THE FOSSILS OF COON CREEK: AN UPPER CRETACEOUS MISSISSIPPI EMBAYMENT MARINE SITE IN MCNAIRY COUNTY, TENNESSEE

with 72 plates of fossils from Bruce Wade's original 1926 United States Geological Survey Professional Paper 137 "Fauna of the Ripley Formation on Coon Creek, Tennessee", additional discussions of discovery of the site by Bruce Wade, later scientific investigations of the site, and establishment of the Coon Creek Science Center by Memphis Museums, Inc.

Ron Brister
Roy Young

Coon Creek Science Center
Memphis Pink Palace Family of Museum
2007

For information on the Coon Creek Science Center call (901) 320-6362

Dedication

To our wives for patiently indulging our enthusiasm.

Contents

Figures

The happy participants of the highly successful May 1987 staff collecting trip to Coon Creek. From left to right Phyllis Whittington, Mary Montgomery, Doug Noble, Roy Young, Ron Brister, Margaret McNutt, and Tom Miller. Image courtesy of the Memphis Pink Palace Museum.

Acknowledgements

One hundred fifty years of research on Coon Creek produced the information contained in this booklet. Investigators include by Gerard Troost, James Safford, Lloyd Stephenson, Edward Berry, T. W. Stanton, J. B. Reeside, Jr., W. P. Woodring, C. W. Cooke, W. H. Dall, Paul Bartsch, Bruce Wade, Julia Gardner, W. C. Gilmore J. W. Gidley, R. S. Bassler, Mary Rathbun, Norman Sohl, Ernest Russell, Harry Moore, Michael Gibson, Toshimasa Maeda, Earl Manning, and Lynn Harrell.

Original photographs of Coon Creek specimens for Professional Paper 137 were made by W. O. Hazard. The images were retouched and assembled by Frances Wieser. Ron Brister gained a great appreciation for graphic artists while scanning, labeling, and organizing the images. Many of the Pink Palace photos were copied by Tammy Braithwaite for this article.

Some of the maps and other images are from Tennessee Division of Geology, United States Geological Survey and the National Oceanic and Atmospheric Administration publications and web sites.

The Pink Palace Coon Creek Fossil Collection

The authors' knowledge of the site and specimens is derived from working with the collections of the Memphis Pink Palace Museum and Vanderbilt University. Ron Brister first visited the site as a member of Dr. Phili DeBoo’s 1966 Memphis State University invertebrate paleontology class. Upon arrival he immediately fell into the creek. Over the next forty years Brister led individual and staff collecting trips to the site, falling into the creek again on more than one occasion. He published a biography of Bruce Wade and actively

encouraged scholarly investigation of Coon Creek by earth scientists.

collecting and preparing specimens.

Figure 1. Doug Noble (l) and George Brown (r) share a tender moment as Roy Young encases the mosasaur skull in a plaster jacket for removal to the laboratory. Image courtesy of the Memphis Pink Palace Museum.

Figure 2. Roy Young, Memphis Pink Palace Museum Conservator, preparing the Coon Creek mosasaur skull with a compressed air micro-pick. The fossil was so fragile that a touch with the tool would cause the teeth to shatter. Cleaning, hardening, and reassembling the skull fragments took hundreds of hours of tedious and nerve-wracking work. Image courtesy of the Memphis Pink Palace Museum.

Most of the intricate and delicate preparations so admired by visitors were made by Roy Young. He applied his exceptional artistic and scientific skills to excavation of the fragile mosasaur skull and vertebra, its subsequent removal from the extremely hard surrounding rock, and the molding and assembly of the final skull cast.

Curator of Education Roger Van Cleef encouraged us with his love for the fossils, even though they were mostly only invertebrates.

Memphis Pink Palace Museum Director Doug Noble's leadership and vision created the Coon Creek Science Center and supported our collecting efforts.

The bulk of the museum's collection was found by staff members Roy Young, Ron Brister, Doug Noble, George Brown, Tom Miller, Margaret McNutt, Mary Montgomery, Phyllis Whittington, Larry Anderson, and Jewell Rosenberg on collecting trips in the 1980s – 1990s.

Additional specimens were collected by museum staff Alma Larsen, Amy Scott, Anne Leonard, Bill Cupo, Brian Hicks, Dianne Curtiss, Joyce Godfrey, Kieran Davis, Marjorie Barnes, Melissa Probstile, Mike Karam, Nancy Albonetti, Natasha McAllister, Pam Riddick, Shanna Davis, and Robby Krampf.

The site has been managed by Bobby King and Kevin Roy and competently interpreted by Pat Broadbent, Vicky Goodrum, Angela Prince, and other instructors who devotedly ran the site with minimum resources.

The Mississippi Embayment

The story of Coon Creek began near the end of the Cretaceous Period, around 71 million years ago. At that time western Tennessee, eastern Arkansas, western Kentucky, and southeast Missouri were submerged beneath the Mississippi Embayment, a bay of the Gulf of Mexico. Coon Creek was formed in shallow coastal water probably less than 100 feet deep. The sea floor was heavily populated with shellfish, crabs, and lobsters. Huge plesiosaurs, marine crocodiles, sea turtles, and mosasaurs shared the waters with sharks and fierce fanged-tooth fishes. The climate was warmer than today. Coon Creek was semi-

tropical, like current-day southern Florida. Heavy waves from severe tropical storms constantly churned up shallower parts of the sea floor.

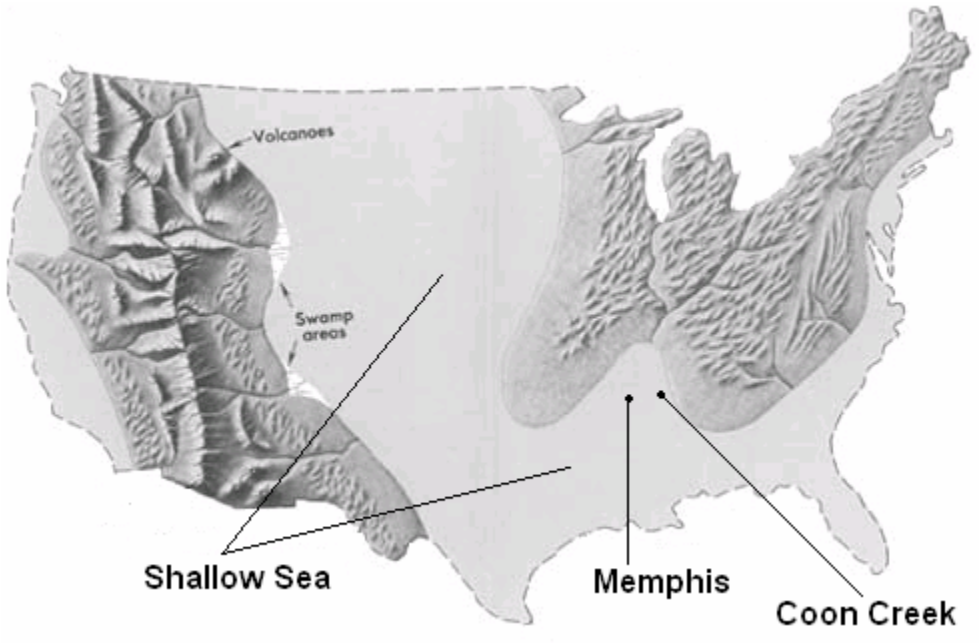

Figure 3. Shallow seas overflowed the eastern and western coasts and covered the interior of North America from the Gulf of Mexico to the Arctic Ocean during the Late Cretaceous Period around 71 million years ago. This rise in sea level was probably caused by expansion of the mid-oceanic ridges during increased periods of plate formation. Modified from a United States Geological Survey image.

A couple of miles to the east lay a marshy lowland bordering the limestone bluffs of the Western Highland Rim of the Nashville Done, home to duckbill and Tyrannosaurus-like dinosaurs. Sluggish rivers annually washed tons of driftwood, along with the occasional dinosaur carcass, from this heavily forested area into the bay.

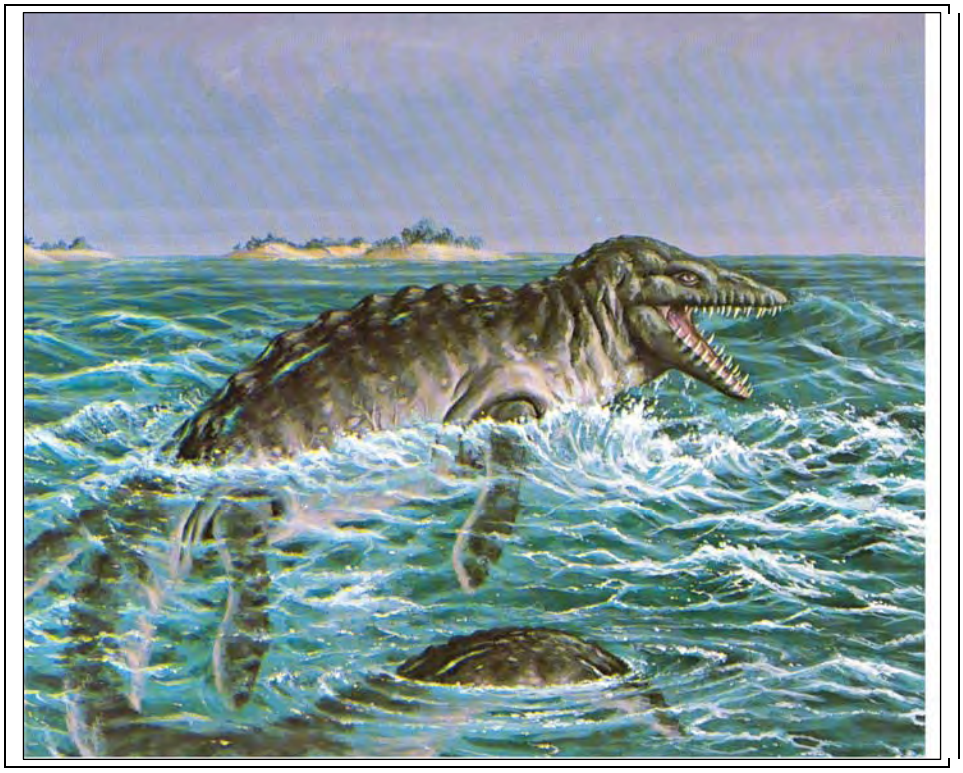

Figure 4. Pink Palace Museum artist Joe Tuccherone painted this conjectural image of a mosasaur swimming above the site of Coon Creek during the Late Cretaceous Period. Image courtesy of the Memphis Pink Palace Museum.

The Geology Of The Mississippi Embayment And Coon Creek

This thumb print-shaped bay extends roughly North-South from central Mississippi to southern Illinois. It was formed when rocks, weakened by gradual spreading of the North American continent, sagged into a wide, shallow trough. The Gulf of Mexico filled the trough on several occasions between 80 and 50 million years ago. The Mississippi Embayment stretched West from the Tennessee Valley to the area of Little Rock, Arkansas. It may have been 1,000 feet deep where Memphis is now. The embayment gradually filled up with sand, clay, and gravel brought in by rivers on uplands to the North, East, and West.

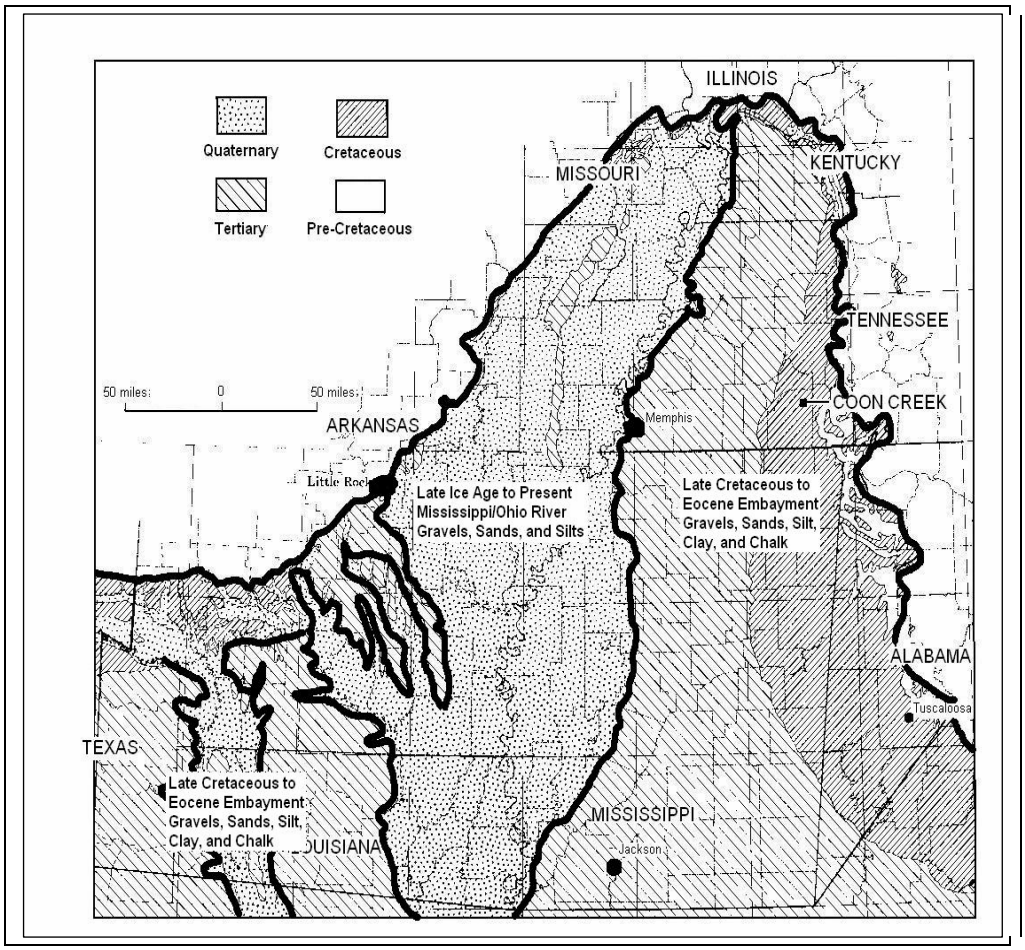

Figure 5. A general geologic map of the Mississippi Embayment. The embayment is a shallow trough filled with sediment from two major geologic events. To the East of Memphis are sands, clays, and gravels from the invasion and subsequent retreat of the Gulf of Mexico. To the West are alluvial soils resulting from the formation of the Mississippi/Ohio valley and its later modification by glacial filling and scouring. This map is from E. H. Boswell, G. K. Moore, and L. M. McCary “Cretaceous Aquifers in the Mississippi Embayment”, United States Geological Survey Professional Paper 448-C, Figure 2.

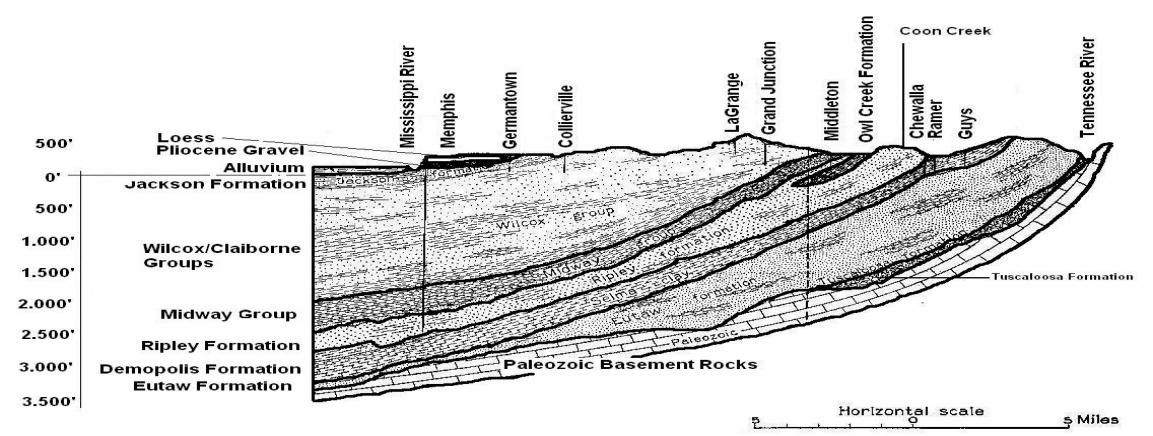

Figure 6. Cross section of The Mississippi Embayment Although some of the stratigraphy is dated, this section shows how sediments filled a shallow around 75 million years ago. The trough formed by rifting when North America almost pulled apart hundreds of millions years earlier. The vertical scale of the deposits are greatly exaggerated. Modified from Francis G. Wells 1933 “Ground Water resources of Western Tennessee”, United States Geological Survey Water-Supply Paper 656, plate 5.

The margins of the bay teemed with marine life. Crabs, snails, lobsters, clams, scallops, whelks, nautilus, sharks, and other familiar animals lived in the warm, shallow sea, eating, reproducing, and being eaten. Giant reptilian mosasaurs, highly ornamented cephalopods, and other less familiar sea creatures lived in the water. Their shells, bones, carapaces, teeth, and other hard parts were constantly being buried in the sandy mud of the sea floor. The lack of distinct layering indicates that clams, shrimps, and other burrowing organisms mixed the bottom sediments. Periodic hurricanes may have brought in heavy loads of river sediment to bury the plants and animals living there. Conditions for life were ideal; the water was warm and of normal salinity. Wave action insured sufficient oxygenation for animal life.

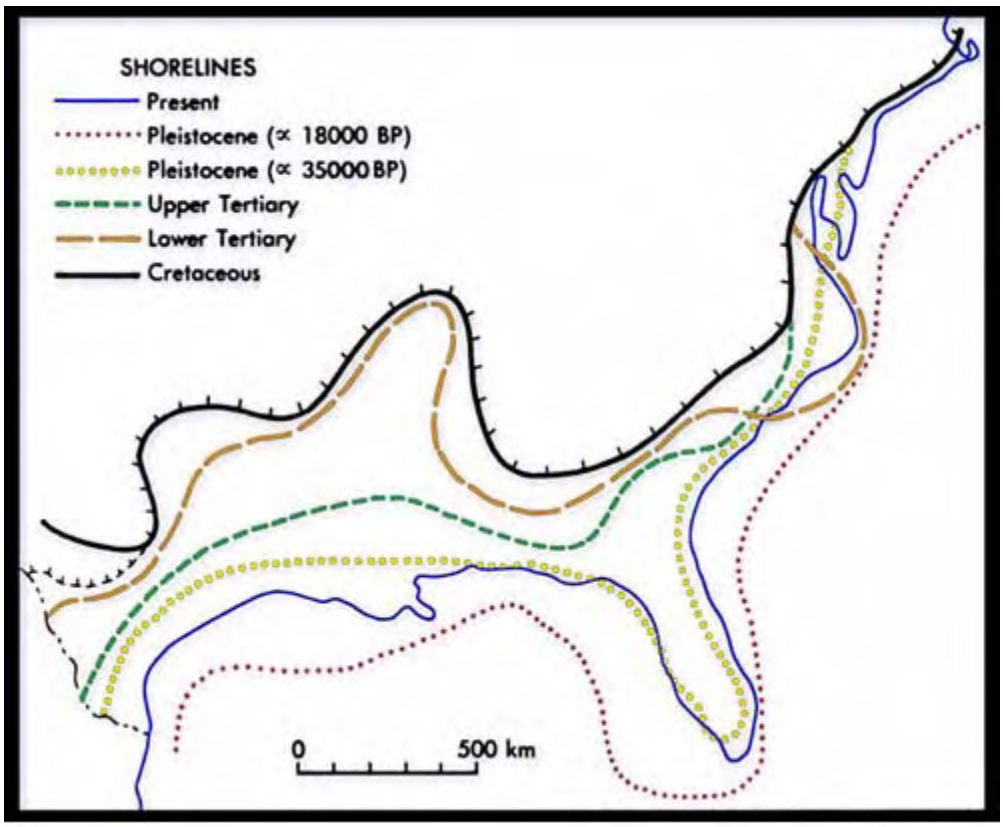

Figure 7. Map showing the receding shorelines of the southeastern United States from the Late Cretaceous Period to the present. Shrinking of the mid-oceanic may have accounted for the lowering of sea level. Modified from a NOAA map.

Ancient Life

Many rivers fed into the sea bringing leaves and driftwood from the land. These served as the base of the food chain. Bacteria and other microscopic scavengers ate the decaying wood. Plankton ate the bacteria. Clams filtered the small plankton out of the water and ate it.

Snails ate the clams and were eaten in turn by crabs and fish. Mosasaurs and cepahlopods ate the fish and crabs. Everybody ate everybody else. Life abounded in the sea. Some organisms were swimmers or floaters, but most lived on or in the sandy mud of the sea bottom. This layer of sandy clay, bones, and shells became the Coon Creek formation.

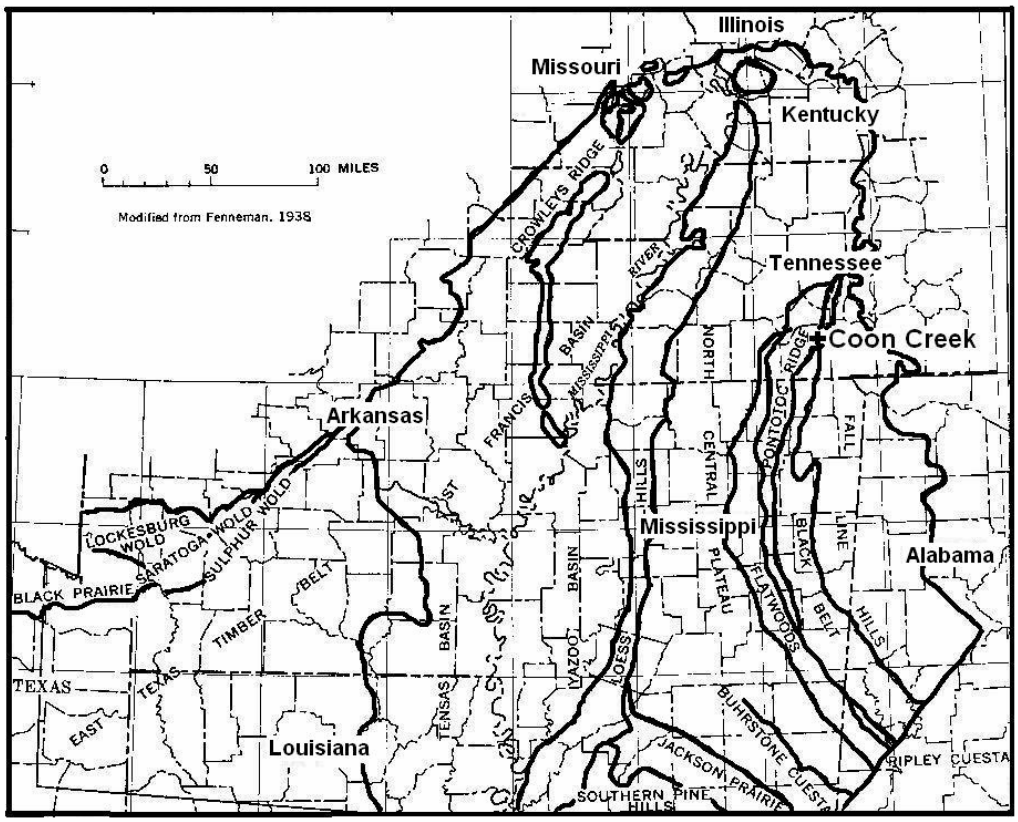

Figure 8. Physiographic Provinces of the Mississippi Embayment. Coon Creek is located on northern end of the Pontotoc Ridge which includes the Upper Cretaceous Ripley, Coon Creek, and Owl Creek Formations and the Tertiary Paleocene Clayton Formations in Tennessee. E. M. Cushing, E. H. Boswell, and R. L. Hosman "General Geology of the Mississippi Embayment" United States Geological Survey Professional Paper 448-B, Figure 10.

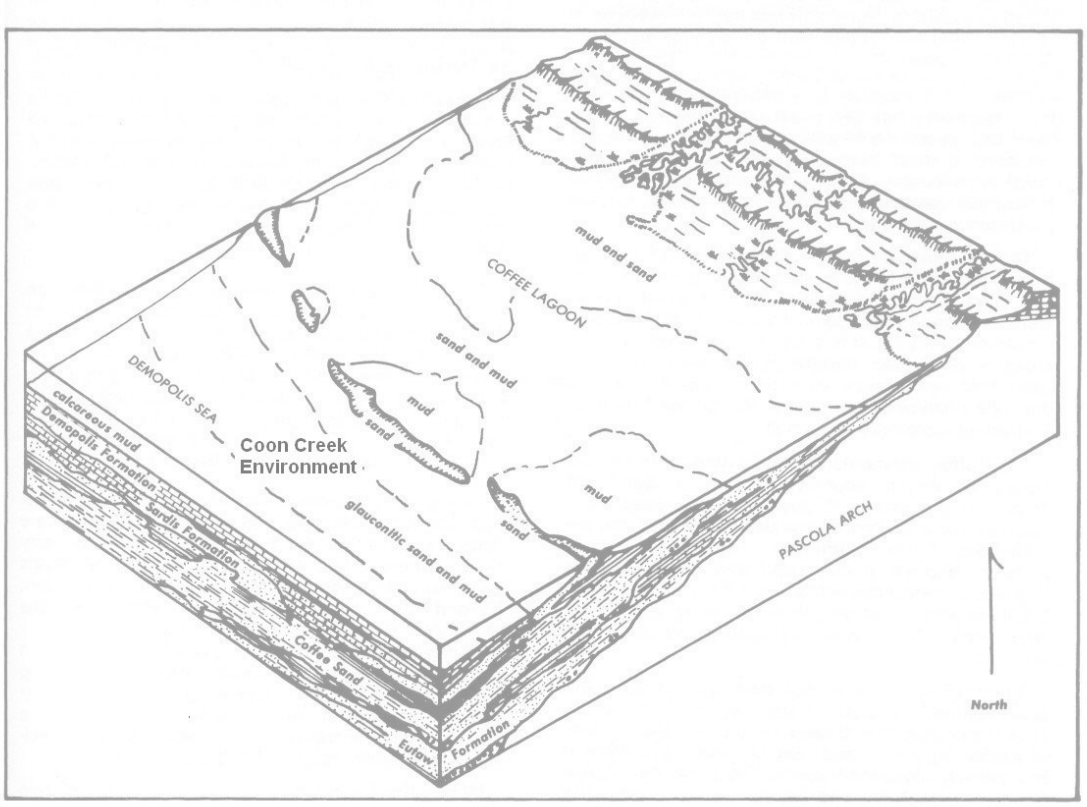

Figure 9. Dr. Ernest Russell's interpretation of the paleogeography of the Coon Creek site. Coon Creek was located in the glauconitic sand and clay zone between the still waters of the Demopolis sea and the brackish waters of the Coffee lagoon. Image modified from Russell and Parks' "Stratigraphy of the Outcropping Upper Cretaceous, Paleocene and Lower Eocene in Western Tennessee including descriptions of younger Fluvial Deposits ". Tennessee Division of Geology Bulletin 75, figure 37, page 53A.

Fossils

Most organisms aren't preserved as fossils. Unless covered quickly after death, their bodies are consumed by other animals and plants or destroyed by weather. Even the bones and shells of animals which were quickly buried after death may be later dissolved by groundwater. The clay in the sediment at Coon Creek sealed off the fragile fossils from the corrosive action of water and the hard parts of the clams, snails, crabs, and shrimps were perfectly preserved. Occasionally the bones of vertebrates are found, as well as the cartilaginous vertebrate of sharks. We sometimes find fish scales and plant leaves as well.

Dinosaurs?

Have we found dinosaurs at Coon Creek? No. While dinosaurs did roam the land of central Tennessee during the same time period, they were land animals and did not live in the sea. Sometimes the dried carcasses of dinosaurs were washed out to sea by rivers. Dinosaur bones and teeth have been found in marine deposits in Mississippi. It is possible that dinosaur bones will turn up at Coon Creek someday. We have found the remains of at least two mosasaurs. They were not dinosaurs but large aquatic lizards that could reach lengths of up to 45 feet. They were carnivorous and would have been the top of the food chain in the Coon Creek area.

Importance

Coon Creek has been named as one of the country's top twelve fossils sites for several reasons.

- The fossils are found in their original state. The hard shells have not been permeated by groundwater and therefore have not been replaced by minerals.
- The number of fossils is stupendous. Many times you will literally find fossils on top of fossils. Most fossil sites require concentrated efforts to find a representative sample of the fossils.
- There is a rich diversity of the animals, with over 600 different species of organisms found.
- Because the Coon Creek Formation sediment is unconsolidated, it makes it very easy to collect and prepare the fossils.

Age

The most accurate way of determining the age of fossils is by estimating the amount of natural decay of radioactive minerals found in the surrounding sediment. Radioactive minerals lose energy at a

known rate over time- like a battery running down. By comparing the amount of original radioactive material with its break-down products, its age in years may be calculated. Unfortunately, Coon Creek sediments don't contain any minerals suitable to radiometric dating. Geologists have turned to the use of the biostratigraphy, the use of index fossils for dating. Index fossils are species of plants or animals which existed over a wide area for a geologically short period of time. The cephalopod Jeletzkytes nodosus is a time-sensitive fossil found in rocks a little younger than 70.6 million years old in the Western United States. Other index fossils from Coon Creek date a little older than 70.6 million years. The overlap indicates that Coon Creek sediments were probably deposited between 70 and 71 million years ago.

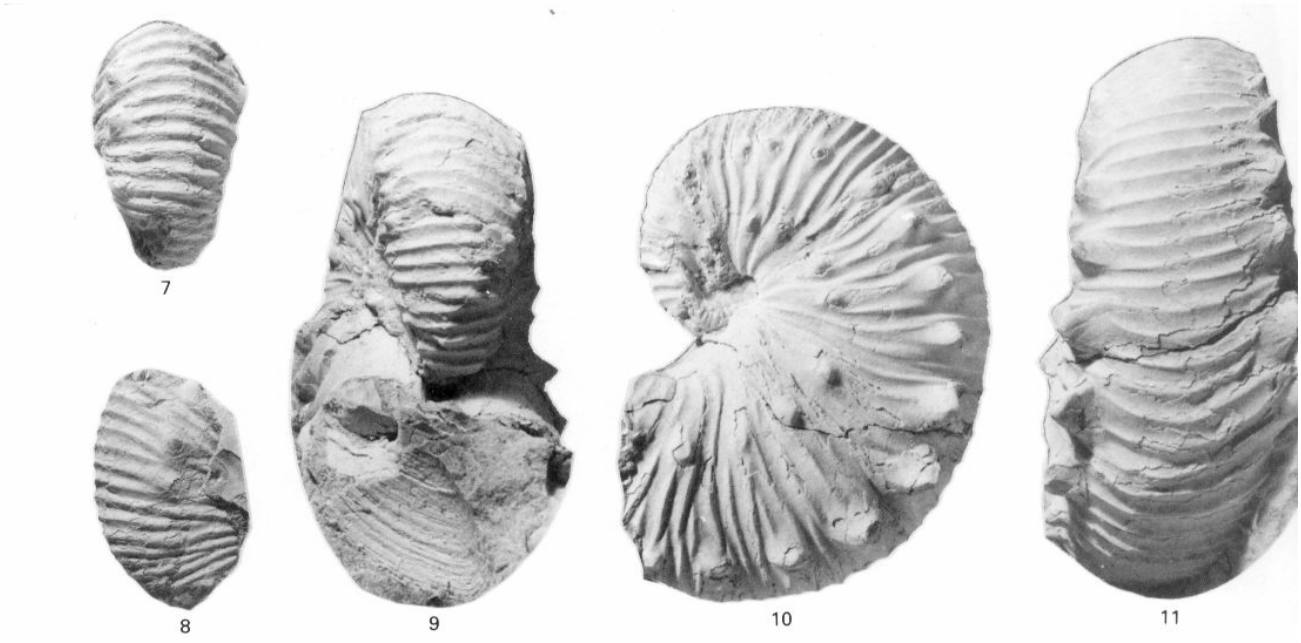

Figure 10. *Jeletzkytes nodosus*, a Coon Creek cephalopod which lived in the Late Campanian Stage about 71 million years ago. Image from the 1994 United States Geological Survey Bulletin 2073 B, "Upper Cretaceous Ammonites from the Coon Creek Tongue of the Ripley Formation at Its Type Locality in McNairy County, Tennessee" by William A. Cobban and W. James Kennedy. plate 9, figures 7-11.

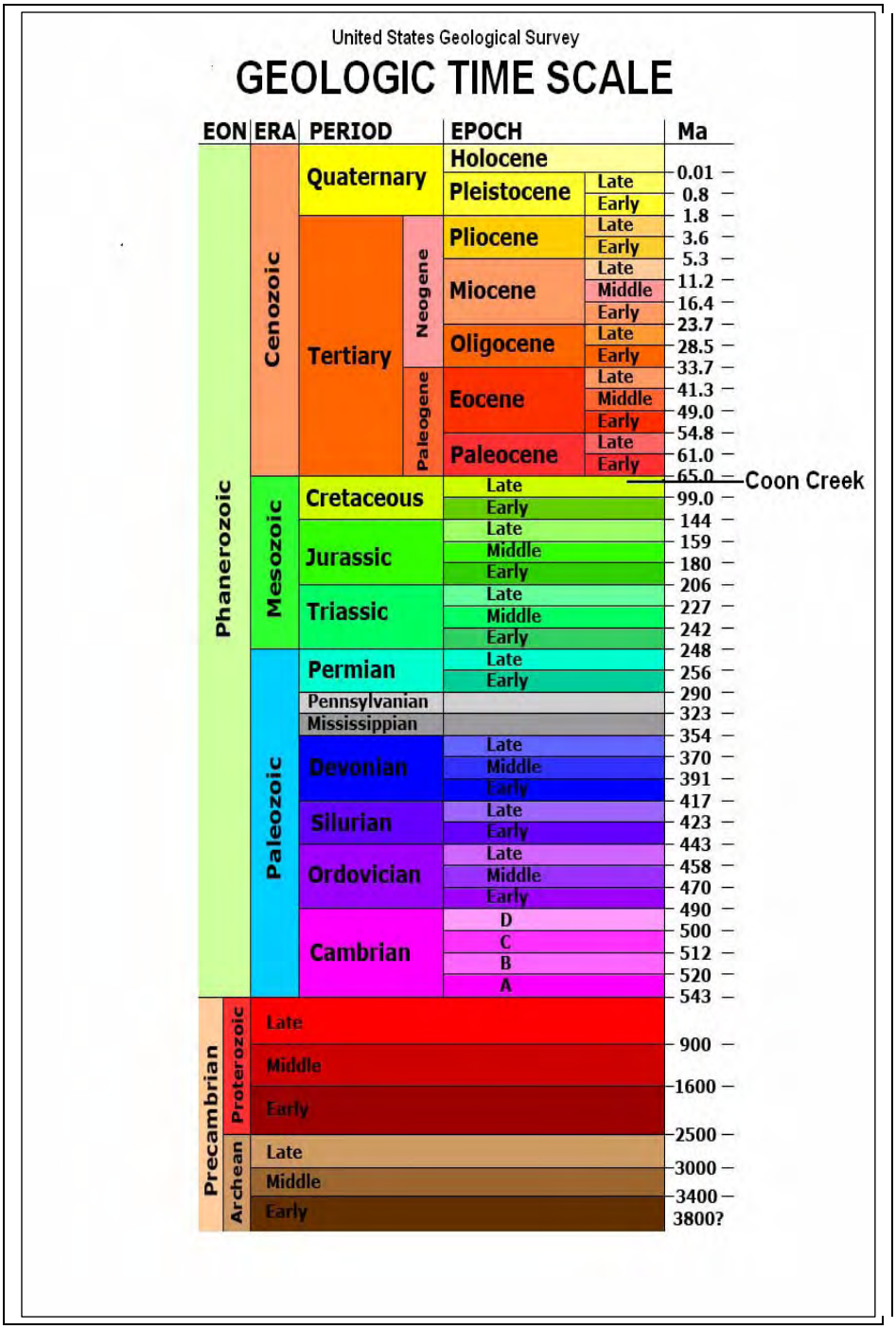

Figure 11. Geological Time Scale showing the age of Coon Creek deposits. Image modified from the United States Geological Survey web page.

Location

- Take I-40 east from Memphis to the US Highway 64 exit.
- Drive east through Somerville, Bolivar, and Selmer to Adamsville.
- At the western city limits of Adamsville turn north on TN Highway 224. Drive 9.5 miles to Bob Williams Road.
- Turn right on Bob Williams at the brown sign and drive 0.8 miles to Hardin Graveyard Road.
- Turn left on Hardin Graveyard Road and immediately to the right into the entrance of the Coon Creek Science Center

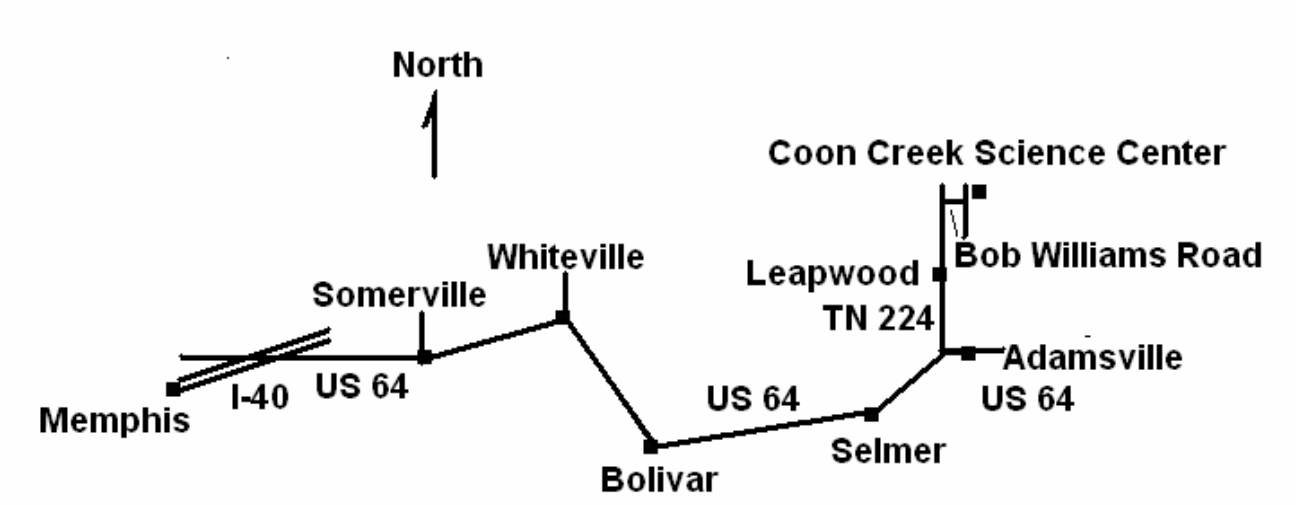

Figure 12. The Coon Creek site is located in northeastern McNairy County, Tennessee, about 100 miles east-northeast of Memphis. Image courtesy of the Memphis Pink Palace Museum.

Description of the Site

Coon Creek, located on West Tennessee farmland, is surrounded by gently rolling hills covered with second growth forest. Numerous creeks flow north and eastward into the Tennessee River draining the land. The sandy soil is susceptible to rapid and extensive erosion forming deep gullies and ravines. Coon Creek flows through the Science Center from south-southwest to north-northeast. The eastern part of the site is marked by a steep, forested bluff about 30 feet high

and cut by deep ravines along the creek. The western side of the creek is a narrow floodplain. Abandoned cornfields, now planted with grass, occupy this floodplain. The western margin of the site is also hilly, but with a gentler bluff than the western side.

Fossils And Farmers

American settlers entering McNairy County in the mid-19th century from the Central Atlantic states would have recognized fossils found in their plowed fields as ancient shellfish. The prevailing Christian view of world history no doubt attributed their presence to the great flood described in the Bible.

The Dave Weeks Place

Dave Weeks told the history of his family's and their purchase of the Coon Creek farm to his grandson, John D. Mills, in the 1930s. Mills told the story to the McNairy County newspaper in 1988.

> On Jan. 9, 1867, the Weeks family purchased 176 acres of the Coon Creek place for $1000 from W. S. Wisdom. Two months later, Dave's father died on March 14, 1867. During a seven-year period, Dave's mother finished paying off the place and continued to own it until Jan. 14, 1888, when Dave purchased it from her for $125. An additional 75 acres or so was purchased by him from sources unknown to me bringing the total acreage to about 250. From then on, until 1953 when A. Z. Smith purchased it from the Weeks family, it was known by geologists world-wide as the Dave Weeks Place Coon Creek, Enville, Tn.
>
> When the Weeks family moved onto Coon Creek place in 1867, it was mainly all in virgin timber. Because it was at the headwaters of Coon Creek, at this point it was only a small ditch and the fossils were still deep underground. With all the land primarily in huge timber, it had to be cleared for farming. There was not much of a market for timber in those days and no way to get it to market if there was, so the only thing they could do was to cut the trees into logs, pile them up and burn them. Neighbors were few and far between,

but they would manage to get a few men together to cut logs. The events were called "log rolling". The women prepared food for the log rollers, which was all the pay the men received.

After clearing his land, Dave later told me he used his shovel to dig the creek deeper in places so it would carry more rain water from his bottom land. After some twenty years or so of washing out by rain water, the fossils were uncovered beneath the site where he had dug.

During the teens and early 1920's, Bruce Wade, a geologist, spent a great deal of time with Dave, collecting and cataloguing fossil specimens. He even named one fossil in honor of my grandfather- the "Cerithium Weeksi" and is pictured on page 246 of a hard cover book titled "Coon Creek Fauna." In 1932, a copy of this book was presented to Dave by the Department of Geology of Vanderbilt University, Nashville, in recognition of the contribution his fossils had made to the science of geology. This book contains autographs of many of the geologists from all over the United States as well as Johannesburg, So. Africa and London, England who visited Coon Creek between 1933 and 1941. Today, the book still remains in the possession of the Weeks family.

My grandfather, Dave Weeks died on November 20, 1941, just a few weeks short of his 89th birthday.

Weeks lived on the farm with his family in a comfortable white frame house, growing cotton on the hills and corn in the bottoms. Farming was hard and not very profitable work so he supplemented his income as a brick mason, building some of the stores in nearby Leapwood .

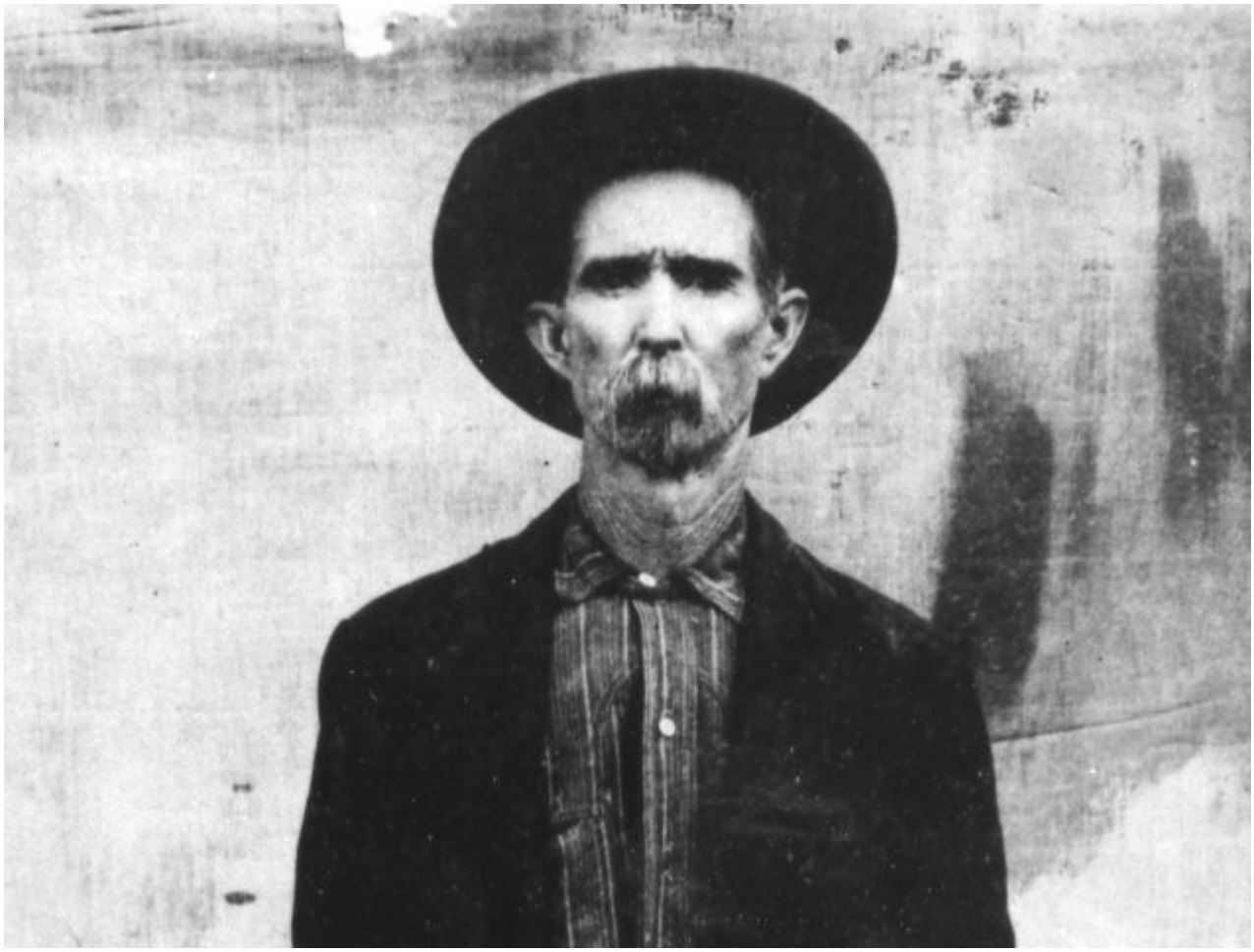

Figure 13. Dave Weeks, 1852-1941, was owner of the Coon Creek site from 1888 until his death. Image courtesy of Dave Week's daughter, Mrs. Bertha Tidwell, Memphis Pink Palace Museum collections.

Weeks met twenty six year old student-geologist Bruce Wade in the summer of 1915. Wade was systematically mapping the outcropping Cretaceous deposits of West Tennessee for his doctoral dissertation at Johns Hopkins University. Wade's advisor, the aptly named Edward W. Berry, was a renowned paleobotanist with extensive field experience with the Eocene plant fossils of western Tennessee. Berry arranged for Wade to spend several weeks in northern Mississippi with Lloyd W. Stephenson and E. N. Lowe to familiarize himself with established Cretaceous and Tertiary geology. Wade then extended the known formations into nearby, geologically unknown McNairy County.

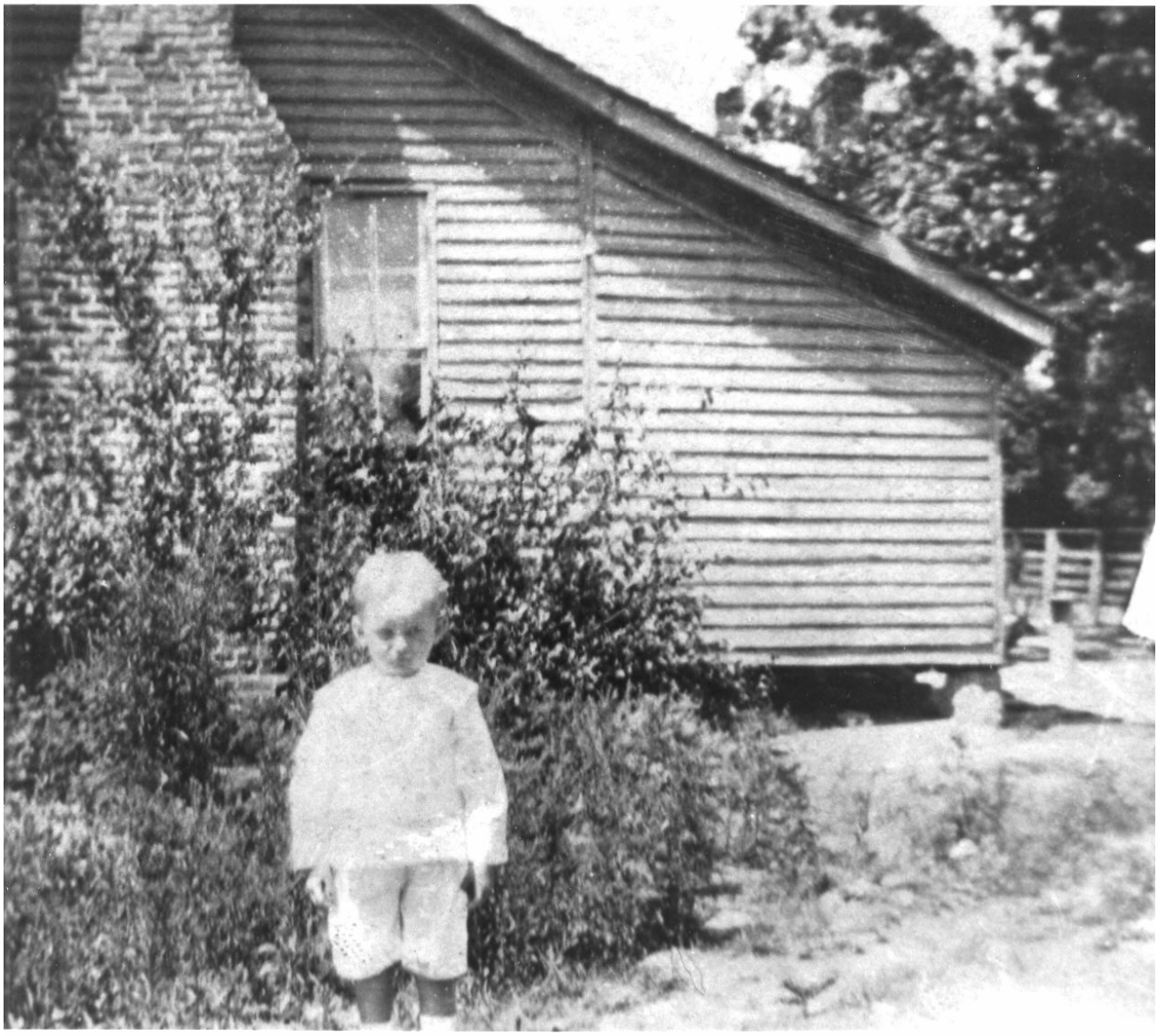

Figure 14. Grandson Hurshel Weeks photographed by Dave Week's modest white frame home on Coon Creek. Image courtesy of Dave Week's daughter, Mrs. Bertha Tidwell, Memphis Pink Palace Museum collections.

Weeks had first noticed an abundance of shells on his property around the turn of the century after he deepened a drainage ditch in the Coon Creek bottoms. The ditch rapidly eroded downward exposing bluish sandy Coon Creek Formation clay and its well preserved fossils. According to family tradition, Weeks ground up some of the fossil shells to feed his chickens to strengthen their egg shells. When Wade drove his rented team and wagon from Selmer up to the Weeks place

in July of 1915, Dave was ready to talk about the shells in his backyard.

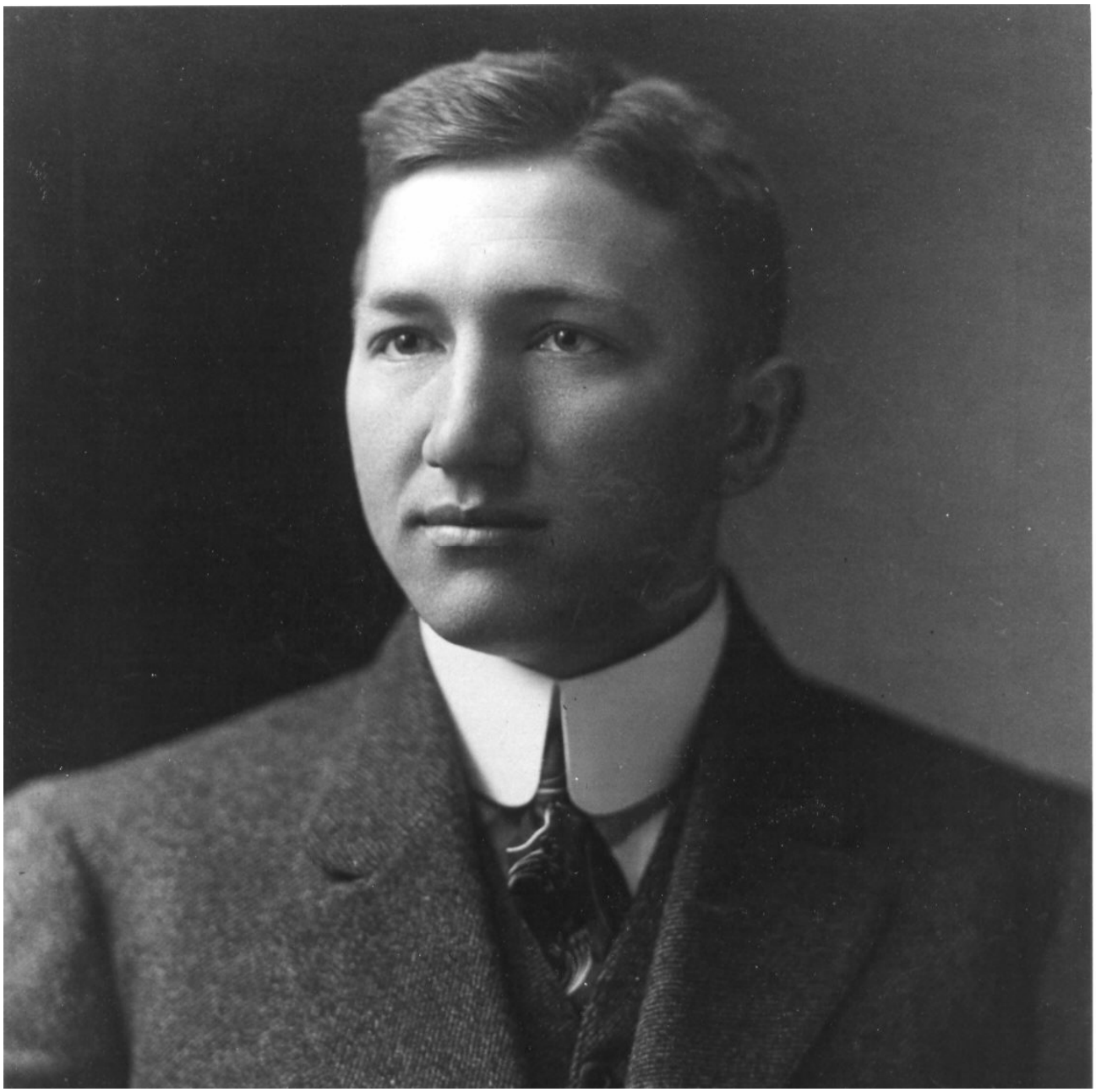

Figure 15. Bruce Wade, 1989-1973, published the first comprehensive description of the Coon Creek fossils and the Cretaceous geology of West Tennessee in 1926. Image courtesy of the Memphis Pink Palace Museum.

Wade made a quick collection of fossils and sent them to Professor Berry in Baltimore. Berry was impressed by the perfect condition, abundance, and large variety of the ancient animals found at Coon Creek. The perfect preservation of the ornamentation and anatomical features was almost unheard of in fossils of their age. Wade was advised to change his dissertation to a monograph on the fossils at Dave Weeks' farm. Wade agreed and began research, writing several interim reports on the site and its uniquely preserved fauna. Wade described Coon Creek in his paper “A Remarkable Upper Cretaceous Fauna from Tennessee”

> A thickness of more than thirty feet of the fossil-bearing bed is exposed along the banks of Coon Creek. For one-third of a mile this stream flows in a narrow V-shaped channel from six to fifteen feet deep which has been cut out during the last twenty years. The stream has a steep gradient and its channel is deepened by each heavy rain. The channel fills quickly after a thundershower and its sides are keep freshly scoured by the rushing water. White shells of *Crassatellites, Cucullaea, Cyprimeria, Gryphaea, Ostrea, Drilluta, Lunatia, Baculites,*etc. project out of the dark greyish blue matrix and glitter in the clear water and sunshine.
>
> The sediments containing the Coon Creek fauna are dark bluish green and grey clayey sands. The sand is of medium fineness and consist of angular and rounded grains of quartz and the major constituent, with glauconite, small flakes of mica, and shell fragments as minor constituents. Pieces of lignitic wood and small nodular masses of pyrite are common but not abundant. All of the above clastics are cemented together with a fine calcareous material, forming a compact impervious mass which varies locally in arenaceous and argillaceous content. There is locally sufficient lime for the matrix to become indurated into a very hard, impure, and concretionary limestone. When this marl is thoroughly weathered the shells are removed leaving casts in a matrix which becomes yellowish brown due to the oxidation of the glauconite and other ferruginous components.

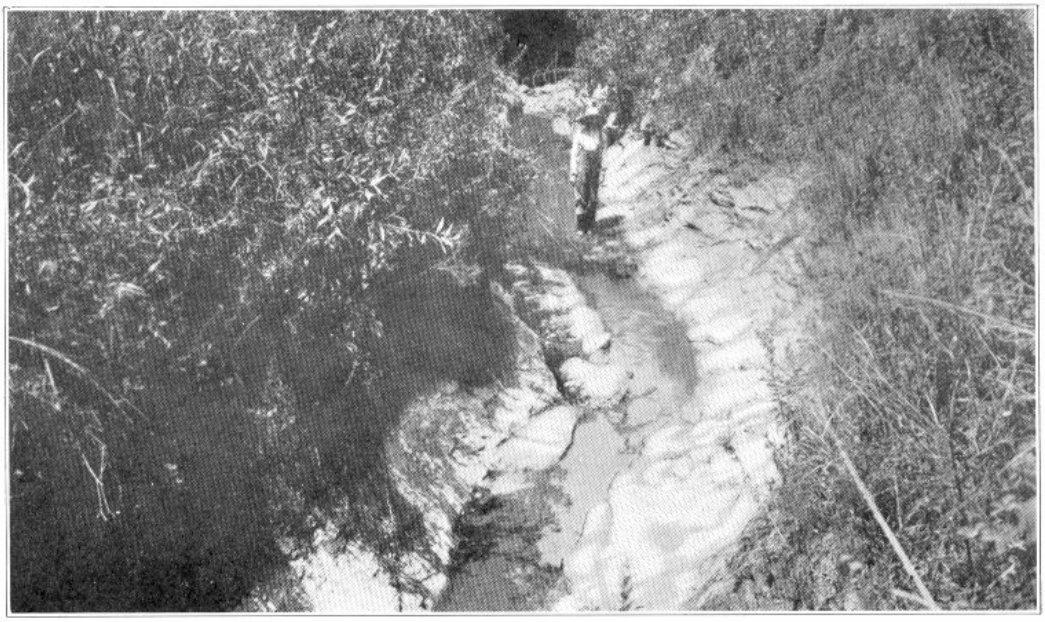

Photo by Bruce Wade.

Very Fossilliferous Sandy Marl, Coon Creek, McNairy County.

Figure 16. A member of the Weeks family in Coon Creek around 1917. Wade's first view of Coon Creek was very different from what is seen today. Rapid erosion has significantly deepened the creek in the 85 years since Wade's last visit. This photo is from Wade's article "Recent Studies of the Upper Cretaceous of Tennessee" published in the Administrative Report of the State Geologist, 1919. Tennessee Geological Survey Bulletin 23, facing page 60.

Wade developed a close relationship with Dave Weeks and his family. Bertha Weeks Tidwell, who had been a young girl during the Wade era, was still living in the 1990s. She had saved a tiny, carefully folded photo of Wade. Around the edge she had written in a childish hand "my sweetheart". The impact of the visits from the sophisticated scholar on the isolated family must have been immense. Whenever Wade dropped by the farm to collect, Dave and his sons were quick to help. Photographs taken by Wade show Dave and the barefoot boys dressed in overalls digging with rock hammers in the overgrown creek bed. The fresh, uncollected exposure furnished exceptional specimens with little effort. Wade's final 272-page monograph on Coon Creek, published in 1926, is based on only two-week's collecting at the site.

Photo by Bruce Wade.

Very Fossilliferous Sandy Marl, Coon Creek, McNairy County.

Figure 17. Unidentified fossil collectors in Coon Creek. Members of the Weeks family generously assisted Bruce Wade in his collecting efforts from 1915 to 1920. This photo is from Wade's article "Recent Studies of the Upper Cretaceous of Tennessee" published in the Administrative Report of the State Geologist, 1919. Tennessee Geological Survey Bulletin 23, facing page 60.

Bruce Wade

Bruce Wade entered Johns Hopkins University as a graduate student on October 5, 1914. He worked in the Geological Laboratories of Dr. W. B. Clark. His advisor was Edward W. Berry whose comprehensive monographs on the fossil plants and ancient ecology of the Southeastern United States made him one of the outstanding paleontologists of the day. Berry suggested that Wade describe and map in detail the Cretaceous deposits of western Tennessee for his dissertation.

Figure 18. Dave Weeks generously helped collect fossilized seashells in the creek on the farm for his friend Bruce Wade. Image from the collections of the Tennessee Division of Geology.

Wade surveyed, first by horse and wagon and then by motorcycle, the Upper Cretaceous deposits of McNairy, Decatur, and Chester Counties of Tennessee during summer vacations. He prepared

a geological map and made rock and mineral collections for county reports. These studies proved to be especially valuable to Professor Berry. Berry's 1925 United States Geological Survey monograph "The Flora of the Ripley Formation" credited Wade for most of the specimens used in the report.

In the course of his work, Wade found the first reported North American insect in amber in the Cretaceous deposits at Coffee Landing, Hardin County, Tennessee.

Bruce Wade discovered the Coon Creek fossil site on the Dave Weeks farm in northeastern McNairy County, Tennessee, on June 29, 1915. His field notes record:

> Dave Week's place
> 20' white clayey material not well exposed
> 30' iron concretion and clay
> 25' fos. Micaceous shale yellowish-red
> 10' bluish micaceous, extremely fossiliferous, shells beautifully preserved. Exposure 1/4 mile down creek. Important that a good collection be made here

Wade collected the locality several times during the 1915 field season. Eight publications from 1917 and 1918 reflect his work on the Coon Creek fauna, the extent of the Tuscaloosa Formation, and the gravel resources of the Lower Tennessee Valley.

Wade noted in his 1917 report, "A Remarkable Upper Cretaceous Fauna from Tennessee, that he had found nearly 300 species of fossil animals. The preservation and variety of fossils from Coon Creek filled a major gap in the fossil record, proving critical to understanding Late Cretaceous- Early Tertiary trends in molluscan evolution. Berry

Figure 19. Coon Creek cuts deeply into Late Cretaceous fossil-bearing clays and sands. Image courtesy of the Memphis Pink Palace Museum.

suggested that Wade change his dissertation topic from the Cretaceous geology of Western Tennessee to the fossil marine snails of Coon Creek. As Wade later remarked in his 1917 paper “Recent Studies of the Upper Cretaceous of Tennessee”,

> The occurrence of so many well-preserved shells in deposits as old as the Cretaceous is uncommon. No other single locality in the American Cretaceous that has yet been studied has produced so large an assemblage of such excellent fossils, which even rival best Cretaceous collections from any of the European or Indian localities.

Wade's dissertation "The Gastropoda of the Ripley Formation, Tennessee", was successfully defended at Johns Hopkins University in May of 1917.

The year 1917 was a year of international turmoil. Culp and Ross state in Gibson County Past and Present: The first general history of one of West Tennessee's most pivotal counties:

> The United States entered World War I before Bruce's graduation. The new Dr. Wade volunteered for the United States Army. Lt. Wade was sent to Europe with the 350th Field Artillery of the famed 92nd "Buffalo" Division, serving as an officer in this traditionally black unit.

Wade served honorably and was wounded in battle.

Wade returned to the Tennessee Geological Survey and his studies of the Cretaceous of West Tennessee after the war. He wrote corrections to several of his pre-war papers, admitting that they were prepared in haste prior to leaving for military service.

Wade's Coon Creek snail studies were expanded to include all animals in 1919 and 1920. The reorganized report was developed into a general monograph on the Coon Creek fauna and Cretaceous geology of West Tennessee. It was published as Professional Paper 137 by the United States Geological Survey. "The Fauna of the Ripley Formation on Coon Creek, Tennessee" reported 350 species from the site including significant populations of bryozoans, gastropods, bivalves, cephalopods, crabs and lobsters, along with bony fish and shark teeth and mosasaur remains Wade, 1926 . Curiously, Wade reported that he found no foraminifera at the site, an inconsistency quickly corrected by micropaleontological studies by Berry and Kelly, in 1929 and Cushman in 1931. Additional scholarly articles on the Upper Cretaceous deposits of Tennessee and the genus *Hamulus* Morton were published during this period.

Wade left academic research in 1921 to join the Transcontinental Petroleum Company in Tampico, Mexico, as an oil exploration geologist. He attended the September 1923 Los Angeles meeting of the American Association of Petroleum Geologists and was listed in the AAPG journal as an active professional member through 1924. Wade