it with calcium carbonate on the ocean floor. Later, the material precipitated out of seawater to form phosphate, which became part of the sediment. When ancient oceans receded, the phosphate was landlocked; today, miners dig through dry land to mine the phosphate, which is used to make fertilizer and other products.

In the Pliocene Epoch, polar ice and glaciers melted, and the sea level rose. Sometimes Florida was covered by water. Many sea creatures thrived. When the temperature of the ocean fell, the habitat changed completely and many marine animals became extinct.

**FOSSIL RECORD:** We find mako teeth and spinal column discs, which look like very short cylinders with squeezed-in sides. (Scientists do not find fossil shark skeletons; the flesh of living sharks is attached to cartilage, not bone, and cartilage is not as hard as bone and does not last as long.)

**ROLE IN PLAY:** Act out swimming and finding smaller sea creatures to eat; enjoy your marine habitat. You do not compete directly with the megalodon, which swam in shallower waters. At the end of the Pliocene Epoch, several species of mako become extinct.
The Prehistoric Oyster
Compiled by: Dr. Sandy Small

DESCRIPTION: Oysters are mollusks, invertebrates (animals lacking a backbone) with a calcium carbonate shell. Every oyster is a bivalve, with two shells that fit together and protect internal organs, nestled in the fleshy mantle. All true oysters belong to the family Ostreidae.

APPEARANCE: Every oyster’s two rough, white or gray shells differ slightly from each other in size and shape. Different genera have distinct shell characteristics. Oysters in the genus Crassotrea have shells that are elongated and deep-cupped; shells of oysters in the genus Ostrea are flatter and more rounded. Almost all shell-bearing mollusks can secrete pearls, though not all pearls are valuable. (Some edible oysters make pearls that resemble gray peas.) When a particle of sand or dirt or an invading organism settles inside the oyster’s mantle, the oyster produces nacre, a soft substance to cover the “intruder.” Eventually, this substance hardens and becomes smooth.

SIZE: Fossil oyster shells found in Florida range from 58 to 112 mm. in length. For comparison, the mature modern Eastern Edible Oyster is 25 centimeters (10”) long.

HABITAT: Prehistoric oysters belong to one of three different genera; two lived on the ocean bed, near the coast. Modern oysters are found in brackish water and in oceans in temperate and tropical climates worldwide. After the larval stage, oysters attach themselves to rocks or shells on the sea floor.

DIET: If prehistoric oysters were like modern oysters, they ate organic debris and plankton. (Modern oysters are called “filter feeders.”)

OFFSPRING: Modern oysters produce millions of eggs. At any given time, an individual may function as a female (creating and releasing eggs) or as a male (releasing material that fertilizes eggs); over time, it is technically possible for an oyster to be both mother and father to its own offspring.

RELATIVES: Three species of early Florida oysters have no close living relatives; distant relatives include scallops and mussels. Oysters from the species Virginica (genus Crassotrea) are living today and are called Edible Eastern Oysters. Note that the so-called spiny oyster or thorny oyster looks very different from prehistoric and modern oysters and belongs to a different family and genus (Spondylidae Spondylus).

EPOCH: Prehistoric oysters lived in Florida seas during the Miocene (“my-oh-seen”) and Pliocene (“ply-oh-seen”) Epochs. The Florida land mass first emerged from the ocean during the Miocene. Later, polar ice and newly formed glaciers melted, sea levels rose. At times in the Pliocene, Florida was completely covered by water; at other times, the only land in Florida was a few islands. Many marine creatures thrived in Florida waters during the Pliocene until a cooling climate changed their habitat.

FOSSIL RECORD: Oyster fossil shells are found in strata called the Caloosahatchee Formation and the Tamiami Formation. Much later, In the Pleistocene Epoch, humans arrived and consumed oysters; during the Holocene Epoch, humans have cultivated oysters in beds. (We know about humans’ prodigious oyster eating from middens, shell piles left by early civilizations.)

ROLE IN PLAY: Take in plankton and other foods, as your cilia beat sea water toward your gills. Attach yourself to the sea floor. When a predator—a crab, a starfish, or a swooping sea bird—threatens your safety, use your strong adductor muscles to close your shell.
The Prehistoric Walrus
Compiled by: Dr. Sandy Small

DESCRIPTION: The walrus was a pinniped, a sub-order of carnivores with limbs adapted to the aquatic life. Besides walruses, pinnipeds include seals and sea lions. The walrus was a vertebrate (it had a backbone).

APPEARANCE: The walrus was a large, fleshy animal with a rounded body. It had two long down-curving ivory tusks (modified canine teeth) that the animal used as levers to haul itself out of seawater and onto land. It had flippers over a structure of short, strong humerus and femur bones. Flippers ended in fingers.

SIZE: The Florida walrus was larger than today’s Alaskan walrus, which weighs in at 1,700 to 3,700 pounds (800-1,700 kg) and is 9 to 12 feet (2.7 to 3.6 meters) in length.

HABITAT: This marine creature lived around Lake Okeechobee when that body of water was a sea.

BEHAVIOR: The walrus was adept at swimming and diving. If the prehistoric walrus was like its modern kin, it spent half its time in the water.

DIET: The animal’s primary diet was clams and mollusks. Walruses whose fossils have been found in the Murdock Station Formation ate Chesapecten scallops.

LIFE STORY: The life of the Florida walrus shows the impact of ocean currents on the food chain. The walruses in the Okeechobean sea ate scallops, which fed on plankton brought to the surface by upwelling currents. When these currents stopped, the plankton died out, the scallops died out, and the walrus became extinct in Florida.

RELATIVES: Pinnipeds are believed to be descended from a bear-like ancestor. Today, walruses live only in shallow arctic waters.

EPOCH: Pliocene (“ply-oh-seen”), 5 million to 1.8 million years ago.

Some scientists think the Pliocene and Pleistocene Epochs were similar because glaciers formed and melted in both epochs. At times in the Pliocene, Florida was completely covered by water; sometimes, the only land in Florida was a few islands; and sometimes there was a peninsula, though it never covered the entire Florida Platform as would be the case during the Pleistocene. Many marine creatures thrived in Florida waters during the Pliocene until cooling at the end of the epoch changed habitats completely.

FOSSIL RECORD: Fossils of walrus tusks have been found in the upper Bone Valley Formation and in the Hawthorn Formation. Paleontologists hope to find skulls, jawbones, and humeri (arm/flipper bones), so they can compare remains of this animal to other Atlantic walruses and make a more complete identification.

ROLE IN PLAY: Swim and dive and rest on a beach. Feast on clams and other shellfish. Enjoy your habitat. When the Pliocene Epoch ends, you become extinct in Florida.
**The Raccoon**
Compiled by: Dr. Sandy Small

**DESCRIPTION:** The common raccoon (Procyon lotor) is a quadruped (a four-legged animal). It is a mammal that ranges throughout the Americas, from Canada to Argentina.

**APPEARANCE:** This animal has grayish brown fur with a black “mask” outlining eyes and black bands on its bushy tail. The muzzle is narrow with white along the sides. Each of the raccoon’s legs end in five flexible, clawed toes which the animal uses to climb trees and wash food. Hind legs are longer than front legs, giving the animal a slouching posture.

**SIZE:** An adult’s body averages 32 inches in length; the tail is 9” long. Adult raccoons in central Florida average 8 to 15 pounds in weight but can be as heavy as 20 pounds; raccoons in the Midwest weigh as much as 30 to 40 pounds (extra stores of fat help those animals survive the winter). Males are 10 to 15% heavier than females.

**HABITAT:** The raccoon lives in woodlands, scrubland, and farm areas with access to water; it may also live in towns. The animal makes its home (den) in a hollow tree, crevice, a ground burrow another animal has abandoned, or a building.

**BEHAVIOR:** The raccoon is nocturnal (more active at night) but is sometimes seen in the daytime. The animal is a good swimmer; it can also run at speeds up to 15 mph. It can climb and even dig. In Florida, raccoons are active year-round; in colder climates they semi-hibernate, sleeping through severe weather.

Raccoons often dunk food in water before they eat it, but if no water is nearby they do not hesitate to eat.

**DIET:** As omnivores, raccoons eat berries, fruits, plants, fish, crabs, beetles, mice, and carrion (the flesh of already killed animals).

**OFFSPRING:** Every spring, a mature female gives birth to 3 to 5 pups. At three weeks, pups open their eyes. Pups remain in the den until they are 8 to 12 weeks old. At two months, they hunt with mom.

**LIFE STORY:** Raccoons have been known to live for sixteen years, but the mortality rate for adults is high. A life span of three to four years is more usual. Many are killed by automobiles. Predators include man, bobcats, coyotes, foxes, and great horned owls. Raccoons also die from malnutrition, distemper, and rabies.

**RELATIVES:** White-nosed coati, ringtail, red panda.

**EPOCH:** Holocene, 10,000 years ago to the present.

For the past 10,000 years, since the end of the Pleistocene Epoch, Earth’s climate has grown warmer. One reason for this warming trend (but not the only reason) is humans’ burning of fossil fuels. Glaciers are shrinking, and sea levels have risen. As human settlement expands, humans have come into closer contact with wild animals, including the raccoon; there is intense competition among land animals for habitat.

**ROLE IN PLAY:** Act out foraging for food in a forest, scrub, or farmland habitat. If you live near humans, forage for food near houses. Wash food before you eat it. Enjoy your habitat.
The Rhinoceros
Compiled by: Dr. Sandy Small

DESCRIPTION: The rhinoceros that lived in Florida during the Miocene was a land mammal. It was a Perissodactyl, a hoofed animal with an odd number of toes. (At least the rhino started out that way; some fossils show four toes on the front hooves.)

APPEARANCE: Rhinos we know about from the Florida fossil record include the Floridiceras whitei, a hornless animal about the size of today’s black rhino; the Aphelops, a smaller hornless species; and the Teloceras, which had stout, short legs, a very rounded ribcage and body, and (on males only) a nasal horn. Both male and female rhinos had tusk-like front teeth (males’ tusks were larger). The Teloceras looked a lot like today’s hippopotamus.

HABITAT: Some experts think the Teloceras divided its time between land and water, but other scientists believe all rhino species were solely land-dwellers.

BEHAVIOR: The rhinoceros ate grass, i.e., it was a grazer. Some people use the words “graze” and “browse” interchangeably, but these terms are slightly different. Browsing involves the eating behavior of those herbivores—usually larger animals—that eat the shoots and twigs of shrubs and trees in preference to grass and other ground plants.

DIET: The prehistoric rhino was an herbivore. We know this from the fossil record. Early rhinos ate soft leaves. The rhino developed high-crowned teeth, useful for grinding up grass. Paleontologists also find traces of carbon in the teeth that point to a vegetarian diet.

LIFE STORY: Early rhinos ate soft forest vegetation. Later in the Miocene, the climate of North America became drier. Grasses spread throughout the continent. Some experts think early rhinoceros species had difficulty competing for food with animals that had more highly developed teeth—such as later species of horses and rhinos. The rhino became extinct in the early Pliocene, around 5 to 4.5 million years ago.

RELATIVES: Though some rhinos from the Miocene looked like hippos, and though the two animals preferred similar habitats, they are not related.

EPOCH: Miocene (“my-oh-seen”), 24 million to 5 million years ago.

During this epoch, land first emerged in Florida from ancient oceans, creating a peninsula that extended southward as far as modern-day Bradenton. In this epoch, much of the phosphate we dig out of the ground today was formed. Wastes and skeletons of tiny sea creatures drifted to the sea floor. Seawater reworked this material, reacting it with calcium carbonate on the ocean floor. Later, the material precipitated out of seawater to form phosphate, which became part of the sediment. When ancient oceans receded, the phosphate was landlocked; today, miners dig through dry land to mine the phosphate, which is used to make fertilizer and other products.

FOSSIL RECORD: Florida locations with abundant rhino fossils are the Love Site, near Archer, and Thomas Farm in Gilchrist County. In central Florida’s Bone Valley, it is more common to find isolated teeth or leg bone fossils, but some complete jawbones have been found here. You can see a mounted skeleton of Teloceras on display at the Florida Museum of Natural History, Gainesville.

ROLE IN PLAY: Adapt to a habitat with less forest than prairie. (Chew grass, perhaps with difficulty.) Enjoy your habitat. After the Miocene Epoch ends, you become extinct.
The Saber-Toothed Cat/Saber-Cat
Compiled by: Dr. Sandy Small

DESCRIPTION: Florida’s Pleistocene saber-toothed cats were muscular quadrupeds with impressive canine teeth. The saber-cat is classified within the family Felidae (true cats). In the late Pleistocene, Smilodon floridanus appeared.

This animal, with its powerful legs and menacing canine teeth, belongs to the order Carnivora. Do not be misled by the name; not all animals in the order were carnivores (meat-eaters), though the saber-cat definitely was. All carnivorans had two bones in their limbs, not just one, and five digits ending in claws on each foot (one of the five may be shorter than the others). Stout jaw muscles enabled these animals to open wide for large chunks of flesh and swallow them whole.

APPEARANCE: The saber-cat’s two curving canine teeth were 9 inches (18 cm) long, the longest teeth of any animal yet found.

SIZE: In Florida, the saber-cat evolved into an animal the size of a modern lion. This big cat was the one of the largest Pleistocene carnivores, weighing several hundred pounds.

HABITAT: The ample Pleistocene landscape. Paleontologists think that smilodon was an opportunist that lured prey onto fragile karst rock, which gave way to form a sinkhole; then the cat could attack an already wounded animal. Though the cat’s legs were powerful, they were not long; the smilodon lacked speed.

BEHAVIOR: With powerful front legs, the saber-toothed cat was an ambush predator that pounced on prey such as horses or mastodons. Currently most experts believe the cat lunged to subdue, then used its curving teeth to wound an animal so it would bleed to death, after which it would eat. Because fossils include scarred bones, scientists think that smilodon may have lived in groups (a group could take care of an injured animal).

DIET: The saber-cat was a carnivore.

LIFE STORY: When increasingly cool, dry weather changed Florida’s forests, the browsing herbivores died or moved on, and the carnivores (such as the cats) that preyed on them for food became extinct.

Smilodon disappeared from Florida around 11,000 years ago.

EPOCH: Pleistocene (“plies-toe-seen”), 1.8 million to 10,000 years ago.

In the Pleistocene Epoch, there were many abrupt changes in Earth’s climate and sea level. The Ice Age included periods when glaciers spread over much of the Earth. When glaciers expanded, Florida’s climate was cool and dry and more dry land was available as habitat for large animals. When glaciers melted, the climate was warm and humid and land animals’ habitat shrunk. Some fauna adapted, some found a new habitat, but others became extinct (died without living offspring).

FOSSIL RECORD: Scientists have found jawbones and teeth of this animal in caves and sinkholes. Saber-cat fossils have been found in Silver Springs in Marion County and in Hillsborough County’s Leisy shell pit, among other locations in the state. A vogue for paleo-tourism beginning in the 19th century brought out-of-state enthusiasts to Florida to collect fossils. Bones of the first American saber-tooth to be discovered were found in Florida in 1886 by a Pennsylvanian who took his find to the Wagner Institute of Science in Philadelphia.

ROLE IN PLAY: Act out pouncing on prey and making a meal out of a bigger, slower animal. Enjoy your habitat. When the Pleistocene Epoch ends, you become extinct.
The Sand Dollar
Compiled by: Dr. Sandy Small

DESCRIPTION: The Sand Dollar was a marine animal belonging to the genus Encope (“en cope ee”). It was an echinoderm (“ih-kine-o-derm”), classified in the phylum Echinodermata because of its body parts that radiated from a center and its stiff wall made up of calcium carbonate protrusions or spines. (The word echinoderm comes from the Greek words for prickly skin.)

APPEARANCE: The animal’s soft body was enclosed in a test (skeleton) that was nearly circular in outline. This animal was flat and thin. The animal’s mouth was on the center of the surface nearest the sea floor (the oral surface). Tiny tube feet pushed food particles to food grooves, and different tube feet pushed food toward and into the mouth.

Gills were located on the aboral or upper surface (“ab” in Latin means from or away, so aboral means the surface away from the mouth). In the gills, oxygen-containing sea water was taken in, and waste gases were eliminated from the body.

SIZE: Some range from two to four inches (five to ten cm) in diameter.

HABITAT: The animal lived in shallow ocean waters in the subtidal zone (beyond the low tide line).

BEHAVIOR: The sand dollar used its tiny legs to move over the ocean floor and to bury itself in sand.

DIET: (If the Pliocene sand dollar was like its modern kin, it ate fine sediment suspended in seawater and tiny particles of food trapped on grains of sand. Tube feet pushed the nutrients toward and into the animal’s mouth.)

LIFE STORY: We know that modern sand dollars are preyed upon by sea stars, snails, and skates.

RELATIVES: Other echinoderms, such as sea urchins and starfish.

EPOCH: Pliocene (“ply-oh-seen”), 5 million to 1.7 million years ago.

Some scientists think the Pliocene and Pleistocene Epochs were similar because glaciers formed and melted in both epochs. The major glaciations, however, occurred during the Pleistocene.

At times in the Pliocene, Florida was completely covered by water; sometimes the only land in Florida was a few islands; and sometimes there was a peninsula, though it never covered the entire Florida Platform, as would be the case in the Pleistocene.

At the end of the Pliocene, the temperature of the ocean fell and the habitat changed completely. Many marine animals became extinct (died without living offspring).

FOSSIL RECORD: The sand dollar skeleton is made of calcium carbonate. When the animal inside died, the skeleton (test) was preserved. Fossils have been found in the Tamiami Formation in Port Charlotte and elsewhere.

ROLE IN PLAY: Act out eating tiny particles you find in sea water and on sand. Walk slowly over the ocean floor. Bury yourself in sand, partially or completely. Enjoy your habitat. When the Pliocene Epoch ends, you become extinct.
**The Scallop**  
Compiled by: Dr. Sandy Small

**DESCRIPTION:** Prehistoric scallops lived in Florida seas during the Miocene, Pliocene, and Pleistocene Epochs. In the Pliocene, the Rough Scallop (Pectinidae aequipecten) and the Chesapeake Scallop (Pectinidae chesapecten) were common marine animals, an important food source for other sea creatures. The scallop was a mollusk, an invertebrate animal (animal lacking a backbone) which had a calcium carbonate shell enclosing a soft, unsegmented body. This mollusk was a bivalve, with two shells that fit together protecting its internal organs. (Bivalves belong to the class Pelecypoda.)

**APPEARANCE:** Members of the family Pectinidae have fan-shaped shells with a radiating, fluted pattern.

**SIZE:** Various Chesapeake scallop fossil shells found in Florida measure 2.1 inches to 4.3 inches (55 mm. to 110 mm) in length.

**HABITAT:** Sea and sea floor. Numerous scallops lived in Lake Okeechobee when that body of water was a (saltwater) sea.

**BEHAVIOR:** Though the animal *could* have used its strong adductor muscle to close its shells completely, the scallop probably did not do this often but left shells partially open. (It tires the animal to keep the shells closed.) To get away from slow-moving predators, the scallop swam in short pulses by moving its two shells together and apart. It could swim forward horizontally and at an angle. It rested by sending out a foot that anchored it to the sea floor. The animal breathed through gills. Tiny, hair-like structures directed water (containing oxygen and other gases) toward the gills.

**DIET:** Phytoplankton (plant organisms drifting in seawater).

**LIFE STORY:** The prehistoric scallop’s predators were walruses and other large marine animals.

**RELATIVES:** The scallop is closely related to the modern scallop and to the oyster.

**EPOCH:** Pliocene ("ply-oh-seen") Epoch, from 5 million to 1.8 million years ago.

Some scientists think the Pliocene and Pleistocene Epochs were similar because glaciers formed and melted in both epochs. The major glaciations, however, occurred during the Pleistocene.

Many mollusks thrived during the Pliocene. When the temperature of the ocean dropped, and currents changed, the habitat changed completely and many marine mollusks became extinct (died with offspring).

**FOSSIL RECORD:** Shells (tests) provide most of our information on prehistoric scallops. We also draw inferences about the prehistoric scallop (reach conclusions from related evidence) based on the biology of modern scallops, their relatives.

**ROLE IN PLAY:** Breathe through your gills. Move your two shells to swim through the ocean. Extend your foot to anchor yourself on the sea floor. Take in seawater to breathe and eat. Enjoy your habitat. When sea currents change and plankton beds die in the mid-Pliocene, your species becomes extinct.
The Six-Horned Pronghorn
Compiled by: Dr. Sandy Small

DESCRIPTION: The six-horned pronghorn (Hexobelomeryx simpsoni) was a land animal in the family Antilocapridae. Pronghorns belonged to the order Artiodactyla: Mammals that have an even number of toes/hoof divisions. The animals had slender legs and grooved ankle bones that fit closely into leg bones. Hind legs were springy.

APPEARANCE: The pronghorn resembled a deer or a modern antelope but was not an ancestor. By each ear, the animal had three horns which tapered toward the tip. Paleontologist David Webb suggests that pronghorns with evenly spaced horns were males and those with the middle horn positioned closer to the rear horn were females.

(Horns are different from antlers; they are made of keratin, a hardened skin tissue. Horns are hollow; they are formed as cones that push upward from a base; they are permanent. Each horn is a single shaft, though in some animals, these shafts twist and form interesting shapes. Antlers, in contrast, are solid bone and grow from the tips. Antlers are branched. An animal sheds antlers once a year.)

BEHAVIOR: The six-horned pronghorn may have traveled in herds. Herds offer protection, since groups are more difficult for predators to attack. Widely spaced eyes allowed the animal to spot predators on either side. Six-horned pronghorns were able to run very fast.

DIET: The animal was an herbivore and probably a browser because it had teeth with crowns that were longer than the root area; such “hypsodont” teeth were an advantage in chewing coarse vegetation. (Grazing animals have shorter teeth for grinding grass.) Teeth were narrower than the diameter of a dime.

As ruminants, pronghorns re-processed partially digested food (a cud) by bringing it back up the digestive tract and chewing it again. Ruminant animals can eat food in one location, then move to a safer spot to finish digesting the meal.

LIFE STORY: Pronghorns lived in Bone Valley in the middle Pliocene, when seas were 35 meters above present levels, and near the Withlacoochee, when sea levels were comparable with today’s level. They died out before the Pleistocene.

RELATIVES: Artiodactyls are related to bovids (such as the bison) and even whales! The only other known six-horned antilocaprid lived in northern Mexico during the early Pliocene. In the Holocene Epoch, modern pronghorns live in the Great Plains of North America.

EPOCH: Pliocene (“ply-oh-seen”), 5 million to 1.8 million years ago.

Some scientists think the Pliocene and Pleistocene Epochs were similar because glaciers formed and melted in both epochs. The major glaciations, however, occurred during the Pleistocene. At times in the Pliocene, Florida was completely covered by water; sometimes the only land in Florida was a few islands; and sometimes there was a peninsula, though it never covered the entire Florida Platform, as would be the case during the Pleistocene. When sea levels rose, land animals lost their habitats and became extinct.

FOSSIL RECORD: Fossil teeth and leg bones have been found in central Florida’s Bone Valley region, though not near horn cores. Horn cores have also been found in Bone Valley. Some fossils have been found on the sites of phosphate mine pits and washer plants.

ROLE IN PLAY: Browse for and chew green plants. Sense a predator nearby and run. Enjoy your habitat. Late in the Pliocene Epoch, you become extinct.
The Spiny Jewel Box
Compiled by: Dr. Sandy Small

DESCRIPTION: The spiny jewel box was a marine animal, a mollusk (an animal with a calcium carbonate shell surrounding soft organs inside), and a bivalve (an animal with two closable shells). It belonged to the genus Arcinella.

APPEARANCE: The spiny jewel box’s two shells were joined by a ligament. Tiny “teeth” that operated like tendons and strong muscles helped the two shells to open and close. The shell was studded with eight rows of spiky spines.

SIZE: One arcinella found in the Caloosahatchee beds measured 1.57 inches (40 mm) in length (and, to gauge from the photograph in the Brayfields’ book, was approximately the same width).

HABITAT: The spiny jewel box lived on the ocean floor.

BEHAVIOR: Researchers believe the spines gave this mollusk protection against predators, such as snails that bored through shells. Their theory is that the spines confused predators, which could not figure out the best place to drill for food. Distracted predators bored through thicker portions of arcinella’s shell, and risked being interrupted or even having to abandon the search for food.

Though bivalves can close their shells tightly, they do not always expend the energy to do so.

DIET: Mollusks ingest small sea creatures that live in sea water.

LIFE STORY: Changes to the temperature and level of the ocean forced marine animals that could not adapt or change habitat to become extinct (die without living offspring).

RELATIVES: There are modern species of spiny jewel box.

EPOCH: Pliocene (“ply-oh-seen”) Epoch, 5 million years ago to 1.8 million years ago.

At times in the Pliocene, Florida was completely covered by water; sometimes the only land in Florida was a few islands; and sometimes there was a peninsula, though it never covered the entire Florida Platform, as would be the case during the Pleistocene. Many marine animals thrived during the Pliocene.

At the end of the Pliocene Epoch, the temperature of the ocean fell and the habitat changed completely. Many marine animals became extinct (died without living offspring).

FOSSIL RECORD: The shell of this animal is made of calcium carbonate. When the animal inside died, the shell was preserved. The spiny jewel box is found in the Pinecrest and Caloosahatchee fossil beds.

ROLE IN PLAY: Act out opening and closing your valves to take in smaller marine organisms. Enjoy your habitat on the ocean floor. When the Pliocene Epoch ends, you become extinct.
The Star Coral
Compiled by: Dr. Sandy Small

DESCRIPTION: The star coral was a marine animal. The visible part of any coral is an exoskeleton, a “condominium” built by tiny animals called polyps.

APPEARANCE: A polyp the size of a pencil eraser lived in a cup-shaped structure beneath the skeleton; after it outgrew this structure, the polyp moved upward and created a new one. A coral reef is a multitude of polyp exoskeletons.

SIZE: The exoskeleton built by the polyp was shaped like a ball, 120 mm. in diameter.

HABITAT: The ocean floor.

BEHAVIOR: We think prehistoric polyps built their reefs by day and fed by night.

DIET: (This description relies on our knowledge of modern coral.) Polyps got food and energy from several sources. The polyp’s mouth was surrounded by tentacles, with stingers on each tentacle. When tiny ocean animals called zooplankton swam by, tentacles stung the animals and pushed them into the polyps’ mouth.

Polyps also received food and energy from microscopic plants that lived inside their tissues. Zooxanthellae are algae that ate the wastes polyps produced. In the process of photosynthesis, these algae used sunlight reaching the reef to produce oxygen, which gave the polyps the energy they needed to continue reef-building.

Polyps also ate sugars and other substances that leaked from the algae’s cells, and they absorbed organic compounds from seawater.

LIFE STORY: Changes to the temperature and sea level of the ocean forced those marine animals that could not adapt or change habitat to become extinct (die without offspring).

RELATIVES: Modern star corals live in the Florida Keys and the Caribbean Sea. Great star coral domes reach over five feet (1.5 meters) in diameter.

EPOCH: Pliocene (“ply-oh-seen”) Epoch, 5 million years ago to 1.8 million years ago.

At times in the Pliocene, Florida was completely covered by water; sometimes the only land in Florida was a few islands; and sometimes there was a peninsula, though it never covered the entire Florida Platform, as would be the case during the Pleistocene. Many marine animals thrived during the Pliocene.

At the end of the Pliocene Epoch, the temperature of the ocean fell and the habitat changed completely. Many marine animals became extinct (die without living offspring).

FOSSIL RECORD: The coral skeleton was made of limestone. When the animal inside died, the skeleton was preserved. Star corals of the genus Dichocoenia have been found in the Caloosahatchee Formation.

ROLE IN PLAY: Act out eating smaller marine organisms. Act out making a new skeleton. (In the puppet mitt, flex your fist to “grow” up and out.) Enjoy your habitat on the ocean floor. When the Pliocene Epoch ends, you become extinct.
The Stingray
Compiled by: Dr. Sandy Small

DESCRIPTION: Like its modern kin, the stingray was a vertebrate (it had a backbone). It had a long tail, twice the length of its body. The tail was equipped with a barb on the dorsal (top) surface. The barb had serrations (saw-like, notched edges) and was a defensive weapon.

APPEARANCE: (Here we rely in part on information about modern rays.) The ray’s body was shaped like a rounded diamond, ending in a snout. This animal’s body was pancake-flat. The ray had a narrow mouth. From the fossil record, we know that instead of individual teeth, the ray had mouth plates consisting of several bars with deeply grooved surfaces that attached the plate to the mouth. These mouth plates ground food.

The animal’s thinness helped it swim undetected by predators. If Miocene stingrays were like their modern kin, they had more vivid coloration on their dorsal surface and a pale underbody, another protection against predatory animals.

HABITAT: Warm coastal ocean waters.

BEHAVIOR: Stingrays swam, propelled by their large pectoral wings. Because the ray’s eyes were on the animal’s dorsal surface and the mouth on the underside, the ray could not see food sources but had to smell them.

If the Miocene stingray was like the modern ray, the animal was not aggressive but could, if threatened, spear predators with its barb. The barb of modern rays contains venom.

DIET: Presumably, the animal’s diet was similar to the diet of modern rays: Anemones, lobsters, clams, and worms.

LIFE STORY: No sources we have found indicate why the stingray became extinct at the end of the Miocene Epoch.

RELATIVES: The stingray, prehistoric and modern, is related to skates, sharks, and other rays.

EPOCH: Miocene (“my-oh-seen”), 24 million to 5 million years ago.

During this epoch, land first emerged in Florida from ancient oceans, creating a peninsula that extended southward to what is now Bradenton. In this epoch, much of the phosphate we dig out of the ground today was formed. Wastes and skeletons of tiny sea creatures drifted to the sea floor. Seawater reworked this material, reacting it with calcium carbonate on the ocean floor. Later, the material precipitated out of seawater to form phosphate, which became part of the sediment. When ancient oceans receded, the phosphate was landlocked; today, miners dig through dry land to mine the phosphate, which is used to make fertilizer and other products.

FOSSIL RECORD: Even though the stingray, as a “cartilage fish,” left no bones for fossil hunters to discover, Florida abounds in stingray fossils, including tail barbs, tooth plates, vertebrae, and sometimes dermal scutes (skin plates). The largest dermal plate found in Florida measured 1 1/8” x 3/8.”

ROLE IN PLAY: As you swim, use your sense of smell to find food, even animals that have buried themselves in the sand on the ocean floor. Feast on shellfish and worms. To avoid sharks, your primary enemy, ruffle up sand and hide in it. When the Miocene Epoch ends, you become extinct.
The Three-Toed Horse
Compiled by: Dr. Sandy Small

DESCRIPTION: The early three-toed horse was a small, browsing forest animal that bore its weight on three metacarpals or toes. Its low-crowned (brachydont) teeth were well adapted to browsing, or eating small shoots and twigs from trees and shrubs. Later on, horses became mixed-feeders, eating shrubs or grass, depending on availability. Later, in the late Miocene and early Pliocene, horse species developed high-crowned (hypsodont) teeth that were better adapted for grazing (eating grass).

SIZE: The three-toed horse was the size of modern racing dogs (greyhounds). Males were slightly larger than females.

HABITAT: Forest and (later) grassland.

BEHAVIOR: This horse lacked the bone and hoof structure to run fast or far. Its toes were ideal for walking over matted and wet vegetation.

DIET: Forest plants; increasingly, as the epoch progressed, grass.

LIFE STORY: Habitat changes forced most of the varieties of small horse to adapt or become extinct (die without offspring) at the end of the Miocene Epoch.

A scientist at Johns Hopkins offers a theory on the importance of long teeth. As the Miocene Epoch progressed, Steven Stanley notes, Earth’s climate became cooler and drier. Gritty C-4 grasses, containing more particles of silica, dominated the landscape. Horses used to eating food with less grit did not thrive on the new grass, which wore down their teeth. This change in diet may have shaved several years from the horse’s lifespan. Animals that die earlier do not reproduce in sufficient numbers to save the species from extinction.

Toes evolved. The Miocene horse placed its weight on three toes. Between 11 and 17 million years ago, the two side toes shrank up; horses increasingly put all their weight on the central metacarpal. In the only horse genus that survives today, Equus, side metacarpals have completely disappeared. Without side toes, the hoof weighs less, and the horse is able to run fast.

RELATIVES: Diohippus, a late Miocene horse without prominent side toes, may have been the ancestor of Equus, the modern horse. The closest living relatives of modern horses are two other Perissodactyls (animals with an odd number of toes), rhinos and tapirs.

EPOCH: Miocene (“my-oh-seen”), 24 million to 5 million years ago.

During this epoch, land first emerged in Florida from ancient oceans, creating a peninsula that extended southward to what is now Bradenton. In this epoch, much of the phosphate we dig out of the ground today was formed. Wastes and skeletons of tiny sea creatures drifted to the sea floor. Seawater reworked this material, reacting it with calcium carbonate on the ocean floor. Later, the material precipitated out of seawater to form phosphate, which became part of the sediment. When ancient oceans receded, the phosphate was landlocked; today, miners dig through dry land to mine the phosphate, which is used to make fertilizer and other products.

During the Miocene Epoch, more kinds of animals lived in Florida than in any other epoch. Habitat changes at the end of the epoch killed off many species.

FOSSIL RECORD: Horses from the Miocene Epoch are very common fossils at Florida sites, including the Thomas Farm. Earliest species are represented only by teeth, so paleontologists cannot identify species by using a common identifier, the shape of the horse’s skull.

ROLE IN PLAY: Browse. Graze if you can find no other food. Adapt with difficulty. As the epoch ends, you become extinct.
Cloze Sentences Activity

Directions: Define each term on a separate piece of paper. Then use the words in the list to complete the sentences below. Some terms are used more than once, some terms may appear in singular and plural forms, and not all terms from the list are used.

geologist  phosphate  extinct  paleontologist
Florida Platform  phosphate  epoch  Pleistocene Epoch
herbivore  Ice Age  glaciers  Miocene Epoch
glacier  Cenozoic Era  upwelling  era
Gulf Trough  Pliocene Epoch  Holocene Epoch  carnivore
fossils

1. On the television show “Friends,” the character Ross Geller is a __________________. He teaches and does research on plant and animal species no longer living on earth. Remains of those plants and animals (evidence that they were once alive) are called ________________.

2. An _______________ is a period of geologic time that can last tens of millions of years. An _______________ is a period of geologic time that can last a few million years or more. We are now living during the Cenozoic _______________, in the Holocene ________________.

3. Debris from the Appalachian Mountains settled on the ________________, defining the peninsula of Florida. At first, ocean currents prevented sediment from filling up the _______________ that separated the peninsula of Florida from the rest of the North American continent. Later, however, currents shifted, sediments built up, and Florida was attached to the continent.

4. ________________ are scientists who study Earth’s crust. Their research can help miners find oil, gas, and minerals, since deposits worth mining are found in certain layers of rocks. These scientists also help us understand what earth was like in previous epochs.

5. ________________ is a mineral used in making fertilizer. Much of it was formed during the ________________, when parts of central Florida were covered by ocean.

6. A large body of ice that moves in a sheet and affects climate is called a ________________. When one of these advances over land, sea levels fall. These moving ice sheets affect the climate even in parts of the Earth (like Florida) they never reach, because when sea levels fall and more land is exposed, the habitat can support more land plants and animals. When climates change and ________________ melt, the sea level rises.

7. Until cold and drought in the late part of the epoch, the greatest variety of land animals lived in Florida during the ________________.

8. An ________________ is an animal that (primarily or only) consumes plants as food.
9. A process that contributed to the formation of phosphate in oceans during the Miocene Epoch is called __________________. This process involved upward movement of ocean currents which brought food to marine animals nearer the surface. When animals ate the food, excreted, and later died, their wastes and skeletons were deposited on underwater plateaus. That organic material underwent a chemical change and formed francolite, a form of phosphate.

10. When an organism of a particular plant or animal species has died and all its offspring have disappeared from the face of the Earth, the organism is said to have died out or become _____________________.

11. Many marine fossils found in Florida date from the _________________________.

12. The last epoch before the modern or Holocene Epoch was the _______________________. During this epoch, there were several periods of glaciations alternating with warmer periods. Near the end of this epoch, around 10,000 years ago, paleo-man first came to Florida. Many large animals died out during the late _______________________, and experts disagree about the cause: climate change that destroyed animals’ habitats, or over-hunting by man, or new diseases the animals could not adapt to or resist.
Cloze Sentences Answers

1. On the television show “Friends,” the character Ross Geller is a paleontologist. He teaches and does research on plant and animal species no longer living on Earth. Remains of those plants and animals (evidence that they were once alive) are called fossils.

2. An era is a period of geologic time that can last tens of millions of years. An epoch is a period of geologic time that can last a few million years or more. We are now living during the Cenozoic Era, in the Holocene Epoch.

3. Debris from the Appalachian Mountains settled on the Florida Platform, defining the peninsula of Florida. At first, currents prevented sediment from filling up the Gulf Trough that separated the peninsula of Florida from the rest of the North American continent. Later, however, currents shifted, sediments built up, and Florida was attached to the continent.

4. Geologists are scientists who study Earth’s crust. Their research can help miners find oil, gas, and minerals, since deposits worth mining are found in certain layers of rocks. These scientists also help us to understand what Earth was like in previous epochs.

5. Phosphate is a mineral used in making fertilizer. Much of the phosphate was formed during the Miocene Epoch, when parts of central Florida were covered by ocean.

6. A large body of ice that moves in a sheet and affects climate is called a glacier. When one of these advances over land, sea levels fall. These moving ice sheets affect the climate even in parts of the Earth (like Florida) they never reach, because when sea levels fall and more land is exposed, the habitat can support more land plants and animals. When climates change and glaciers melt, sea levels rise.

7. Until cold and drought in the late part of the epoch, the greatest variety of land animals lived during the Miocene Epoch.

8. An herbivore is an animal that (primarily or only) consumes plants as food.

9. The process which contributed to the formation of phosphate in oceans during the Miocene Epoch is called upwelling. This process involved upward movement of ocean currents which brought food to marine animals nearer the surface. When these animals ate the food and later died, their wastes and skeletons were deposited on underwater plateaus. The organic material underwent a chemical process and formed francolite, a form of phosphate.

10. When an organism of a particular plant or animal species has died and all offspring have disappeared from Earth, the organism is said to have died out or become extinct.

11. Many marine fossils found in Florida date from the Pliocene Epoch.

12. The last epoch before the modern or Holocene Epoch was the Pleistocene Epoch. In this epoch there were several periods of glaciations alternating with warmer periods. During this epoch paleo-man first came to Florida, around 10,000 years ago. Many large animals died out during the late Pleistocene Epoch, and experts think this happened because man over-hunted them, or drastic climate change ruined their habitat, or the animals were exposed to new diseases to which they had no resistance.
Florida’s Ancient Oceans

Dire Wolf

The Dire Wolf (Canis dirus) was a large, carnivorous animal.

EPOCH: Pleistocene ("pli­toe­see­en"), 1.8 million to 10,000 years ago.

DESCRIPTION: Once, scientists believed the dire wolf was much larger than the modern gray wolf. Now most agree it was around the same size. Adults were 6 feet in length and weighed around 110 pounds. The dire wolf became extinct 16,000-10,000 years ago. The gray wolf, better equipped than the dire wolf to chase quick-moving prey, survived.

FOSSIL RECORD: Fossils of dire wolf adults and pups have been found in the Cutler Hammock sinkhole near Miami.

Dugong

The Dugong was an aquatic mammal belonging to a class called stenurians.

EPOCH: Miocene ("my­oh­see­en"), 24 million to 5 million years ago.

DESCRIPTION: Dugongs had no hind limbs but had a divided tail with pointed horizontal branches. It had one pair of tusks—like teeth below a bivalved snout. They were 6.9 feet in length, like modern manatees. Dugongs disappeared from Florida at the end of the Miocene Epoch; however, in the Holocene Epoch, manatees, which also belong to the Stenurian order, live in warm water all over the world.

FOSSIL RECORD: Florida fossil hunters have found dugong bones and even entire skeletons. A dugong skeleton from Bonita Springs can be found at the Mulberry Phosphate Museum.

Giant Ground Stag

The Giant Ground Stag (Eremotherium) was the largest of the ground stags in Florida.

EPOCH: Pleistocene ("pli­toe­see­en"), 1.6 million to 10,000 years ago.

DESCRIPTION: The length of a ground stag has been estimated at 20 feet, from nose to tail, and their weight has been estimated at 5 tons. The giant stag walked on four legs, but its claws were so curved that the animal had to walk on the sides of its feet. The giant stag was probably an herbivore, grazing on live oak, magnolia, and sweet gum trees. The giant stag had few enemies, and no Pleistocene land animal was big enough or strong enough to challenge it. The giant stag became extinct 11,000-10,000 years ago. Modern relatives include two- and three-toed sloths, which are much smaller and live in trees.

FOSSIL RECORD: In 1986, a geology student found a stag skeleton in a limestone quarry near Gainesville, Florida.

Glyptodont

The Glyptodont belongs to the family, Glyptodontidae.

EPOCH: Pleistocene ("pli­toe­see­en"), 1.6 million to 10,000 years ago.

DESCRIPTION: Adult glyptodonts weighed over 1 ton and were around 5 feet in length. They were covered with over 1,000 armored plates coated with scales and their head and tail were protected by bony plates. The animal was an herbivore and moved slowly on powerful short legs. Few predators posed any danger to this massive animal. The glyptodont became extinct 10,000 years ago. They are related to modern armadillos, anteaters, and modern sloths.

FOSSIL RECORD: The Florida Natural History Museum displays a glyptodont skeleton.

Megalodon

Megalodon name means "big tooth."

EPOCH: Miocene ("my­oh­see­en"), 24 million to 5 million years ago.

DESCRIPTION: Adult megalodons were 40 to 70 feet in length, twice the size of the modern great white shark. Adult megalodons are estimated to have weighed as much as 100,000 pounds. Megalodons ate baleen and sperm whales, large fish, dugongs, seals, sea lions, and giant squid. Food became scarce when some whales (the megalodon's main diet) became faster swimmers and moved to cooler waters. The megalodon became extinct 5 million to 1.6 million years ago.

FOSSIL RECORD: Trilobate animals were found worldwide.

Mammoth

The Mammoth was a large, tusker mammal. Columbian mammoths lived in warm climates.

EPOCH: Pleistocene ("pli­toe­see­en"), 1.6 million to 10,000 years ago.

DESCRIPTION: The adult mammoths stood 13 feet tall and weighed as much as 10 tons. Their tusks could reach 14 feet in length. The mammoth was an herbivore and may have eaten 700 pounds of plant material every day. The mammoth's tusks were longer and more curved than the mastodonts. The modern elephant is closely related to the mammoth.

FOSSIL RECORD: Complete fossilized mammoth skeletons, as well as skull, tusk fragments, and teeth, have been found.

Mastodon

The Mastodon (Mammut americanum) was a large, tusker mammal.

EPOCH: Pleistocene ("pli­toe­see­en"), 1.6 million to 10,000 years ago.

DESCRIPTION: North American mastodons stood 7 to 8 feet tall at the shoulder and adults weighed from four to six tons. Mastodon tusks are straighter than the long curved tusks of the mammoth. The mastodon was a browsing herbivore and lived in forests. It ate leaves, twigs, fruits, nuts, and berries. The mastodon roamed North America 3.7 million to 100,000 years ago.

FOSSIL RECORD: Fossil hunters have found partial and complete mastodon skeletons.

Saber-Tooth Cat

The Saber-Tooth Cat is classified within the family Felidae (true cats). In the late Pleistocene, Smilodon floridanus appeared.

EPOCH: Pleistocene ("pli­toe­see­en"), 1.8 million to 10,000 years ago.

DESCRIPTION: The sabre-tooths' two curving canine teeth were 9 inches long, the longest teeth of any animal yet found. In Florida, the sabre-tooth (Smilodon) evolved into an animal the size of a modern lion. The big cat was the one of the largest Pleistocene carnivores, weighing several hundred pounds. The sabre-tooth was a carnivore with powerful front legs and an ambush predator that pounced on prey such as horses or mastodons. Smilodon disappeared from Florida around 11,000 years ago.

FOSSIL RECORD: Saber-tooth fossils have been found in Silver Springs in Marion County and in Hillsborough County's Lely Shell pit, among other locations in the state.

Sparry Jewelry Box

The Sparry Jewelry Box was a marine bivalve animal that belonged to the genus Ancheliella.

EPOCH: Miocene ("my­oh­see­en") Epoch, 5 million years ago to 1.8 million years ago.

DESCRIPTION: The sparry jewelry box lived on the ocean floor and ingested small sea creatures that lived in the sea water. Tiny "teeth" that operated like tongs and strong muscles helped the two shells to open and close. The shell was studied with eight rows of spiny spines. Researchers believe the spines gave this mollusk protection against predators, such as snails that bored through shells. A fossilized shell found in the Caloosahatchee beds measured 1.57 inches in length.

FOSSIL RECORD: The sparry jewelry boxes found in the Pinellas and Caloosahatchee fossil beds.
Materials

Pencils
Manila file folders
Crayons
Glue
Stapler
Double-stick tape
Scissors
Blue construction paper
100-foot rope
Masking tape
Old newspapers
Markers
Map of Florida

To research prehistoric animals:
Internet access
Reference books