

STORIES IN STONE — THE REST OF THE STORY

AN EXHIBIT GUIDEBOOK

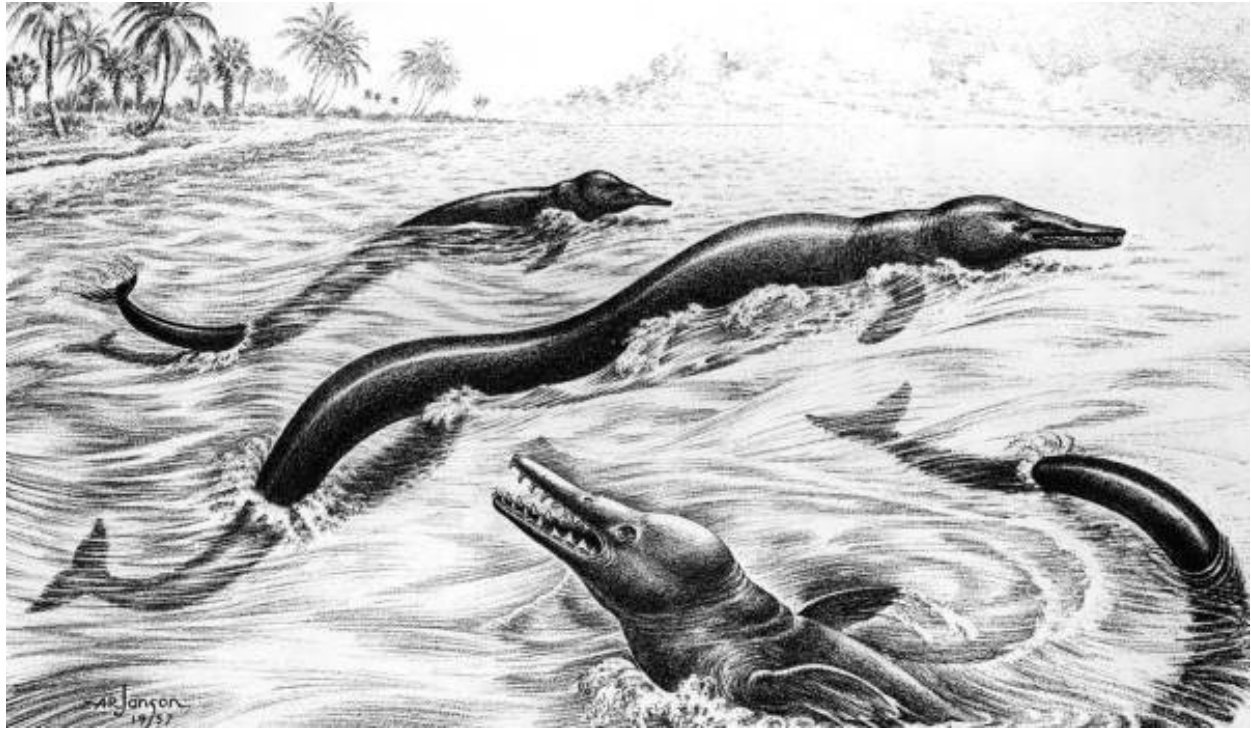
David T. Dockery III, RPG, and George E. Phillips



MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF GEOLOGY, CIRCULAR 8

David T. Dockery III, Office of Geology Director

2026



Cover Illustrations

TOP: The panoramic picture of the 'Stories in Stone' exhibit in the Mississippi Museum of Natural Science was taken by Gil Ford on Monday, June 26, 2000, shortly after the exhibit was completed. Gil Ford also photographed the seven individual display cases featured below—in the original arrangement.

BOTTOM: A close-up of the background thematic imagery in the Eocene section of 'Stories in Stone' shows a blue-green tinted image of three *Basilosaurus* whales in front of a palm-covered beach. The image originated from the *Fossil Mammals of Florida* by Stanely J. Olsen (1959) via the Print Collection of Florida Memory, State Library and Archives of Florida. The scene is a rendition of sea life during a time in the late Eocene Epoch preserved in the Crystal River Formation of Florida. This formation has preserved *Basilosaurus* remains among several widely scattered localities throughout the northern portion of the state.

Foreword

The Mississippi Museum of Natural Science has worked to discover, document, preserve, and share the natural heritage of our state. Our natural history includes a story written in stone—a story of ancient seas, changing landscapes, remarkable creatures, and millions of years of change beneath the ground on which we stand today.

Long before the creation of the exhibit we now know as Stories in Stone, fossils from Mississippi were collected, studied, and preserved by individuals and institutions across the state. Many of those specimens found their way to the Museum, where they joined new discoveries and helped form an increasingly important scientific collection.

The creation of the Stories in Stone exhibit transformed those individual specimens into something larger: a journey through time. It introduces visitors to Mississippi's geologic past and inspires the imagination about what lived here long ago. Through the knowledge, vision, and collaboration of the Mississippi Department of Environmental Quality Office of Geology, Museum staff, associate scientists, collectors, and partnering institutions, generations of visitors are now able to encounter Mississippi as it existed millions of years before us.

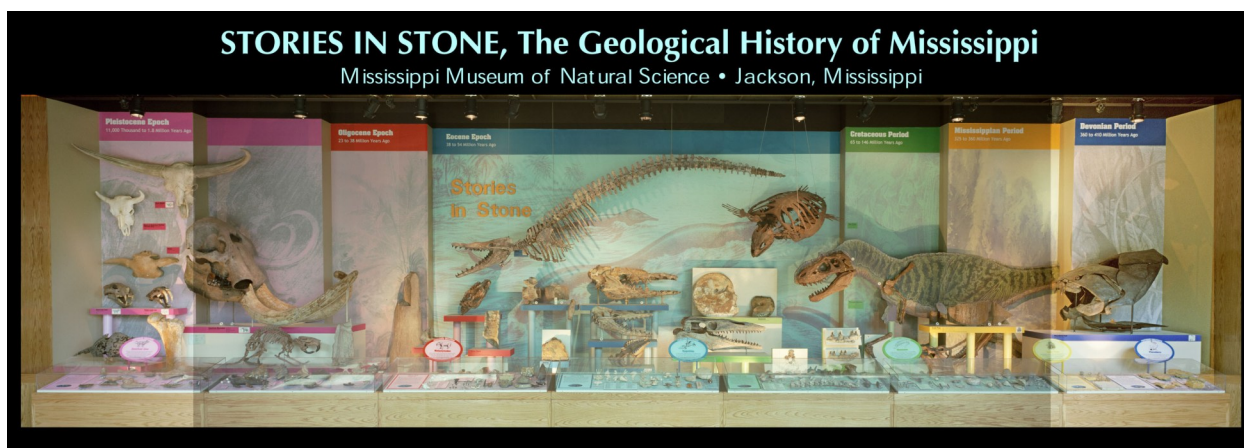
The fossils on display represent only a glimpse of what the Museum preserves. Beyond the exhibit is a vast scientific collection maintained for research, education, and future generations. Museums are entrusted with preserving more than objects; we preserve knowledge, context, and stories. The specimen and data collections at the Museum allow scientists to continue asking questions and revealing new information about Mississippi's changing environments and the organisms that once inhabited them. That is what makes this guide so important.

The Stories in Stone exhibit guide provides the 'story behind the story'—the discoveries, people, places, and scientific knowledge behind the fossils on display. Within these pages are stories that are uniquely Mississippi: an ancient volcano beneath Jackson, dinosaurs that roamed Columbus and Amory, an abundance of fossil whales from the Central Prairie, the Natchez Lion, coastal rhinos from Edwards, and other discoveries of scientific significance and local interest.

I hope this guide deepens your appreciation not only for the fossils displayed at the Mississippi Museum of Natural Science, but also for the many people whose work made their preservation possible. The story of Mississippi began long before us. It is our privilege to preserve that story, our responsibility to understand it, and our honor to share it with you.

Angel Rohnke
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STORIES IN STONE — THE REST OF THE STORY

David T. Dockery III and George E. Phillips

INTRODUCTION

The ‘Stories in Stone’ exhibit at the Mississippi Museum of Natural Science (MMNS) is a timeline featuring a diversity of Mississippi fossils used to illustrate our state’s geologic past. This timeline represents the efforts of many people and organizations, especially the Mississippi Department of Environmental Quality (MDEQ), Office of Geology, working in conjunction with museum staff, volunteers, and donors, to bring together some of the best fossils from around the state in order to tell a story of how ancient life and landscapes have changed over time in the Magnolia State. There are 336 items on display, including individual specimens and composite reconstructions, as well as replicas of fossils from other collections. Most of this material is from the state fossil collection here at MMNS and was accumulated largely beginning in 1978 when the paleontology program was created. Updates since the creation of the exhibit in 1999 include numerous additional donated specimens, and all collector/donors are acknowledged in the specimen inventory occurring later in this document.

The MDEQ, Office of Geology, contributed significantly to the exhibit in its design, as well as providing 20% of the specimens, namely mollusks, utilized in the telling of Mississippi’s fossil story. Interest in creating a public display of Mississippi’s fossil treasures has been a goal of the MDEQ Office of Geology for many years. In a 1969 *Clarion-Ledger* article, state geologist William H. Moore lamented that “Mississippi has a wealth of fossil, mineral and rock materials as beautiful and important academically as any place in the world...Yet we have no place to display this material so the geological community and general public can see it.” The exhibit before you is a realization of Moore’s dream—and that of countless others vested in public education.

What is the purpose of this guidebook? Space limitations within the exhibit allow for little more than the common and scientific names, plus the county of origin. Here we give ‘the rest of

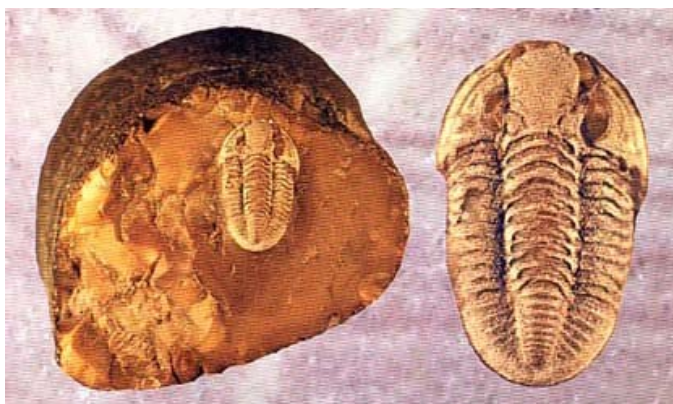
the story.’ This publication is a storied, illustrated guidebook and catalogue of the fossils on display at MMNS as originally designed and arranged in 1999-2000. Some changes have been made since that time and updates are planned, although they will be minor and not interfere with the grand chronological design. The guide allows people to visualize the exhibit if they cannot visit, but it also allows the public to review the exhibit contents preceding a visit. We also encourage patrons to bring it along for a self-guided walk through Mississippi’s prehistoric past.

PALEOZOIC ERA

The Paleozoic Era includes the oldest rocks having a fossil record of shelled invertebrates, such as trilobites, brachiopods, bryozoans, corals, and mollusks. Seven periods are recognized in this era, which from oldest to youngest are the Cambrian, Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, and Permian. Most geologists outside of North America combine the Mississippian and Pennsylvanian periods into one Carboniferous Period, a period named for its coal seams. In Mississippi, only rocks of the Devonian and Mississippian periods of the Paleozoic are found at the surface naturally and in the very northeast corner of the state.

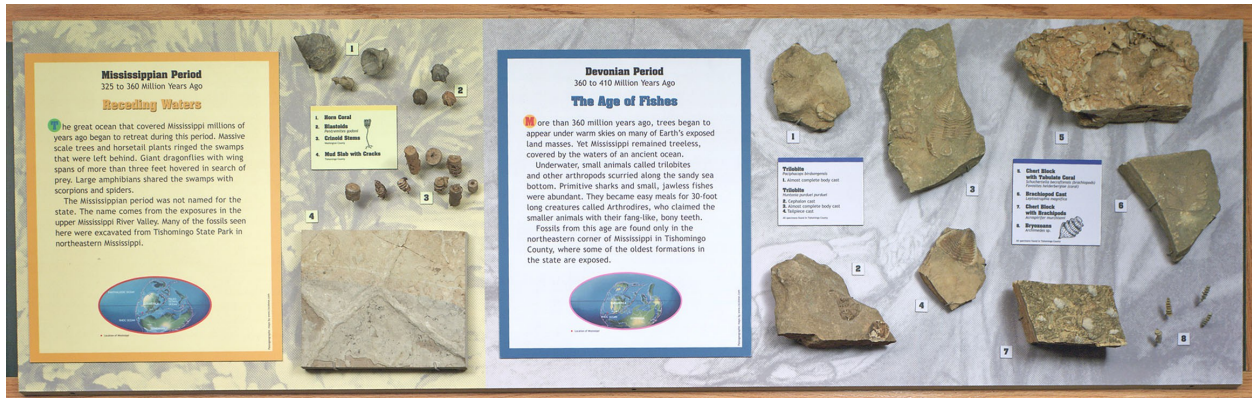
The Mississippian Period section of the Paleozoic case below features fossils found in Mississippi’s gravel deposits, which occur to varying degrees throughout the state but are particularly thick and fossil-rich in the western part of the state. The movement of the Mississippi River within its valley over time, particularly during the Pleistocene Epoch (‘Ice Age’), has resulted in the transport of prodigious volumes of rock fragments originating from the U.S. interior. This material, mostly rounded pebbles of chert (and some quartz), occurs in vast alluvial deposits of considerable engineering and economic importance, particularly in the paving of rural roads and driveways throughout the state. Because it is a relatively cheap and readily available resource for surfacing roads (cheaper than asphalt or concrete), chert gravel, which can be rich in Paleozoic fossils, has become widely distributed, including in areas it does not naturally occur. Thus, the fossils within these gravels are now accessible to curious folks in almost every corner of the state, including areas that are otherwise ‘fossil poor.’ We’ve featured the Mississippian fossils from these gravels, but they also contain fossils of Devonian and Silurian age, plus a minority of fossils from other time periods.

At right is a Mississippian proetid trilobite found in the driveway gravel of a Madison, Mississippi, home.

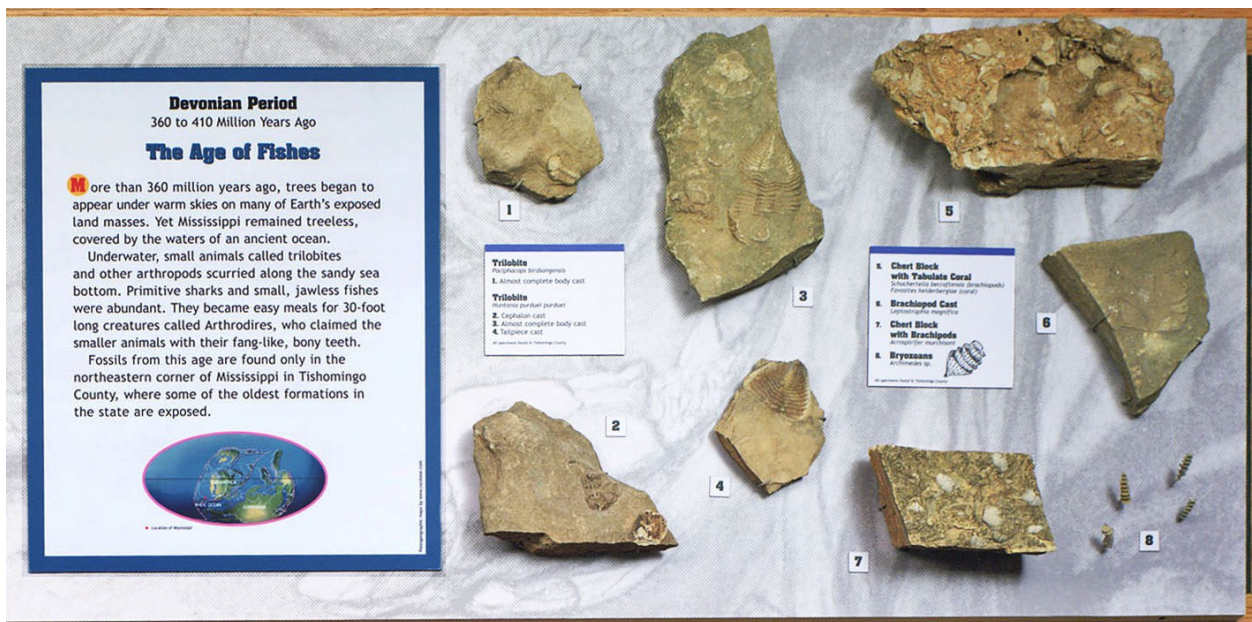


DEVONIAN PERIOD

(Dark Blue)



The Devonian Period was named by Sedgwick and Murchison in 1837 for rock exposures at Devon in southern England. Devonian rocks of the Ross Formation are the oldest rocks to be found at the surface in Mississippi. To collect these rocks, one must travel to the northeastern corner of the state and take a boat to Island Hill in Pickwick Lake just south of the Tennessee shore. This island is one of the few places in Mississippi where trilobites can be found. The presence of the trilobites *Huntonia purduei* (Dunbar, 1919) and *Paciphacops birdsongensis* (Delo, 1940) place the age of Mississippi's Devonian rocks as Early Devonian and the same age as those found in Helderberg, New York, which make up the Helderbergian Group. Island Hill's Early Devonian rocks are some 400 million years old.



PALEOZOIC Case: DEVONIAN {right side}

Most of the Devonian fossils in this array (under glass) were collected during field work for the Tishomingo County geologic map and are figured in the Tishomingo County geology

bulletin (Merrill et al., 1988).

Brachiopods. Brachiopods, such as *Schuchertella* (#5), *Leptostrophia* (#6), and *Acro-spirifer* (#7) were the common sea-shells of their time. However, at the end of the Paleozoic Era, their numbers were decimated by perhaps the greatest extinction event in earth history. After the Permian extinction, the dinosaurs came to dominate the land, and mollusks, such as clams, replaced the brachiopods as the dominant shellfish of the sea floor. Today brachiopods, which are also called lamp shells because of their semitranslucent, light-weight shells, are often found in deeper waters where they have less competition from shallow water clams.

Corals. The coral *Favosites* is a tabulate coral, which, like many of the brachiopods, became extinct at the end of the Paleozoic Era. While the specimen of *Favosites helderbergiae* on display (#5) came from bedrock, tabulate corals are also found in gravel deposits across the state. Their tightly packed polygonal coral cells, called corallites, are often thought to be fossil wasp nests or honeycombs by those who collect them. The presence of these corals (and other Paleozoic fossils) indicates that Mississippi's gravels were eroded from Paleozoic bedrock to the north and carried into Mississippi by ancient rivers during the Pleistocene Epoch (and earlier). In fact, rock formations exposed along the Mississippi River, particularly from St. Louis to Davenport, Iowa, have been shedding Paleozoic fossils (primarily Devonian and Mississippian) and seeding our gravel deposits with them for several million years (book on gravel fossils at right).

Trilobites. The trilobite specimens of *Huntonia*, including the cephalon (head) and pygidium (tail) and the complete specimen of *Paciphacops*, with its tail tucked beneath its body, were illustrated by Dockery and Merrill (1984). Not illustrated in that paper is the nearly complete specimen of *Huntonia* (#3), which was collected at a later time during a summer geology



field camp for the Millsaps Geology Department. Both *Huntonia* and *Paciphacops* have large compound eyes with many lenses much like the eyes of a fly. When fossil trilobites weather out of bedrock in Mississippi, they are exposed to sunlight for the first time since their burial some 400 million years ago. Once exposed, imagine their multifaceted eyes gazing across Pickwick Lake toward a marina on the Tennessee side, which brings to mind the following by Timothy Conrad, a 19th Century paleontologist who studied Mississippi's fossils:

*The race of man shall perish, but the eye
Of trilobites eternal be in stone,
And seem to stare about in mild surprise
At changes greater than they have yet known.*



Below are the heads of three trilobites of the species *Paciphacops birdsongensis* from the Ross Formation of Mississippi. The first cephalon (head) is right-side-up, the second is facing up showing its multifaceted right eye, and the third is upside down. The multifaceted middle eye above at right is an enlargement of the middle head.



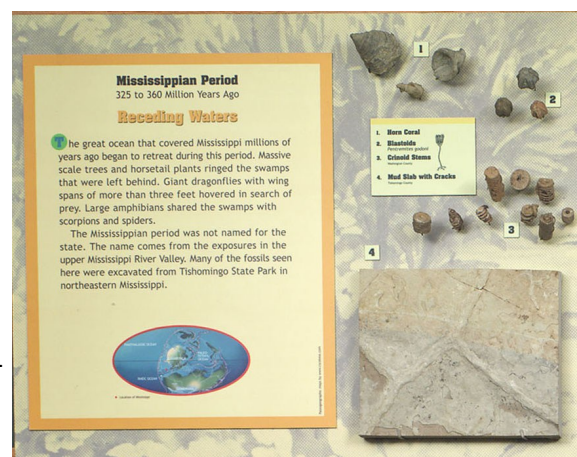


Placoderms. Above, the largest predators of the Devonian were bone-armored fish known as placoderms—one of several groups in an incredibly growing diversity of fishes. In fact, the Devonian has been called “The Age of Fishes.” Among the placoderms, a group known as the arthrodires were the very largest. These fearsome predators lacked true teeth but had large, paired bony structures called tooth plates and a jointed skull that ‘cocked’ back for a larger bite.

Featured Creature. The “Featured Creature” for the Devonian Period is the placoderm and is represented by a cast of the arthrodire *Dunkleosteus terrelli* (shown above) from the Late Devonian (360 million years old) of Cuyahoga County, Ohio. When the Stories in Stone exhibit was in the planning stage, we needed a large item on the Devonian end of the timeline to visually mirror the equally large mastodon skull on the Pleistocene end. That’s when I (Dockery) saw an image of the *Dunkleosteus terrelli* cast purchased by the Paleontological Research Institution for its Museum of the Earth. I showed the picture to Libby Hartfield who contacted the Cleveland Museum of Natural History, the cast manufacturer. The institution had just finished making a *Dunkleosteus* cast for another museum. There was not sufficient time for a new cast to be made for our display, so that museum allowed us to purchase theirs and would wait for another one. Our cast of a really ‘bad’ fish is a reminder of some really nice people.

MISSISSIPPIAN PERIOD (Yellow)

The Mississippian Period was not named for the State of Mississippi but was named by Winchell in 1870 for exposures in the upper Mississippi River Valley. This period is known by most



geologists outside of North America as the lower part of the Carboniferous Period, a period characterized by scale trees and coal seams. Many insects of this Period, such as dragon flies and cockroaches, were gigantic, and some scientists believe that the oxygen concentration of the atmosphere at this time reached a record high of nearly 35% as opposed to today's level of 21% (Berner et al., 2000).

Scale Trees. One major contributor to the plant debris that formed the Carboniferous coals was the scale tree *Lepidodendron*. Stumps of scale trees are often rooted in coal seams and pose hazards in some underground coal mines. When the coal seam is mined, the stumps, or sandstone pipes as the miners call them, are exposed in the ceiling and sometimes drop to the floor. A fossil *Lepidodendron* trunk from the Hartselle Sandstone of Mississippi is shown at right.



Close-up of *Lepidodendron* log at the Gresham Quarry. Stratification can be seen in the sandstone filling of the log interior. Photograph (black and white negative; Image 848) taken by Ed Blake on June 3, 1966.

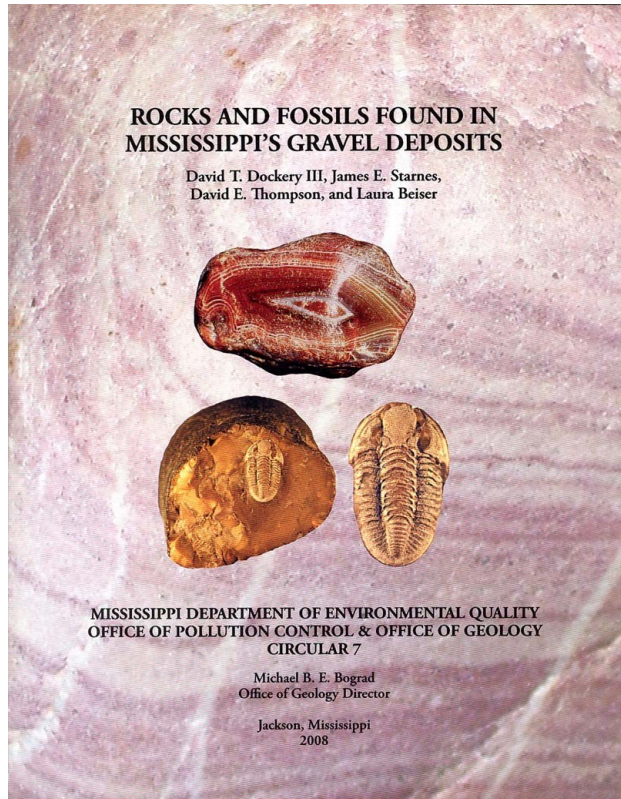
Featured Creature. The scale tree is the Featured Creature for the Mississippian Period. This tree is named for its prominent surface texture as seen in the three specimens on the stand behind the display case. Leaves grew directly from the trunks of scale trees, leaving a characteristic pattern of scale-like leaf-attachment scars. In *Lepidodendron*, the scars are diamond-shaped, and the lines between them intersect to produce a network of lines called a reticulate pattern. The triangular specimen of *Lepidodendron* bark on the display stand is cut along and across the grain of its scar pattern and looks like a game board for Chinese checkers. This specimen was collected from the Hartselle Sandstone in the Gresham Quarry near Tishomingo State Park, a quarry that once supplied building stone for many buildings in northeastern Mississippi. The Hartselle Sandstone is also exposed in Tishomingo State Park and in the canal cut below the Bay Springs Lock and Dam on the Tennessee-Tombigbee Waterway. The cylindrical *Lepidodendron* log section on display sat in front of the Mississippi Geological Survey building for over twenty years and likely came from the Gresham Quarry. Another log still rests in a large block of sandstone on the quarry floor. To the left of the *Lepidodendron* log is a carbonized section of *Lepidodendron* "bark" and a small trunk section.

PALEOZOIC Case: MISSISSIPPIAN {left side}

Animal fossils derived from rocks of the Mississippian Period are particularly common in our alluvial gravels and include solitary and colonial corals, brachiopods, bryozoans, and crinoids.

Crinoids, or ‘sea lilies,’ were so common in Paleozoic times that limestone beds, called crinoidal limestones, were composed largely of crinoid remains. This group of animals is not as common and diverse today as they were during the Paleozoic, but modern representatives include species inhabiting cold waters along the shores of Antarctica.

Mississippian fossils from alluvial gravels populate this display board. These specimens were found in streams in western Mississippi—mostly the Loess Hills and the Mississippi River. However, the same fossil-bearing gravel deposits are also exposed in rock quarries and sand pits in the same region. Solitary rugose corals, known commonly as ‘horn’ corals, are among a half dozen different common types of Paleozoic marine invertebrates one expects to find re-worked into our native gravels. The others are colonial rugose corals, tabulates (‘honeycomb’ corals), crinoids, brachiopods, and bryozoans. You can view additional examples of these and other Paleozoic gravel fossils in Circular 7—*Rocks and fossils found in Mississippi’s gravel deposits* (Dockery et al, 2008, upper right).



MESOZOIC ERA

The Mesozoic Era is known as the “Age of Reptiles.” It was a time when the dinosaurs ruled the land, the sky filled with flying reptiles called pterosaurs, and the oceans teemed with giant marine reptiles such as mosasaurs, plesiosaurs, and ichthyosaurs. Three periods are recognized in this era: the Triassic, Jurassic, and Cretaceous periods. Only sediments of the Cretaceous Period are found at the surface in Mississippi.

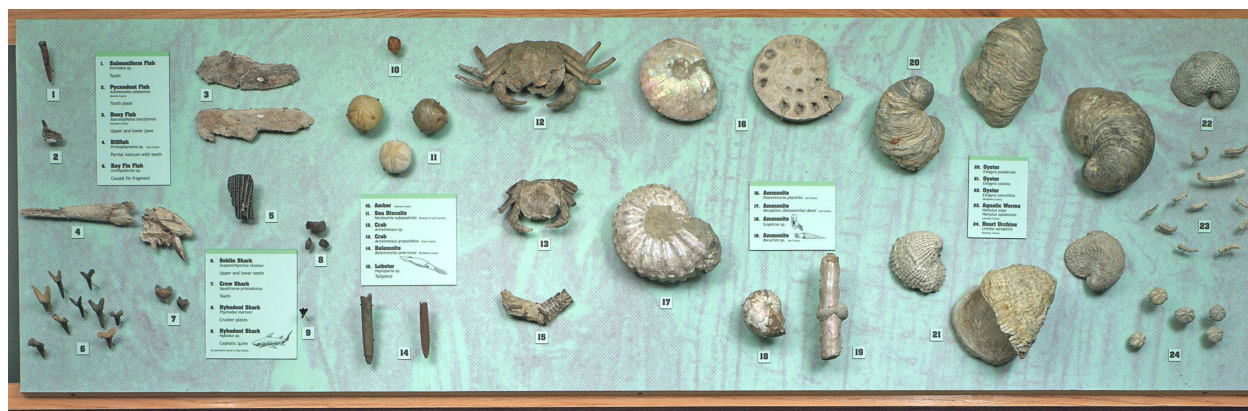
CRETACEOUS PERIOD

The Cretaceous Period was named by Belgian geologist Omalius d’Halloy (1822) for its chalk content. The White Cliffs of Dover along the southeastern coast of England, opposite Calais, France, are chalk exposures of Cretaceous age. These brilliantly bright sea cliffs were used as a landmark by German bombers during World War II. Cretaceous chalk also underlies the rich, black soils of the Black Prairie in northeastern Mississippi. The Cretaceous Period was a time of warm climate when dinosaurs dominated the land and giant reptiles dominated the air and sea.



Fossil dinosaurs from Mississippi consist largely of isolated, often fragmentary teeth and bones and are the remains of dinosaur carcasses that were carried out to sea by rivers and tides. Most of the state was covered by the ocean during the Cretaceous. For this reason, fossils of marine reptiles such as mosasaurs, turtles, and crocodiles are more common. Cretaceous fossils that Mississippi is most famous for are the invertebrates known as mollusks ('seashells'). We are fortunate that some Cretaceous sediments in our state preserve ammonites, gastropods (marine snails), and bivalves (marine clams) with their original shells intact, which are made of aragonite. This skeletal mineral of invertebrate shells is a less stable mineral than calcite and typically leaves fossils as shell-less molds or casts. Paleontologists have visited from around the world to collect these fossils in Mississippi.





Display Case 2

Annelids. Annelids include marine worms known as polychaetes and earthworms known as oligochaetes. Except for the mineralized jaws (called *scolecodonts*) of some polychaete worms, most worms lack hard parts and leave no fossil record. The Cretaceous polychaete worm *Hamulus* (#24) secreted a calcite tube around its body for protection. These fossil worm tubes are common in the Cretaceous marine sediments of northeastern Mississippi.



The ammonite *Menabites (Delawarella) danei* from the Chapelville horizon of the Coffee Sand at MGS locality 129 in Lee County. The ammonite is resting on part of the concretion from which it was broken free by USGS geologist Wayne Newell.



Placenticeras intercalare Meek & Hayden 1860
Coffee Sand, Chapelville Beds
MGS locality 128 - Lee County, Mississippi

Ammonites. Ammonites were squid-like animals with a coiled or sometimes straight shell. They were common in the oceans of Cretaceous times, where they fed on fish, and in turn were preyed upon by such large predators as the mosasaurs. Ammonites exhibited in Display Case 2 include a small *Placenticeras* (#17, top left) with its shell preserved, a well preserved specimen of *Menabites (Delawarella) danei*, (#18, at top right), and the straight-shelled *Baculites* (#20), all from the Coffee Sand of Lee County. The specimen of *Menabites* was discovered by U. S. Geological Survey geologist Wayne Newell who, by chance, kicked a sandstone concretion, which broke open with the ammonite inside. This species of *Menabites* is particularly useful to geologists as it lived only during a narrow interval of geologic time at the boundary between the lower and middle part of the Campanian Stage of the Cretaceous Peri-



A young man standing in front of a large specimen of the ammonite *Placenticerus placenta* from the Coffee Sand in Prentiss County Mississippi.



Specimen of the ammonite *Placenticerus* from the Coffee Sand collected during construction of the Natchez Trace near the Twenty Mile Creek overlook in Lee County on May 19, 1976.

od. Such fossils are called guide fossils and serve as indicators of a particular geologic age. *Menabites (Delawarella) danei* is also found in the Arcola Limestone Member at the top of the Mooreville Formation in Alabama (Kennedy et al., 1997).

The two large ammonites (above) centrally placed against the back wall are a species well known from the Pierre Shale of South Dakota, *Placenticerus placenta*. However, these specimens are from the Coffee Sand of Mississippi. At about two and a half feet in diameter (29 inches) and over two hundred pounds in weight, the specimen on the left is one of the largest specimens of *Placenticerus* on display anywhere. Dr. Ernest E. Russell of the Mississippi State University Geology Department discovered this fossil along Highway 364 in Prentiss County where fill material from the Coffee Sand covered a steep slope. He used a tow strap tied to his bumper to pull the ammonite up the bank and found some helpful people passing by to assist in loading the specimen into the back seat of his Buick sedan. The smaller specimen (above at right) was collected from the Coffee Sand in Lee County during the construction of the Natchez Trace Parkway at the Twenty Mile Creek Overlook. Both specimens preserve some of the original outer shell with its mother-of-pearl iridescence.

Belemnites. Belemnites were squid-like creatures with an internal shell or rostrum similar to the cuttlebone inside the modern cuttlefish. They were common during Mesozoic times but became extinct at the end of the Cretaceous Period. The internal skeleton is a singular, solid structure called a guard or rostrum, and it is typically the only part that is preserved. Belemnite rostra are analogous to the cuttlebone of squid (and other cephalopods) and consist of a cylindri-



Belemnitella americana from the Bluffport Marl Member at Rock Hill in Oktibbeha County, Mississippi.



Exogyra ponderosa s.s. Roemer, 1849, from the Tombigbee Sand at the Fowlkes Bentonite Mine (MGS locality 162) in Monroe County, Mississippi.



Exogyra ponderosa erraticostata Stephenson, 1914, from the Tupelo Tongue of the Coffee Sand at MGS locality 129 near Friendship in Lee County, Mississippi.



Exogyra cancellata Stephenson, 1914, from the Bluffport Member of the Demopolis Chalk at the Birmingham Ridge Lime Pit in Lee County.



Exogyra costata Say, 1820, from the Ripley Formation in a borrow pit at the University Hills Trailer Park east of the Mississippi State University campus on Highway 182.

cal shaft of translucent, 'gem-like' calcite, which tapers to a point on one end. Belemnites are only found within a certain interval of time (the last ~5 million years) within the Cretaceous deposits of Mississippi; however, they tend to occur in numbers such that if you find one you are guaranteed to find others nearby. The two specimens on display were found in Starkville.

Oysters. A sedentary group of bivalve mollusks, the oysters (above), are important guide fossils for Cretaceous sediments as their heavy calcitic shells are easily preserved and are often very common. Of the oysters, the genus *Exogyra* is the most useful guide fossil and occurs in Cretaceous formations as far away as North Africa. This genus has a heavy coiled bottom shell (called the left valve) and a flat plate-like top shell (right valve). *Exogyra ponderosa* (#21) is a guide fossil to the lower part of Mississippi's Upper Cretaceous section, occurring in the Tombigbee Sand, the overlying Mooreville Formation, and the lower part of the Demopolis Formation. *Exogyra costata* (#22) and *Exogyra cancellata* (#23) occur together as guide fossils in the Bluffport Marl Member of the upper Demopolis Formation just above the extinction level of *Exogyra ponderosa*. *Exogyra costata* continues above the extinction level of *Exogyra cancellata* and occurs all the way to the top of the Cretaceous. It is found in the Ripley, Prairie Bluff, and Owl Creek formations (Stephenson, 1914). At the end of the Cretaceous Period, the last species of *Exogyra* became extinct along with the dinosaurs and many other creatures.

Crabs. Certain intervals in the Ripley Formation in Union County, Mississippi, are known for concentrations of fossil decapods, which include the crabs, shrimp, and lobsters. One such locality is a road cut on Highway 9 at the Highway 78 Blue Springs exit where over 1,300 crab fossils were collected by crab expert Gale Bishop (Bishop, 1983). These fossils belonged to 11 different decapod species including the lobster *Linuparus* (#16). A large species of fossil crab *Avitelmessus grapsoides* (#13) was once commercially mined in the state and sold worldwide. This coveted crab is often completely preserved with its claws and legs extended (at right).



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Echinoids. Echinoids include sea urchins, heart urchins, sea biscuits, and sand dollars. The sea biscuit *Hardouinia subquadrata* (#12) is common in the Chiwapa Sandstone Member of the Ripley Formation, where it is found in association with the ammonite *Sphenodiscus*. Also on display is the heart urchin *Linthia variabilis* (#25).



The echinoid *Hardouinia mortonis* from the Chiwapa Sandstone of the Ripley Formation at Davis Creek, Chickasaw County, Mississippi.

Amber. Amber, the fossil resin of ancient trees, occurs in the McShan and Eutaw formations of northeastern Mississippi. The gem-quality specimen displayed here (#11) was found in the McShan Formation at the excavation of Lock A of the Tennessee-Tombigbee Waterway in Monroe County. Here amber was found in association with lignitized wood. The Lock A site is also the locality of several dinosaur bones on display.

One of the scientific errors in the movie "Jurassic Park" was the movie's source of dinosaur DNA from amber mined in the Dominican Republic. The amber there is Miocene in age and, thus, could not contain the fossilized remains of biting insects filled with dinosaur blood. A locality in the McShan formation of Mississippi would have been a scientifically correct site, as this formation contains both amber and dinosaur bones.



Lignitized wood and gem-quality amber from a vertebrate-bearing bed in the Eutaw Formation on Luxapalila Creek at Columbus in Lowndes County, Mississippi.

Sharks. Shark teeth are perhaps the most frequently collected vertebrate fossils in Mississippi and have fascinated young and old alike since the time of the Indians, who used them in tools and weapons. Several sharks are known only from the Cretaceous, the most common of which are the goblin shark *Scapanorhynchus texanus* (#7) with its dagger-like teeth and the crow shark *Squalicorax pristodontus* (#8) with its broadly-curved, serrated teeth. *Scapanorhynchus* teeth are common in shallow-water Cretaceous sediments, but its modern relative, the goblin shark *Mitsukurina owstoni*, only lives in the deep water of the Atlantic, Indian, and Pacific oceans. The specimens on display are from the Tombigbee Sand at Vinton Bluff on the Tombigbee River and were found in a lag deposit of bones and teeth concentrated by the ancient surf zone. This locality is also famous for the occurrence of a rare Cretaceous mammal tooth (Emery, 1981).



Shark teeth of the shark *Scapanorhynchus raphiodon texanus* from the Frankstown sand at the Frankstown site.

An abundance of *Scapanorhynchus* and *Squalicorax* teeth were found in 1990 during the excavation of the Highway 45 Bypass at Frankstown, in Prentiss County. When word spread about these fossils, people from distant states drove their campers to the spot. Booneville High School students won a National Science Foundation grant to study the site and appeared on a national ABC newscast collecting shark teeth. The paleontologists who assisted this program were given the key to the City of Booneville by the mayor, and today an eight-foot-high granite monument marks the fossil site just north of the Highway 45 Frankstown exit (that's how serious people are about fossil shark teeth). Fossils from the Frankstown locality include mosasaur, crocodile, and dinosaur teeth as well as shark teeth. These fossils are illustrated in Mississippi Office of Geology Circular 4 (see Manning and Dockery, 1992).



Millsaps College Invertebrate Paleontology class students collect shark teeth in Twenty Mile Creek below the W. M. Browning Fossil Park. Picture was taken on April 1, 2010.

Bony Fish. Seas of Cretaceous times were much more dangerous than they are today. Besides the threat of predatory sharks, there were also large predatory fish with fang-like teeth. The most common of these were *Enchodus* (#1, #2) and *Xiphactinus*. The billfish *Protosphyraena* (#5) also had an impressive set of teeth, while the pycnodont fish *Anomoeodus phaseolus* (#3) ate shellfish and, for this purpose, had a set of button-like teeth called pharyngeal tooth plates in its throat for crushing shells.



Skull and lower jaws of the Cretaceous crocodile *Thoracosaurus neocesariensis* from the Ripley Formation in Oktibbeha County, Mississippi.



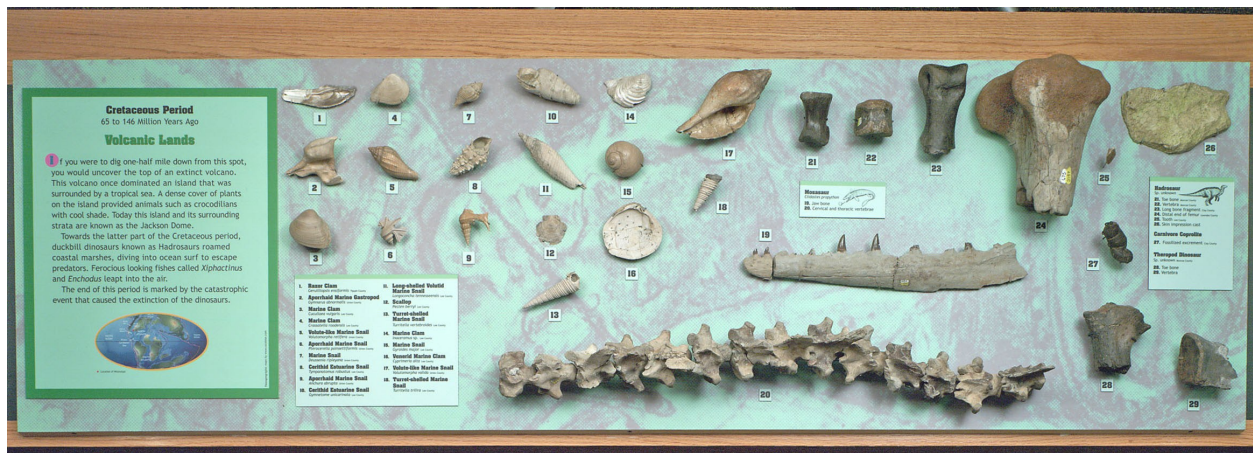
Side view of skull and lower jaws of the Cretaceous crocodile *Thoracosaurus neocesariensis* from the Ripley Formation of Oktibbeha County, Mississippi.

Crocodiles. Crocodiles of the Cretaceous, as well as those living today, include three main groups, the slender-snouted gavials now living in the Ganges River of India, the narrow-snouted crocodiles found in tropical waters worldwide, and the broad-snouted alligators of North and South America. Crocodile fossils usually consist of isolated teeth, vertebrae, and osteoscutes (the bony, dermal plates protecting the crocodile's back). Such fragmentary remains were found at the base of the Demopolis Formation at Frankstown and in the Tombigbee Sand at Vinton Bluff.

The most complete skeleton known of the gavial-like crocodile *Thoracosaurus neocesariensis*, including a complete skull and lower jaws, came from the Ripley Formation of Oktibbeha County and is in the Mississippi State University Geology Department collection (Carpenter, 1983). Exhibited here on a display stand is the partial skull of the giant crocodile *Deinosuchus*, a name meaning "terrible crocodile." Though this specimen is small, other *Deinosuchus* skulls are up to six-foot long and indicate an animal of some fifty to sixty feet in length (Norman, 1985, p. 177). At more than twice the length of a large Nile crocodile, *Deinosuchus* could pull a dinosaur under water for its next meal.



Partial skull of the giant crocodile *Deinosuchus rugosus* from the Coffee Sand at Tulip Creek in Lee County, Mississippi.



CRETACEOUS: Left Case

Dinosaurs. Remains of the plant-eating duck-billed dinosaur called a hadrosaur are the most common dinosaur fossils found in the state. As these dinosaurs were believed to be good swimmers, it's not surprising that their remains occur in our Cretaceous marine sediments. The hadrosaur jaw contains batteries of small teeth closely joined to form a tooth plate. Individual teeth were not uncommon at the Frankstown locality. However, the specimen on display (#23) is from the basal Demopolis Formation (or Coffee Sand) at Saltillo in Lee County, Mississippi. Other hadrosaur remains on display include a toe bone (#21) and a hoof bone (#22).

Mounted on the display stand behind the case are casts of the limb bones of a young hadrosaur, including the femur (top), tibia (middle), and metatarsal (bottom). The original bones were found by J. H. Pope in the ~84 million-year-old Tombigbee Sand along the river of the same name above Columbus. Initially, there was some debate if this juvenile limb was actually a hadrosaur or some other closely related ornithomimid (a group that formerly included hadrosaurs). These bones and others found with them were illustrated by Kaye and Russell (1973) as belonging to a hadrosaur and, at the time, constituted the oldest hadrosaur remains recorded from North America. However, this record has since been matched and even exceeded by discoveries in Alabama and Texas, respectively.

The excavation of Lock A of the Tennessee-Tombigbee Waterway cut into the McShan Formation, exposing even older dinosaur remains than those found further south along the river. These fossils included toe bones of a hadrosaur (#21) and a carnivorous theropod (#27). Paleontologist Ken Carpenter, a well-known dinosaur expert, published a paper on the Lock A dinosaur remains, describing the theropod toe bone as being similar to that of the Canadian dinosaur *Albertosaurus* (Carpenter, 1982). Carpenter is also the paleontologist who mounted the smaller fossil whale and Cretaceous sea turtle hanging from the rafters.

The cast of an *Albertosaurus libratus* skull, arm, and leg bones are mounted on a sil-



houette-replica of the dinosaur. This replica shows what the rest of the dinosaur may have looked like. The complete skeleton from which the casts were made was discovered on the Red Deer River in Alberta, Canada, and now rests in the Royal Ontario Museum.

Turtles. A hanging cast of the sea turtle *Protostega gigas* is based on a subadult skeleton from the Upper Cretaceous chalk of Kansas. The original specimen is in the Denver Museum of Nature and Science and was collected from the Niobrara Formation of the Smokey Hill drainage, Logan County. Fossil *Protostega* remains have been found in the upper Demopolis Chalk of Mississippi (Derstler, 1988). *Protostega gigas* was one of the largest sea turtles to have ever lived, but even larger was its contemporary—the giant *Archelon*—the largest sea turtle known. A specimen of *Archelon ischyros* collected from Shannon County, South Dakota, and now displayed at the Natural History Museum of Vienna, Austria, measures 15 feet from snout to tail (Derstler et al., 1993). Only scattered, fragmentary remains of protostegid turtles have been found in Mississippi; more complete and commoner are sea turtle fossils of the smaller Toxochelyidae.





Carapace of the Cretaceous turtle *Bothremys barberi* from the Tombigbee Sand at Plymouth Bluff on the Tombigbee River in Lowndes County, Mississippi.



Plastron of the Cretaceous turtle *Bothremys barberi* from the Tombigbee Sand at Plymouth Bluff on the Tombigbee River in Lowndes County, Mississippi.

The photographs above show the top and bottom of the Cretaceous turtle *Chedighaii barberi*—previously known as *Bothremys*. This nearly complete shell is from the Tombigbee Sand at Plymouth Bluff, a famous fossil site on the Tombigbee River near Columbus, Mississippi. It was found by a Mississippi State University student in 1971 and now resides in the Dunn-Seiler Museum on the MSU campus [MSU 3348].

Mosasaurs. Mosasaurs were giant sea-going lizards with paddle-like legs for swimming. Fish-eating mosasaurs had sharply-pointed teeth, while a rarer mosasaur known as *Globidens* had blunt teeth for crushing shellfish. Isolated mosasaur teeth and vertebrae are frequently found across the Cretaceous chalk belt of northeastern Mississippi. Less common are jaw parts with the teeth in place. The mosasaurs replaced their lost teeth as did the dinosaurs and as do other reptiles today. The lower jaw (#19), the column of 14 vertebrae (#20), and the flipper bones (on stand) of *Clidastes propython* were collected from the Mooreville Formation on the left bank of the Tombigbee River one kilometer below the Gainesville Bridge in Greene County, Alabama. It was found by Paul Hartfield and other museum staff members as they were diving in search of endangered mussel species.

Featured Creature. The mosasaur is the Featured Creature for the Cretaceous Period and is best portrayed in the exhibit by a cast of a skull sold as “*Mosasaurus conodon*.”



The mosasaur skull cast above is identified on the stand as *Mosasaurus conodon* but is actually in the genus *Tylosaurus*.

Belonging instead to the genus *Tylosaurus*, the original specimen is from the Niobrara Formation of Kansas and resides in a private collection. Jaw sections of an actual *Mosasaurus conodon* specimen from the Demopolis Chalk in Oktibbeha County are exhibited on a display stand to the right of the Kansas skull. The lingual side (the inside surface against the tongue) of the jaw fragment on top shows an unerupted tooth, a tooth ready to replace the one above. Mosasaurs became extinct at the end of the Cretaceous Period along with the dinosaurs, pterosaurs, ammonites, and 75% of the species on Earth.



Mosasaur jaw and teeth, possibly of the Genus *Clidastes*, in the Mooreville Formation exposed in a Mississippi creek bed.

Mosasaur Excavation, August 22-23, 2023. The MDEQ Office of Geology excavation team of James Starnes, Paul Parrish, Jonathan Leard, Tim Palmer, and Andrew Newcomb excavated a mosasaur skull, jaws and other bones on August 22-23, through heat and a powerful storm, and delivered it to the Mississippi Museum of Natural Sciences on August 25, 2023. According to MDEQ's #FossilFriday report by James Starnes, The mosasaur was probably of the Genus *Clidastes*, a relatively small to medium sized mosasaur reaching only about 20 to 30 feet in length. The skull of this specimen was approximately 4 feet in length, making it large from its genus. At right is a picture of the plaster jacket containing the mosasaur bones. In the picture, James Starnes, Tim Palmer, and Andrew Newcomb are prying the fossil out of the creek bed as Jonathn Leard takes the picture.



Gastropods. The name gastropod means "stomach foot" or animals that crawl on their stomach; gastropods are snails. The shells of marine gastropods exhibit some of the most beautiful artwork found in nature. Specimens displayed here are the best preserved Cretaceous gastropods known worldwide and they came from sites in the Coffee Sand of Lee County and Ripley Formation of Union County in northeast Mississippi (see the publications of Sohl, 1960 and 1964a & b and Dockery, 1993). Paleontologists from France, Germany, the Netherlands, Japan, and elsewhere have traveled to Mississippi just to collect Cretaceous gastropods with the original shell preserved. Fossil gastropods of this age are commonly replaced by calcite or occur as molds and casts.



Specimen of the aporrhaid gastropod *Pterocerella poinsettiformis* from the Coon Creek Tongue of the Ripley Formation in Union County, Mississippi.



Three views of a specimen of *Volutomorpha valida* Sohl, 1964, from the Coon Creek Tongue at MGS locality 127, showing the digitate outer lip. Scale in inches.

Twelve species of gastropods are displayed in Case 3. Among these are the aporrhais *Gymnarus* (#2), *Pterocerella* (#6), and *Anchura* (#9), which have flaring extensions of the outer lip bordering the shell aperture or opening. Aporrhais bury themselves in the sea-floor and filter their food from the water, a feeding mechanism also found in the turret-shelled *Turritella* (#13 & #18). Large volutes, such as *Volutomorpha* (#5 & #17) and *Longoconcha* (#11), are active predators of the sea floor. Naticid snails, such as *Gyrodes* (#15), make their living by boring holes in other shells, inserting their mouths, and eating the creature out of house and home. Cerithid snails, such as *Tympanotomus* (#8) and *Gymnetome* (#10) live in the brackish water of estuaries along the shore. Specimens of *Gymnetome* are always abraded, and it is likely that this snail inhabited rivers along the shore.

Bivalves. Bivalves are mollusks with two shells such as clams, oysters, and scallops.



Gervilliopsis ensiformis (Conrad, 1858), right valve, incomplete length 94.5 mm, height 32.9, Owl Creek Formation, Mississippi.



Cucullaea (Idonearca) carolinensis Gabb, 1876, right valve, length 57.8 mm, height 55.8 mm, Coffee Sand, Mississippi.



Crassatella roodensis (Stephenson, 1923), left valve, length 61.1 mm, height 47.4 mm, Coffee Sand, Mississippi.

Cyprimeria alta Conrad, 1875, both valves showing left valve, length 75.0 mm, height 71.8 mm, Coffee Sand, Mississippi.

Cretaceous oysters include the species of *Exogyra* in Case 2. In Case 3, the scallop is represented by *Pecten* (#12), and the marine clams by *Geruilliopsis* (#1), *Cucullaea* (#3), *Crassatella* (#4), *Inoceramus* (#14), and *Cyprimeria* (#16) [see above].



CENOZOIC ERA

The Cenozoic Era began with the extinction of the dinosaurs and is known as the “Age of Mammals.” This is the era in which we now live. Two periods are recognized in the Cenozoic Era, the Tertiary Period, which covers the most time and includes the Paleocene, Eocene, Oligocene, Miocene and Pliocene epochs, and the Quaternary Period, which includes the Pleistocene and Recent epochs. Rocks and unconsolidated sediments from all the periods and epochs of the Cenozoic Era can be found at the surface in Mississippi. However, only those sediments of Eocene, Oligocene, and Pleistocene age are well represented by fossils, and only these epochs are included in the Stories in Stone exhibit.



TERTIARY PERIOD EOCENE EPOCH

The Eocene Epoch was the first of three epochs in the Tertiary Period named by the English geologist Charles Lyell in 1830. The name means “dawn of the recent,” referring to the present “Age of Mammals” following the extinction of the dinosaurs. Lyell visited Jackson, Mississippi, on March 20 of 1846, and collected Eocene fossil mollusks and corals from the Moodys Branch Formation at Town Creek (Wilson, 1998, p. 246). Most of the mollusk specimens in Case 4 are from the Town Creek locality.

Lyell based his original three-fold division of the Tertiary on the percentage of extant or still living species of fossil mollusks contained in each division. Following the Eocene, he named the Miocene Epoch, meaning “less recent,” and the Pliocene Epoch, meaning “more recent.” The Paleocene, meaning “ancient recent,” was later named for the oldest Eocene sediments, and the Oligocene, meaning “little recent,” was named for the youngest Eocene sediments (Dunbar, 1965, p. 353).

Turquoise is the color code for the Eocene display stands and labels. The Eocene exhibit includes a hanging whale skeleton, four display stands, and one case with a total of 44 specimen lots displayed.

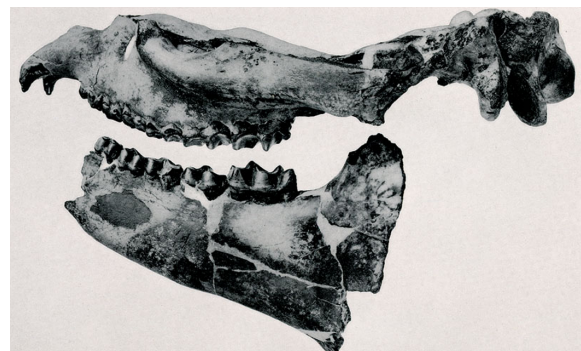


DISPLAY CASE 4

Mississippi is world renowned for its fossils of Middle Eocene age from the Claiborne Group, named for Claiborne Bluff on the Alabama River in Alabama, and of Late Eocene age from the Jackson Group, named for exposures of the Moodys Branch Formation at Town Creek. Fossiliferous exposures of the Moodys Branch Formation can also be seen at the Fossil Gulch locality behind the museum.

Plants. The coconut-like fossil fruit of the mangrove palm called *Nypa* in the display case was collected by James K. Smith from the Cook Mountain Formation at the I-20 exchange of Newton, Mississippi. *Nypa* is the most common fossil fruit found in the Eocene London Clay of England, but, today, it only lives in the tropical climates of Indonesia. The willow-like fossil leaf (#37, right) is from the Tallahatta Formation on the banks of Grenada Lake. The fossil leaf next to it (#37, left) is from the Tallahatta Formation at a clay pit in Benton County where fossil insects and spiders have been found (Johnson, 1993). Featured on the display stand is a slab of sandstone from the Kosciusko Formation with several fossil leaves. All of these plant fossils are of Middle Eocene age.

Land Mammals. Not much is known of the Eocene land mammal fauna of eastern North America because much of the Gulf and Atlantic coastal plains were under the ocean at the time. A really rare find in Mississippi is that of the skull and jaw of the titanothere *Notiotitanops mississippiensis* from the Cook Mountain Formation on the Chickasawhay River near Quitman in Clarke County. A cast of the skull's palate and teeth is on the display stand; the original is at the Smithsonian Institution. The specimen was found in a marine limestone with oyster shells. The titanothere was probably washed out to sea in some ancient storm.



Skull and lower jaws of the titanothere *Notiotitanops mississippiensis* from the Archusa Marl Member in Clarke County, Mississippi.

Sharks. Teeth of the giant shark *Otodus* cf. *sokolovi* are frequently found in the Moodys Branch Formation and Yazoo Clay of the Jackson Group. A tooth (#34) and a calcified vertebra (#33) are shown here. *Otodus sokolovi* was larger than any shark living today. Its serrated teeth were well adapted for tearing flesh, and this shark may have competed with archaeocetes (Late Eocene whales) for the position of the ocean's top predator. The *Otodus sokolovi* tooth at right is from the Moodys Branch Formation in Jackson, Mississippi.



Sawfish. The rostra ('snouts') of sawfish are lined with large pointed teeth along both sides called denticles. A large rostral denticle of the sawfish *Pristis lathamii* is on display (#32) and, based on its size, suggests an individual 10-14 feet long. The denticle has a polished tip resulting from use of the rostrum as a rake to flush out fish and crabs hiding in the sandy seafloor. The rostral denticles of sawfish are a considerably commoner find than the oral teeth (within the mouth), which are exceedingly small and almost undetectable unless one is sampling sediments with a fine sieve.



Snake vertebrae from left to right: (1) *Palaeophis virginianus* from the Bashi Formation at Meridian, Mississippi, (2) *Pterospheus schucherti* from the Moodys Branch Formation at Jackson, Mississippi, (3) *Pterospheus schucherti* from the Yazoo Clay at Cynthia, Mississippi, and (4) a recent large python vertebra.

Sea Snakes. A string of 11 vertebrae (#26) belong to the sea snake *Pterospheus schucherti*, one of four fossil snake species known from Mississippi. Vertebrae of *Pterospheus* are found in Late Eocene marine sediments of the Jackson Group. This snake is related to the modern python but spent much of its life at sea. The largest fossil vertebra found indicate that *Pterospheus* grew to a length of 18 feet and weighed 70 pounds (Holman et al., 1991).



The sanddollar *Periarchus lyelli* in the Moodys Branch on Techeva Creek in Yazoo County, Mississippi.

Sand Dollars. Sand dollars are flat echinoids that are related to sea biscuits such as *Oligopygus* (#29) and sea urchins. A guide fossil to the Moodys Branch Formation is the sand dollar *Periarchus lyelli*, a species named for the English geologist Charles Lyell. This fossil occurs locally in large numbers as shown by the block of sediment containing 5 specimens (#28), which came from the Moodys Branch Formation along Techeva Creek in Yazoo County.

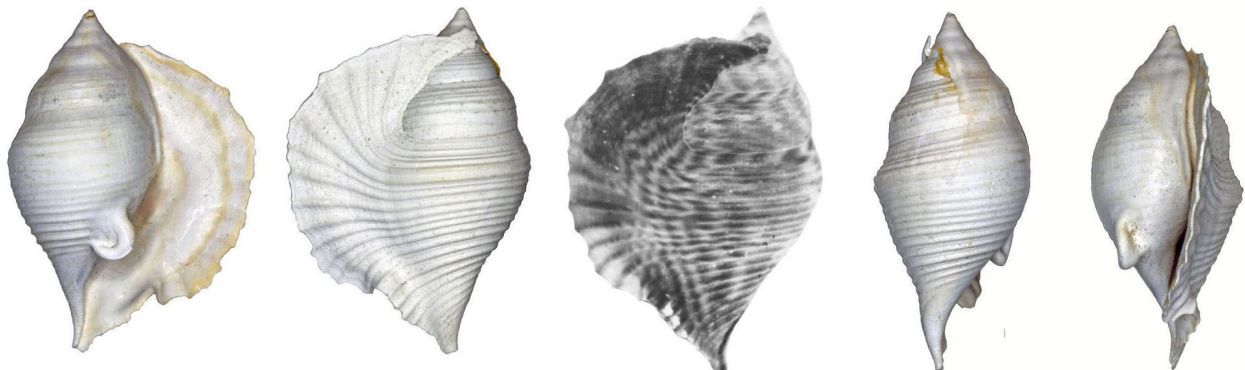
Corals. The solitary coral *Flabellum* is common in the Moodys Branch Formation and the Yazoo Clay of the Jackson Group. The subspecies *Flabellum cuneiforme wailesi* (#27) is very common at Fossil Gulch on the bluff below the museum. This coral was named for B. L. C. Wailes, who wrote the first book on the geology of Mississippi in 1854.

Nautiloids. The large nautiloid *Aturia alabamensis* occurs frequently in the upper part of the Moodys Branch Formation at Jackson. The complete specimen shown here (#35) was collected by James K. Smith from the Town Creek locality. A second specimen (#36) shows individual sediment-filled chambers. *Aturia* is related to the modern *Nautilus*, which today is found in the tropical waters of the Indian and Pacific oceans.

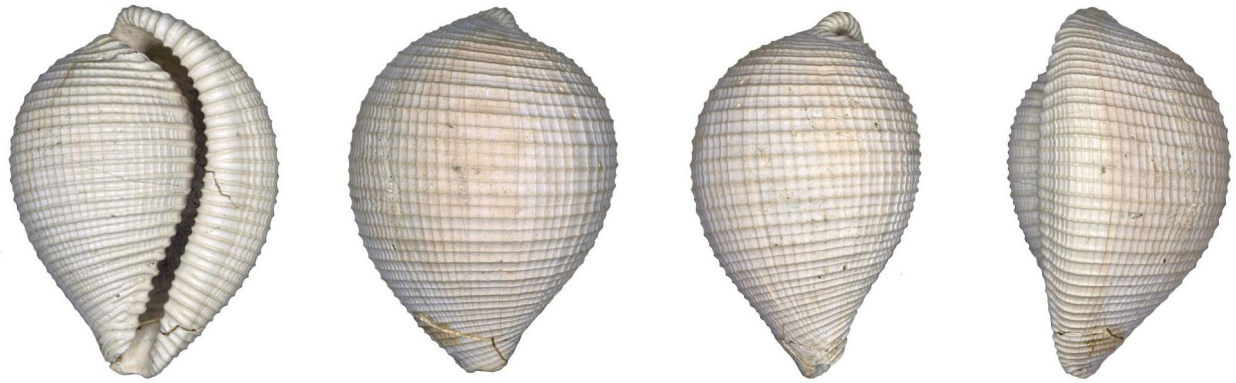


Aturia alabamensis (Morton, 1834), diameter 122.0 mm, width 60.0 mm, Moodys Branch Formation, Jackson, Mississippi.

Gastropods. The Late Eocene Moodys Branch Formation in Mississippi contains a large diversity of tropical marine mollusks, including some 265 species (Dockery, 1977). Only 148 species of shelled mollusks are known from Mississippi's Gulf Coast today (Moore, 1961). Among the Eocene mollusks, the marine gastropods or snails are the most diverse. The 19 gastropod species displayed here are from the Moodys Branch Formation at Jackson, with the exception of the whelk *Levifusus branneri*, which is from Techeva Creek in Yazoo County. Nine of these shells, including specimens #2, #4, #12, #14, #20, #21, #22, and the two specimens of #23, are the actual specimens figured in the plate of Mississippi Geological Survey, Bulletin 120, a guidebook to the fossil mollusks of the Moodys Branch Formation in Mississippi (Dockery, 1977). These figured specimens, and others from the Town Creek locality, were selected in January of 1988 for an exhibit on "Cenozoic Mollusks" at the U.S. National Museum but were cut from the display when the exhibit was downsized to include only specimens from the USNM collections.



Platyoptera extenta (Conrad in Wailes, 1854), height 40.0 mm, width 29.5 mm, Moodys Branch Formation, Jackson, Mississippi [middle image showing color pattern under ultraviolet light].



Cypraedia fenestralis Conrad in Wailes, 1854, height 40.5 mm, width 29.5 mm, Moodys Branch Formation, Jackson, Mississippi.

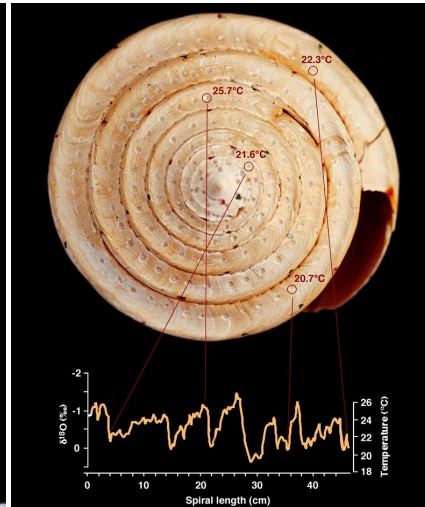
The elegant strombid gastropod *Platyop-tera* (#2 and #24) has a name that means “broad wing” in reference to the shell’s outer lip. Also very elegant is the cowrie shell *Cypraedia fenes-tralis* (#12) with its fine intersecting ribs. The long mitrid *Fusimitra millingtoni* was named for Dr. John N. Millington, one of the first four faculty members at the University of Mississippi and the first Director of the State Geological Survey from 1850 to 1853 (Mellen and Parks, 1963, p. 117). *Conus tortilis* belongs to the cone shells, which capture their prey by paralyzing them with a poi-



Mitra (Fusimitra) millingtoni Conrad in Wailes, 1854, height 92.0 mm, width 23.0 mm, Moodys Branch Formation, Jackson, Mississippi.

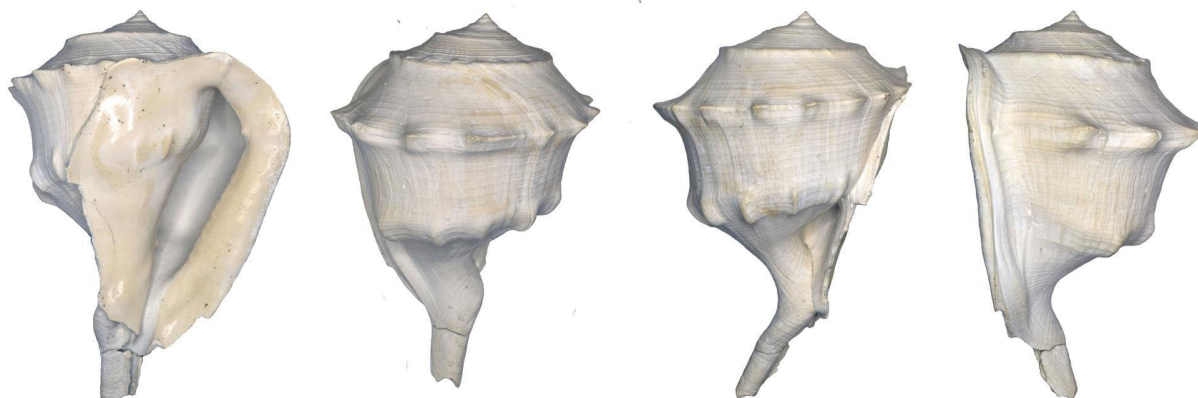


Conus tortilis from the Moodys Branch Formation at Jackson, Mississippi, showing pits along spire where shell samples were taken for oxygen isotope analysis.



Oxygen isotope/sea-water temperature sample sites along the spire of a 7.5-year-old specimen of *Conus tortilis* from the Moodys Branch Formation in Jackson, Mississippi.

sonous dart fired from their proboscis, a tubular extension of their mouth. Cones prey on both invertebrates and fish. Those that prey on fish have a neural toxin that can be fatal to people



Galeodea millsapsi Sullivan and Gardner, 1939, Moodys Branch Formation, Jackson, Mississippi, collected by James K. Smith and displayed in the MMNS *Stories in Stone* exhibit.

as well. In the movie “Lost World,” it was cone venom that was used in rifle darts to knock out the dinosaurs.

The previously mentioned gastropods from Jackson were named and figured in plates 15-17 of Wailes’ (1854) *Report on the Agriculture and Geology of Mississippi*. The large helmet shell *Galeodea millsapsi* (#8) was named in honor of Millsaps College in a publication by Sullivan and Gardner in 1939. John M. Sullivan was a geology professor at Millsaps who took his students fossil collecting at Town Creek in South Jackson and at the Fossil Gulch locality here, and Julia Gardner was a famous paleontologist and malacologist with the U.S. Geological Survey. The type specimen collected by Sullivan is at the Smithsonian. The excellent specimen on exhibit here was collected by James K. Smith. A smaller relative of *Galeodea* is the helmet shell *Phalium taitii johnsoni* (#22). The specimen on display was collected not far from the museum at Fossil Gulch as were the two sundial shells *Architectonica acuta* (#23).

Bivalves. Two bivalves from the Moodys Branch Formation are displayed here, *Venericardia* (*Venericor*) *apodensata* from Techeva Creek in Yazoo County and *Barbatia* (*Cucullaearca*) *cuculoides* from Jackson. The first of these species is very close to *Venericardia* (*Venericor*) *planicosta*, which is a guide fossil to the Eocene of Europe. When Charles Lyell collected fossils from Town Creek in 1846, this one shell proved the site to be of Eocene age.



Venericor apodensata Gardner and Bowles, 1939, left valve, length 40.0 mm, height 36.5 mm, Moodys Branch Formation, MGS 1. Figured in Dockery, 1977, pl. 24, fig. 15. MGS figured specimen 2238.

Whales. Five species of fossil whales are known from Mississippi, including *Natchitochia jonesi* (top row below), *Cynthiacetus maxwelli* (next page), *Basilosaurus cetoides* (bottom row below) *Zygorhiza kochii* (middle row below), and *Agorophius* cf. *pygmaeus*. All but the last are Eocene archaeocetes (ancient toothed whales); *Agorophius* is an archaic Oligocene



Excavation of a block of Archusa Marl containing two vertebrae of the protocetid whale *Natchitochia* at a site on the Chickasawhay River south of Quitman in Clarke County, Mississippi.



Right innominate (right pelvis) and left femur (left thigh bone) of the protocetid whale *Natchitochia* from the Archusa Marl Member on the Chickasawhay River near Quitman in Clarke County, Mississippi.



Basilosaurus cetoides skull and lower right jaw from the Yazoo clay at the Miss Lite clay pit in Cynthia, Mississippi. Specimen excavated by Tollie and Jenny Waldrup and reconstructed by David Dockery.



Jenny Waldrup excavating the lower right jaw and ulna of the archaeocete whale *Basilosaurus cetoides* from the Yazoo Clay at the Miss Lite clay pit in Cynthia, Mississippi.

odontocete (modern toothed whale. The basilosaurid archaeocetes *Basilosaurus* and *Zygorhiza* lived during the Late Eocene but became extinct by the end of the epoch.

The *Basilosaurus* skull and right jaw on the display stand against the wall (and previous page) were collected by Tollie and Jenny Waldrup from the upper Yazoo Clay in the old Miss Lite clay pit at Cynthia, just northwest of Jackson, and were later restored by the senior writer. Tollie, the Miss-Lite superintendent, monitored an area of the pit where vertebrae had been exposed during the mining of the clay and eventually discovered the skull. Radiometric ages from layers of altered volcanic ash (bentonite) in the Yazoo Clay indicate the age of this *Basilosaurus* specimen to be 34 million years old, a time near the end of the Eocene Epoch. *Basilosaurus cetoides* grew to be some 56 to 70 feet in length. Interestingly, the skull actually more



Volunteers from the Mississippi Gem and Mineral Society bail water from behind a gravel dam to keep water away from the *Zygorhiza* excavation site.



Excavation of *Zygorhiza* lower jaw just before removal from the Moodys Branch Formation in the bed of Thompson Creek in Yazoo County, Mississippi.

complete than the reconstruction exhibited at the U. S. National Museum (The Smithsonian Institution).

Zygorhiza kochii, simply referred to in the 1981 Senate Concurrent Resolution 557 as “The Prehistoric Whale,” became the State Fossil of Mississippi by legislative endorsement. The specimen hanging from the ceiling, the focal inspiration for a state fossil, was discovered by Dorothy Shaefer in 1971 in a creek bed near Tinsley, Mississippi. It was found in a limey layer at the top of the Moodys Branch Formation and is about 40 million years old. The skeleton was excavated and initially prepared by the Mississippi Gem and Mineral Society and was mounted by Ken Carpenter (Carpenter & Dockery, 1985). Those involved in the funding to complete the restoration, reconstruction, and mounting of this scientifically important specimen bestowed



Eleanor Daly excavating the holotype specimen of *Cynthiacetus maxwelli* from the Yazoo Clay at the Miss Lite clay pit at Cynthia, Mississippi.

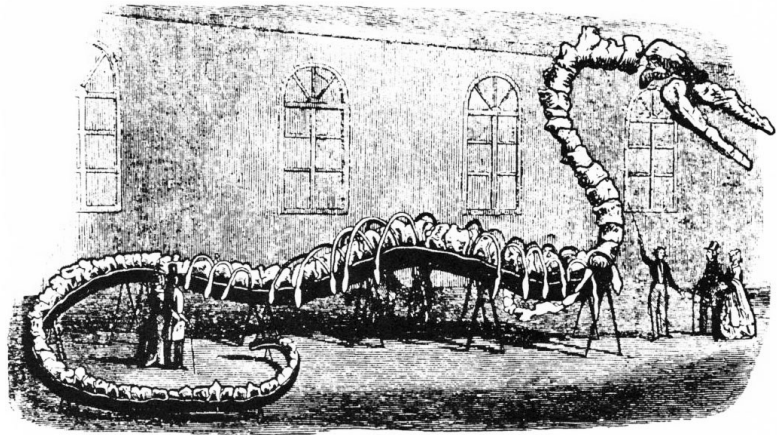


Above is *Cynthiacetus peruvianus* from Peru as mounted in the National Museum of Natural History in Paris, France. The type specimen of the genus *Cynthiacetus* is from Cynthia, Mississippi.

the name “Ziggy” on the fossil, a shorter and more affectionate corruption of the scientific epithet.

Zygorhiza kochii, simply referred to in the 1981 Senate Concurrent Resolution 557 as “The Prehistoric Whale,” is the State Fossil of Mississippi. The specimen hanging from the ceiling was discovered by Dorothy Shaefer in 1971 in the bed of Thompson Creek near Tinsley, Mississippi. It was excavated and mostly prepared by the Mississippi Gem and Mineral Society and was mounted by Ken Carpenter (Carpenter and Dockery, 1985). It was found in a limey layer at the top of the Moodys Branch Formation and is about 40 million years old.

Basilosaurus cetoides is the State Fossil of Alabama. The skull on display here is much more complete than the one exhibited at the U. S. National Museum (The Smithsonian Institution). This whale species was first known from some 28 vertebrae found in Caldwell Parish, Louisiana. One of these vertebrae was sent to the President of the American Philosophical Society in 1832, who assigned Dr. Richard Harlan the task of describing it. Believing the vertebra to be reptilian, Dr. Harlan called the animal *Basilosaurus*, meaning “the king of the lizards.” Additional *Basilosaurus* remains, including teeth, were found in Clarke County, Alabama, in 1834 and 1835. It was from these teeth that Professor Richard Owen of England in 1839 recognized the *Basilosaurus* to be a mammal. Owen recognized the vertebrae to belong to a whale and proposed a more appropriate name for the fossil, *Zeuglodon cetoides*, which alluded to the yoke-like appearance of the cheek teeth. But, according to the rules of scientific nomenclature, the first published name counts, so the fossil is *Basilosaurus cetoides* even though it was a whale, not a reptile.



The discovery of *Basilosaurus* remains in Alabama came to the attention of a German collector, Dr. Albert Koch, who traveled to Alabama in 1845 and assembled the remains of some six individuals into a skeleton that was 114 feet long (Jones, 1989, p.13). Koch named his sea monster *Hydrargos sillimanii*. He billed this creature as a sea-serpent and exhibited it for weeks in the Apollo Room on Broadway in New York City. Later, it was shipped to Germany and exhibited in the principal cities of Europe (above). Dr. Koch sold his *Basilosaurus* collection to the King of Prussia in 1846. Among his collection were the skull remains of a smaller whale, which Reichenbach in 1847 named *Basilosaurus kochii* in honor of Dr. Koch (Kellogg, 1936, p.4). We know this fossil today as *Zygorhiza kochii*.

When Charles Lyell traveled to Clarke County, Alabama, in 1846, he asked those who

had helped Koch excavate the *Basilosaurus* to show him the site, or rather sites, of the excavation. Lyell found that the head and teeth were excavated from Judge Creagh's plantation four miles southwest of Clarkesville, but that the main group of vertebrae were from a site some fifteen miles away (Wilson, 1998, p. 208). After arriving in Jackson, Mississippi, that same



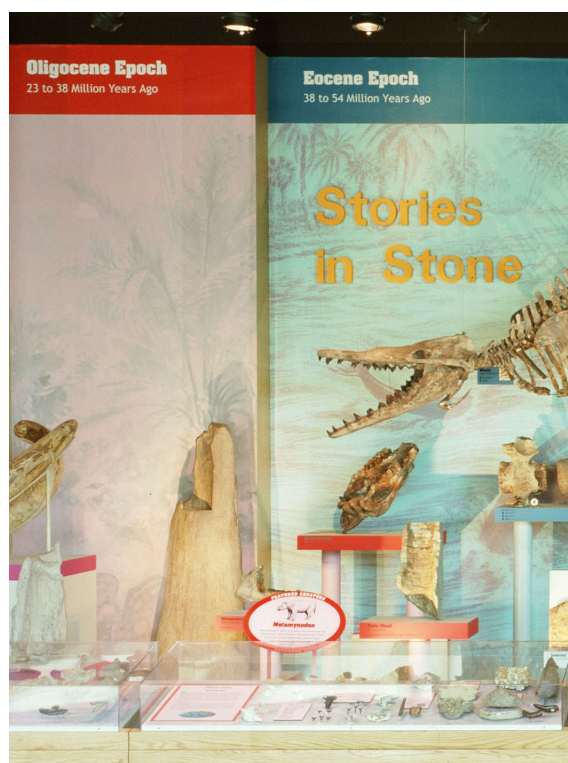
Excavation of the whale *Basilosaurus cetoides* at the Clearview Landfill in Scott County. The rib cage is above the box at lower left, and the skull is above and right of the aluminum foil box at center. The lower jaw is at the feet of Will Selman at right.



Reconstruction of the archaic whale *Basilosaurus cetoides* made from casts of a skull and other anterior bones found in the lower Yazoo Clay at Montgomery Landing in Louisiana and from vertebrae and ribs found in the upper Yazoo Clay at the Clearview Landfill in Scott County, Mississippi.

year, Lyell took time to examine a site on the Pearl River five miles south of town where a *Basilosaurus* skeleton had been found (Wilson, 1998, p. 248). The Jackson Group became known as the horizon of the *Zeuglodon* bones (Owen's name for the *Basilosaurus*).

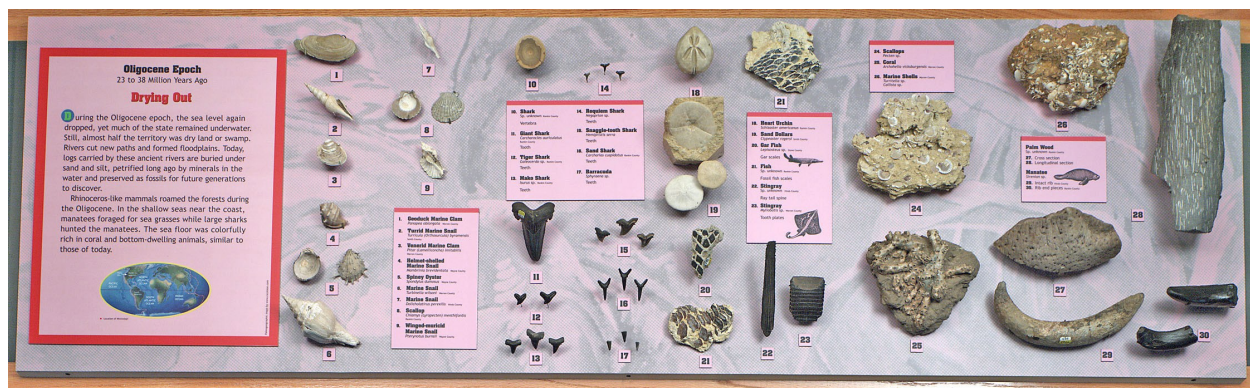
A *Basilosaurus* replica composite reconstruction, composed of molded/cast elements from several individuals, hangs near the balcony. It was produced by Dinolab, Inc., in Salt Lake City in 2006. The reconstruction utilizes bones from the Louisiana Museum of Natural History, the Mississippi Museum of Natural Science, and the University of Southern Mississippi, although sculpted elements were used to fill in the missing pieces. An interpretive wall-mounted panel nearby documents the excavation of the Mississippi contribution, which was recovered in Scott County in 2002, and presents evidence of scavenging by sharks on one of the ribs. As the smaller fossil whale earned the name "Ziggy" during reconstruction efforts, so the *Basilosaurus* skeletal replica naturally became "Basil" as its various contributions coalesced into the mount now suspended in the museum's atrium.



OLIGOCENE EPOCH

The Oligocene Epoch was named by Beyrich in 1854 for marine exposures in Germany. When Lyell encountered marine sediments of this age at Vicksburg in 1846, he called them upper Eocene as he had no division between the Eocene and Miocene epochs in which to place them. The molluscan fauna of the Vicksburg Group is distinguished from the Eocene fauna of the Jackson group by what is missing. The planicostate venericards such as *Venericardia* (*Venericor*) *apodensata* become extinct at the end of the Eocene as did such gastropods as *Platyoptera*, *Cypraedia*, *Calyptrophorus*, and *Lapparia*. Also, *Pseudoliva* and *Athleta*, which are common in most Eocene marine sediments, disappeared regionally from the Gulf Coast area at the end of the Eocene Epoch. A slab of rock from an ancient Oligocene beach found in an excavation near Vicksburg is exhibited on a display stand. This slab preserves oscillation ripples, which are produced by wave action and found at low tide along modern beaches.

Red is the color code for Oligocene display stands and labels. The Oligocene exhibit includes five display stands and one case with a total of 35 specimen lots displayed.



OLIGOCENE Case

Palm "Wood." Palm trees are in the grass family, and their trunks are made of fibers and not true wood. These fibers can be seen in the sections of petrified palm on display (#27 and #28). Petrified palm specimens are frequently found in the rivers and creeks of southern Mississippi below Interstate 20 and are sometimes found in streams along the bluff line in Yazoo County. Most of these specimens are believed to come from the Catahoula Formation, which ranges from Oligocene to Miocene in age. A true Oligocene specimen is the palm trunk imprint in the block of Glendon Limestone on the display stand. This specimen came from the old Marquette Cement Manufacturing Company limestone quarry in Brandon. The large petrified trunk standing upright against the wall is probably from the Catahoula Formation and may be Miocene in age. Petrified palm from Bayou Pierre in Copiah and Claiborne counties has been identified as the extinct species *Palmoxylon lacunosum* (Blackwell, 1989).

Manatee. The manatees, or sea cows, are endangered aquatic mammals that live in Florida rivers today. Manatee fossils from the Oligocene of Mississippi are more closely relat-

ed to the ocean-going dugong, which lives along the Pacific coasts of Madagascar and Australia. Generally, only the dense ribs of these animals are found as fossils. A complete skeleton of a recent manatee hangs in the Endangered Species Display opposite the fossil exhibit for the Pleistocene Epoch.

Corals. Whereas, the solitary coral *Flabellum* is common in Mississippi's Eocene sediments, the reef-forming coral *Archohelia* is somewhat regularly encountered in the our Oligocene sediments. A branching specimen of *Archohelia vicksburgensis*, a species named for the city of Vicksburg, is displayed in matrix (#25).

Sharks. Shark teeth on display include that of the giant shark *Otodus* cf. *sokolovi* (#11), the tiger shark *Galeocerdo* cf. *casei* (#12), the mako shark *Macrorhizodus praecursor* (#13), the snaggle-tooth shark *Hemipristis intermedia* (#15), and the sand tiger shark *Carcharias cuspidatus* (#16). Ray fossils include a tooth plate from *Myliobatis* sp. (#23) collected by James Starnes from the Glendon Limestone on Old Highway 61 at Vicksburg and a caudal barb (tail stinger) (#22) collected by Daniel Dear from the Byram Marl on the Big Black River near Edwards. The Edwards locality is where fossil terrestrial mammals, discussed further below, have also been found.

Bony Fish. The scales of an unidentified fish (#21, in two pieces) are from the Glendon Limestone at Brandon, Mississippi. Barracuda (*Sphyræna*) teeth (#17) are regularly encountered in the Vicksburg Group. Associated scales of the gar *Lepisosteus* (#20) were found in freshwater Miocene sediments in Wiggins, Mississippi. The occurrence of vertebrate fossils, like the gar scales, in the southernmost part of the state is atypical due to the generally acidic sediments occurring at the surface in that region. Without clay and calcium carbonate, which are crucial to optimal fossil preservation (in most cases), high sand content is inhospitable to the preservation of bones and shells.

Sea Cookies. Unlike 'true' (scutelline) sand dollars, which are commonly found in sandy nearshore and onshore environments, sea biscuits (or clypeasterine sand dollars) live in shallow water further offshore and are commonly found associated with seagrass meadows. Also known as sea cookies, fossil *Clypeaster* is a common constituent in limestones deposited in the shallower reaches of continental shelves. Such an environment existed in what we now know as central Mississippi during the Early Oligocene, where *Clypeaster rogersi*, or Rogers' sea cookie played an integral role in the seafloor ecosystem. In the Oligocene case, two specimens are displayed top side up, while the specimen embedded in limestone matrix shows the bottom (#19).



Clypeaster rogersi from the Marianna Limestone

Heart Urchin. *Schizaster americanus* is the common heart urchin of the Marianna and

Glendon limestones and has a striking form with depressed petal structures on the upper surface (#18). The junior author has observed aggregations of this urchin in the upper Marianna Formation near Bay Springs. Since eggs are fertilized externally (to produce free-living larvae), modern urchins have been observed to aggregate in order to increase chances of reproduction given the short lifespan of the larvae over greater distances.

Gastropods. Over 550 species of mollusks, including gastropods, bivalves, and scaphopods, are known from the Vicksburg Group of Mississippi. On display from the Byram Formation are the large *Tubinella wilsoni* and the medium-sized *Turricula (Orthosurcula) byramensis* and *Dolicholatirus perexilis*. From the Red Bluff Formation in Wayne County are the helmet shell *Mambrinia brevidentata* and the elegant and rare winged-muricid *Pterynotus burnsii*. The only other complete specimen of *Pterynotus burnsii* is at the Smithsonian Institution. The specimen displayed here was collected by the writer's dissertation advisor at Tulane University, Dr. Emily Vokes, who was a step ahead of him as they were collecting shells at Red Bluff on the Chickasawhay River. Upon her retirement, Dr. Vokes sent the shell wrapped as a gift with a card saying "Merry Christmas." *Pterynotus burnsii* is named in honor of Frank Burns, who, in the late 1800s, collected Oligocene fossils from Mississippi in barrels by the wagon loads and shipped them to the U.S. National Museum where he later washed and sorted them.



Pterynotus burnsii (Aldrich, 1894) collected by Dr. Emily Vokes from the Red Bluff Formation at the type locality at Red Bluff on the Chickasawhay River in Wayne County, Mississippi.

Bivalves. Bivalves on display include scallop shells of *Pecten* sp. in matrix (#24), the scallop *Chlamys (Lyropecten) menthifontis*, both valves of the venerid clam *Pitar (Lamelliconcha) imitabilis*, the spiny oyster *Spondylus dumosus*, and both valves of the geoduck *Panopea oblongata*. Geoducks are common in Mississippi's Late Eocene and Oligocene marine sediments, but today live on the West Coast of North America. The geoduck is an edible clam that can burrow up to 2 to 3 feet below the surface and has a long siphon. It is the school mascot of Evergreen State College, which is situated on Puget Sound in Washington State.

Land Mammals. Oligocene land mammals are common in the badlands of South Dakota but are known from only one locality east of the Mississippi River, and that locality is an exposure of the Byram Formation along the bluffs of the Big Black River at Edwards, Mississippi. The skull of *Metamynodon planifrons* was discovered in 1985 with its coral-encrusted snout protruding from the sediments. It was excavated by the Mississippi Office of Geology in August 29 and 30 of 1985 just ahead of the approaching hurricane Elena, which threatened to flood the Big Black River and wash away the skull. This skull is mounted upside down with its snout pointed upward to show its large molar teeth and is on a display stand against the back wall. *Metamynodon planifrons* was a semiaquatic amynodont, a group related to the rhinoceroses, which lived in rivers much as hippopotamuses do today. The specimen found in the Byram



Excavation of a *Metamynodon* skull from the Byram Formation on the Big Black River at Edwards, Mississippi. The skull is right-side up and encrusted with oysters and corals.



Dave and Emily Dear beside the plaster-jacket-enclosed *Metamynodon* skull excavated from bed E (excavation pit just to the lower right) of the Byram Formation on the Big Black River.

Formation was probably washed to sea in a storm. After floating for some time, the head separated from the body and sank to the seafloor. A description of the Byram *Metamynodon* can be found in Manning et al., 1985.

The second land mammal find, the jaws of the hornless rhinoceros *Subhyracodon occidentalis*, was discovered in 1988. It is mounted on the display stand in front of the *Metamynodon*. The discoveries of *Metamynodon* and *Subhyracodon* remains in the marine sediments of the Byram Formation made possible an important correlation between the Chadronian Land Mammal Age of the Great Plains and the marine Vicksburg Group of the Gulf Coast. A description of the *Subhyracodon* jaw can be found in Manning, 1997.

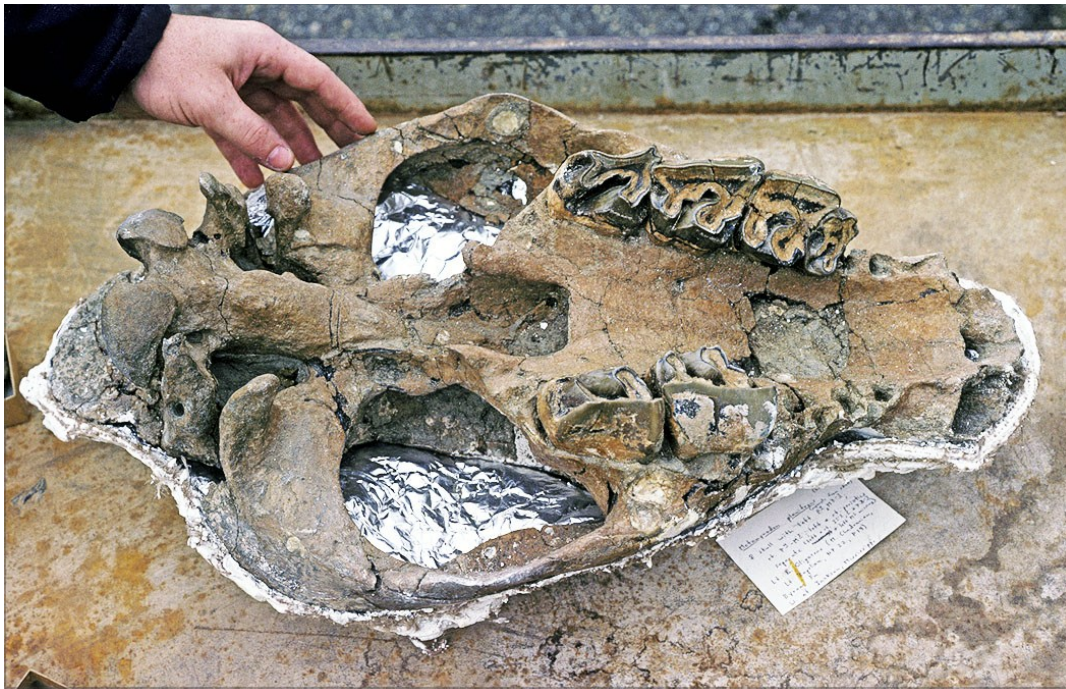


Howard Davis Dear III at excavation of the lower jaws of the rhinoceros *Subhyracodon occidentalis* from bed K of the Byram Formation at Edwards, Mississippi. Howard's brother, Daniel, found the fossil when he noticed teeth protruding from a concretion.



Photograph of *Subhyracodon* lower jaws from the Byram Formation the Big Black River near Edwards. Picture by Gil Ford Photography.

Fossils on Trial. The *Metamynodon* and *Subhyracodon* specimens have twice appeared as evidence. First they appeared before the Mississippi Gaming Commission on November 15, 1996, in opposition to a \$150 million casino and super speedway development, which threatened to open an important paleontological and wilderness site to pilfering by artifact collectors. Details of the hearings were reported by the *American Paleontologist* (Dockery, 1996). To the surprise of many, on December 16, 1996, the Gaming Commission deemed the Big Black River site unsuitable. The February 1997 issue (page 13) of the *American Paleontologist* reported the decision under the heading “Mississippi Casino Loses Gamble.” Later, when a \$238 million lawsuit was filed against those who allegedly conspired to block the casino project, the *Metamynodon* and *Subhyracodon* fossils appeared as evidence again, this time in civil court in Magnolia, Mississippi, on October 26, 1999. Details of the trial were published the next day in the Business Section of the Jackson newspaper, *The Clarion Ledger*.



Palatal view of the skull of *Metamynodon planifrons* from the Byram Formation on the Big Black River at Edwards, Mississippi.

Featured Creature. The featured creature of the Oligocene Epoch is the amynodont *Metamynodon planifrons*. This animal was at home in the rivers of the Gulf Coastal Plains as well as those of the Great Plains. Its remains have played an important role in tying the stratigraphy of the terrestrial beds of North America’s Western Interior with the marine beds of the Gulf Coast.

QUATERNARY PERIOD

PLEISTOCENE EPOCH

The Pleistocene Epoch was named by Lyell in 1839. This epoch extends from the beginning to the end of the Ice Age and marks the appearance of man. In the early 1800s, a brown-stained human pelvis was found along with the bones of extinct mammals in Mammoth Bayou in Natchez, Mississippi. This find became known as the Natchez Man and began a debate that lasted over a hundred years as to when the first humans arrived in the Americas. Charles Lyell made a point to visit Mammoth Bayou in 1846 and concluded that the pelvis had eroded from an Indian grave and mixed with older bones in the creek. Others argued that the pelvis was as strongly mineralized as the bones found with it. The debate was recently settled at the University of Arizona where radiocarbon ages were determined for the pelvis and for an associated ground sloth bone. The results were: ground sloth $17,840 \pm 125$ years old and Natchez Man $5,580 \pm 80$ years old (Hamilton, 1990). Lyell was right; the Natchez man pelvis had indeed fallen from an Indian grave and mixed with much older bones.

Mississippi's wildlife in the Pleistocene resembled a mix of today's African savannas and the arctic tundra and included such animals as lions, wolves, bears, giant beavers, pigs, llamas, deer, giant bison, musk ox, horses, zebras, tapirs, mastodons, mammoths, and giant ground sloths. Many of these animals, including the horses, became extinct in North America toward the end of the Pleistocene. Horses were reintroduced into North America by the Spanish. Some have drawn a correlation between the first appearance of Paleo-Indians in the Americas some 12,000 to 11,000 years ago and the extinction of large Pleistocene mammals. What part man played in these extinctions is still debated.

Magenta, a purplish-red, is the color code for the Pleistocene display stands and labels. The Pleistocene exhibit includes 4 skulls mounted on the wall, four display stands (most with multiple specimens), and two cases with a total of 41 specimen lots displayed.



PLEISTOCENE: Right Case

Giant Sloth. Three giant sloths are known from Mississippi. Harlan's giant sloth *Glossotherium harlani* is represented in the display by two teeth, a canine and premolar (#17) from Tibbee

Creek in Clay County one mile upstream of the Highway 45 Alternate bridge. Jefferson's giant sloth, *Megalonyx jeffersoni* is represented by a distal half of the humerus (#12) from Tibbee Creek in Clay County, posterior skull (#13) from a Mississippi River bar in Bolivar County, the cast of a claw (#14) from a specimen found on a Mississippi River gravel bar at Victoria Bend northwest of Rosedale in Bolivar County, one left rib from the Big Black River in Warren County and three right ribs from Piney Creek in Yazoo County (#15), and a vertebra from the Big Black River in Warren County (#16). The sloth bones from the Big Black River were found by Paul Hartfield while he was studying the river's mussel fauna. In a river bend near the confluence of Mill/Buck Creek, he noticed fossil mussel shells eroding from the bank and began digging them out to study the river's ancient fauna. While digging he found the sloth bones and a bison vertebra. The fossil mussels included the ebony shell *Fusconaia ebena*, the gulf pigtoe *Fusconaia cerina*, the purple pimpleback *Quadrula refulgens*, and the southern mapleleaf *Quadrula apiculata*. These are the same clams that live in the Big Black River today.

Our third president, Thomas Jefferson, had a long-standing interest in the fossil bones of large 'Ice Age' mammals and fancied that such creatures might still live in the unexplored wilderness of America's western territories. When he was vice president, he assigned the name *Megalonyx* to a partial association of large fossil mammal bones from a Virginia cave, although he was under the impression that they belonged to a large cat several times the size of an African lion, in part based on the massive claws (Jefferson, 1799). It didn't take long for Jefferson to realize his mistake when reviewing a recent description by French paleontologist Georges Cuvier of an even larger giant sloth from Argentina. Later, Desmarest (1822) honored Jefferson for his discovery by bestowing the species name *jeffersoni*.

Regarding their impressive claws, giant ground sloths used them for feeding, digging, and defense, although the young of *Megalonyx* may have escaped predation by climbing trees. When we talk about fossil giant ground sloth claws, we are often referring the bony claw core, exclusive of the part made of keratin that originating from the skin, as in the claws, nails, and talons of other animals. The keratinous part of the claw covers the bone, somewhat analogous to a sheath and knife relationship. The keratinous part of the ground sloth claw would have extended beyond the end of the claw core, the core length at least 2/3 the entire claw length. Thus, a *Megalonyx* foot claw core measuring 8 inches on the outside curve would have a claw extending nearly a foot from the base of the nail bed. In *Eremotherium*, one of the largest ground sloths to have ever lived and the size of an elephant, a foot claw core can measure 18 inches along the outside curve, which translates to nearly 2 ft of actual claw.



Giant sloth claw as found by Lonnie Looer on a gravel bar of the Mississippi River.

Horse. Completely extinct in the Western Hemisphere by the end of the Pleistocene Epoch 11,000-12,000 years ago, horses were reintroduced by Spanish explorers in the 16th century, after which feral populations soon become established (e.g. the mustangs). Along with several other nonnative ungulates (hooved animals), like camels/llamas, rhinos, and tapirs, horses have a long evolutionary history in North America. What happened? The extinction event at the end of the Pleistocene Epoch was devastating to most species over 90 lb, so the few that survived were the resilient exceptions. There was no singular ‘smoking gun’ but the coupled effects of global warming, hunting pressure from the first human immigrants, and disease spread by human immigrants and domestic dogs.

The articulated horse foot (#s7-10) is indistinguishable in size and proportions from that of an average modern domestic horse. The same goes for the molars (#11). In fact, all Pleistocene horse fossils from Mississippi are identified as belonging to the modern genus *Equus*. That said, as common as horse fossils are in the Pleistocene of Mississippi, and in North America in general, a significant sample size is needed, along with relatively complete remains, including the skull, to accurately characterize and identify a species in a given fossil population. Unfortunately, no whole or partial skulls have been recovered from Mississippi, and the vast majority of fossil finds consist of isolated teeth and toe bones. Earlier estimates suggested as many as a half dozen different species occur in the Late Pleistocene deposits of Mississippi (Kaye, 1974; Kúrten & Anderson, 1980). However, Winans (1985) proposed that as few as five species are recorded in the entire Pleistocene of North America. Conversations with experts on Pleistocene *Equus* in North America, like Melissa Winans at the University of Texas, Eric Scott at the San Bernadino County Museum (Redlands, California), and Richard Hulbert at the Florida Museum of Natural History have led the junior author to the conclusion that Late Pleistocene horse fossil dataset in the state fossil collection at MMNS contains no more than 2-3 species, and the vast majority of the material represents a single species, something similar in size and proportions to an American Standardbred or Morgan.

Mastodon. Bones and teeth of the American mastodon *Mammut americanum* are some of the most common Pleistocene fossils collected in Mississippi. One reason for this is that the animal’s large bones are easily seen and are more likely to be collected. In addition, the enamel is very dense and thick and quite durable. Although the softer and more fragile dentine composes the

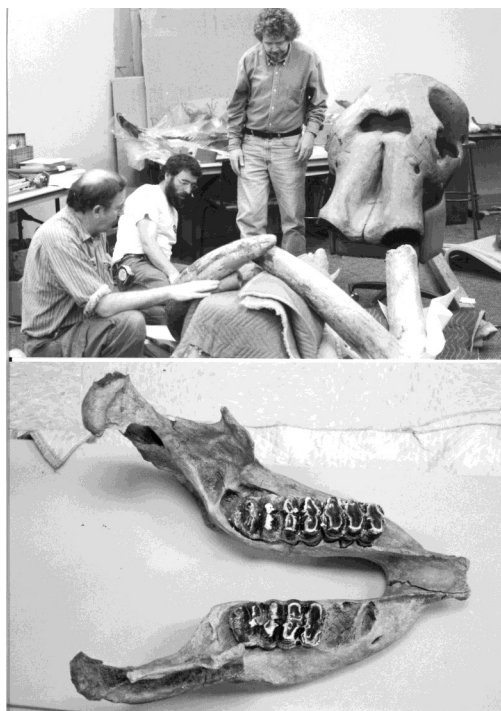


Eleanor Daly and Paul Hartfield (with shovel) excavating a mastodon in the loess at Pemberton Mall and Interstate 20. Pair of tusks wrapped in plaster jacket are at left. Survey lines form a grid for mapping the location of bones.

roots and holds the tooth together, the enamel crown will break up into shards that will persist in the environment for some time postmortem. The cusps of these teeth as seen in specimen #5 are quite different from the folded, slightly thinner enamel of the mammoth (#4) and African elephant (#6). Analyses of undigested plant remains found in the rib cages of carefully excavated mastodons reveal a diet of conifer twigs and cones, leaves, coarse grasses, swamp plants, mosses (Kurtén & Anderson, 1980); dung deposits tell of a variety of other arboraceous browse palatable to the American mastodon, including grape vines, various nuts and stone fruits, and several thorny shrubs, like honey locust (Newsom and Muhlbachler, 2006).

The mastodon skull, jaws, and tusks on the display stand are a composite of three individuals. The skull is a cast of a specimen found in Indiana and owned by the Illinois State Museum (#4). The jaws are original and were found by Eddie Templeton in the Loess Hills of Yazoo County; they were extricated from a deposit of alluvial loess containing aquatic mollusks and partially lignitized logs (#3). One of these logs has been sectioned and identified as being either cedar or perhaps bald cypress by Dr. Terry Amburgey of the Forest Products Laboratory at Mississippi State University. The tusks are from an individual excavated by the Museum's staff and many volunteers in the spring of 1984. The excavation was adjacent to the Interstate 20 right-of-way at the construction site of Pemberton Mall in Vicksburg. When excavated, the right tusk was found lying across the left one. The large leg bone (a femur) displayed in an upright position below the skull was found alongside the tusks. An account of the Pemberton Mall mastodon excavation and a survey of where the bones were found, is given in Knox and Pitts (1984).

Mammoth. Mammoth remains are not as common in Mississippi as those of mastodon, but this is generally the case of most fossil-bearing Ice Age deposits in the eastern U.S. Mammoths were grazers that preferred grasslands, while mastodons were browsers and thus better suited for the forests that dominated the Pleistocene (and modern) landscapes east of the Mississippi River. A mammoth molar found between New Albany and Ripley in northeast Mississippi (#4) is displayed next to that of a mastodon from the Loess Hills. The molar of the recent African elephant *Loxodonta africana* (#6) is provided for comparison. Is the Elephant tooth more like that of the mammoth or the mastodon? The shape of the tooth seems to be somewhere in between, which is consistent with the 'mixed feeding' of the modern African elephant—grazing on grasses in the wet season and feedings on woodier vegetation when it's dry.



Putting the mastodon together for the display.
The lower jaws were donated by Eddie Templeton.



Eddie Templeton, who found and donated the mastodon jaws shown at upper right, recently discovered a mammoth tusk in a creek bottom in Madison County, Mississippi. Eddie and the tusk are shown below.

Above at left James Starnes prepares the mammoth tusk for transport in a plaster jacket. Above at right, a rare baby mammoth tooth from the Pontotoc Ridge in northeast Mississippi makes front-page news on May 24, 2026.

Land Snails. The Pleistocene loess of the Mississippi River Valley Bluff Line in western Mississippi is largely a deposit of wind-blown dust stripped from the river's alluvial plain during dry months and low water. The most common fossils in these deposits are the shells of land snails. Shimek (1902) illustrated 21 species of land snails from the loess of Natchez, Mississippi, and Hubricht (1963, p. 52) listed 31 species from Warren County. One of the largest and also most common land snails in the loess of southern Mississippi is *Mesodon zaletus* (#3). Shells of this species were found with the mastodon tusks excavated at Vicksburg. *Mesodon* was named for a tooth-like ridge in the middle of the shell's parietal lip. A similar-looking species found with *Mesodon* is the large land snail *Triodopsis albolabris*, but this species lacks the tooth (parietal ridge) of *Mesodon*. Today, *Mesodon zaletus* and *Triodopsis albolabris* live in the cooler climates of the upper Mississippi River Valley and in the Appalachians of northern Alabama.

Giant Beaver. The mounted skeleton of the giant beaver *Castoroides ohioensis* is a cast of a skeleton found around 1890 in Randolph County, Indiana (Moore, 1893). The giant beaver jaw fragment (#1) with incisor (#2) were found in northeast Mississippi. Beside the skeleton is a section of petrified wood from Mississippi, which appears to have been beaver-gnawed. At right is a giant beaver partial inci-





sor found in the summer of 2026 near Starkville, as featured in a #FossilFriday post by James Starnes.

Bison. The long-horned bison skull mounted on the back wall is that of the giant bison *Bison latifrons*. It is a cast of a skull found in the American Falls area of southeastern Idaho and resides in the collections at Idaho State University Museum of Natural History. A fossil limb bone (radio-ulna) of this species (#9) found on a Mississippi River sand bar in Bolivar County, Mississippi, appears in the display case next to that of a modern cow. The American Buffalo is still living but is only half the size of the extinct giant bison. Below the giant bison skull cast is the bleached skull of a recent American Buffalo and the brown fossil skull of the extinct 'antique' bison, or *Bison antiquus*. The *B. antiquus* skull was found on a Mississippi River sand bar in Bolivar County. Such fossils are washed up by the river when it cuts into older Pleistocene river deposits along its channel. Other bison fossils displayed include isolated upper mo-

lars (#12, #13) and a lower jaw fragment with three molars intact (#11).

Bears. Pleistocene bears of Mississippi include the great short-faced bear *Arctodus simus*, a replica left jaw of which is on display (#8). The original is owned by Delta State University (DSU) and was found in 1992 on a Mississippi River gravel bar near Rosedale by the late Lonnie Looper of Greenville. Lonnie and his wife Freida made regular fossil-collecting trips to the river between 1989 and 1995 and made some amazing discoveries, which today are shared between DSU and MMNS. *Arctodus* fossils are rare in Mississippi, so anyone who finds one is pretty lucky—like ten-year-old Sarah Thomas, who found a thigh bone of a great short-faced bear on the Mississippi River in 2004 (photo, right). Sarah's big bone is one of only three *Arctodus* fossils from Mississippi known in public holdings. The third is a small molar found in the Mississippi Black Prairie in the 1970s (Kurtén & Kaye, 1982).



PLEISTOCENE Right Case

Tapirs. Like horses, rhinos, and members of the camel family, tapirs actually evolved in North America only to eventually become extinct here yet seemingly thrive at other locations around the world. Today, tapirs are only found in Central and South America and Southeast Asia. The best known 'Ice Age' tapir throughout most of the Southeast was *Tapirus veroensis*, named for Vero Beach, Florida, where the first complete skull was discovered and described. Our display features a tapir jaw fragment with molar (#6) and a molar crown (#7) found in the Black Prairie near West Point.

Deer. Bones, teeth, and antler fragments of odocoileine deer (*Odocoileus* spp.) are among the commoner vertebrate fossils found in Mississippi Pleistocene deposits. Ice Age fossils consistent with, or at least closely resembling, both living species—*Odocoileus virginianus* (white-tailed deer) and *O. hemionus* (black-tailed deer)—have been recovered within the state's borders. However, remains of the latter are only known from the Mississippi River. Antlers are perhaps the more diagnostic skeletal feature distinguishing these two closely related species. The partial antler in the case before you (#3) represents a white-tailed deer, although

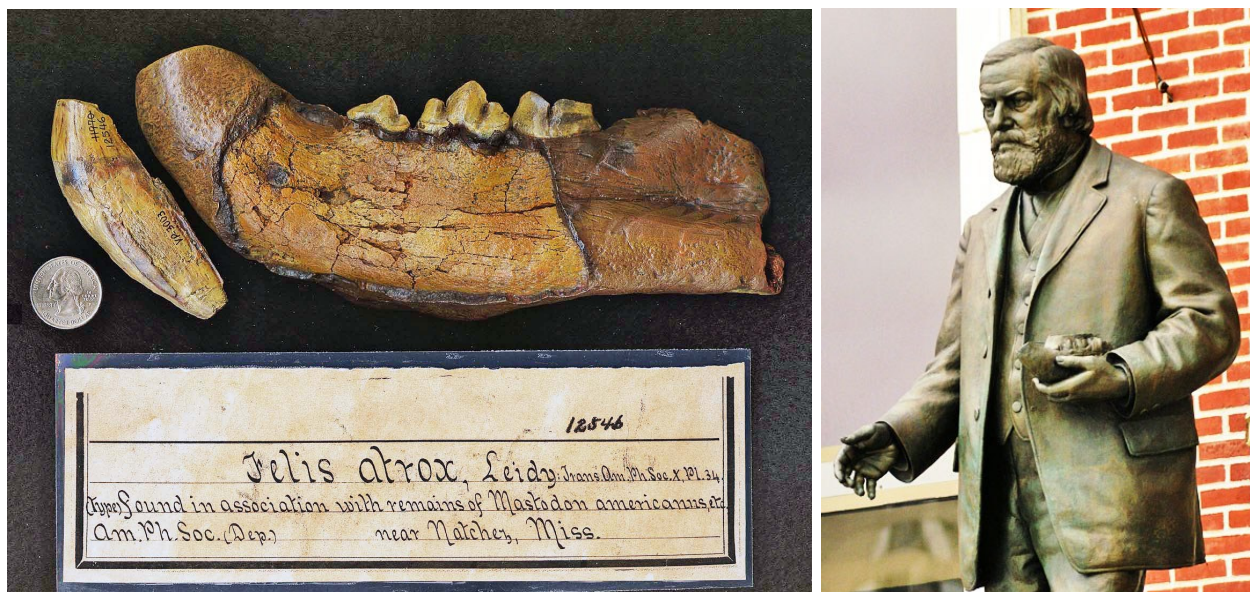
the cranium (#1) and upper jaw fragment (#2) are ambiguous. All three of these fossils are from the Mississippi River. However, fossil odocoileine deer antlers from the Black Prairie do not obtain the impressive sizes of modern white-tails or the Mississippi River fossil antlers. Did the Ice Age deer of the Black Prairie region actually possess smaller antlers? The vast majority of the antlers in the MMNS sample are sheds with 0-1 tines (branches) each and are recovered from deposits suggestive of upland streams. Larger antlers are found in lower elevation alluvial deposits indicative of larger streams. The different antler sizes distributed among different environments may reflect the influence of water use on demographic characteristics, namely herd structure.

Rodents. Given enough time to lie about before entering the fossil record, a bone or antler will likely be gnawed on by rodents (#5). Rodents do this to file down their constantly growing teeth when necessary, and the bone calcium and phosphorus can be nutritionally significant to rodent populations that have few other sources for these minerals.

Sabertooth Cats. Various types of sabertooth cats and cat-like carnivores are known from deposits of Oligocene to Pleistocene age, although there is a major distinction between the last two species that inhabited North America—*Smilodon* and *Homotherium*. The dirk-toothed cat *Smilodon* is the only one of the two known from Mississippi, and its remains have been recovered from numerous localities in both North and South America. The other Pleistocene sabertooth was the scimitar-toothed cat *Homotherium*, which is known from Eurasia as well as North America, although its remains seem to be notably scarcer than those of *Smilodon* everywhere within its range. The closest record of *Homotherium* to our state is neighboring Tennessee (Rawn-Schatzinger & Collin, 1981), but it is also well-documented alongside an abundance of juvenile mammoth remains from a famous cave in Texas (Rawn-Schatzinger, 1992). The available evidence suggests that *Homotherium* was a long-legged, fleet-footed sabertooth of open-country, and its diet did not include the bones of its prey (DeSantis et al., 2021). This contrasts with *Smilodon*—a relatively short-legged ambush predator of forests and woodlands with carnassial teeth exhibiting evidence of bone-crushing.

A cast of the skull of *Smilodon fatalis*, a name meaning ‘fatal knife-tooth’ cat, is on the display stand to the left. The original skull is in the collections of the Los Angeles County Museum of Natural History and came from the famous La Brea tar pits near Los Angeles where over a thousand such skulls have been found. The paired saber teeth of the skull are up to six inches long and could pierce deeply into the hide of the cat’s prey.

Sabertooth cat fossils are rare, due in large part to the naturally low predator-prey ratios among mammals in terrestrial ecosystems. A metatarsal found near West Point is on display below the *Smilodon* skeleton standing alongside Jefferson's Ground Sloth—one of its principal prey.



Featured Creature. The Featured Creature of Mississippi's Pleistocene is the American Lion *Panthera atrox*, a name meaning 'cruel lion.' This strictly North American species was named in 1853 by the famous vertebrate paleontologist and medical doctor Joseph Leidy, who is regarded by many as the "father of American vertebrate paleontology." The fossil Leidy named, the type specimen, was a left lower jaw with three molars and a broken canine tooth found in Natchez, Mississippi (see at bottom left). At the Academy of Natural Sciences, Philadelphia, Pennsylvania, is an eight and one half-foot bronze statue of Leidy posed as if he were addressing a class; in his hand he carefully cradles the *Panthera atrox* jaw from Natchez (at top right; see also Spamer and Forster, 1989, p. 160). A cast of a left lower jaw resides in one of the glass cases below the giant ground sloth skeleton; it was found on the Mississippi River near Rosedale. The picture bottom right is an American lion jaw found in the Tunica Hills of southwest Mississippi in 2026. Both of these fossils are in private collections. The skull cast on display is based on a specimen from the tar pits at Rancho La Brea in the collections of the Los Angeles County Museum of Natural History.



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‘Stories in Stone’: 2026 Inventory of Exhibited Fossils

We have made every effort over the years to stock this exhibit with specimens originating from Mississippi, although we occasionally employ casts of more complete or composite fossils from other states. Since the exhibit’s creation in 1999, several changes have been made to the contents and text for purposes of maintaining scientific accuracy and displaying more public donations. All place names provided as provenance in the specimen inventory below are references to Mississippi locales, unless otherwise stated.

Note the sequence presented in this document is chronologic—a natural order for even non-geologists. However, the chronologic order within the ‘Stories in Stone’ exhibit is right-to-left, which is opposite the typical ‘left to right’ manner in which most Westerners read and perform other tasks. This may be awkward for some, but we believe the document must follow a natural, geologic sequence.

The specimens in the exhibit are from the Mississippi Museum of Natural Science (MMNS) and Mississippi Geological Survey (MGS) collections, thus the catalogue numbers include the abbreviations of these two institutions.

Mollusks in the Cretaceous section were all collected by the senior writer. Those from the Coon Creek Tongue of the Ripley Formation at Union County Lake (MGS loc. 127) were collected between 1970 and 1978. Fossil shells from the Coffee Sand at the Twenty Mile Creel Overlook (MGS loc. 128) were collected from 1976 to c.1990. Mollusks from the Coffee Sand in a sand pit near Chapelville (MGS loc. 129) were collected from 1982 to c.1993 (Dockery, 1993). Some of the specimens displayed were figured in that report.

Eocene mollusks from the Moodys Branch Formation in Fossil Gulch on the museum grounds (MGS loc. 2) were collected by the senior writer in the early 1960s. Mollusks from the Moodys Branch Formation at Town Creek in Jackson (MGS loc. 1) were collected from about 1965 to 1977 (Dockery, 1977). Some of the specimens on display were figured in that report.

Oligocene mollusks from the Red Bluff Formation, the Mint Spring Formation, the Glendon Limestone, and the Bryam Formation were collected by the senior writer between 1975 and 1984 (MacNeil and Dockery, 1984).

Lastly, if you spot any errors or outdated information in the display or in the inventory to follow, please contact the paleontology curator at the Mississippi Museum of Natural Science.

Devonian Period

(DARK BLUE)

Background

Placoderm Fish. *Dunkleosteus terrelli* (Newberry, 1873). Replica skull of a large placoderm from the Late Devonian Cleveland Shale of Cuyahoga County, Ohio. The original specimen, one of the most complete ever recovered, resides in the Cleveland Museum of Natural History [CMNH 6090]. In the past, body length estimates for this placoderm ranged from 16 to 32 ft; however, a more recent methodology, utilizing this famous specimen as well as other skulls, suggests adult body lengths half that—under 14 ft (Engelman, 2023).

Foreground

Trilobite

1. *Paciphacops birdsongensis* (Delo, 1940). Trilobite body cast in slab. Collected by David Dockery in the Ross Formation at Island Hill, Pickwick Lake [MGS collection]. Figured in Dockery & Merrill (1984) and Merrill et al. (1988).

Trilobite. *Huntonia purduei purduei* (Dunbar, 1919).

2. Trilobite cephalon (head) cast in matrix block. Collected by David Dockery in the Ross Formation at Island Hill, Pickwick Lake [MGS collection]. Figured in Dockery & Merrill (1984) and Merrill et al. (1988).
3. Trilobite body cast, missing part of cephalon (head), in matrix block. Collected by David Dockery in the Ross Formation at Island Hill, Pickwick Lake [MGS collection].
4. Trilobite pygidium (tail) cast in slab. Collected by David Dockery in the Ross Formation at Island Hill, Pickwick Lake [MGS collection].
5. **Chert Block with Coral & Brachiopods.** Fragmentary valves of the brachiopod *Schuchertella becraftensis* (Clarke) and a tabulate coral colony *Favosites helderbergiae* Hall (at center) in a matrix block. Collected by David Dockery in the Ross Formation at Island Hill, Pickwick Lake [MGS collection].
6. **Brachiopod (“Lampshell”) Cast.** The brachiopod *Leptostrophia magnifica* Hall in a chert block. Collected by Robert K. Merrill in the Ross Formation at Island Hill, Pickwick Lake [MGS collection].

7. **Chert Block with Brachiopods.** *Acrospirifer murchisoni* (Castelnau) in a rhomboidal matrix block broken along natural joints. Collected by Robert K. Merrill in the Ross Formation at Island Hill, Pickwick Lake [MGS collection].
8. **Coralline Sponge.** A Devonian stromatoporoid sponge reworked as a Pleistocene ('Ice Age') alluvial gravel cobble. Collected by Michael Shuttlesworth from a stream at Rocky Springs in 2013 [MMNS IP-5645].

Mississippian Period (YELLOW)

Background

Scale Tree. *Lepidodendron* sp.

1. Trunk impression cut in a triangular shape. Collected by David Dockery from the Gresham Quarry in Tishomingo County [MGS collection].
2. Piece of carbonized exterior, believed to be from the eastern U.S. [OCM lot #447, MMNS collection].
3. '*Stigmaria*', or *Lepidodendron* root. Small cylindrical section, believed to be from the eastern U.S. [OCM lot #447, MMNS teaching collection].
4. Large cylindrical trunk section of *Lepidodendron*. Specimen sat in front of the Mississippi Office of Geology for over 20 years and is assumed to have come from the Hartselle Sandstone in Tishomingo County [MGS collection].

Foreground

Corals

1. Rugosa. Two solitary corallites found in western Mississippi; exact origin unknown [MMNS collection]. Solitary rugose corals are also known as 'horn corals.' Specimens retired from instructional kit used by museum volunteer and science educator John Davis for many years at the annual MMNS Fossil Road Show.
2. Rugosa. Corallum (colonial coral) fragment found in western Mississippi; exact origin unknown [MMNS teaching collection]. Specimen retired from instructional kit used by museum volunteer and science educator John Davis for many years at the annual MMNS Fossil Road Show.

3. Tabulata. Colonial 'honeycomb coral' collected by Joy Rushing on a Mississippi Gem & Mineral Society trip near Zieglerville in 2008 [MMNS IP-2163].
4. **Crinoid ("Sea Lilly")**. Crinoid trunk sections, four fragments. Collected by Gaston Gill, Jr, from a Mississippi River gravel bar near Greenville in the 1970s [MMNS IP-374].
5. **Brachiopod ("Lamp Shell")**. Spiriferida. Spirifer brachiopod external impression. Collected by Ruby Grace Lanford on a Mississippi Gem & Mineral Society trip near Zieglerville in 2006.
6. **Bryozoan ("Moss Animal")**. Fenestellidae. Fragmentary fenestrate (lacey) bryozoan colonies in two pebbles. Found in western Mississippi; exact origin unknown [MMNS teaching collection]. Specimen retired from instructional kit used by museum volunteer and science educator John Davis for many years at the annual MMNS Fossil Road Show.

Cretaceous Period

(GREEN)

Background

Ammonite. *Placenticerus placenta* (DeKay, 1828). Larger specimen on left has a diameter of 29 inches, making it one of the largest ammonites ever recovered in Mississippi (on official record). It was discovered around 1983 by Mississippi State University geologist Dr. Ernest E. Russell in the Coffee Sand along MS Hwy 364 in Prentiss County [MSU 3346]. The specimen was so heavy it took four men to roll into it Dr. Russell's sedan. This specimen is on long-term loan from Mississippi State University Dunn-Seiler Museum.

Ammonite. *Placenticerus placenta* (DeKay, 1828). The smaller specimen on the right was collected by David Dockery and Wilbur T. Baughman in 1976 from the Coffee Sand during the construction of the Natchez Trace Parkway at the Twenty Mile Creek Overlook [MGS collection].

Mosasauro. *Tylosaurus nepaeolicus* (Cope, 1874). Replica mosasauro skull with lower jaw. The original is from the Niobrara Chalk of Kansas, although details regarding its origins have never been disclosed by the owners, the identity of which is also not public knowledge. Replication for resale was first licensed to Valley Anatomical Prepara-

tions in Chatsworth, California, although other outlets now offer this cast. Vendors market this skull as “*Mosasaurus conodon*,” but this is incorrect.

Mosasaur. *Mosasaurus conodon* (Cope, 1881). Partial lower jaw halves discovered by USM’s Southern Geological Society and recovered by SGS member Michael Bradshaw and MMNS curator Eleanor Daly in 1982 from the Demopolis Formation at Rock Hill in Starkville [MMNS VP-468].

Mosasaur. *Clidastes propython* Cope, 1869. Mosasaur partial forelimb (‘flipper’) recovered by MMNS biologists Paul Hartfield & Bob Jones from the Mooreville Formation exposed in the Tombigbee River near Gainesville, Alabama, in 1982 [MMNS VP-502].

Sea Turtle. *Protostega gigas* Cope, 1872. Hanging sea turtle replica skeleton is based on a nearly complete individual recovered from the Niobrara Chalk in Logan County, Kansas, by George Sternberg (et al.) in 1945. The original specimen resides in the Denver Museum of Nature and Science [DMNH EPV.1663]. Cast produced by Valley Anatomical Preparations, Chatsworth, California.

Theropod Dinosaur. *Gorgosaurus libratus* Lambe, 1914. Previously referred to as *Albertosaurus*, this reproduction tyrannosaurid theropod mount consists of a replica hindfoot (1), forearm (2), and skull with lower jaw (3). in anatomical arrangement on an illustration of the body created by MMNS artist Steve Peterson. The original skeleton is owned by the Royal Ontario Museum in Toronto [ROM 1247]. The casts of select elements were produced by Dinolab, Inc, formerly of Salt Lake City, Utah.

Duck-billed Dinosaur. Hadrosaur left femur (thigh bone) recovered in 2008 from the Coon Creek beds exposed in a borrow pit across from the Toyota plant at Blue Springs [MMNS VP-5118]. The bone was exposed erosive processes for a lengthy period prior to burial in a large Late Cretaceous bay; this is why many of its features are worn and the distal (knee) end is missing.

Ornithopod Dinosaur. Hadrosaur (duck-billed dinosaur) partial juvenile left hindlimb consisting of three replica bones—femur (4), tibia (5), and middle metatarsal (6). although the original fossil included over twenty individual elements. Found by James H. Pope on the Tombigbee River north of Columbus in 1963, the fossil was donated to the Smithsonian [USNM 175583] and published as the oldest record of hadrosaurian (duck-billed) dinosaurs in North America (Kaye & Russell, 1974), at least at that time. It is the second most complete dinosaur ever recovered from Mississippi.

Crocodylian. *Deinosuchus schwimmeri* Cossette & Brochu, 2020. Crocodylian skull consisting of only the rear portion and missing most of the snout. This rare fossil [MMNS VP-256] is the type specimen of the species (Cossette & Brochu, 2020) and is named in honor of paleontologist David Schwimmer of Columbus State University, Georgia, for his career contributions to the understanding of ‘The King of the Crocodylians’ (Schwimmer, 2002). It was found in 1978 in a Tupelo creek by Danny & Kay Sheffield, William S. Rutland, and Ronny Hall with Dr. Ernest Mancini of the Geological Survey of Alabama assisting in its recovery from the Coffee Sand.

Far Right Corner

Dinosaur Shin Bone. Hadrosauridae. In a stand-alone vitrine to the right of the main exhibit is one of the museum’s more famous fossils. It is a restored adult duck-billed dinosaur tibia recovered from the Coffee Sand in a creek bed west of Marietta. Collected by rockhound Eldon Boman, the bone was ‘traded’ into the commercial market where it eventually appeared in an antique shop in Henderson, Tennessee. There it was found (again) by Mike Wolfe and Frank Fritz of the popular American Pickers TV show, who were uncertain of its identity. MMNS paleontologist George Phillips was invited by Cineflix Media to identify the bone on a scheduled AP episode, called ‘Jurassic Pick,’ at the conclusion of which Mike and Cineflix donated the specimen to the Museum of Natural Science [MMNS VP-6016]. MMNS is very grateful to Mike Wolfe and Cineflix, as well as the landowner, Ted Ryan. Mr. Ryan knew nothing about the discovery until the show first aired in October 2011, but he was nevertheless glad to hear of the fossil’s ultimate residence in the state fossil collection.

Foreground, Case-LEFT

Mollusks provided courtesy of David Dockery, Mississippi Office of Geology.

1. **Razor Clam.** *Gervilliaopsis ensiformis* (Conrad, 1858). Knife-like marine bivalve collected by David Dockery from the Owl Creek Formation at the type locality east of Ripley.
2. **Aporrhaid Gastropod.** *Bizarrus abnormalis* (Wade, 1926). Stromboid snail collected by David Dockery from the Coffee Sand near Chapelville (MGS 129). Figured in Dockery, 1993, pl. 12, fig. 7-9.
3. **Marine Clam.** *Cucullaea vulgaris* Morton, 1830. False ark shell collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).

4. **Marine Clam.** *Crassatella roodensis* (Stephenson, 1923). Carditid clam collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).
5. **Volute Snail.** *Volutomorpha retifera* Dall, 1907. Cretaceous marine gastropod collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).
6. **Aporrhaid Gastropod.** *Pterocerella pointsettiformis* Stephenson, 1941. 'Pelican's foot' snail collected by David Dockery from the Coon Creek Tongue of the Ripley Formation at exposed at Union County Lake (MGS 127). Figured in Dockery, 1993, pl. 16, fig. 6-7.
7. **Marine Snail.** *Deussenia ripleyana* Harbison, 1945. Cretaceous crown conch collected by David Dockery from the Coon Creek Tongue of the Ripley Formation at Union County Lake (MGS 127).
8. **Cerithioid Snail.** *Tympanotonos robustus* Dockery, 1993. Mudwhelk collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).
9. **Aporrhaid Gastropod.** *Anchura abrupta* Conrad, 1860. 'Pelican's foot' snail collected by David Dockery from the Coon Creek Tongue of the Ripley Formation at Union County Lake (MGS 127).
10. **Cerithioid Snail.** *Gymnentome unicarinata* Dockery, 1993. Cassiopid marine gastropod collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).
11. **Long-shelled Volutid.** *Longoconcha tennesseensis* (Wade, 1926). Elongate volute collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).
12. **Scallop.** *Camptonectes burlingtonensis* (Gabb, 1860). Cretaceous bivalve collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).
13. **Turret Shell.** *Turritella vertebroides* Morton, 1834. Marine gastropod collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).
14. **Marine Clam.** Inoceramidae. Bivalve collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).
15. **Marine Snail.** *Gyrodes major* Wade, 1926. Cretaceous moon snail collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).
16. **Venerid Clam.** *Cyprimeria alta* Conrad, 1875. Marine bivalve collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).
17. **Volute-like Marine Snail.** *Volutomorpha valida* Sohl, 1964. Gastropod collected by David Dockery from the Coon Creek Tongue at Union County Lake (MGS 127).

18. **Turret-shelled Marine Snail.** *Turritella trilira* Conrad, 1860. Gastropod collected by David Dockery from the Coffee Sand near Chapelville (MGS 129).
19. **Mosasauro.** *Clidastes propython* Cope, 1869. Giant marine lizard jaw with teeth, collected by Paul Hartfield and Bob Jones on August 17, 1988, from the Mooreville Formation on the left bank of the Tombigbee River one kilometer below the Gainesville Bridge in Greene County, Alabama [MMNS VP-502].
20. **Mosasauro.** *Clidastes propython* Cope, 1869. Lot of 14 cervical and thoracic mosasauro vertebrae likewise collected by Hartfield and Jones. The jaw above (19) and *Clidastes* flipper bones on a display stand behind the case are all part of the same skeletal association [MMNS VP-502].

Duck-billed Dinosaur. Hadrosauridae.

21. Pedal phalanx (hindlimb toe bone) collected 978 by Jere Bruce, project engineer with USACE, from the McShan Formation at the excavation site of Lock A on the Tennessee-Tombigbee Waterway near Amory [MMNS VP 108]. Figured specimen in Carpenter, 1982, pl. 1, fig. 4.
22. Hadrosaur ungual phalanx ('hoof' bone) collected by David Troskey from the Mooreville Formation near Muldon in 2012 [MMNS VP-6452].
23. Hadrosaur tooth from the collection of J. Magruder Sullivan, Millsaps College; collected from the Coffee Sand in the 1930s [MMNS VP-118].
24. **"Ostrich" Dinosaur.** Ornithomimidae. Composite toe of an 'ostrich-mimic' dinosaur collected in the Eutaw Formation at the John M. Kaye Fossil Park in Columbus. The phalanges composing the reconstructed toe were found by (top to bottom) Richard Rolke in 2001 [MMNS VP-4955], Eric Loftis in 1997 [MMNS VP-6378], and David Troskey in 2012 [MMNS VP-6437]. The bone at top was a consequential specimen in understanding the nature of the species of ornithomimosaur living in the Columbus area 85 million years ago (Tsogtbaatar et al., 2022).

Armored Dinosaur. Nodosauridae.

25. Ungual phalanx ('hoof' bone) of an armored dinosaur collected from the Eutaw Formation at John M. Kaye Fossil Park in Columbus by David Troskey, 2012 [VP-6355]. Compare to the shape of the hadrosaur ungual nearby.
26. Tooth collected from the Tombigbee Sand near Vinton by MMNS curator George Phillips, 2009 [VP-5254]. Compare to the shape of the hadrosaur tooth nearby.

27. **Tyrannosaur.** Tyrannosauroidae. An incomplete theropod phalanx collected from the Eutaw Formation at the Amory Lock & Dam by Ross McCollum (USACE) in 1978 [VP-103]. Originally thought to be akin to a tyrannosaur by Carpenter (1982), this bone was later reevaluated as belonging to an ornithomimosaur (Baird, 1986). However, after forty years of growing knowledge about Late Cretaceous theropods, including what few remains have been recovered from the eastern U.S., Chinzorig Tsogtbaatar at the North Carolina Museum of Natural Sciences believes that Carpenter (1982) was correct.
28. **Pterosaur.** Flying reptile partial phalanx (wing bone fragment) collected by David Dockery in 1987 from the Coffee Sand near Chapelville (MGS 129) [VP-5757].
29. **Crocodylian.** Coprolite (fossil scat) collected from the Tombigbee Sand near Vinton by MMNS curator Eleanor Daly in 1982 [VP-469].

Foreground, Case-RIGHT

Cretaceous Fang Fish. *Enchodus* sp.

1. Palatine bone with fang belonging to one of the commonest fishes of the Late Cretaceous seas—the ‘saber-toothed herring.’ Collected 2006 by MMNS curator George Phillips from the Tombigbee Sand in the bentonite clay mines near Aberdeen [MMNS VP-4414].
2. *Enchodus* lateral tooth collected 2010 by George Phillips from the Coon Creek beds exposed in a borrow pit across from the Toyota automotive plant at Blue Springs [MMNS VP-5785].
3. **Pycnodont Fish.** *Phacodus punctatus* Dixon, 1850. Left prearticular (lower jaw bone) of a pycnodont collected 1993 by Del Faulkner from the Tombigbee Sand in the bentonite clay mines near Aberdeen [MMNS VP-633].
4. **Cretaceous Lizard-head Fish.** *Saurocephalus lanciformis* Harlan, 1824. Associated upper and lower jaw bones found in the Mooreville Formation near Prairie Point, east of Macon, by MMNS curator Michael Frazier (et al.) in 1979 [MMNS VP-259].
5. **Pseudoswordfish.** *Protosphyraena* sp. Partial rostrum (bill/snout) with several teeth found in the Demopolis Formation near the town of Tibbee by MMNS curator Michael Frazier in 1979 [MMNS VP-260].
6. **Bonner Fish.** *Bonnerichthys gladius* Friedman et al., 2010. Pectoral fin spine fragment collected by MMNS curator George Phillips in the Demopolis Formation near Deersbrook in 1986 [MMNS VP-5427]. Such large, dense, hatchet-shaped fin fragments

were originally identified by many experts as belonging to the aforementioned pseudoswordfish *Protosphyraena*. However, with the discovery and report of more complete skeletal remains, particularly from Kansas, similar fragmentary fin fossils from across the eastern U.S., including this specimen, were later reattributed to the Bonner Fish (Friedman et al., 2013).

7. **Goblin Shark.** *Scapanorhynchus texanus* (Roemer, 1849). Teeth (9) belonging to the ubiquitous ‘Texas goblin shark.’ Collected from the Tombigbee Sand at Vinton Bluff on the Tombigbee River in 1982 by MMNS curator Eleanor Daly [MMNS VP-34].
8. **Crow Shark.** *Squalicorax pristodontus* (Agassiz, 1843. Teeth (2) of the very last species of crow shark, an ecologically consequential genus of scavenging sharks that became extinct at the end of the Cretaceous Period. These two teeth were recovered in 2005 from the Prairie Bluff Formation in Starkville by Jason Robinson [MMNS VP-4004].
9. **Ptychodont Shark.** *Ptychodus mortoni* Mantell, 1836. Teeth (3) of a shell-crushing ptychodont recovered from the Tombigbee Sand at Vinton Bluff, Tombigbee River, in 1982 by MMNS curator Eleanor Daly [MMNS VP-34].
10. **Hybodont Shark.** *Meristodonoides* (aka *Hybodus*) sp. Cephalic (head) clasper of a hybodont shark collected by MMNS curator Eleanor Daly along the Tombigbee River at Plymouth Bluff in 1982 [MMNS VP-148]. Only the males were thought to have possessed such structures.
11. **Amber.** Fossil plant resin from the McShan Formation recovered by an unnamed USACE employee during the excavation of the Amory Lock & Dam on the Tenn-Tom Waterway in 1978 [MGS specimen].
12. **Sea Biscuits.** *Hardouinia mortonis* (Michelin, 1850). Like the teeth of the goblin shark *Scapanorhynchus*, this species of lamp urchin (often called ‘sea biscuits’) is iconic in Late Cretaceous deposits in the Southeast, from Houston, Mississippi, to the vicinity of Wilmington, North Carolina. Clockwise from top left, these specimens were found by Clyde Clark near Houlika in 1963 [MMNS IP-190]; J. Magruder Sullivan, Millsaps College, in the 1920s near Pontotoc [OCM 63.19.71]; and David Peel near Concord in 2000 [MMNS IP-15]. All are from the Chiwapa Sandstone.
13. **Muffin Crab.** *Avitelmessus grapsoideus* Rathbun, 1923. Crab collected by the Memphis Museums of Science & History (formerly the Pink Palace Museum) c.1980 from the Coon Creek Formation in Selmer, Tennessee [MMNS IP-369].

14. **Southern Dakota Crab.** *Tetracarcinus australis* (Rathbun, 135). Previously known for many years as *Dakoticanter* (= 'Dakota crab'), this crab was a common seafloor scavenger from Texas to North Carolina towards the end of the Cretaceous Period. This specimen was found by George Phillips and MSU geologists Ernie Russell and Darrell Schmitz in 2000 north of Van Vleet in the 'Troy beds' of the Ripley Formation [MMNS IP-19].
15. **Belemnite.** *Belemnitella americana* Emmons, 1858. Calcite-replaced guards (internal skeletal shells) of belemnite cephalopods, which somewhat resembled modern cuttlefish. Collected from the Ripley Formation by Bob Durr in 2000 [MMNS IP-17] (left) and the Prairie Bluff Formation by George Phillips in 2008 [MMNS IP-1918] (right), both specimens are from north of Starkville.
16. **Cretaceous Spiny Lobster.** *Linuparus keyesi* Kornecki et al., 2017. Partial exoskeletal molt of a palinurid lobster collected by MMNS curator Michael Frazier in 1981 from the Coon Creek beds near Blue Springs, Mississippi [MMNS lot #1378].

Ammonites

17. *Placenticerus intercalare* Meek, 1860. Ammonite with intact original shell collected by David Dockery from the Coffee Sand near the Twenty Mile Creek Overlook (MGS 128). To the right of this specimen is a Jurassic ammonite—*Stephanoceras* from Dorset, England—that has been cross-sectioned to show the internal chambering characteristic of this group [both MGS collection].
 18. *Menabites (Delawarella) danei* (Morton, 1834). Ammonite [MGS collection] with shell collected by Wayne Newell in 1989 from the Coffee Sand near Chapelville (MGS 129).
 19. *Discoscaphites iris* (Conrad, 1858). Small scaphitid ammonite recovered from the Owl Creek Formation near Ripley in 2010 by James Starnes of the Mississippi Geological Survey [MMNS IP-4705].
 20. *Baculites* sp. Partial baculitid ammonite with shell [MGS specimen] collected by David Dockery from the Coffee Sand near the Twenty Mile Creek Overlook (MGS 128). Baculitids are mostly straight to gently curved in maturity, but, like most ammonites, they are coiled in the larval and juvenile stages.
- Oyster.** *Exogyra*. Translated, the name describes the shape, which 'spirals outwards.' An iconic and ubiquitous oyster in the Mississippi Cretaceous, there are a half dozen species of *Exogyra* in our state and the three on display here are the most familiar.

21. *Exogyra ponderosa* Roemer, 1849. The bottoms of three gryphaeid oysters from the upper Tombigbee Sand at Plymouth Bluff near Columbus. Collected by David Butts in 1971 [left & center, MMNS lot #2038] and J. Magruder Sullivan (et al.) of Millsaps College in the 1920s [right, OCM 63.67.29]. In the evolution of *Exogyra* in the Gulf Coastal Plain, this species succeeds *Exogyra upatoiensis* and is replaced by *E. errat-costata* then eventually *E. cancellata* and *E. costata*.
22. *Exogyra costata* Say, 1820. Three gryphaeid oysters from the Prairie Bluff Formation in Pontotoc County collected by J. Magruder Sullivan (et. al.), Millsaps College, in the 1920s [OCM 63.19.73]. This species succeeds *Exogyra cancellata* in the Cretaceous fossil record of the Gulf and Atlantic Coastal Plain; it is the last species of *Exogyra* prior to the end-Cretaceous extinction event.
23. *Exogyra cancellata* Stephenson, 1940. This oyster shell was collected by David Dockery in 1993 from the Bluffport Marl Member of the Demopolis Formation at Rock Hill near Starkville (MGS 153) [MGS collection].
24. **Aquatic Worms.** *Pyrgopolon onyx* (Morton, 1834). Tubicular shells of a sedentary polychaete worm (also known as *Hamulus*) collected in the 1920s from the Tombigbee Sand at Plymouth Bluff (Columbus) by J. Magruder Sullivan (et. al.), Millsaps College [MMNS IP-4867].
25. **Heart Urchins.** *Schizaster variabilis* (Slocum, 1909). Small heart urchins (spines not preserved) from the Prairie Bluff Formation in Pontotoc County; collected by J. Magruder Sullivan (et. al.), Millsaps College, in the 1920s [MMNS IP-1514].

Eocene Epoch

(LIGHT BLUE)

Background

Whales

1. *Basilosaurus cetoides* (Owen, 1839). Archaeocete partial rib from the Yazoo Clay at the Cynthia Clay Pit northwest of Jackson; donated in 1986 by Rickey Watkins of Jackson Ready-Mix, the company that once operated the pit [MMNS VP-611].
2. *Cynthiacetus maxwelli* Uhen, 2005. Archaeocete anterior lumbar vertebra with preserved transverse processes and neural arch found in the Moodys Branch Formation within the Jackson Metro area (most likely Town Creek) by J. Magruder Sullivan (and students) of Millsaps College in the 1930s [MMNS VP-94].

3. *Basilosaurus cetoides* (Owen, 1839). Archaeocete posterior lumbar vertebra belonging to a partial whale skeleton collected by J. Magruder Sullivan and Millsaps College students in the 1930s from Pachuta Marl in Choctaw County, Alabama, near the Mississippi state line [MMNS VP-93]. The discovery is mentioned briefly in the Millsaps College student newspaper—*The Purple & White*—in the July 1943 and December 1951 editions.
4. *Basilosaurus cetoides* (Owen, 1839). Skull and right lower jaw collected by 1990 Tollie and Jenny Waldrup from the upper Yazoo Clay at the Miss-Lite Clay Pit in Cynthia [MMNS VP-12291]. Archaeocetes, aka “zeuglodonts,” constituted a group of Late Eocene whales.

Whale. *Zygorhiza kochii* (Reichenbach, 1847). Mississippi State Fossil.

5. Hanging mount of a nearly complete skeleton of a small archaeocete (ancient whale) discovered in a creek bed near Tinsley by Dorothy Schaefer in 1971; excavated, preserved, and partially restored by the Mississippi Gem & Mineral Society; and further restored and mounted by Ken Carpenter, and finally hung in 1983 (Daly, 1983, 1999; Carpenter & Dockery, 1985) [MMNS VP-130]. This specimen inspired legislation for the creation of a Mississippi State Fossil in 1981 (*Mississippi Geology* 1983, v3, n3, p13).
6. This is the original skull of the Tinsley whale discovered in 1971 (see previous item). The skull on the hanging skeleton is actually a cast of this specimen [MMNS VP-130], which is too cumbersome and fragile to suspend on cables.

Leaves. Lanceolate fossil leaves in sandstone. Collected by Timothy Oakes in the 1990s from the lower Kosciusko Formation in the town of Kosciusko [MMNS PB-114].

Titanotheres. *Notiotitanops mississippiensis* Gazin & Sullivan, 1942. Titanotheres skull, overturned to show molar arrangement. This is a reproduction of an original discovery that also included the lower jaw. The fossil was found in the summer of 1940 south of Quitman on the Covington Farm (MGS 52) where it was recovered from the Archusa Marl Member of the Cook Mountain Formation. Quitman resident V. G. Clifford brought it to the attention of Millsaps head of geology J. Magruder Sullivan, who donated it to the Smithsonian for scientific study [USNM V16646]. Although fragmentary teeth of titanotheres have been reported from Georgia (Westgate, 2001; Rhinehart et al., 2019), the Quitman skull is the most diagnostic and complete titanotheres fossil from east of the Great Plains.

Foreground

Mollusks courtesy of David Dockery, Mississippi Office of Geology.

1. **Tusk Shells.** *Dentalium mississippiensis jacksonense* Palmer, 1947. The characteristic tubular valves of a common Late Eocene scaphopod occurring in the Moodys Branch Formation. These specimens [MMNS IP-4127] were found at the Moodys Branch type locality in Jackson by J. Magruder Sullivan (et. al.) of Millsaps College.
2. **Strombid Snail.** *Platyoptera extenta* (Conrad, 1854). Marine conch collected by David Dockery from the Moodys Branch Formation in the state capitol (MGS 1). Figured in Dockery, 1977, pl. 5, fig. 5.
3. **Strombid Snail.** *Calyptrophorus stamineus* (Conrad, 1856). Two marine conchs in the center of a small matrix block collected from the Moodys Branch Formation in the state capitol (MGS 1). The block also contains, on the right, portions of the tubular shell of the boring clam *Teredo mississippiensis* (Conrad, 1854) and a partial valve of the clam *Pitar securiformis* (Conrad, 1865), as well as, along the left margin, the solitary coral *Flabellum cuneiforme wailesi* Conrad, 1855, and the volutid snail *Lapparia dumosa* (Conrad, 1854).
4. **Marine Snail.** *Umbraculum planulatum* (Conrad, 1854). The uncoiled shell of a Late Eocene “umbrella slug” collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 1). This specimen is figured by Dockery, 1977, pl. 18, fig. 11.
5. **Volutid Snail.** *Lapparia dumosa* (Conrad, 1854). Small marine volute species collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 1).
6. **Harp Shell.** *Harpa (Eocithara) jacksonensis* Harris, 1897. Late Eocene marine gastropod collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 1).
7. **Marine Snail.** *Dolicholatirus leaensis* (Harris, 1997). Spindle snail collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 1).
8. **Helmet Shell.** *Galeodea millsapsi* Sullivan and Gardner, 1939. Marine gastropod collected by James K. Smith from the Moodys Branch Formation in Jackson (MGS 1). The species name honors the academic residence of the senior author J. Magruder Sullivan.
9. **Mitrid Snail.** *Fusimitra millingtoni* (Conrad, 1854). Mitre shell collected by David Dockery from the Moodys Branch Formation in the state capitol (MGS 1).

10. **False-Olive.** *Pseudoliva vetusta perspectiva* Conrad, 1860. Gastropod collected by David Dockery from the Moodys Branch Formation in the state capitol (MGS 1).
11. **Fig Shell.** *Ficus filia* (Meyer, 1885). Marine gastropod collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 1).
12. **Egg Cowry.** *Cypraedia fenestralis* Conrad, 1854. Marine snail collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 1). Figured in Dockery, 1977, pl. 7, fig. 8.
13. **Volutid Snail.** *Caricella howei* Palmer, 1947. Marine gastropod collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 1). Figured in Dockery, 1977, pl. 13, fig. 7.
14. **Marine Snail.** *Vasum humerosum* Vaughan, 1896. Vase shell collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 1). Figured in Dockery, 1977, pl. 11, fig. 5.
15. **Turret Shell.** *Turritella alveata* Conrad, 1854. Marine snail collected by David Dockery from the Moodys Branch Formation in the state capitol (MGS 1).
16. **Marine Snail.** *Clavilithes humerosus* Conrad, 1854. Fascioliid gastropod collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 1).
17. **Marine Clam.** *Venericardia (Venericor) apodensata* Gardner and Bowles, 1939. Carditid bivalve collected by David Dockery from the Moodys Branch Formation near Benton (MGS 11).
18. **Cone Snail.** *Conus tortilis* Conrad, 1854. Marine gastropod collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 1). Figured in Dockery, 1977, pl. 16, fig. 12.
19. **Turkey-wing Clam.** *Barbatia (Cucullaearca) cuculoides* (Conrad, 1833). Marine bivalve collected by David Dockery from the Moodys Branch Formation in the state capitol (MGS 1). This genus is also known as the “bearded” arks.
20. **Volutid Snail.** *Athleta symmetricus* (Conrad, 1854). Marine gastropod collected by David Dockery from the Moodys Branch Formation in the state capitol (MGS 1). Figured in Dockery, 1977, pl. 12, fig. 10.
21. **Strombid Snail.** *Calyptrophorus stamineus* (Conrad, 1856). Marine gastropod collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 1). Figured in Dockery, 1977, pl. 4, fig. 10.

22. **Helmet Shell.** *Phalium taitii johnsoni* Palmer, 1947. Marine gastropod collected by David Dockery from the Moodys Branch Formation in Jackson (MGS 2). Figured in Dockery, 1977, pl. 8, fig. 4.
 23. **Sundial Snail.** *Architectonica acuta* Conrad, 1854. Two sundials collected by David Dockery in the Moodys Branch Formation at different locations within Jackson. The larger valve on the right, overturned to show the umbilicus, is figured in Dockery, 1977, pl. 2, fig. 5 (MGS 2). The smaller one showing the apical view is also figured in Dockery, 1977, pl. 2, fig. 2 (MGS 1).
 24. **Strombid Snail.** *Platyoptera extenta* Conrad, 1854. Marine gastropod in matrix block [MMNS IP-370] from the Moodys Branch Formation in Jackson (MGS 1); collected by J. Magruder Sullivan in the 1920s.
 25. **Marine Snail.** *Levifusus branneri* Harris, 1894. Predatory whelk collected by David Dockery from the Moodys Branch Formation near Benton (MGS 11).
 26. **Sea Snake.** *Pterosphenus schucherti* Lucas, 1899. Eleven (of 15) associated vertebrae [MMNS IP-287] reportedly from the Moodys Branch Formation in Jackson, at least according to the records of the Old Capitol Museum, which received the J. Magruder Sullivan fossil collection from Millsaps in the 1960s. However, only one associated set of fossil sea snake vertebrae is known to have resided in the Sullivan/Millsaps collection, and Sullivan reported to Gilmore (1938) that it was found near Melvin, Alabama (see also Daly, 1992), from where Millsaps College was also recovering whale fossils (*The Purple & White*, July 1943 & December 1951 editions).
 27. **Solitary Coral.** *Flabellum cuneiforme wailesi* Conrad, 1855. Lot of five individual corallites from the Moodys Branch Formation in Jackson [J. Magruder Sullivan collection, MMNS].
 28. **Sand Dollars.** *Periarchus lyelli* (Conrad, 1834. Matrix block of four complete scutelline sand dollars collected by David Dockery from the Moodys Branch Formation near Benton (MGS 11) [MGS collection]. To the right of the block are three isolated specimens [MMNS IP-14128] collected in 1978 by MMNS curator Mike Frazier, *Mississippi Outdoors* host Melvin Tingle, and MDWFP Conservation Officer David Geen from the Cocoa Sand on the Chickasawhay River at Shubuta (MGS 158).
- Extinct Billfish.** *Xiphiorhynchus eocaenicus* (Woodward, 1901).
29. Rostrum (snout) of an extinct billfish collected in 2000 from the Moodys Branch Formation near Benton by James Starnes, Mississippi Office of Geology [MMNS VP-2957].

30. *Pycnodonte trigonalis* (Conrad, 1854). Oysters encrusting the surface of the rostrum. Such oyster encrustations of objects on the seafloor are not uncommon and have also been observed on whale skulls from Mississippi.
31. Billfish vertebra [MMNS VP-3142] found in the Yazoo Clay in close association with a *Basilosaurus* skeleton [MMNS VP-2960] uncovered by landfill operations near Lake, 2002.
32. **Sawfish.** *Pristis lathamii* Galeotti, 1837. Rostral ‘tooth’ (spine) from an extinct sawfish found in 1981 in an exposure of the Moodys Branch Formation near Benton by MDWFP Conservation Officer Donnie Green [MMNS VP-441].

Giant Shark. *Otodus cf. sokolovi* (Jaekel, 1895).

33. “Megatooth” shark tooth collected in the 1990s by T. K. Gust from the Moodys Branch Formation in Jackson [MMNS VP-483]. Megatooth sharks include over a half dozen species of Cenozoic otodontid sharks, culminating in *Otodus megalodon* (Agassiz) of the Miocene and Pliocene. *Otodus sokolovi* is transitional between the better older *O. auriculatus* and younger *O. angustidens*.
34. “Megatooth” shark vertebra collected in 2000 by Laurie Cummings in the Moodys Branch Formation near Benton [MMNS VP-2979].

Nautiloid. *Aturia alabamensis* (Morton, 1834).

35. Nautiloid shell collected by Mississippi Geological Society Member James K. Smith from the Moodys Branch Formation in Jackson (MGS 1).
36. Internal mold showing adjacent nautiloid chambers; shell not preserved. Found by Millsaps geologist J. Magruder Sullivan (et al.) in the Moodys Branch of Jackson (MGS 1).
37. **Leaves.** Both preserved in shale, the broader leaf on the left was collected from the Bolden Clay Pit near Hudsonville (Blanchard et al., 2016) where the shale is known to also contain insects (Johnston, 1993); the narrower, elongate leaf on the right is from High White State Park near Grenada. Both were collected from the Tallahatta Formation by David Dockery.

Mangrove Palm Fruit. *Nypa* sp. Specimen collected by James K. Smith from the Cook Mountain Formation exposed in the 1960s along the I-20 construction at Newton [MGS collection].

Hanging Mount & Wall Panel

Ancient Toothed Whale (*Zeuglodon*). *Basilosaurus cetoides* (Owen, 1839). This specimen is a replica composite reconstruction based on several individuals from Mississippi and Louisiana [MMNS VP-4193]. Most of the material utilized in the reconstruction belonged to two of these individuals. The front part of the replica body—skull, upper part of forelimbs, and the neck vertebrae—are borrowed from a partial skeleton [LSUMG V1] recovered in 1980 by the Louisiana State University Geology Department from Montgomery Landing on the banks of the Red River, Grant Parish, Louisiana (Schiebout, 1986). Much of the rear portion of the reconstruction is derived from a skeleton collected by the Mississippi Office of Geology, and numerous volunteers, from the Clearview Environmental Landfill near Lake, Mississippi [MMNS VP-2960]. Most of the replica elements in this composite are based on actual fossils recovered from the Yazoo Clay, although the entire pelvis, lower part of forelimbs, and much of the tail are based on interpretive sculptures created by the fabricator—Dinolab, Inc., of Salt Lake City, Utah. The final product, which hangs near the museum's balcony, was the result of a 2006 collaboration between Dinolab, the Mississippi Museum of Natural Science, the Louisiana Museum of Natural History, the Mississippi Office of Geology, and the University of Southern Mississippi, although Dinolab performed all the molding/casting and interpretive reconstruction. In addition, Al Klatt of the Georgia Mineral Society helped the MMNS Foundation with funding the replica delivered to the Museum of Natural Science.

One of the original ribs of the Clearview whale is included in the wall panel near the hanging skeletal mount. The rib exhibits fine, parallel striations, often in sets, that are consistent with marks made by scavenging sharks. Lancaster (1986) reported similar marks on the Montgomery Landing skeleton.

Oligocene Epoch

(RED)

Background

Palm Tree. *Palmoxylon lacunosum* (Unger, 1845). Petrified palm trunk found near Reedtown in 1963 by Jack Harding [MMNS PB-36]. Presumably from the Catahoula Formation (Miocene Epoch).

Metamynodon. *Metamynodon planifrons* Scott & Osborn, 1887. Skull of an amynodont rhino [MMNS VP-12989] from the Byram Marl exposed on the Big Black River near

Edwards (MGS 106). Discovered by David Dockery in 1985 while hosting French paleomalacologist Luc Dolin (and his wife Therese), excavated by the Mississippi Office of Geology, and prepared by the Louisiana State University Museum of Geoscience (Manning et al., 1985).

Cast of the Seafloor. Ripple marks in sandstone from the Vicksburg Group of Warren County [former Old Capitol Museum collection].

Rhinoceros. *Subhyracodon orientalis* (Leidy, 1854). Rhinoceros lower jaw found on the Big Black River near Edwards (MGS 106) in 1988. Discovered by Daniel Dear, excavated by David Dockery, and prepared by the Louisiana State University Museum of Geoscience [MGS collection].

Palm “Wood”. External impression of a palm trunk preserved in a block of Glendon Limestone [MMNS PB-35] from the old Marquette Quarry near Brandon (MGS 98) in the 1960s. Marquette Cement Manufacturing Company originally presented the specimen to the Mississippi Gem and Mineral Society, who later donated it to MMNS in 1983.

Foreground

Mollusks courtesy of David Dockery, Mississippi Office of Geology.

1. **Geoduck.** *Panopea oblongata* Conrad, 1848. Burrowing clam with both valves collected by Gary Zumwalt from the Glendon Limestone at the old Mississippi Valley Portland Cement quarry north of Redwood (MGS 112).
2. **Turrid Snail.** *Turricula (Orthosurcula) byramensis* MacNeil, 1984. Turrid snail collected by David Dockery from the Byram Marl near Sylvarena (MGS 93).
3. **Venerid Clam.** *Pitar (Lamelliconcha) imitabilis* (Conrad, 1848). Articulated marine clam collected by David Dockery from the Byram Marl north of Vicksburg (MGS 140).
4. **Helmet Shell.** *Galeodea (Mambrinia) brevidentata* (Aldrich, 1885). Marine gastropod recovered by David Dockery from the Red Bluff Formation on the Chickasawhay River near Hiwannee (MGS 35).
5. **Spiny Oyster.** *Spondylus dumosus* (Morton, 1834). Two bivalves, showing internal and external views, collected by David Dockery from the Red Bluff Formation on the Chickasawhay River near Hiwannee (MGS 38).
6. **Marine Snail.** *Turbinella wilsoni* Conrad, 1848. Belonging to a group of gastropods called “chanks,” this large valve was collected by Frederick F. Mellen in Vicksburg (MGS 115).

7. **Marine Snail.** *Dolicholatirus perexilis* (Conrad, 1848). Long-tailed latirus collected by David Dockery from the Byram Marl exposed on the Big Black River near Edwards (MGS 106).
8. **Scallop.** *Chlamys (Lyropecten) menthifontis* Glawe, 1970. Marine bivalve collected by David Dockery from the Mint Spring Marl near Cleary (MGS 99).
9. **Muricid Snail.** *Pterynotus burnsii* (Aldrich, 1894). “Mouse-eared” murex collected by Emily H. Vokes from the Red Bluff Formation on the Chickasawhay River south of Shubuta (MGS 37).
10. **Shark.** Otodontidae. Vertebra of an otodontid, or “megatooth” shark, collected 2005 by James Starnes, Mississippi Office of Geology, in the Marianna Limestone north of Raleigh near Burns [MMNS VP-3972].
11. **Giant Shark.** *Otodus* cf. *sokolovi* (Jaekel, 1895). Megatooth shark tooth collected from the Glendon Limestone by Charlie Audirsch on a Mississippi Gem & Mineral Society field trip to a lime quarry near Bay Springs in 2003 [MMNS VP-6644].
12. **Tiger Shark.** *Galeocerdo* cf. *casei* Müller, 1999. Two teeth collected from the Mint Spring Marl c.1970 by the Marquette Cement Manufacturing Company staff in the old lime quarries near Brandon [MMNS VP-478].
13. **Mako Shark.** *Macrorhizodus praecursor* (Leriche, 1905). Teeth collected from the Mint Spring Marl c.1970 by the Marquette Cement Manufacturing Company staff in the old lime quarries near Brandon [MMNS VP-476].
14. **Crocodile.** Species undetermined. Crocodilian tooth [MMNS VP-4382] and osteoderm [VP-4371], or bony back plate, collected by MMNS staff Terry Majure and George Phillips in 2006 from the Paynes Hammock Formation on the Chickasawhay River near Waynesboro.
15. **Snaggletooth Shark.** *Hemipristis intermedia* Cicimurri et al., 2015. Shark teeth collected in 2013 by Andy Weller from the lower Catahoula Formation in Waynesboro. Waynesboro is the type locality for this species of shark [MMNS VP-6625].
16. **Sand Tiger Shark.** *Carcharias cuspidatus* (Agassiz, 1843). Teeth collected from the Mint Spring Marl c.1970 by the Marquette Cement Manufacturing Company staff in the old lime quarries near Brandon [MMNS VP-474].
17. **Barracuda.** *Sphyræna* sp. Teeth collected in 2005 by George Phillips from the Chickasawhay Limestone exposed near Waynesboro [MMNS VP-4143].

18. **Heart Urchin.** *Schizaster americanus* (Clark, 1915). Burrowing urchin [MGS collection] from the Mint Spring Formation at the old Marquette Quarry in Brandon (MGS 97).
 19. **Sand Dollars.** *Clypeaster rogersi* (Morton, 1834). Lot of three sand dollars [MGS collection], this type more appropriately known as “sea cookies” to distinguish from true sand dollars. The specimen in matrix, upside down with peristome (mouth) up, is presumably from the Glendon Limestone at the old Marquette Quarry in Brandon. The loose specimens below it are from the Marianna Limestone at a lime quarry near Bay Springs (MGS 92).
 20. **Gar Fish.** *Lepisosteus* sp. Associated gar scales in matrix collected in the 1990s by Robert Reams of the U.S. Forest Service from the Pascagoula Formation (Miocene Epoch) near Wiggins [MMNS VP-766].
 21. **Squirrelfish.** *Holocentrites* sp. Two blocks of associated fish scales from the Glendon Limestone collected by James K. Smith from the old Marquette Quarry in Brandon [MGS collection].
- Eagle Ray.** *Myliobatis* sp.
22. Large caudal (tail) stinger/barb [MGS collection] collected by Daniel Dear from the Byram Marl on the Big Black River at Edwards (MGS 106).
 23. Lower tooth-plate collected 1998 by James Starnes from the Mint Springs Marl north of Vicksburg [MMNS VP-3801].
 24. **Scallops.** *Pecten* sp. Marine bivalves in matrix collected by Leslie & Sue Pitts, c.1970, from a lime quarry near Bay Springs [MMNS lot #4267].
 25. **Coral.** *Archohelia vicksburgensis* (Conrad, 1848). Extinct “ivory bush” coral from the Byram Marl near Vicksburg, from the J. Magruder Sullivan collection [MMNS lot #976].
 26. **Marine Shells.** Block of *Turritella* (turret snails) and *Callista* (clams) shells from the Byram Marl near Vicksburg, from the J. Magruder Sullivan collection [MMNS lot #976].
- Palm “Wood”.** *Palmoxydon lacunosum* (Unger, 1845).
27. Fragment of palm “wood” collected near Utica c.1970 by Leslie & Sue Pitts and most likely derived from the Catahoula Formation [MMNS lot #536, cf. MMNS PB-4].

28. In spite of their arborescent (tree-like) appearance, the dense, fibrous tissue characteristic of palm trunks is quite different from 'true' wood. Distributed throughout their parenchymatous tissue are fibrovascular bundles, which conduct water and nutrients and strengthen the trunk like reinforcement rods in concrete. When fossilized, the vascular bundles present a straw-like appearance, imparting the characteristic pattern seen in sections of fossil palm. The previous specimen shows the 'straws' in cross section, and this specimen, of unknown provenance, shows these same structures in long section.

Dugong. Dugongidae.

29. Sea cow rib recovered c.1981 by Granville L. Gore from the Byram Formation on the Big Black River near Edwards [MMNS VP-535].

30. Sea cow rib fragments [MMNS VP-472] collected in c.1970 by Marquette Cement Manufacturing Company staff from the Mint Spring Formation at the old Marquette Quarry in Brandon (MGS 97).

Pleistocene Epoch

(PINK)

Background

Giant Bison. *Bison latifrons* (Harland, 1825). Replica skull with horns spanning ~7 feet from tip to tip. The original fossil was discovered in 1954 by Mary Kitaj & Louis Dellaporte at American Falls Reservoir in Idaho and is curated at the Idaho Museum of Natural History [IMNH 48001/1770]. Because giant bison skulls as well-preserved and intact as this specimen are so rare, the IMNH personnel involved in its recovery nicknamed the fossil "Mary Lou" in honor of the discoverers Mary and Louis. Molding/casting was performed by Dinolab, Inc, formerly of Salt Lake City, Utah. The crack on the left side of the face was produced during the molding process.

American Buffalo. *Bison bison* (Linnaeus, 1758). Skull of a modern bison, more appropriately known as the Plains Bison. This specimen originated from Wyoming and was donated by Bob Wilson [MMNS CO-309].

Antique Bison. *Bison antiquus* Leidy, 1852. "Big horn" bison posterior skull with horns collected by L. W. Bays from the Mississippi River in Washington County during extremely low water in 1973 [MMNS VP-11].

American Lion. *Panthera atrox* (Leidy, 1853). Cast of an atypically large and somewhat famous male lion skull, the original [LACMHC 2900-3] of which was found at the Rancho La Brea tar pits near Los Angeles and resides in the exhibit hall of the Natural History Museum of Los Angeles County. Purchased from Bone Clones in Chatsworth, California.

Saber-toothed Cat. *Smilodon fatalis* Leidy, 1868. Cast of a skull from the Rancho La Brea tar pits near Los Angeles [LACMHC 2001-249]. Purchased from Bone Clones in Chatsworth, California. Bone Clones casts of this particular skull have been used in a number of biomechanical studies of *Smilodon*'s bite technique.

Great Short-faced Bear. *Arctodus simus* (Cope, 1879). Replica skull of a specimen in the private collection of Mike Wigger. The original was part of an associated skeleton found in Fairbanks, Alaska, c.2001. Cast produced by John Babiarz of BIOPSI and made available through Bone Clones in Chatsworth, California.

American Mastodon. *Mammut americanum* (Kerr, 1972).

1. Pair of tusks from an associated partial skeleton collected 1984 by MMNS curator Eleanor Daly (et al.) from Pleistocene loess deposits encountered at the construction site of the old Pemberton Mall in Vicksburg [MMNS VP-492].
2. Left femur (thigh bone) belonging to the Pemberton Mall skeleton [MMNS VP-492]. Numerous other skeletal elements were found in association with this discovery, altogether constituting ~85% of the skeleton, although most elements were fragmentary and poorly preserved, like the skull, ribs, and most of the vertebrae. Advanced consolidation/preservation of the bones for purposes of possibly mounting the skeleton was explored several times over the 1980s and 90s, but the projections proved to be too costly and elements suitable for mounting too few.
3. Lower jaw with three molars collected 1997 by Eddie Templeton from Pleistocene alluvium in the Loess Hills, Yazoo County [MMNS VP-12972].
4. Replica skull produced by the Illinois State Museum, the original reportedly found in Indiana [MMNS VP-3196].

Giant Beaver. *Castoroides ohioensis* Foster, 1838. Replica skeletal composite based primarily on a nearly complete specimen recovered in 1890 from swamp deposits in Randolph County, Indiana. The original material belongs to Earlham College in Richmond, Indiana, and the skeletal cast was produced by Dinolab, Inc., Salt Lake City.

Petrified wood. Peculiarly shaped section of tree trunk resembling gnaw marks produced by beavers. Collected 1994 by Elvin Whitehead in the Buffalo River, Wilkinson County.

Foreground, Case-LEFT

White-tailed & Mule Deer. *Odocoileus* spp.

1. Mature male deer skull in 'post-shed' (missing antlers) recovered in 1973 from the Mississippi River near Arkansas City by Sam Sugg and Pete King [MMNS VP-3915].
2. Maxillary (upper) jaw fragment with three molars collected in the 1970s by Gaston Gill, Jr, from a Mississippi River sand bar near Greenville [MMNS VP-586].
3. *Odocoileus virginianus* (Zimmerman, 1780). Trunk of antler recovered in 1976 from the Mississippi River near Arkansas City by MDWFP conservation officer F. L. Sanders [MMNS VP-8]. In this instance, we are more certain of the species in this fossil because of the way the unevenly antler branches—a characteristic of white-tailed deer. In mule deer, each branch is approximately the same size as the trunk from which it extends.
4. **Turkey.** *Meleagris gallopavo* Linnaeus, 1758. Partial turkey wing reconstruction with humerus on left [MMNS VP-2207] and ulna on right [VP-4066] with a partial tarso-metatarsus (lower leg bone) showing spur nearby [VP-2849]. All specimens collected by George Phillips from 1986 to 2002 northeast of West Point.
5. **Gnawed Bone.** Limb bone fragments belonging to large mammals and exhibiting numerous gnaw marks produced by rodents. The two pieces were found by Eddie Templeton in the vicinity of Adelle, near Flora [MMNS collection].

Tapir. *Tapirus veroensis* Sellards, 1918.

6. Posterior fragment of right lower jaw with 3rd molar intact. Collected 1995 by MMNS biologists Charles Knight, Bob Jones, and Terry Majure while sampling for mussels in a stream south of West Point [MMNS VP-656].
7. Isolated upper molar collected by the same museum party [VP-657].
8. **Great Short-faced Bear.** *Arctodus simus* (Cope, 1879). Cast of a short-faced bear left mandible with portions of several teeth intact. The original was collected by Lonnie Looper from the channel of the Mississippi River west of Benoit [MMNS VP-11074] and later donated by Nina Baghai-Riding and Keith Riding.

Extinct Bison. *Bison* cf. *antiquus* Leidy, 1852.

9. Radio-ulna (lower leg bones) collected c.1971 by Matt Dakin, Sr, from the Mississippi River in Bolivar County [MMNS VP-137].
10. Radio-ulna of a **modern domestic cow** (*Bos taurus*) for size comparison.
11. Lower jaw fragment with three molars collected by MDWFP conservation officers on the Mississippi River west of Benoit in 1976 [MMNS VP-89].
12. Fossil bison tooth collected c.1970 by Gaston Gill, Jr, from a Mississippi River sand bar near Greenville [MMNS VP-580]. This upper molar exhibits intermediate to advanced stages of wear and is thus from an older individual than the tooth to the right from the same location [VP-581].
13. This bison upper molar, also collected by Gaston Gill from the same location [MMNS VP-581], exhibits an earlier stage of wear than the specimen on the left [VP-580] and is therefore from a younger individual.

Foreground, Case-RIGHT

Giant Beaver. *Castoroides* cf. *ohioensis* Foster, 1838.

1. Partial left lower jaw with two molars collected 1991 by Jason Robinson near Mayhew [MMNS VP-1819].
2. Lower left incisor collected 1998 by John Robbins collected near Beech Springs north of Tupelo [MMNS VP-2954].
3. **Toothed Globe Snail.** *Mesodon zaletus* (Binney, 1837). The shells at top and left are from *M. zaletus*; the similar-looking shell on the right actually belongs to the broad-banded forestsnail—*Allogona profunda* (Say). Both species are polygyrid pulmonates (air-breathing snails) commonly found in the Pleistocene loess and are still living today. All three valves were found during the Pemberton Mall mastodon [MMNS VP-492] excavation in 1984.
4. **Mammoth.** *Mammuthus* cf. *columbi* (Falconer, 1857). Upper third molar found in 2012 by Michael Mitchell near Cotton Plant, just north of New Albany [MMNS VP-6246].
5. **American Mastodon.** *Mammut americanum* (Kerr, 1792). Mastodon upper third molar collected by Brien Craig on a 1992 deer hunt near Benton, Mississippi [MMNS VP-13190].

6. **African Elephant.** *Loxodonta africana* (Blumenbach, 1797). Modern elephant molar for comparison to the mammoth and mastodon. Collected 1980 by John Sullivan in the Mateke Hills of Rhodesia while on a permitted safari. The crowns of modern elephant teeth exhibit a morphology intermediate between that of the mammoth, very dominantly a grazer (of grasses), and the mastodon, a browser (particularly of immature woody vegetation). The modern elephant is considered a mixed feeder, whose diet changes seasonally—often from dominantly grazing to dominantly browsing.

Horse. *Equus* spp.

7. Metacarpal (forefoot bone) collected 2006 by MMNS biologist Bob Jones on the Mississippi River near Rosedale [MMNS VP-4572].
8. Proximal phalanx (upper toe bone) collected c.1990 by Charles Bishop on the Mississippi River west of Benoit [MMNS VP-4867].
9. Medial phalanx (middle toe bone) collected 2006 by MMNS biologist Mike Sisson near Shannon, just south of Tupelo [MMNS VP-4493].
10. Ungual phalanx (hoof bone) collected c.2004 by Danny West on the Mississippi River near Lake Washington, south of Greenville [MMNS VP-7253].
11. Upper (left) and lower (right) 3rd molars collected in the 1990s by James Starnes, Mississippi Office of Geology, near Bovina [MMNS VP-3345 & VP-4416, respectively].

Jefferson's Giant Ground Sloth. *Megalonyx jeffersoni* (Desmarest, 1882).

12. Partial humerus (upper arm bone) collected 1995 by MMNS biologists Charles Knight, Bob Jones, and Terry Majure while sampling a creek bottom for mussels south of West Point [MMNS VP-651].
13. Posterior skull collected c.1971 by Matt Dakin, Sr, from the Mississippi River in Bolivar County [MMNS VP-133].
14. Ungual (claw core) collected 2005 by Danny West on the Mississippi River at Greenville [MMNS VP-7235].
15. Vertebra and single rib accompanying a very fragmentary skeletal association discovered by MMNS biologist Paul Hartfield from the Big Black River near Rawhide [MMNS VP-590].

16. Three associated ribs collected by MMNS curator Eleanor Daly from a creek bed near Benton [VP-485,486,487, on right].
17. **Harlan's Giant Ground Sloth.** *Paramylodon harlani* (Owen, 1840). Upper teeth collected 1995 by MMNS biologists Charles Knight, Bob Jones, and Terry Majure while sampling a large stream near West Point for mussels [MMNS VP-653].

Sloth-Sabertooth Display, Center

Jefferson's Ground Sloth. *Megalonyx jeffersoni* (Desmarest, 1882). Cast composite skeletal mount produced by the Illinois State Museum and based on a nearly complete specimen found by Lowell Carter in the late 1960s while dredging a kettle bog near Ansonia, Ohio, in 1970. The original skeleton is in the collections of the Dayton Museum of Natural History.

Saber-toothed Cat. *Smilodon fatalis* Leidy, 1868. Reproduction skeletal mount based on numerous remains of this extinct species from the tar pits at Rancho La Brea, near Los Angeles, California. Molding/casting by Bone Clones in Chatsworth, California.

Sloth-Sabertooth Display, Vitrine-LEFT

Ice Age Stag Moose. *Cervalces scotti* (Lydekker, 1898).

1. Proximal phalanx (toe bone) collected c.2000 by Allen Jackson on the Mississippi River near Tunica [MMNS VP-5050].
2. Metatarsal (hindlimb foot bone) collected in the 1990s by Tony Eddins on the Mississippi River near Rosedale [MMNS VP-3359].
3. Replica of a lower 3rd molar collected by Mississippi State University geologist Jack Kaye from the Mississippi River at Rosedale c.1970. The original is repositied with the Florida Museum of Natural History [UF 40081]; mold/casts made by Loonie Looper.
4. Lower trunk of antler collected 2001 by Lee Harding on the Mississippi River near Eagle Bend north of Vicksburg [MMNS VP-6193].

Harlan's Muskox. *Bootherium bombifrons* (Harlan, 1825).

5. Axis (2nd neck vertebra) found 1991 by Lonnie Looper on the Mississippi River near Gunnison, north of Rosedale [MMNS VP-3035].

6. Third molar found c.2005 by Danny West on the Mississippi River north of Greenville [MMNS VP-6365].
7. **Stout-legged Llama.** *Palaeolama mirifica* (Simpson, 1929). Proximal phalanx (toe bone) collected 1988 by Jason Robinson near Vinton, northeast of West Point [MMNS VP-2675].
8. **Blue Catfish.** *Ictalurus furcatus* (Valenciennes, 1840). Neurocranium (skull) collected 2007 by USFWS biologist Paul Hartfield in the Mississippi River at Tara Wildlife near Eagle Bend [MMNS VP-4735].

Sloth-Sabertooth Display, Vitrine-RIGHT

1. **Jefferson's Ground Sloth.** *Megalonyx jeffersoni* (Desmarest, 1822). Nearly complete lower jaw collected in 2008 by Larry Edwards in the vicinity of Mechanicsburg [MMNS VP-5038].
2. **Giant Tortoise.** *Hesperotestudo crassiscutata* (Leidy, 1889). Fragment of carapace margin found in the 1990s by Larry & Sherry Ragan on the Mississippi River west of Benoit [MMNS VP-3369].
3. **Putnam's Box Turtle.** *Terrapene carolina putnami* Hay, 1906. Marginal carapace element collected 2002 in the Mississippi River just north of Vicksburg by USFWS biologist Paul Hartfield [MMNS VP-1171].
4. **Florida Spectacled Bear.** *Tremarctos floridanus* (Gidley, 1928). Right mandible with reconstructed 2nd molar collected 2012 by Allen Morehead on the Mississippi River west of Benoit [MMNS VP-6357].
5. **Black Bear.** *Ursus americanus* Pallas, 1780. Right mandible collected 1993 by MMNS curator George Phillips in the vicinity of Mayhew [MMNS VP-1999]. This specimen may be younger than Pleistocene; its context was somewhat ambiguous.
6. **Pampathere.** *Holmesina septentrionalis* (Leidy, 1889). Dermal ossicle ('skin bone' from flexible carapace) collected 2013 by Carol Ischee near Bovina [MMNS VP-6576].
7. **American Lion.** *Panthera atrox* (Leidy, 1853). Replica of left lower jaw collected 1996 by Tony Eddins on the Mississippi River north of Rosedale; the original was acquired from the Eddins estate for a private collection. Mold/casts made by MMNS volunteer Peter Kuchirka in 2012.

Sloth-Sabertooth Display, Front Panel

Saber-toothed Cat. *Smilodon fatalis* Leidy, 1868.

Replica canine based on an original from the La Brea Tar Pits, Los Angeles Co., California.

Metatarsal (hindlimb foot bone) collected 1987 by George Phillips northeast of West Point [MMNS VP-1158].

Jefferson's Ground Sloth. *Megalonyx jeffersoni* (Desmarest, 1822).

Rib collected 1995 by MMNS biologists Charles Knight, Bob Jones, and Terry Majure while conducting mussel surveys in a stream south of West Point [MMNS VP-652].

Medial and ungual phalanges (toe & claw bones) collected in the 1970s by Mississippi State University geologist Jack Kaye northeast of Mayhew [MMNS VP-1166].

Molar collected in the 1990s by Jason Robinson at Oktoc, just south of Starkville [MMNS VP-1163].

Bullfrog. *Lithobates catesbeianus* (Shaw, 1802). Ilium (hip bone) collected 1983 by George Phillips near Mayhew [MMNS VP-1159].

Cottonmouth. *Agkistrodon piscivorus* (Lacépède, 1789). Vertebra found by MMNS curator Michael Frazier in 1979 near Mayhew [MMNS VP-819].

Eastern Mole. *Scalopus aquaticus* (Linnaeus, 1758). Scapula (shoulder blade) and ulna (outer forelimb bone) collected near Mayhew in the 1990s by George Phillips [MMNS VP-1160 & 1161, respectively].

Mink. *Neovison vison* (Schreber, 1777). Fragmentary right mandible collected c.1980 by Barbara Cushman northeast of Mayhew and donated by Rufus Ward [MMNS VP-1162].

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