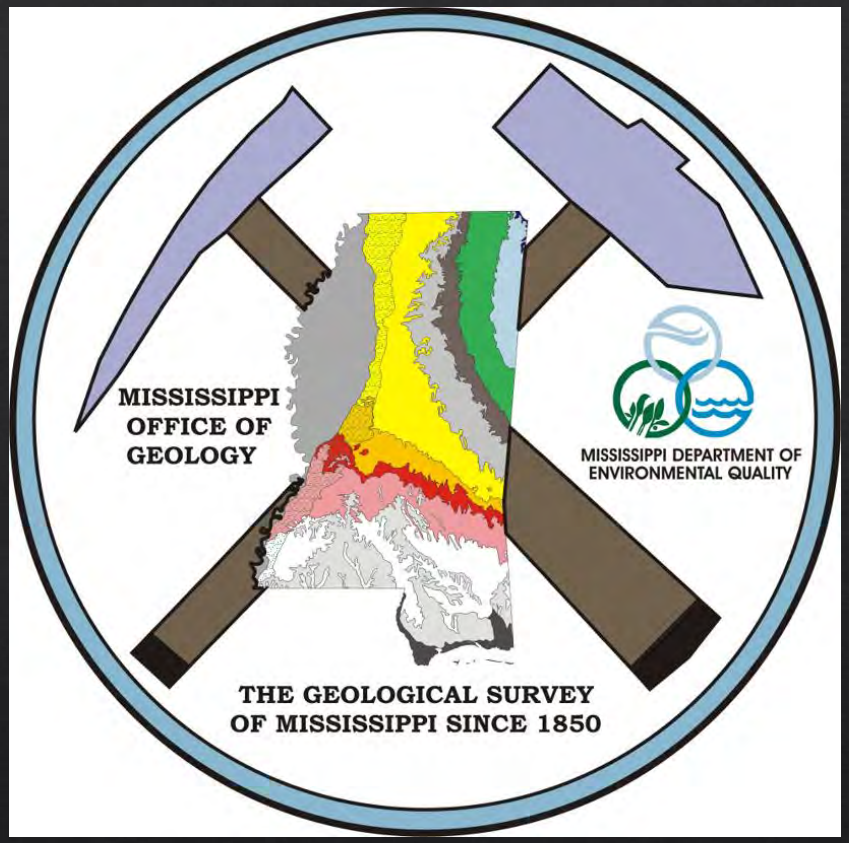
2020 STATEMAP
StateMap Advisory Committee Meeting

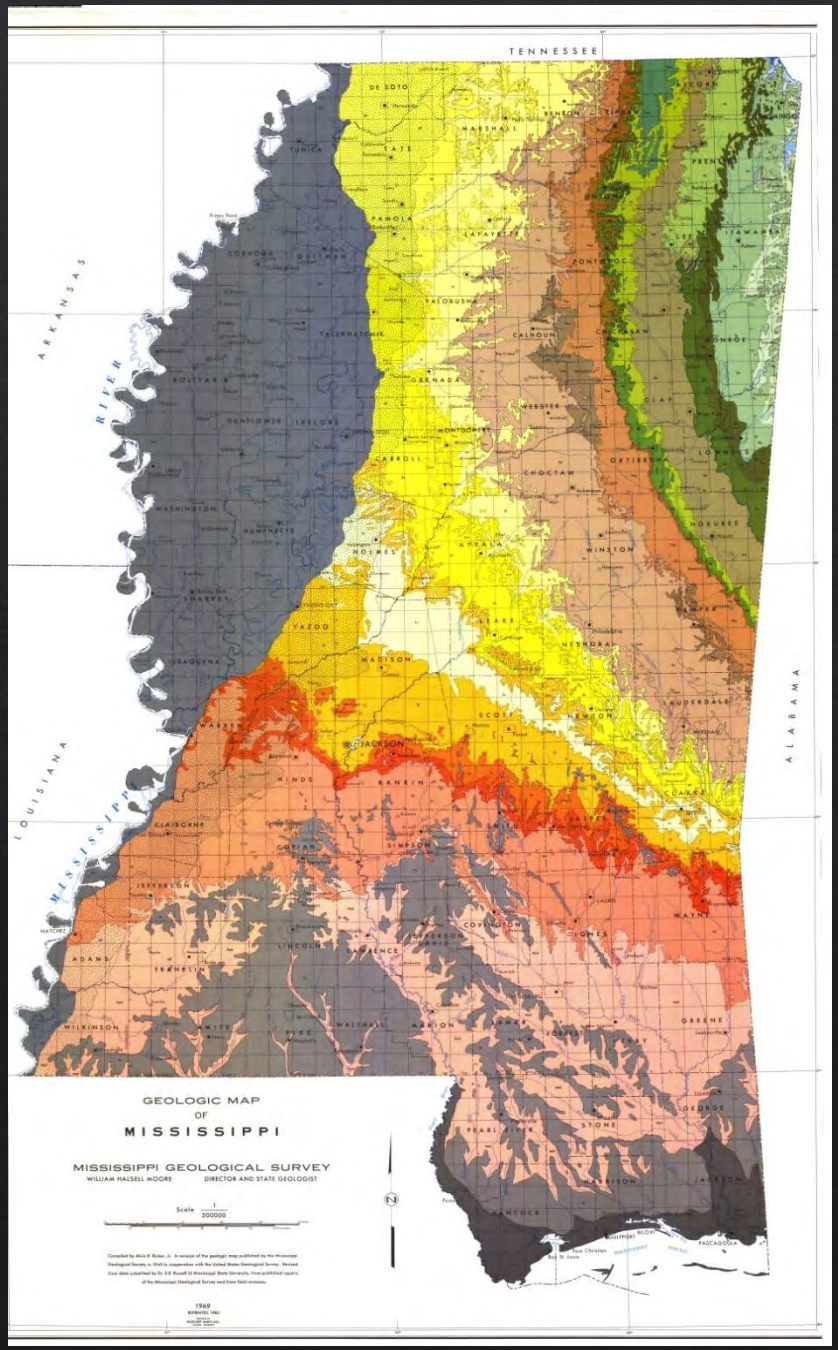


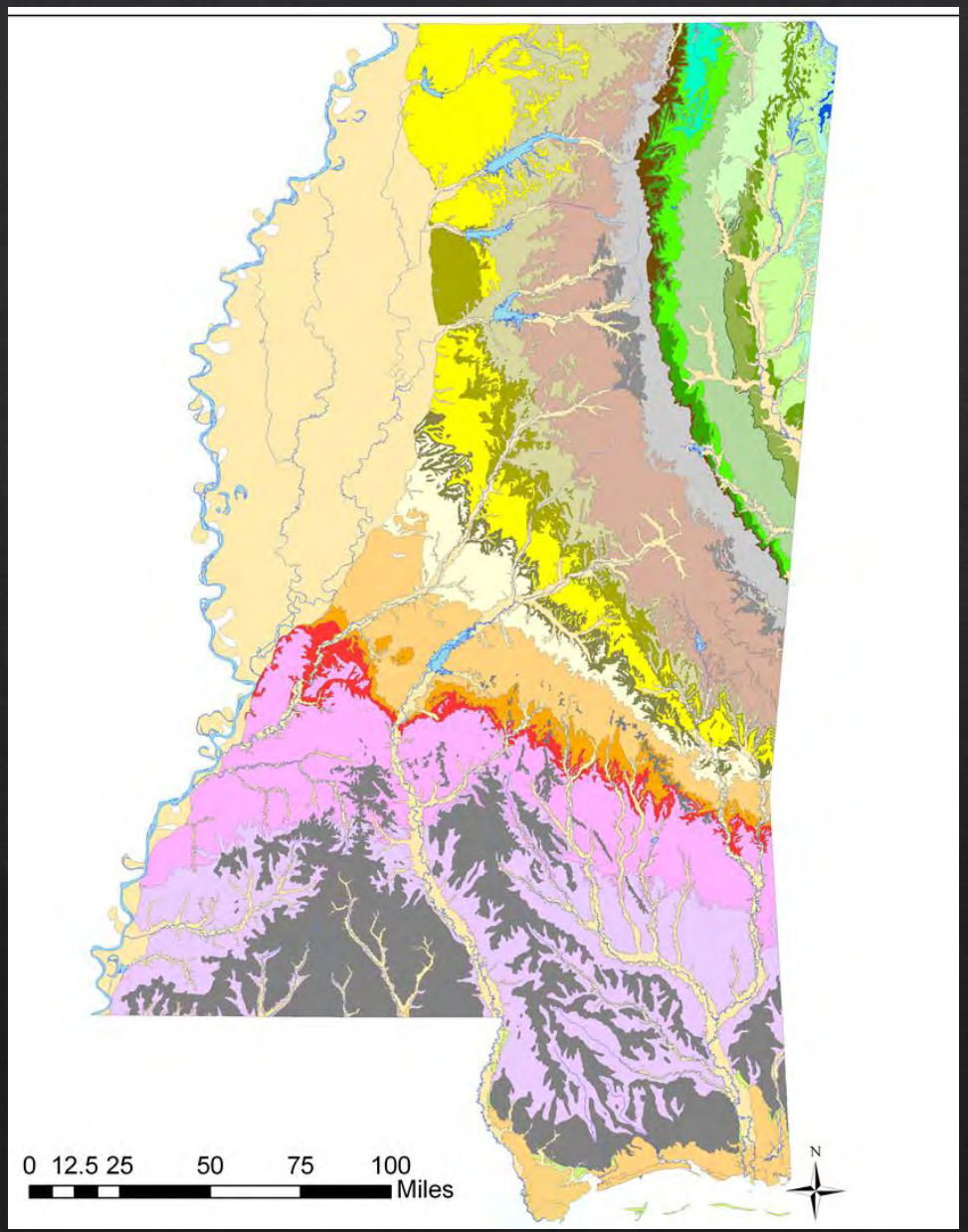
Mississippi Department of Environmental Quality

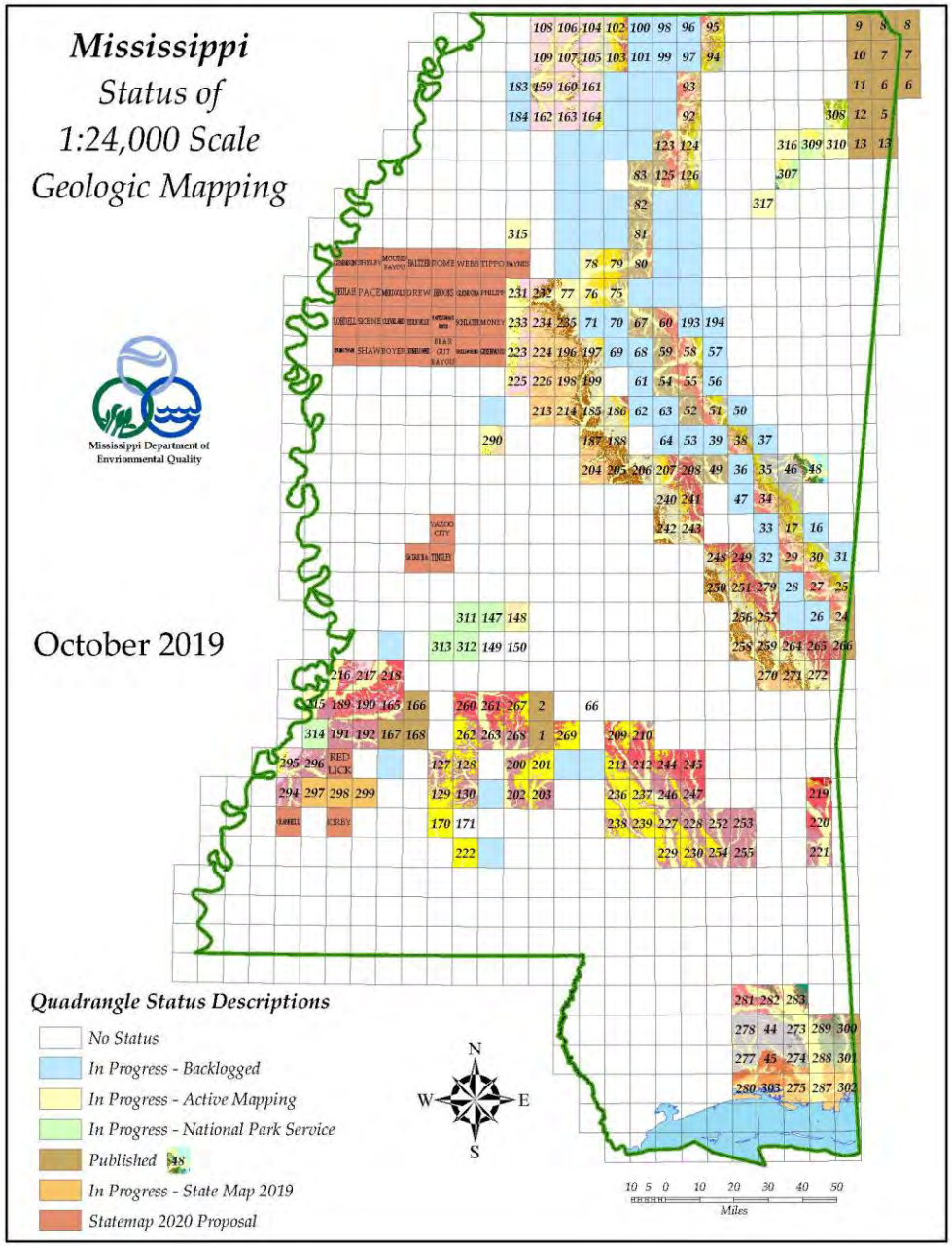
Office of Geology

October 29, 2019

Geologic Mapping in Mississippi


TENNESSEE
ARKANSAS
RIVER
LOUISIANA
MISSISSIPPI
ALABAMA
GEOLOGIC MAP
OF
MISSISSIPPI
MISSISSIPPI GEOLOGICAL SURVEY
WILLIAM HALSELL MOORE DIRECTOR AND STATE GEOLOGIST
Scale 1 500000
1969


0 12.5 25 50 75 100
Miles
N


Mississippi
Status of
1:24,000 Scale
Geologic Mapping
Mississippi Department of Envrionmental Quality
October 2019
Quadrangle Status Descriptions
No Status
In Progress - Backlogged
In Progress - Active Mapping
In Progress - National Park Service
Published
In Progress - State Map 2019
Statemap 2020 Proposal
N
W
E
S
10 5 0 10 20 30 40 50
Miles

AASG
Association of American State Geologists

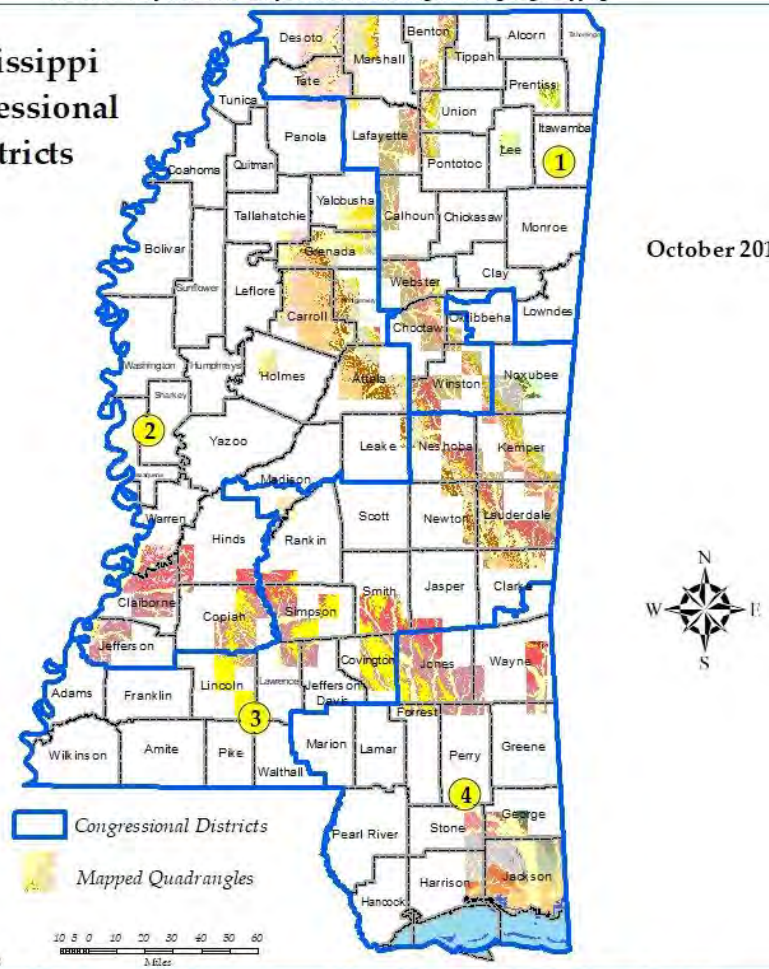
Mississippi Department of Environmental Quality

USGS
science for a changing world

National Cooperative Geologic Mapping Program

STATEMAP Component: States Compete for federal matching funds for geologic mapping.

Mississippi Congressional Districts



October 2019

N
W
E
S

Contact Information:

Mississippi Department of Environmental Quality
Office of Geology
State Geologist: David T. Dockery: **(601)-961-5544**
STATEMAP Contact: James E. Stames: **(601)-961-5542**
https://mdeq.ms.gov

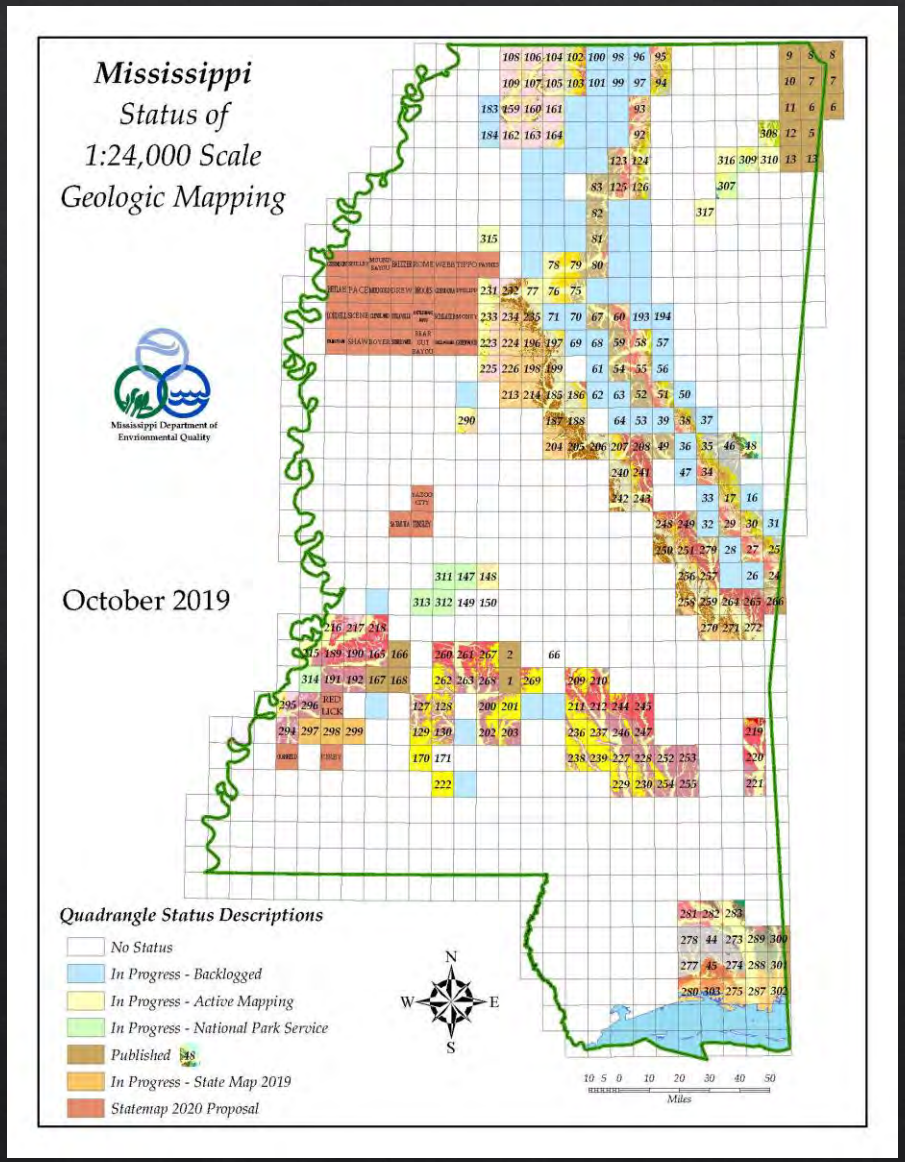
National Cooperative Geologic Mapping Program
United States Geological Survey
Program Coordinator: John Brock: **(703)-648-6053**
Associate Program Coordinator: Darcy K. McPhee: **(703)-648-6976**
https://ncgmp.usgs.gov

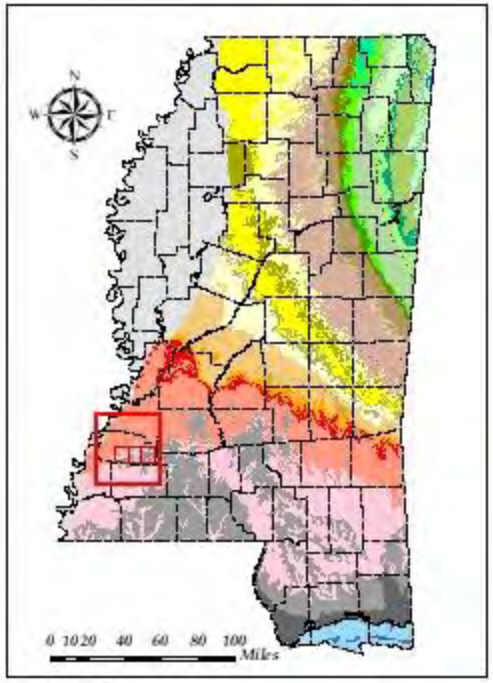
2018-2019 MOG Published Mapping

1. OFR 294 Church Hill 7.5 Minute Geologic Quadrangle
2. OFR 295 Rodney 7.5 Minute Geologic Quadrangle
3. OFR 296 Lorman 7.5 Minute Geologic Quadrangle
4. OFR 148 Madison 7.5 Minute Geologic Quadrangle
5. OFR 307 Tupelo 7.5 Minute Geologic Quadrangle
6. OFR 308 Marietta 7.5 Minute Geologic Quadrangle
7. OFR 309 Ratliff 7.5 Minute Geologic Quadrangle

In Progress Mapping

- STATEMAP 2019
  1. Fayette 7.5 Minute Geologic Quadrangle
  2. Union Church 7.5 Minute Geologic Quadrangle
  3. Gin Branch 7.5 Minute Geologic Quadrangle
- Federal Park Service Mapping (2019-2022)
  - *MOG*
  4. Ridgeland 7.5 Minute Geologic Quadrangle
  5. Widows Creek 7.5 Minute Geologic Quadrangle
  6. Pocahontas 7.5 Minute Geologic Quadrangle
  7. Clinton 7.5 Minute Geologic Quadrangle
  8. Raymond 7.5 Minute Geologic Quadrangle
  - *Darrel Schmitz, RPG and MOG*
  9. Kirkville 7.5 Minute Geologic Quadrangle
  10. Guntown 7.5 Minute Geologic Quadrangle
  11. Bissell 7.5 Minute Geologic Quadrangle
- Ole Miss EDMAP (Ronald Counts, RPG)
  12. Charleston 7.5 Minute Geologic Quadrangle
- MOG Backlog of 70 Geologic Quadrangles



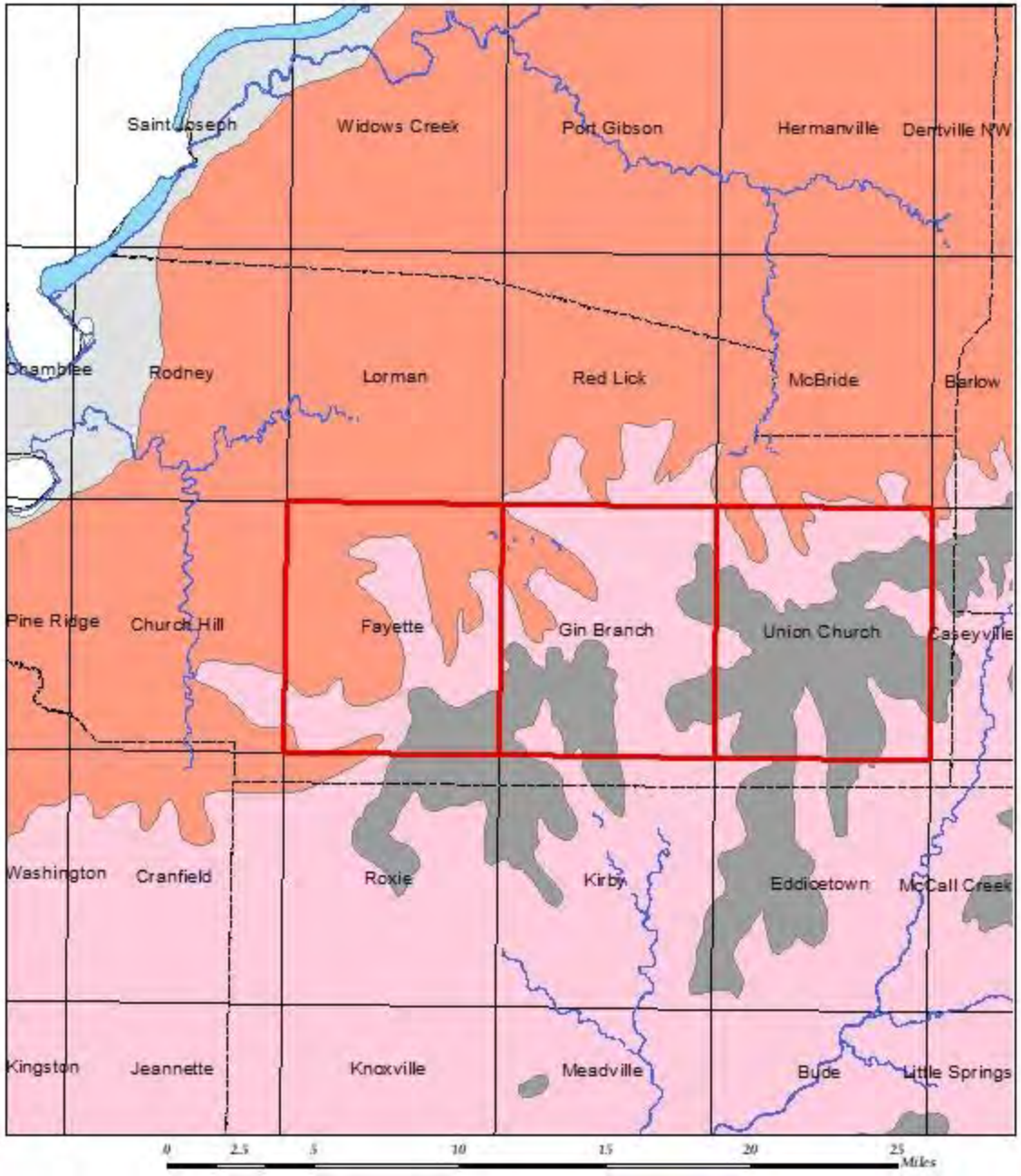


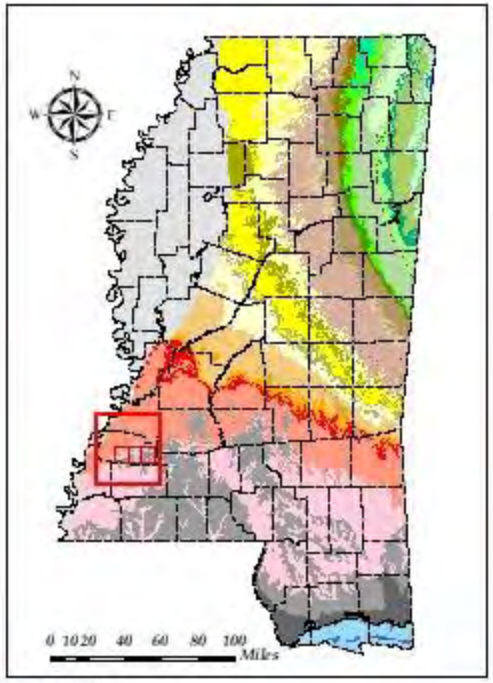
Legend

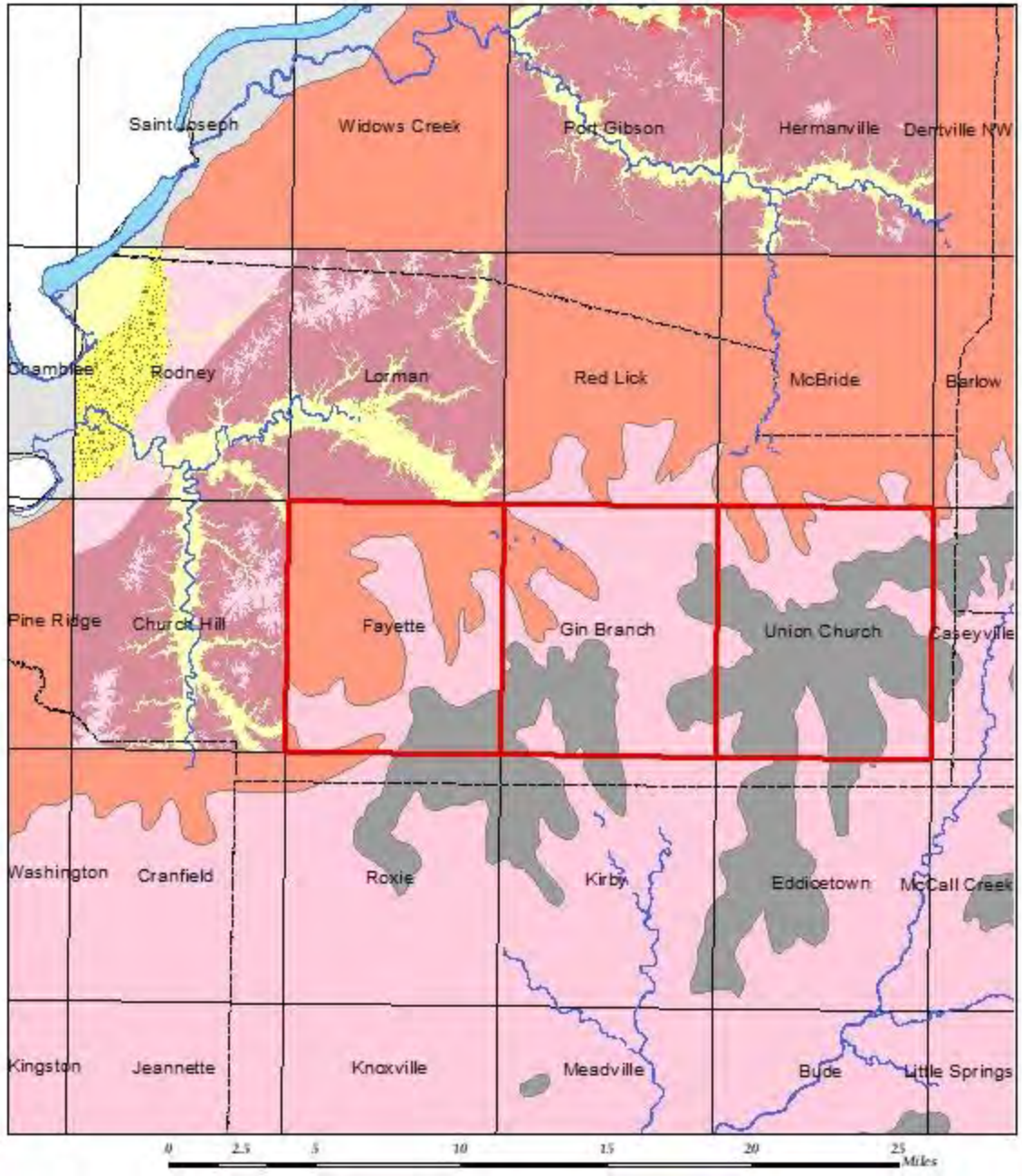
Current 2019 STATEMAP project

1969 Mississippi Geologic Map

- Catahoula Formation
- Citronelle Formation
- Mississippi River Alluvium
- Pascagoula/Hattiesburg Formation







Legend

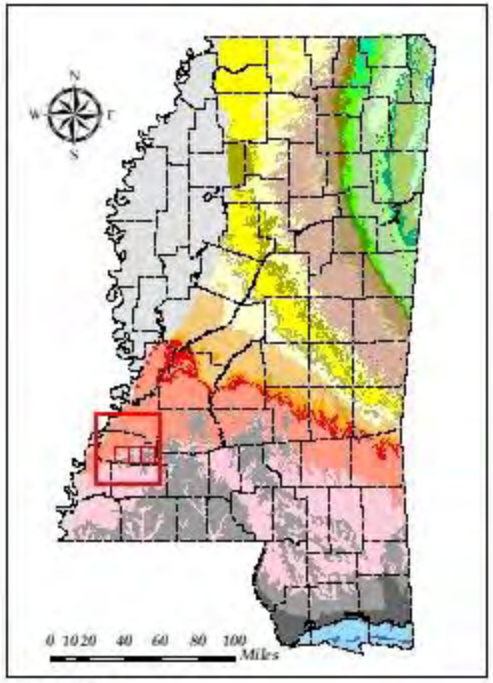
Current 2019 STATEMAP project

1:24k Mapped by the Office of Geology

- Alluvial Fan
- Alluvium
- Terrace
- Low Terrace
- Pre-Loess Terrace
- Cathoula Formation
- Hattiesburg Formation

1969 Mississippi Geologic Map

- Catahoula Formation
- Citronelle Formation
- Mississippi River Alluvium
- Pascagoula/Hattiesburg Formation

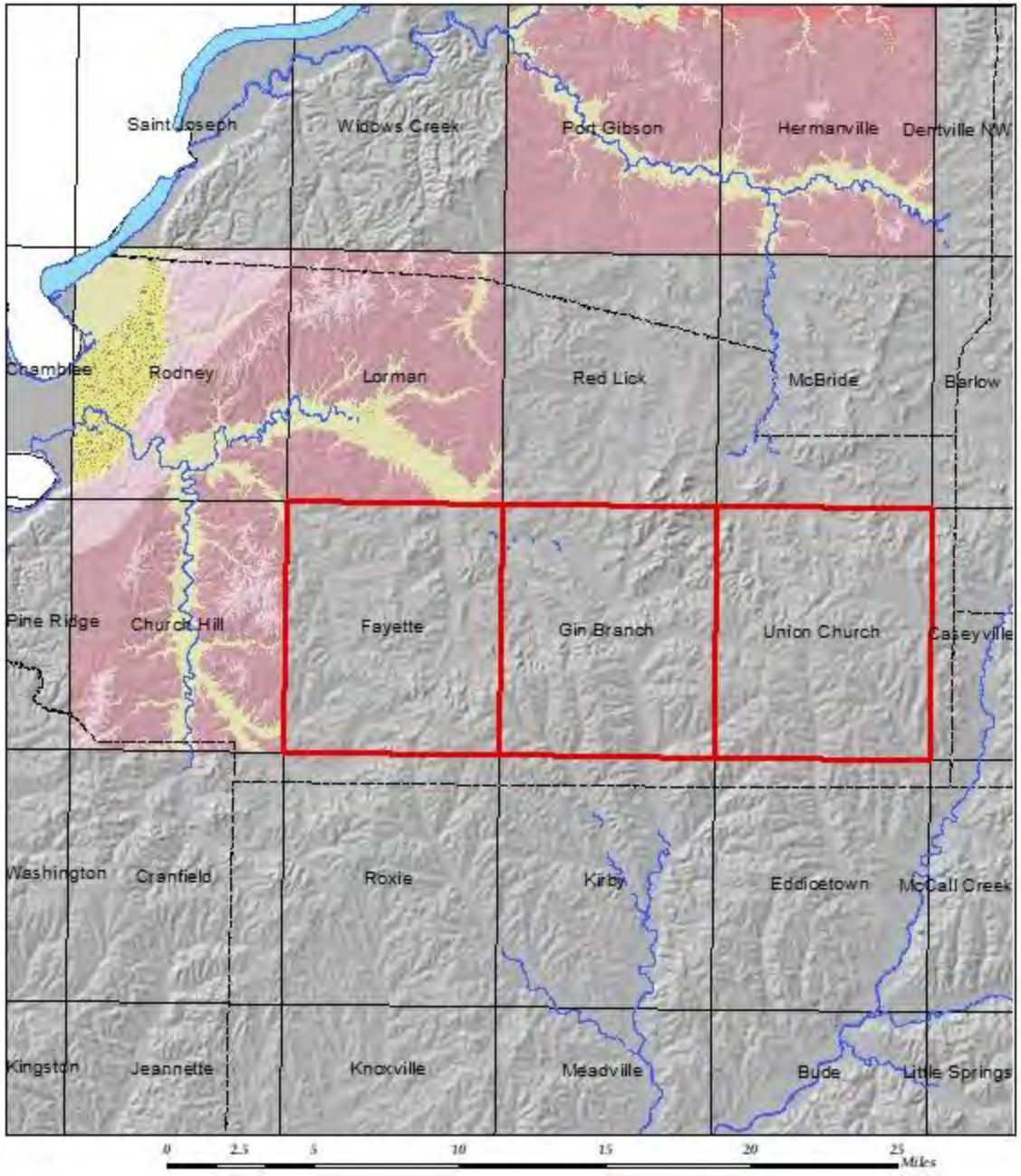


Legend

Current 2019 STATEMAP project

1:24k Mapped by the Office of Geology

- Alluvial Fan
- Alluvium
- Terrace
- Low Terrace
- Pre-Loess Terrace
- Cathoula Formation
- Hattiesburg Formation



2020 Proposal

Project 1: Jefferson County

- 1:24k Geologic Map of the Cranfield Quadrangle, Jefferson, Adams, and Franklin Counties, Mississippi.
- 1:24k Geologic Map of the Red Lick Quadrangle, Jefferson and Claiborne Counties, Mississippi.
- 1:24k Geologic Map of the Kirby Quadrangle, Jefferson and Franklin Counties, Mississippi.

Project 2: Yazoo County

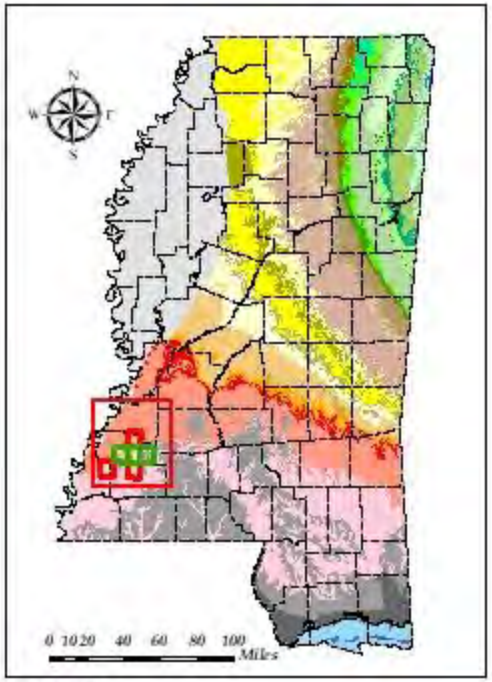
- 1:24k Geologic Map of the Tinsley Quadrangle, Yazoo County, Mississippi
- 1:24k Geologic Map of the Yazoo City Quadrangle, Yazoo County, Mississippi
- 1:24k Geologic Map of the Satartia Quadrangle, Yazoo County, Mississippi

Project 3: Greenwood

- 1:100k Geologic Map of the Greenwood Quadrangle, Coahoma, Tallahatchie, Bolivar, Sunflower, Grenada, Leflore, Carrol, and Washington Counties

Project 1: Jefferson County

- A continuation of STATEMAP 2018 and STATEMAP 2019
- Deliverables:
  - 1:24k Geologic Map of the Cranfield Quadrangle, Jefferson, Adams, and Franklin Counties, Mississippi.
  - 1:24k Geologic Map of the Red Lick Quadrangle, Jefferson and Claiborne Counties, Mississippi.
  - 1:24k Geologic Map of the Kirby Quadrangle, Jefferson and Franklin Counties, Mississippi.
- Conclusion of mapping in Jefferson County. In addition to the proposed project, the following are to be published:
  - Composite Geologic Map of Jefferson County
  - McBride 7.5-Minute Geologic Quadrangle
  - Barlow 7.5-Minute Geologic Quadrangle
  - Caseyville 7.5-Minute Geologic Quadrangle
  - McCall Creek 7.5-Minute Geologic Quadrangle
  - Eddicetown 7.5-Minute Geologic Quadrangle
  - Roxie 7.5-Minute Geologic Quadrangle
  - Pine Ridge 7.5-Minute Geologic Quadrangle
  - Chamblee 7.5-Minute Geologic Quadrangle
- Will provide additional data to delineate between Brookhaven Terrace and the different levels of Pre-Loess Terrace Deposits
- Will provide information to delineate the Pascagoula/Hattiesburg contact in southwest Mississippi
- Will aid in identifying recharge areas of MRVA through Alluvial Fans.

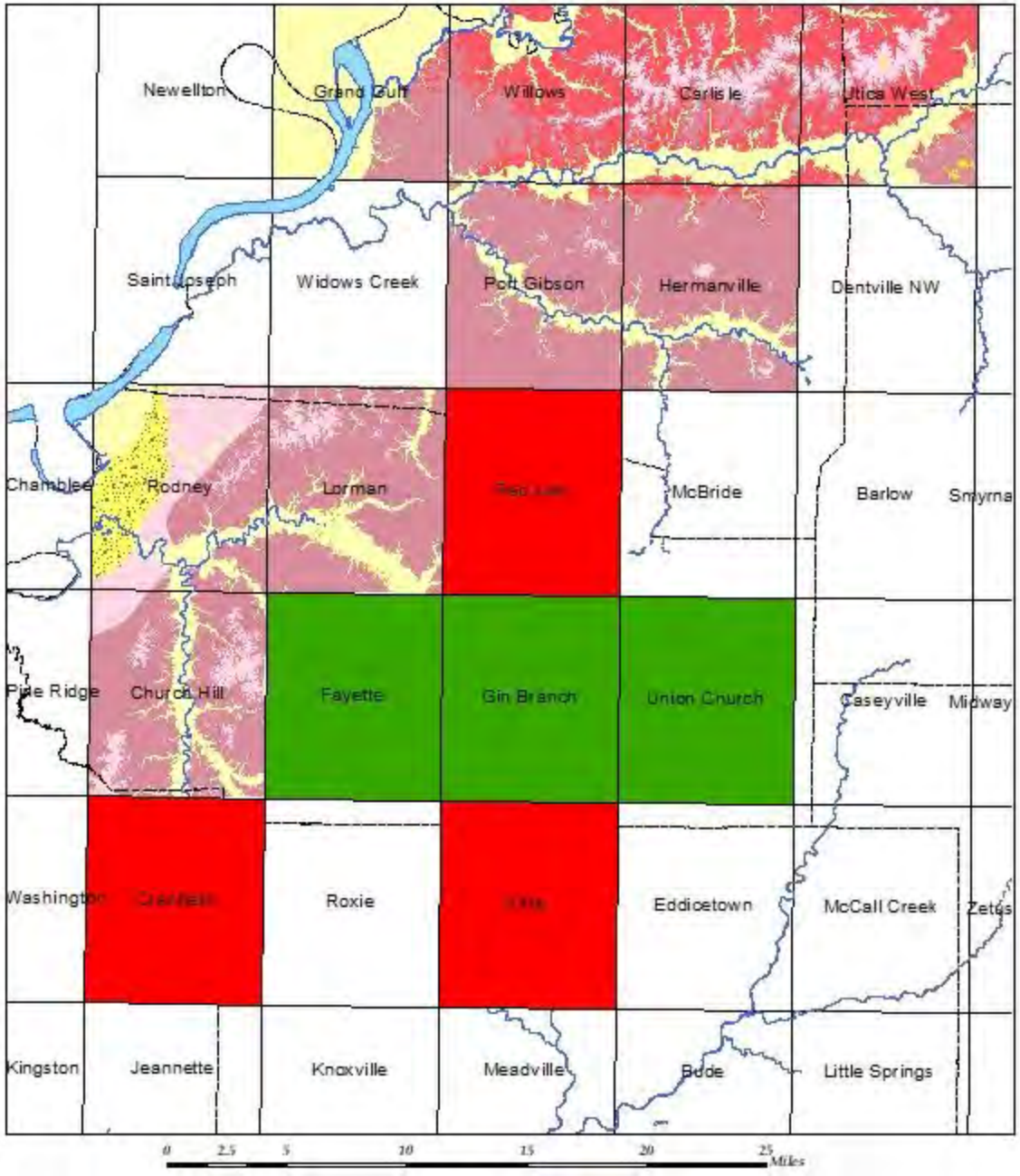


Legend

- 2019 STATEMAP
- Project 1 Proposal

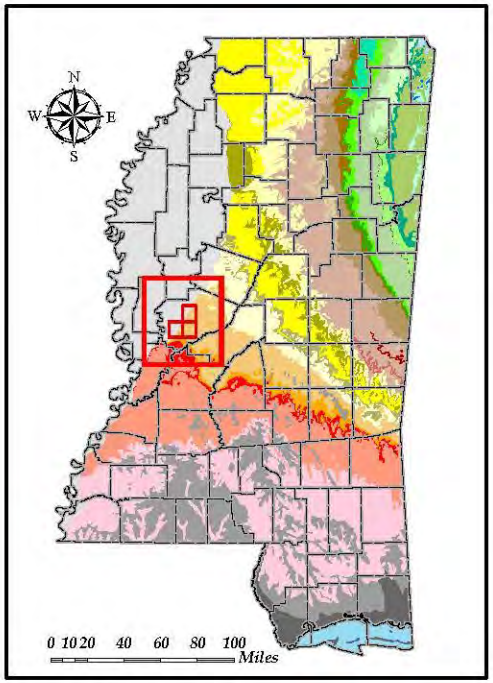
1:24k Mapped by the Office of Geology

- Brookhaven Terrace
- Alluvial Fan
- Alluvium
- Terrace
- Low Terrace
- Pre-Loess Terrace
- Cathoula Formation
- Hattiesburg Formation



Project 2: Yazoo County

- Deliverables:
  - 1:24k Geologic Map of the Tinsley Quadrangle, Yazoo County, Mississippi
  - 1:24k Geologic Map of the Yazoo City Quadrangle, Yazoo County, Mississippi
  - 1:24k Geologic Map of the Satartia Quadrangle, Yazoo County, Mississippi
- Will provide additional data to delineate the different Pre-Loess Terrace Deposits along the Bluff line
- Will provide an environmental background for the Tinsley area
- Will aid in identifying recharge areas of MRVA through alluvial fans
- Will aid in a detailed geomorphologic recharacterization of the Delta

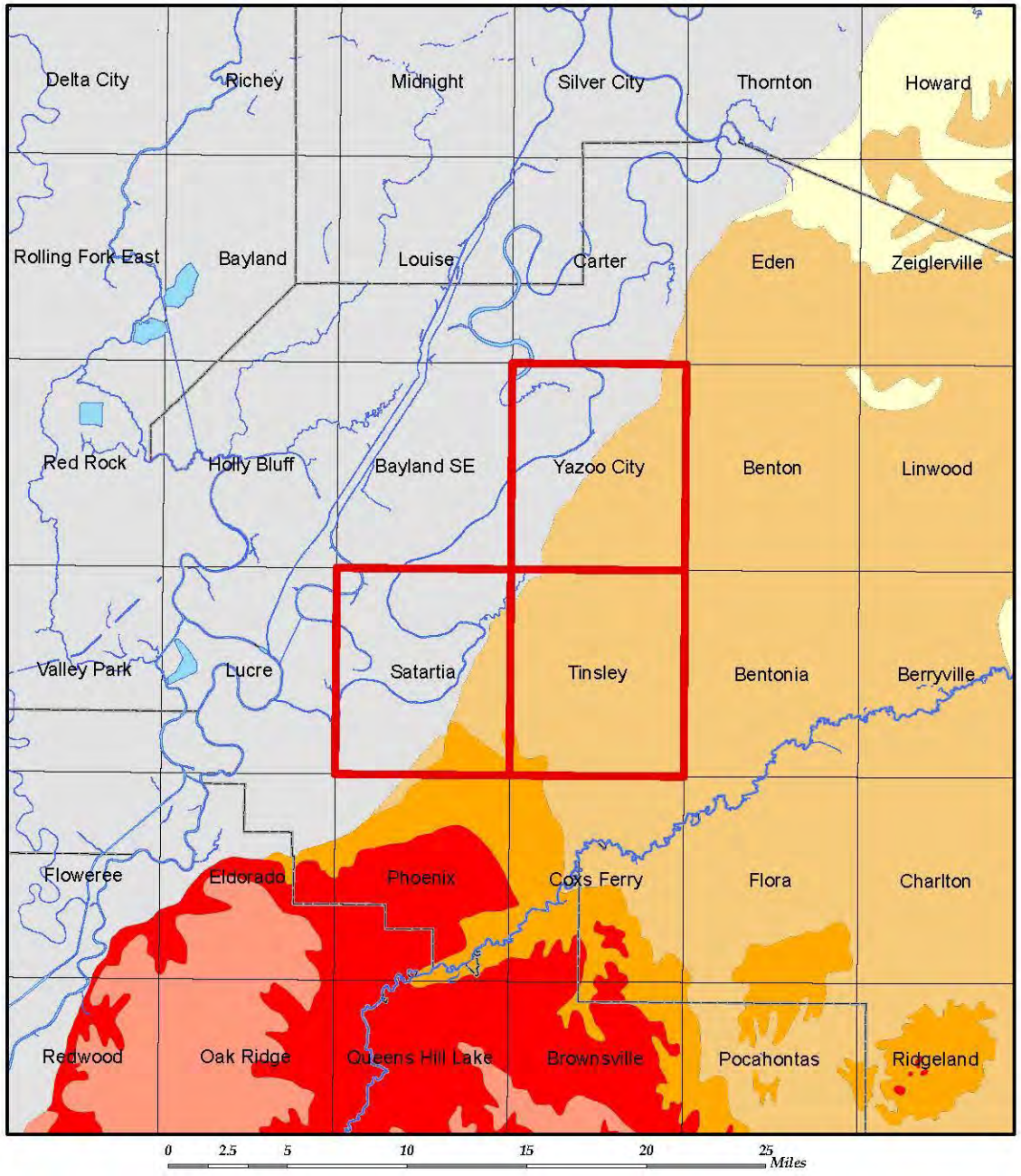


Legend

Project 2 Quadrangles

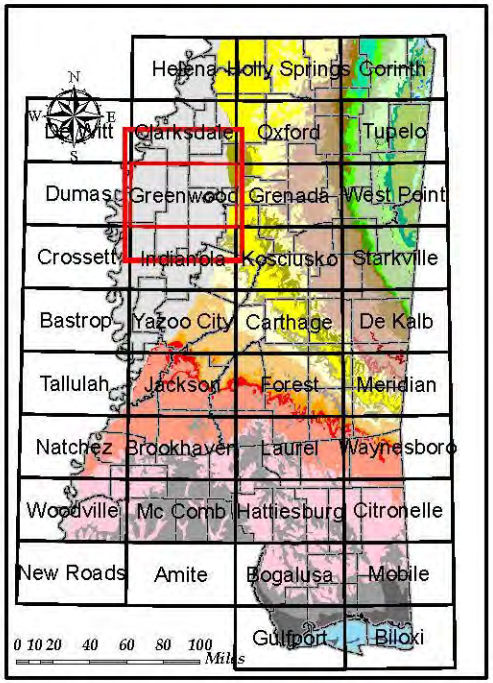
1969 Mississippi Geologic Map

- CATAHOULA
- COCKFIELD
- FOREST HILL/RED BLUFF
- JACKSON GROUP
- MS RIVER ALLUVIUM
- VICKSBURG/CHICKASAWHAY



Project 3: Delta

- Deliverable:
  - 1:100k Geologic Map of the Greenwood Quadrangle, Coahoma, Tallahatchie, Bolivar, Sunflower, Grenada, Leflore, Carrol, and Washington Counties
- Will provide additional data to delineate the different levels of Pre-Loess Terrace Deposits
- Will correct errors in the accepted interpretation of the Mississippi River Alluvial Plain by Saucier
- Will aid in identifying recharge areas of MRVA through Alluvial Fans



Legend

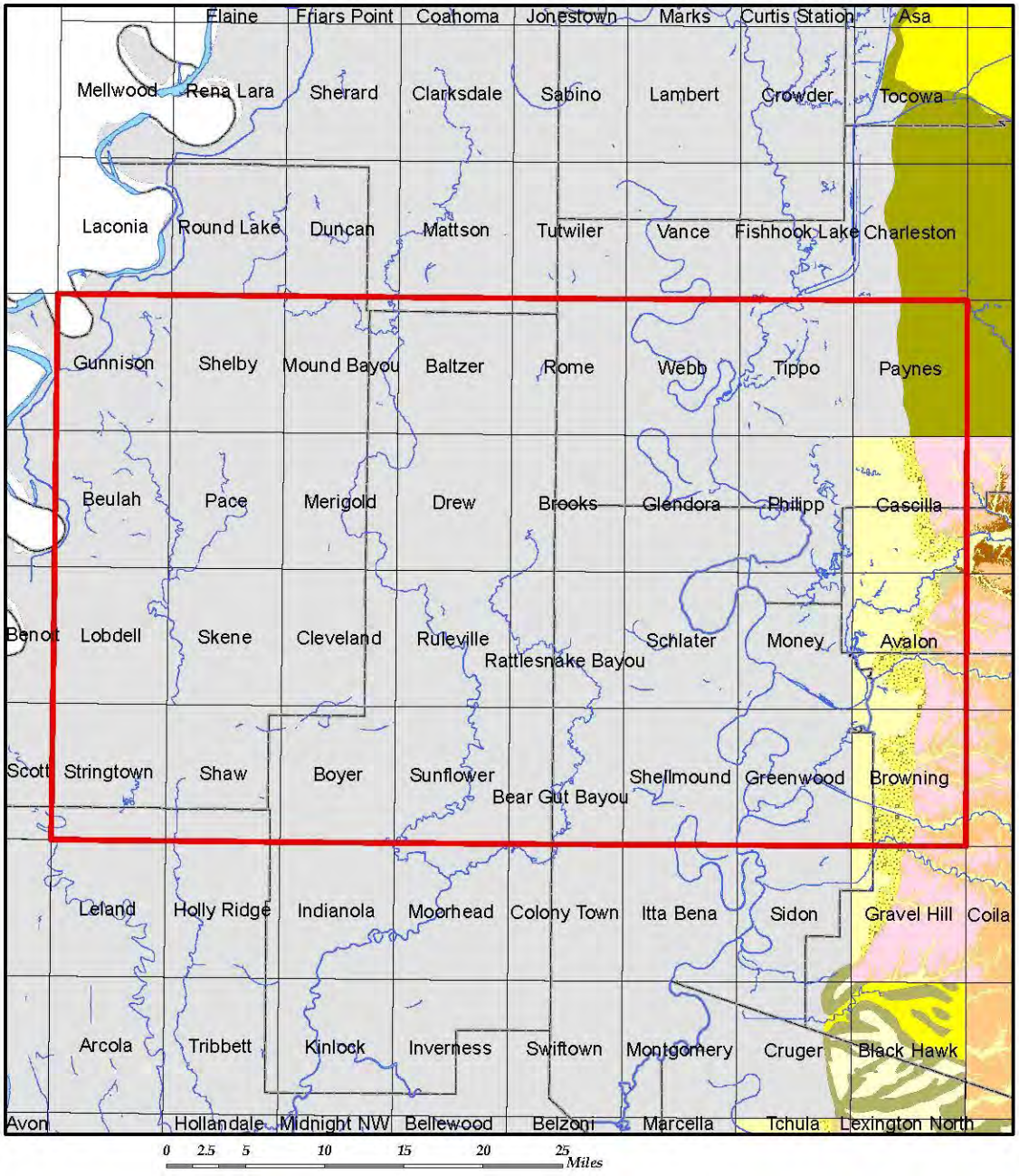
Project 3 Quadrangle

1:24k Mapped by the Office of Geology

- Alluvial Fan
- Alluvium
- Qp
- Terrace
- Tco
- Tk
- Twn-Tz

1969 Mississippi Geologic Map

- COCKFIELD
- COOK MOUNTAIN
- KOSCIUSKO
- MS RIVER ALLUVIUM
- TALLAHATTA
- ZILPHA/WINONA



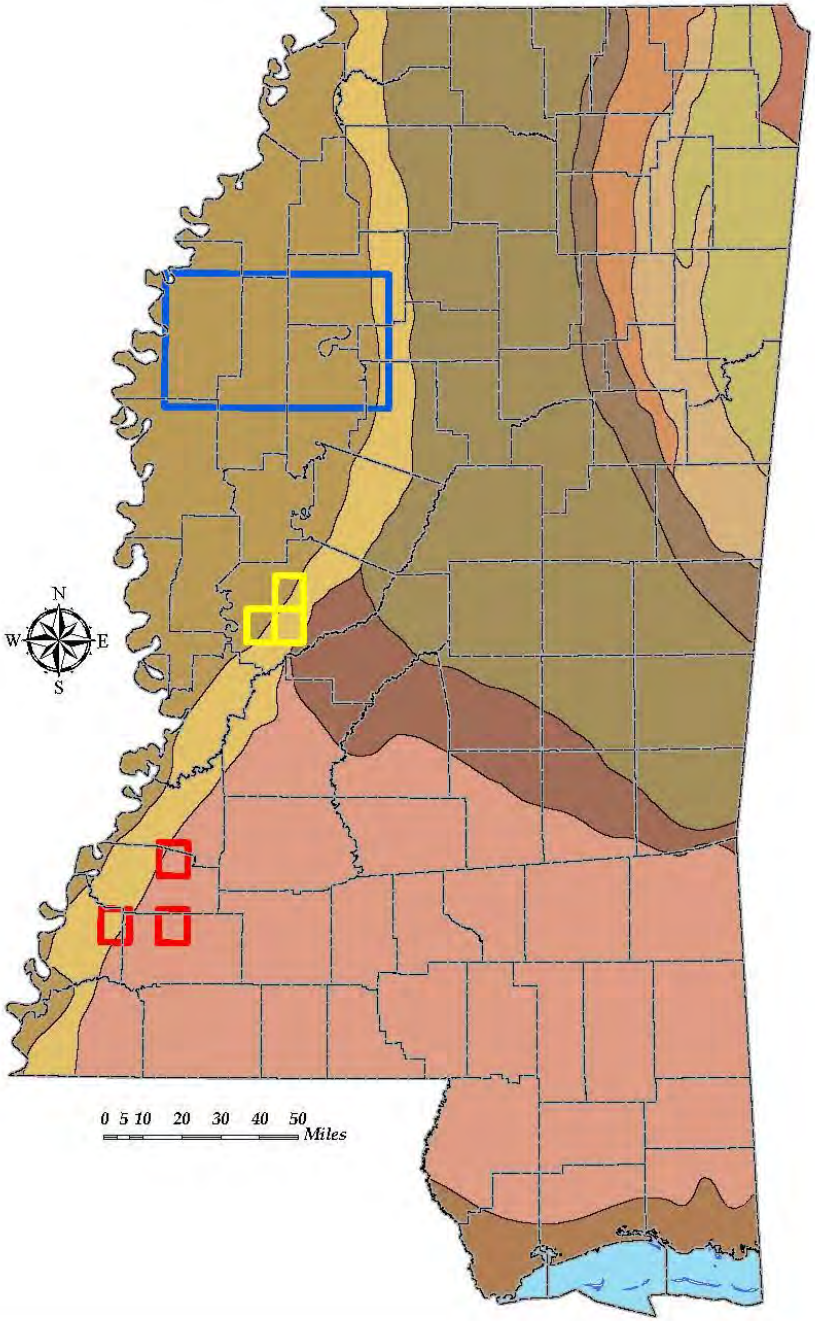
Geographic Setting

Legend

- *Project 1 Proposal*
- *Project 2 Proposal*
- *Project 3 Proposal*

Mississippi Physiographic Regions

- *Alluvial Plain*
- *Black Prarie*
- *Coastal Meadows*
- *Flatwoods*
- *Jackson Prarie*
- *Loess Hills*
- *North Central Hills*
- *Pontotoc Ridge*
- *Paleozoic Bottoms*
- *Southern Pine Hills*
- *Tombigbee and Tennesse River Hills*



Physiographic Regions

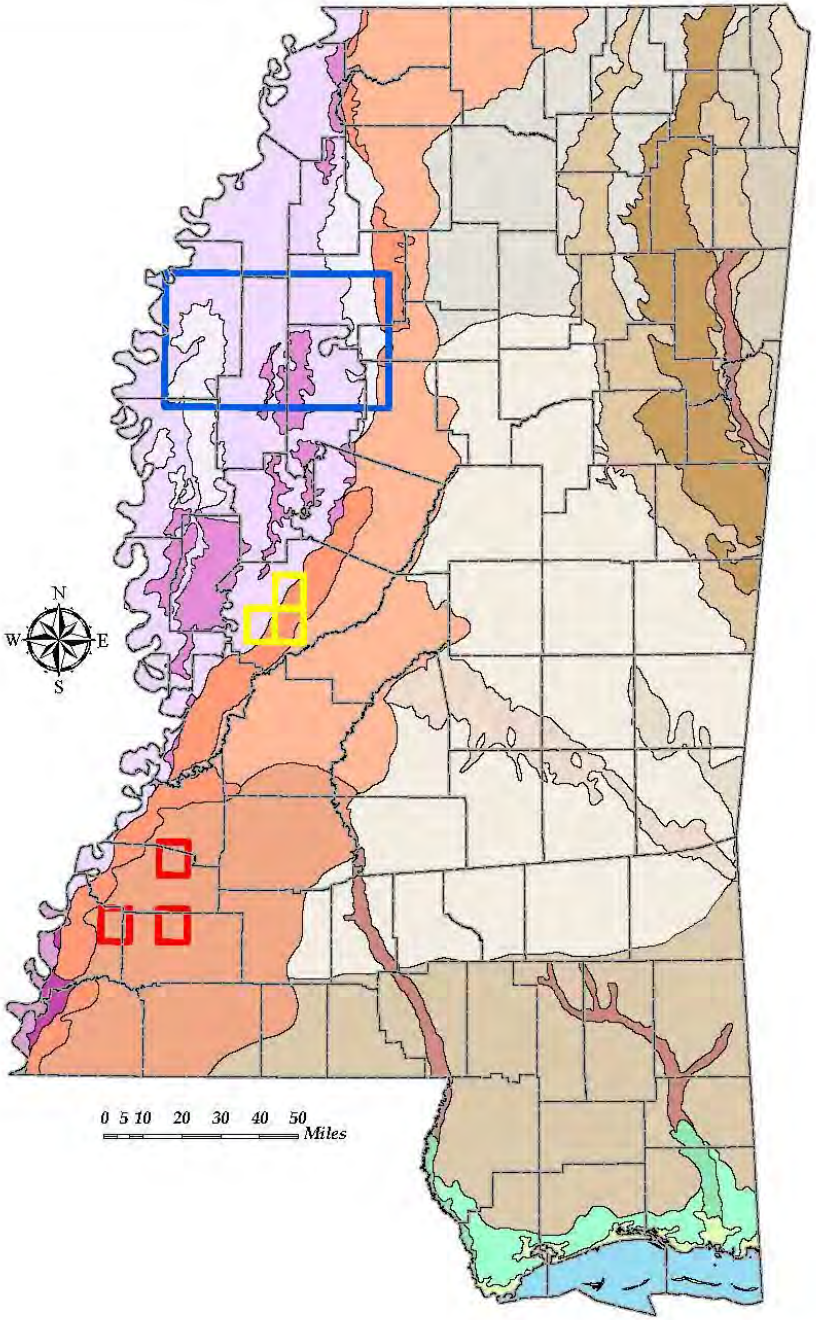
- Alluvial Plain: Projects 2 & 3, related to 1; The Mississippi River Alluvial Plain, also known as the Yazoo River basin, was once densely forested. It is the richest agricultural area of Mississippi that has been cleared for the planting of cotton and other crops.
- Loess Hills: Projects 1, 2, & 3; rugged terrain that borders the eastern edge of the Mississippi River alluvial valley from Tennessee to the Louisiana state line.
- Southern Pine Hills: Project 1; overlies the sand and clay units of the Miocene Grand Gulf Group.
- Jackson Prairie: Project 2; Overlies the Late Eocene marine Yazoo Clay; Is an important agricultural region and is particularly rich where it meets the Loess Hills.

Legend

- Project 1 Proposal
- Project 2 Proposal
- Project 3 Proposal

Mississippi Level IV Ecoregions

- 65a Blackland Prairie
- 65b Flatwoods/Blackland Prairie Margins
- 65d Southern Hilly Gulf Coastal Plain
- 65e Northern Hilly Gulf Coastal Plain
- 65f Southern Pine Plains and Hills
- 65i Fall Line Hills
- 65j Transition Hills
- 65p Southeastern Floodplains and Low Terraces
- 65q Buhrstone/Lime Hills
- 65r Jackson Prairie
- 73a Northern Holocene Meander Belts
- 73b Northern Pleistocene Valley Trains
- 73d Northern Backswamps
- 73k Southern Holocene Meander Belts
- 73m Southern Backswamps
- 74a Bluff Hills
- 74b Loess Plains
- 74c Southern Rolling Plains
- 75a Gulf Coast Flatwoods
- 75i Floodplains and Low Terraces
- 75k Gulf Barrier Islands and Coastal Marshes



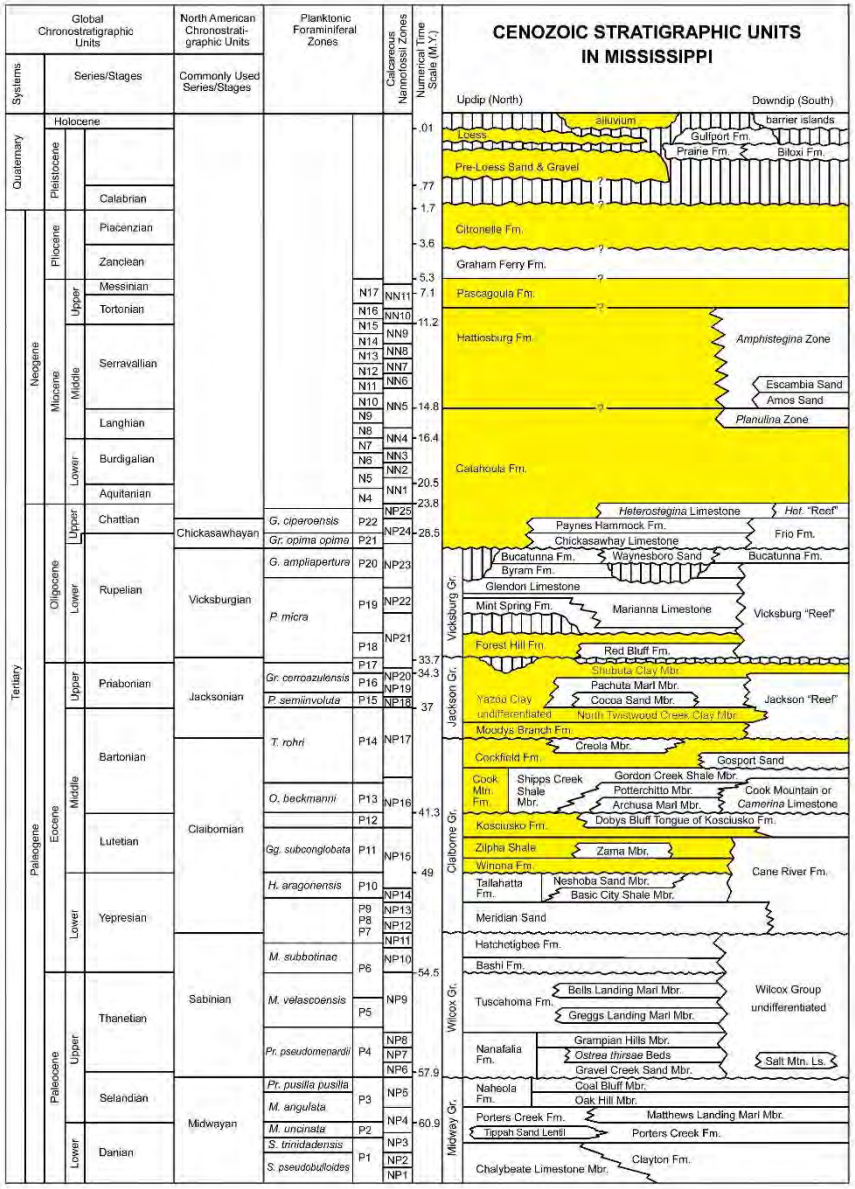
EPA Level IV Ecoregions

- Designed by the EPA to denote areas of general similarity in ecosystem.
- Project 1: Southern Rolling Plains
- Project 2: Bluff Hills, Northern Holocene Meander Belts, Loess Plains
- Project 3: Northern Pleistocene Valley Trains, Bluff Hills, Northern Backswamps, Northern Holocene Meander Belts, Loess Plains

Mapping Units

Mississippi Office of Geology
David T. Dockery III, 2008

After *MISSISSIPPI GEOLOGY*, V. 17, No. 1, March 1996, pp. 1-8.



Zilpha-Winona Formation

- Will be mapped in Project 3.

- Winona Sequence Cycle TAGC-3.2:

(1) Winona Formation - marine destructional shelf; transgressive systems tract and condensed section,

(2) Zilpha Formation - marine shelf and prodelta; highstand regressive systems tract

Jonathan Leard prying echinoids entombed in sandstone on the bank of the Chickasawhay River in Enterprise, MS

Kosciusko sandstone boulders resting on weathered Zilpha clay with an exposure of the Zilpha clay in the background in the SW/4 of Section 4, T. 15 N., R. 5 E. in Carroll County near Highway 51 south of the town of West. Picture (digital CD 15; Image 905) taken on March 6, 2007.

Protoscutella mississippiensis collected by MOG staff at Enterprise, MS

Kosciusko Formation

- Will be mapped in Project 3.
- Sparta Aquifer
  - an important ground-water resource in the sub-surface of central and northwestern Mississippi for public and industrial water supplies.
  - The most important aquifer for public water systems in the Greater Jackson Area.

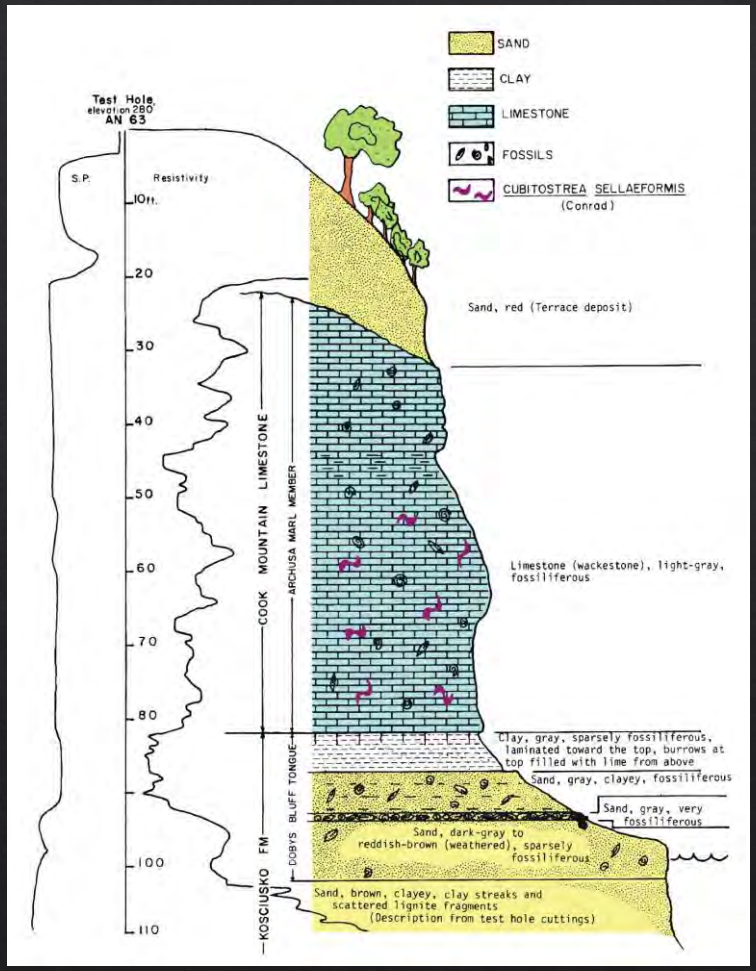
Winona Sequence Cycle TAGC-3.2:
(3) Kosciusko Formation - delta front and delta plain; highstand regressive systems tract.

Various artifacts of Kosciusko Sandstone and Orthoquartzite (not to scale)

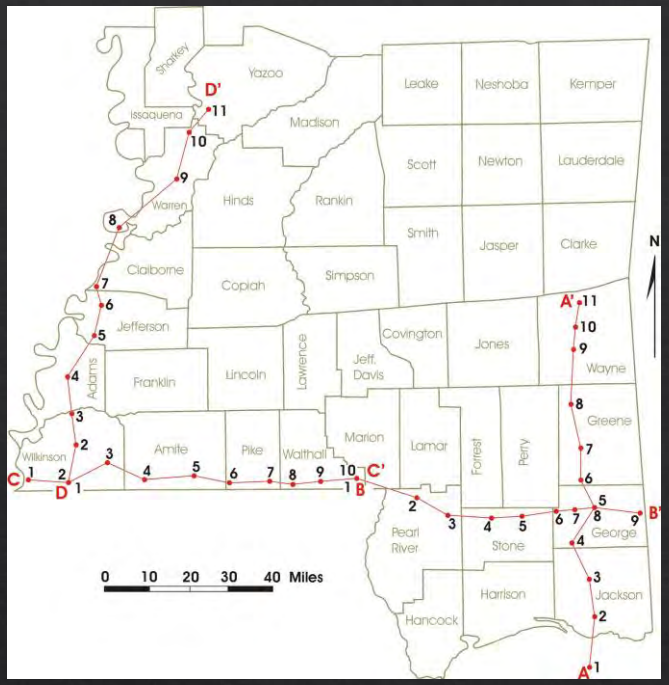
Cook Mountain Formation

- Will be mapped in Project 3.
- Non-Marine in this area of the state.

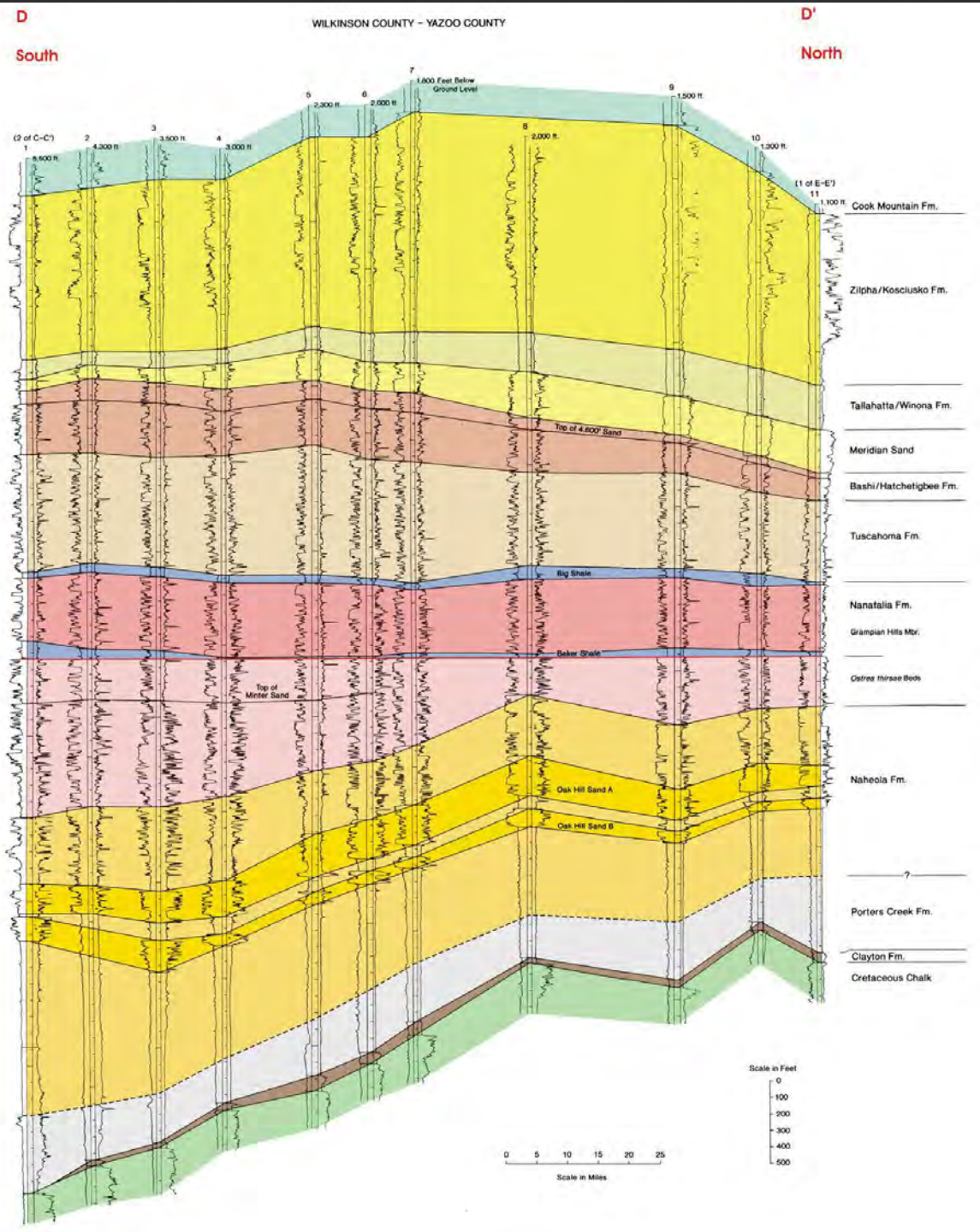
James Starnes standing on eroded clays of the Cook Mountain Formation on the east side of Highway 25 just north of the intersection with Highway 487 in Leake County. Picture (digital CD 23; Image 949) taken on June 30, 2007.(From Dockery, 2017)



Test hole geophysical log and measured section of the type locality of the Dobys Bluff Tongue of the Kosciusko Formation and the overlying Archusa Marl Member of the Cook Mountain Formation.

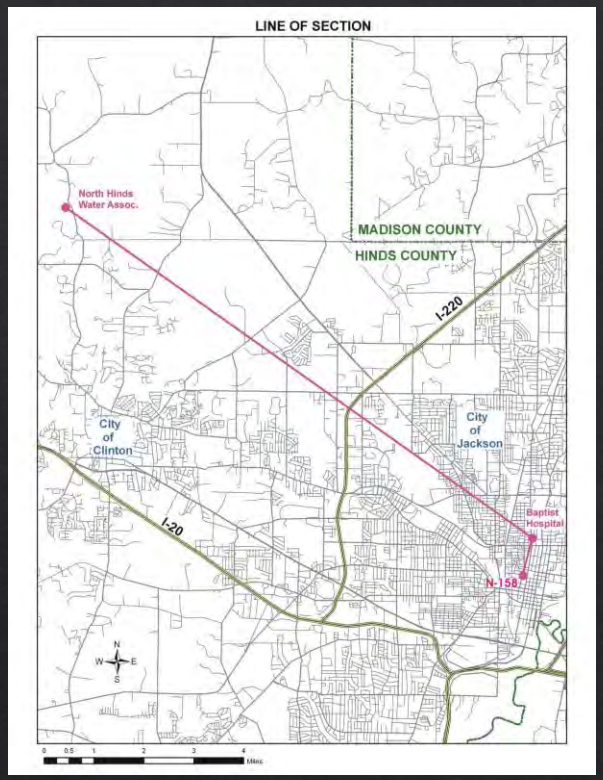


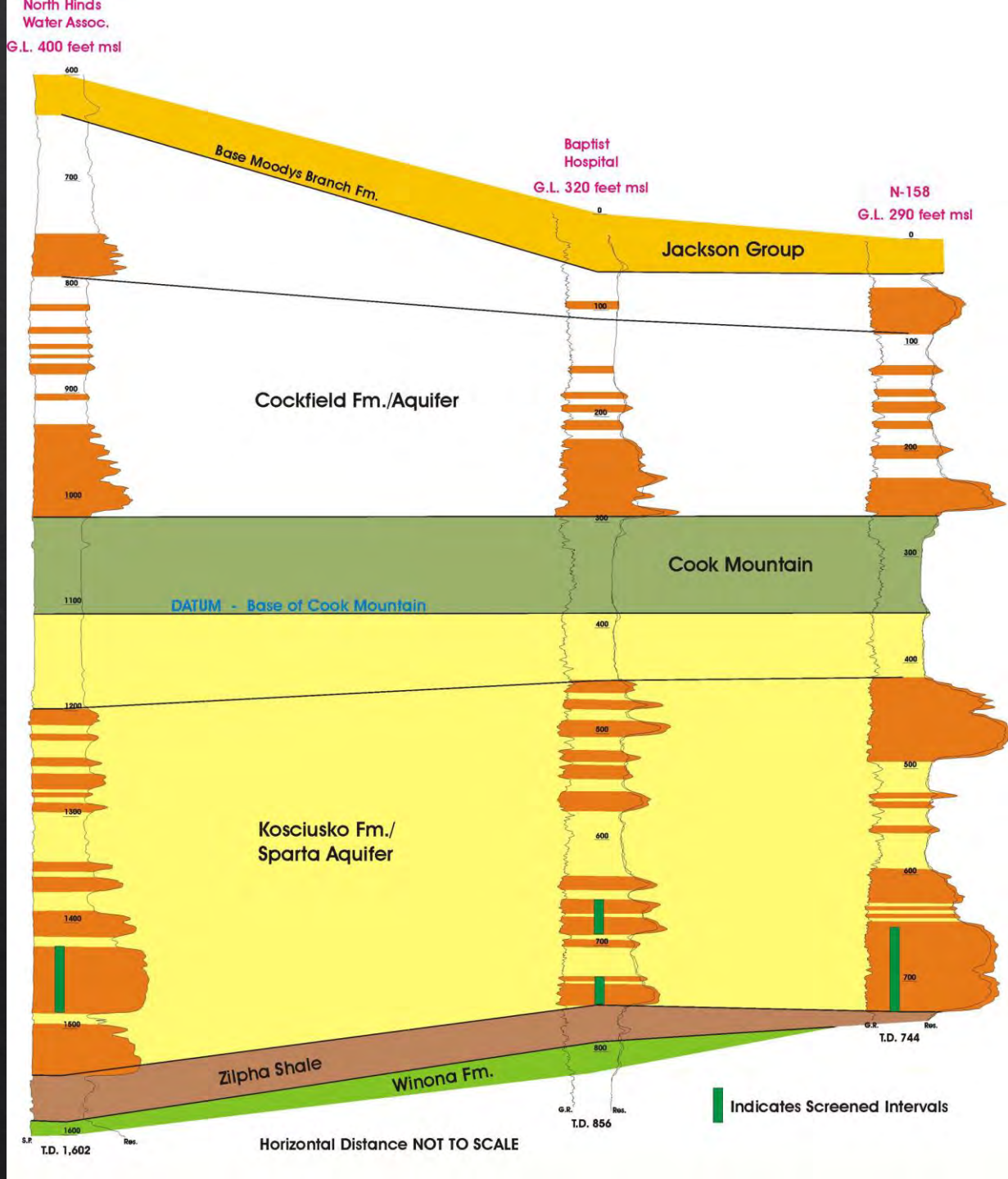
North-south cross section D-D' of the Midway, Wilcox, and lower Claiborne groups in southwestern Mississippi from Wilkinson to Yazoo County (from Dockery, 2001).



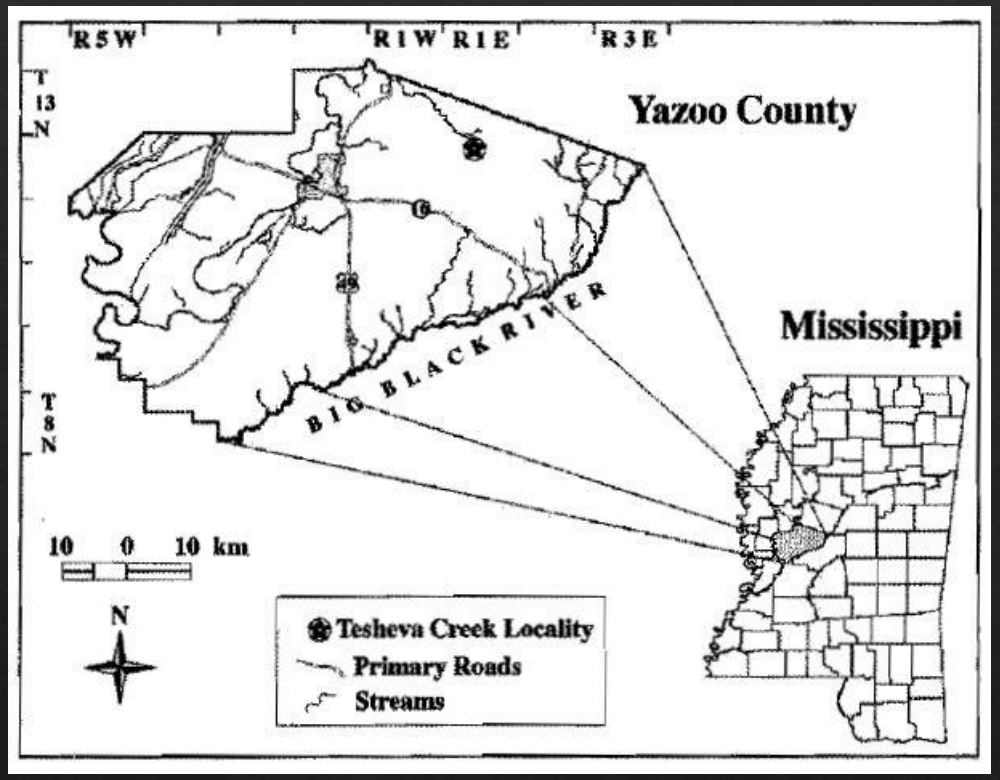
Cockfield Formation

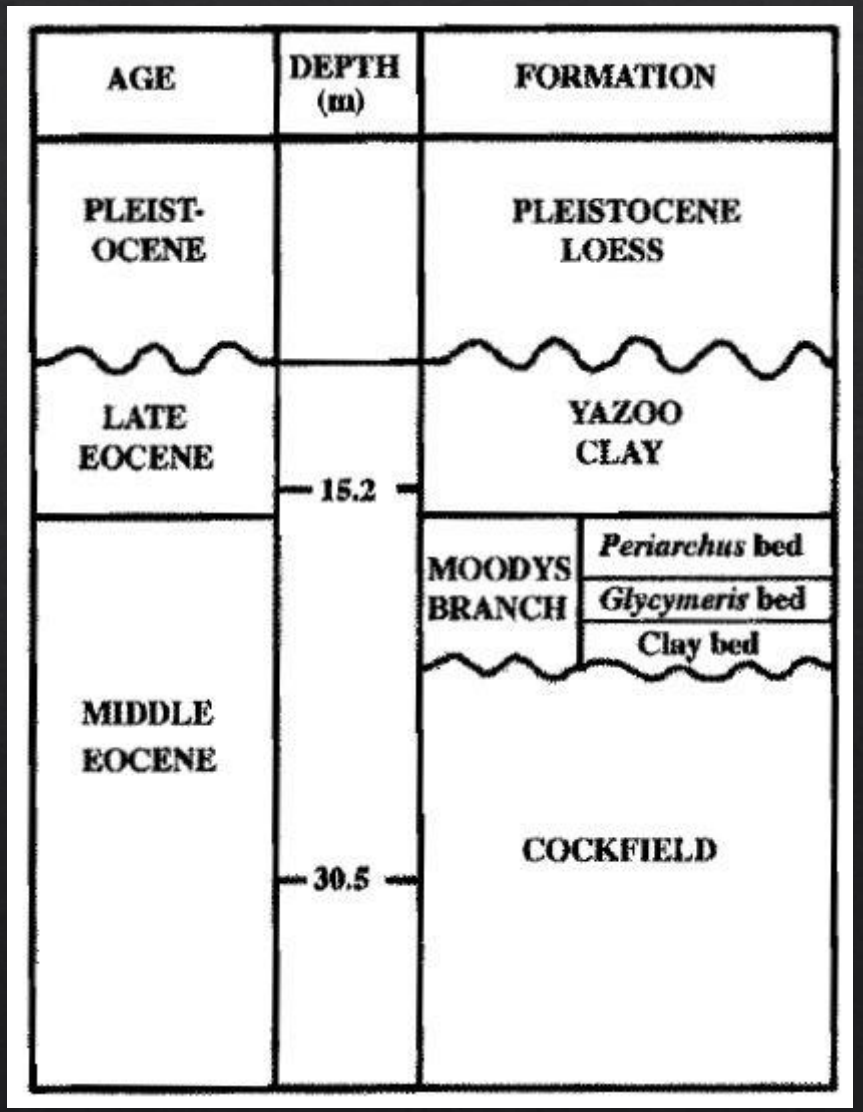
- Many residential wells acquire their water from the Cockfield aquifer in Hinds County
- Creola Member


LINE OF SECTION
North Hinds Water Assoc.
MADISON COUNTY
HINDS COUNTY
I-220
City of Clinton
City of Jackson
I-20
Baptist Hospital
N-158
N
W
E
S
0 0.5 1 2 3 4
Miles


North Hinds Water Assoc.
G.L. 400 feet msl
Base Moodys Branch Fm.
Baptist Hospital
G.L. 320 feet msl
N-158
G.L. 290 feet msl
Jackson Group
Cockfield Fm./Aquifer
Cook Mountain
DATUM - Base of Cook Mountain
Kosciusko Fm./
Sparta Aquifer
Zilpha Shale
Winona Fm.
S.P.
Res.
T.D. 1,602
G.R.
Res.
T.D. 856
G.R.
Res.
T.D. 744
Indicates Screened Intervals
Horizontal Distance NOT TO SCALE

Moodys Branch Formation





Moodys Branch Formation

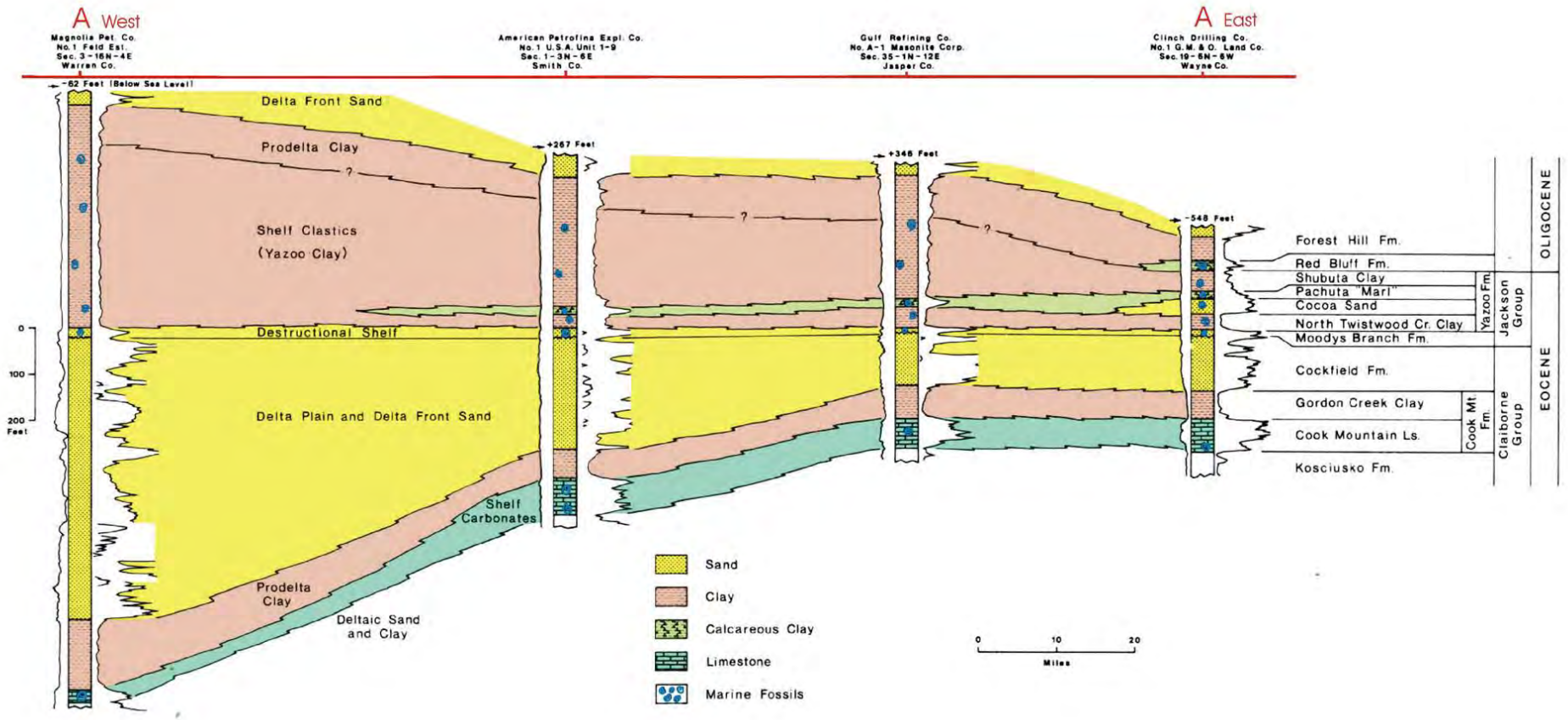
The Moodys Branch Formation is a thin, marine, destructional-shelf, sand facies overlying the Cockfield delta systems. This sand contains an abundance of well-preserved molluscan fossils.

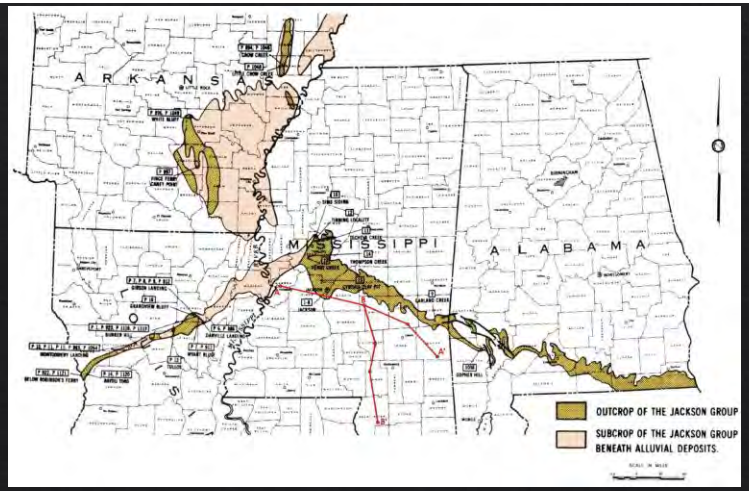
Yazoo Clay

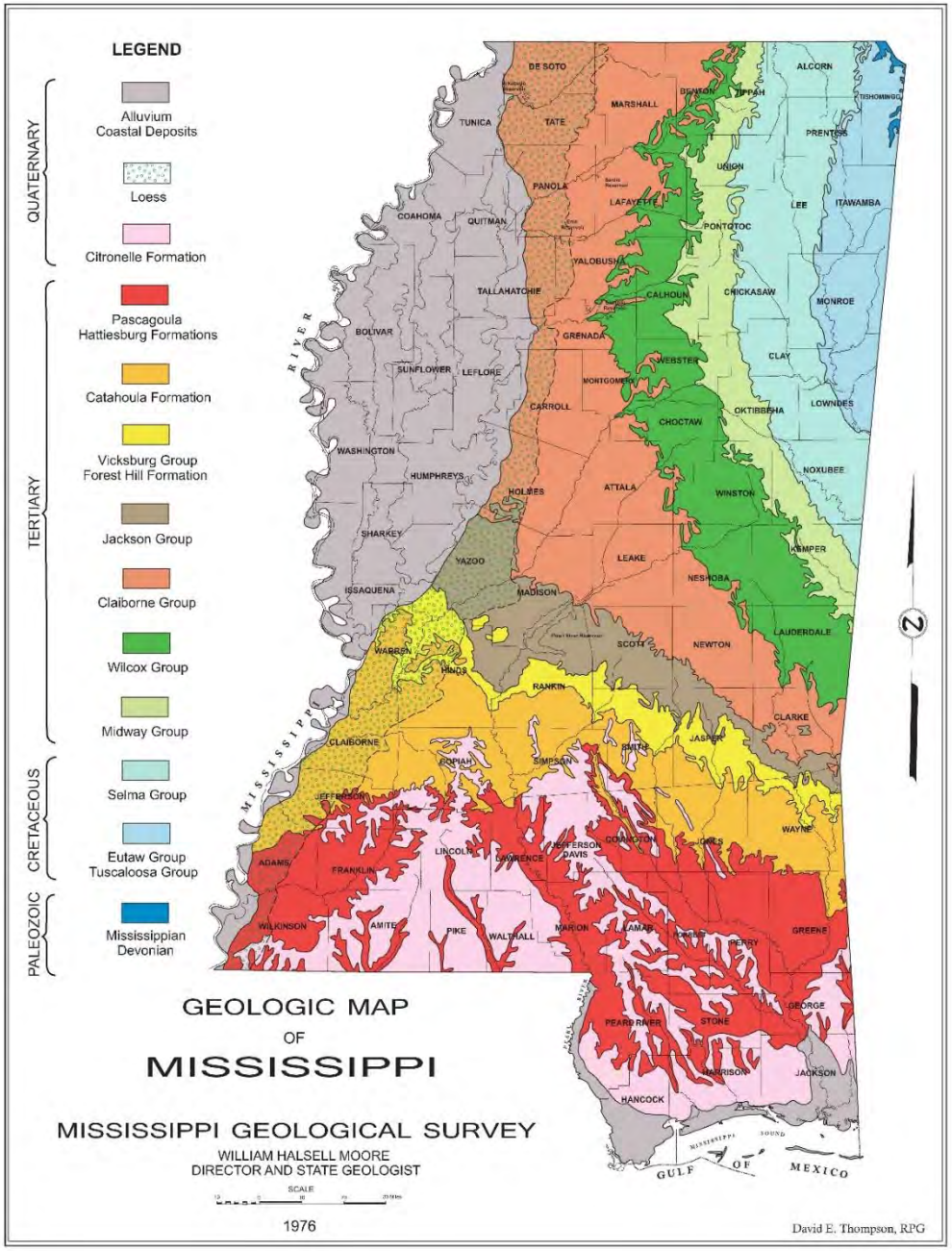
The Yazoo Formation is a thick, undifferentiated, marine shelf, clay sequence in western and central Mississippi. This clay sequence thins to the east and grades into the following members, in ascending order: (1) the North Twistwood Creek Clay, (2) the Cocoa Sand, (3) the Pachuta Marl, and (4) the Shubuta Clay. The contacts between these members are gradational, and all contain marine fossils.

Forest Hill Formation

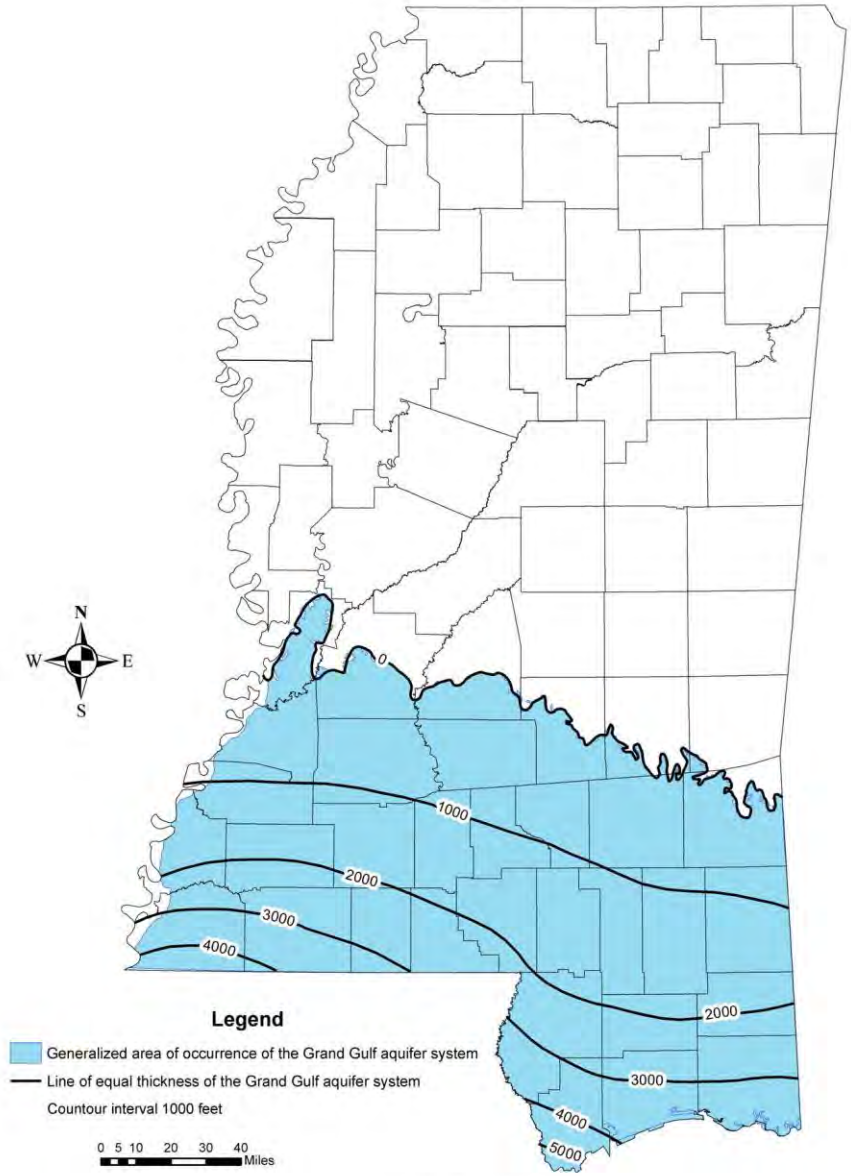
The Forrest Hill Formation is a thick, undifferentiated, deltaic sequence of sands and clays in western and central Mississippi. This clay sequence thins to the east and grades into the following members: (1) the marine fossiliferous Red Bluff Formation, (2) non-marine Forrest Hill Clay


A West
Magnolia Pet. Co.
No. 1 Feld Est.
Sec. 3-15N-4E
Warren Co.
American Petrofina Expl. Co.
No. 1 U.S.A. Unit 1-9
Sec. 1-3N-6E
Smith Co.
Gulf Refining Co.
No. A-1 Masonite Corp.
Sec. 35-1N-12E
Jasper Co.
A East
Clinch Drilling Co.
No. 1 G.M. & O. Land Co.
Sec. 19-6N-6W
Wayne Co.
-62 Feet (Below Sea Level)
+267 Feet
+346 Feet
-548 Feet
Delta Front Sand
Prodelta Clay
Shelf Clastics
(Yazoo Clay)
Destructional Shelf
Delta Plain and Delta Front Sand
Shelf Carbonates
Prodelta Clay
Deltaic Sand and Clay
0
100
200 Feet
Forest Hill Fm.
Red Bluff Fm.
Shubuta Clay
Pachuta "Marl"
Cocoa Sand
North Twistwood Cr. Clay
Moodys Branch Fm.
Cockfield Fm.
Gordon Creek Clay
Cook Mountain Ls.
Kosciusko Fm.
Yazoo Fm.
Jackson Group
Cook Mt. Fm.
Claiborne Group
OLIGOCENE
EOCENE
Sand
Clay
Calcareous Clay
Limestone
Marine Fossils
0 10 20
Miles


ARKANSAS
MISSISSIPPI
ALABAMA
OUTCROP OF THE JACKSON GROUP
SUBCROP OF THE JACKSON GROUP BENEATH ALLUVIAL DEPOSITS.



- The Miocene section covers approximately $^{1}/_{3}$ of the state. However, this region is poorly understood. The nature of south Mississippi formational boundaries, as shown on the State Geologic Map, have never been adequately defined.



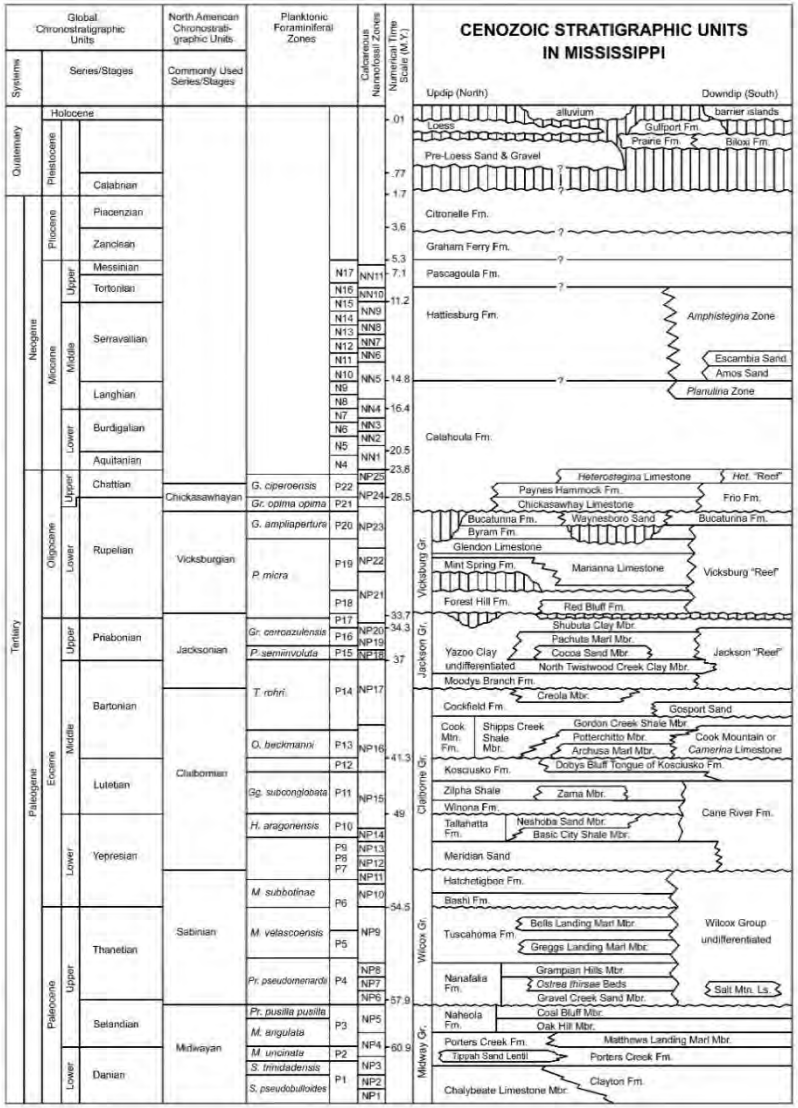
(modified from Gandl, 1982)

Figure 1: Generalized Thickness of the Grand Gulf Aquifer System

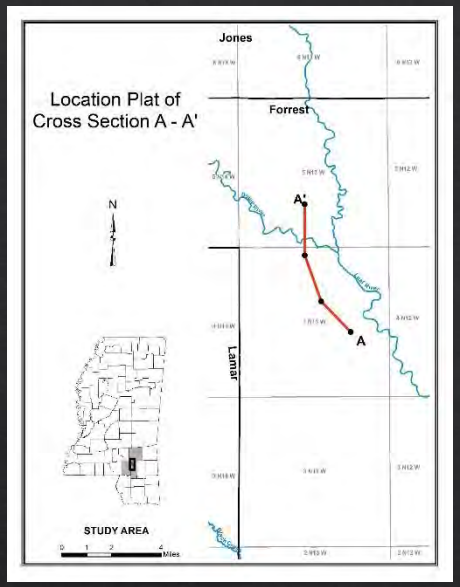
From: *OF-284 Geohydrologic Cross-Sections of the Grand Gulf Aquifer System in Southeastern Mississippi* - James Hoffman, Lindsey Stewart, and Jo F. Everett

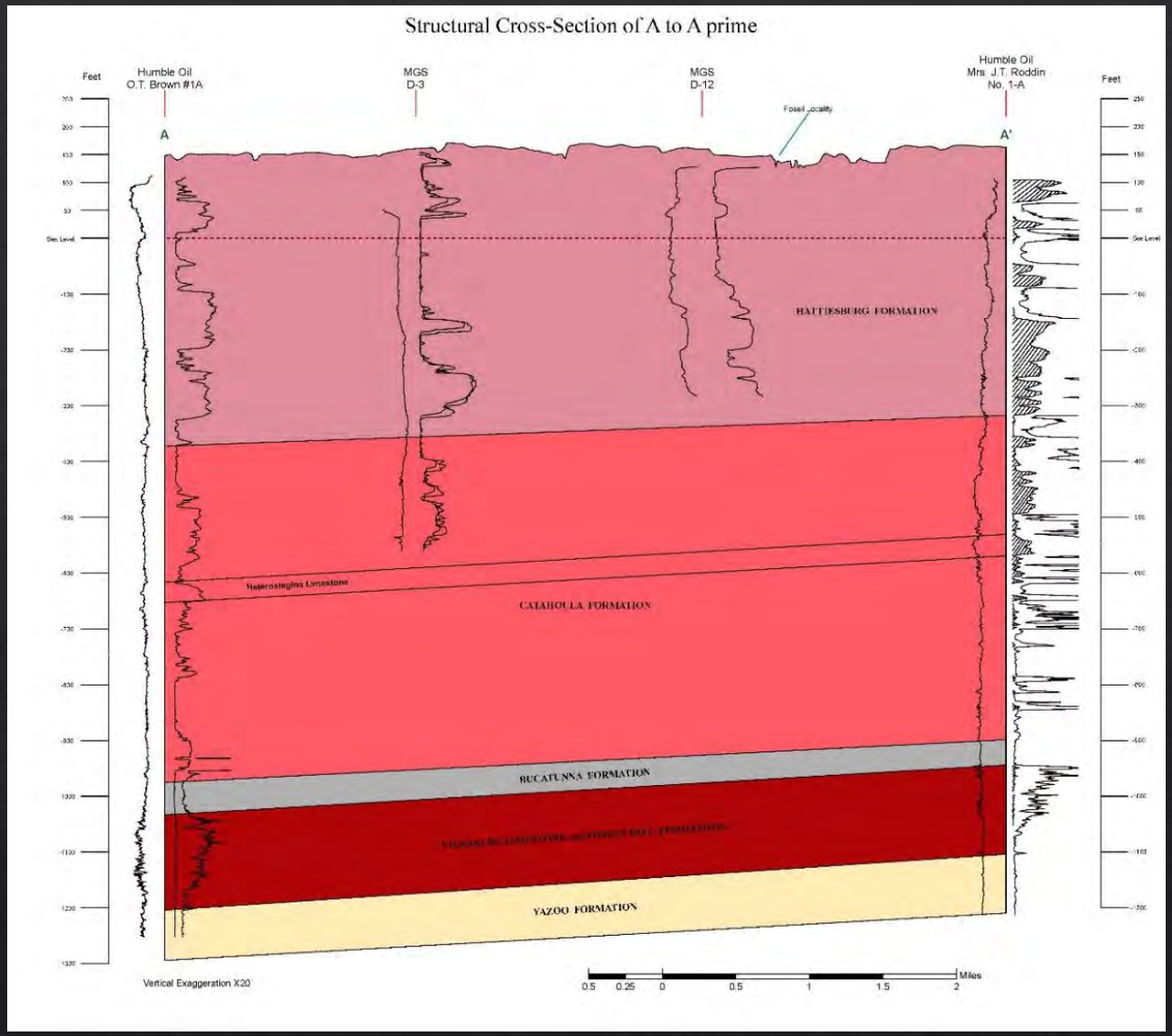
Mississippi Office of Geology
David T. Dockery III, 2008

After *MISSISSIPPI GEOLOGY*, V. 17, No. 1, March 1996, pp. 1-8.



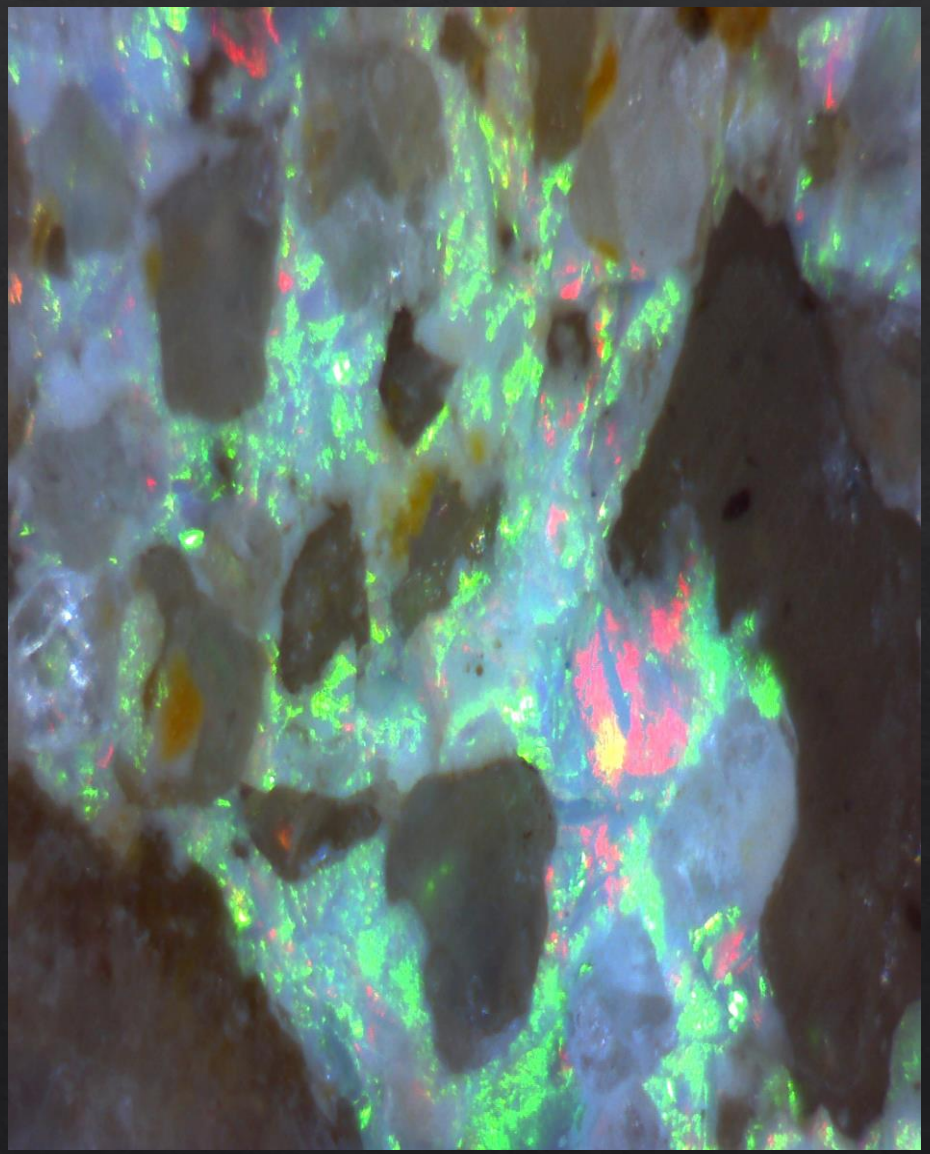
- Much work needs to be done to accurately define the stratigraphic boundaries of the Pascagoula and Hattiesburg formations. Also, the delineation of overlying terrace deposits once mapped as "Citronelle" which are now delineated as Pre-Loess Terrace Deposits, the Brookhaven Terrace, and other terraces.


Location Plat of
Cross Section A - A'
Jones
Forrest
Lamar
A'
A
N
STUDY AREA
0 1 2 4
Miles


Structural Cross-Section of A to A prime
Feet
Humble Oil
O.T. Brown #1A
MGS
D-3
MGS
D-12
Humble Oil
Mrs. J.T. Roddin
No. 1-A
Fossil Locality
A
A'
HATTIESBURG FORMATION
Heterostegina Limestone
CATAHOULA FORMATION
BUCATUNNA FORMATION
YAZOO FORMATION
Sea Level
Vertical Exaggeration X20
0.5 0.25 0 0.5 1 1.5 2
Miles

Miocene Subcrop (not exposed)

- Catahoula Sandstone (Claiborne Co.)



- Catahoula Opal Cement

Catahoula Formation

THE JONES BRANCH LOCAL FAUNA: AN EARLY ARIKAREEAN ASSEMBLAGE FROM THE UPPER OLIGOCENE CATAHOULA CLAY, WAYNE COUNTY, MS

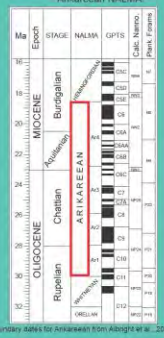
L. Barry **Albright III,** University of North Florida; George E. **Phillips**, Mississippi Museum of Natural Science;
James E. **Starnes**, Mississippi Office of Geology; Gary L. **Stringer**, University of Louisiana at Monroe; and Andy **Weller**, Waynesboro, MS.

INTRODUCTION

Fossil mammal assemblages representative of the Arikareean North American Land Mammal Age (~18-30 Ma; Fig. 1) are known primarily from the Great Plains, where this age was typified, and also from the John Day Formation of Oregon. A few rare and isolated sites, however, are also known from the Gulf Coastal Plain. Noteable among these are the **Buda**, **White Springs**, and **Brooksville local faunas** of Florida and the **Toledo Bend Fauna** of easternmost Texas (Fig. 2). Several species from these southeastern faunas were originally described from the more northern, mid-continental localities; but the Arikareean of the Gulf Coast also includes several endemic taxa (Albright, 1998). Recently, an important new addition to the list of Arikareean faunas from the Southeast was discovered in Mississippi: the **Jones Branch Local Fauna**. The fossils from the Jones Branch site are derived from a distributary channel lag at **the base of the Catahoula Formation** that rests unconformably on interbedded marl-clay beds of the subjacent, upper Oligocene, marine Paynes Hammock Formation (Fig. 3).

Discoverer of the Jones Branch site, Andy Weller (center).

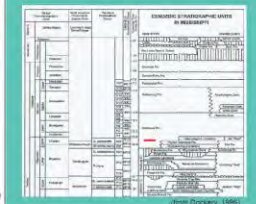
Figure 1. Temporal span of the Arikareean NALMA.



Boundary dates for Arikareean from Albright et al., 2008).

Figure 2. Locations of major Arikareean sites of the Gulf Coastal Plain and Florida, including Jones Branch.

Figure 3. Location of the Jones Branch site in SE Mississippi and its stratigraphic placement at the base of the Catahoula Formation (indicated by ——).



(from Dockery, 1996)

THE FAUNA AND ITS AGE

To date, the mammalian component of the fauna includes a lepond, rodents, carnivores, artiodactyls, perissodactyls, and a small sirenian, known ranges of which indicate an **early Arikareean** age (Fig. 4). This age determination is based on the presence of a eutypomyine castorid, the tapir *Protapirus*, the rhinoceros *Subhyracodon*, the anthracothere *Elomeryx*, and a leptochoerid provisionally assigned to *Leptochoerus*. Except for *Subhyracodon*, all of these occurrences are firsts for the Gulf Coastal Plain. Additional taxa include the horse *Miohippus*, the giant entelodont *Dinohyus*, a tiny species of *Hypertragulus*, and a small protoceratid similar to *Prosynthetoceras orthrionanus* from the later Arikareean Toledo Bend Fauna. Two of three carnivores appear representative of small borophagine canids; and the third is a mustelid-like species superficially resembling *"Plesictis."* A very small sirenian appears referable to *Crenatosiren*. Like the Toledo Bend Fauna, the Jones Branch Local Fauna lacks camels and oreodonts. The Jones Branch Local Fauna is the only assemblage of early Arikareean age yet known from the Gulf Coastal Plain.

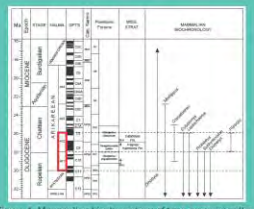


Figure 4. Mammalian biochronology of taxa comprising the Jones Branch LF indicate an early Arikareean age.

Further supporting the early Arikareean age (= lower Chattian Stage) are numeous teleostean otoliths, which are dominated by sciaenids (drums), including three taxa that are known only from the Oligocene: *Apiodinotus gemma*, *Apiodinotus distortus*, and *"Sciaenida" radians* (Fig. 5). The predominance of sciaenid otoliths, the preferred habitats of sciaenids based on Recent analogs, and the size of the otoliths (i.e., age of the fish) are strong indicators of a tidally influenced estuarine paleoenvironmental setting - exactly that expected given the inferred location of the Jones Branch site during the mid-Oligocene (Fig. 6). Into this setting washed the remains of terrestrial and marine-adapted mammals. Fossils of reptiles, amphibians, and terrestrial plants have also been recovered from the site and are currently under study by other members of the Jones Branch research team.

Figure 5. Oligocene species of the Jones Branch otolith assemblage.

Figure 6. Oligocene shoreline for the southeasern US based on mapped surface geology (S. Ebersole, 2016, Geological Survey of Alabama).

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Albright, L.B. III. 1998. The Arikareean Land Mammal Age in Texas and Florida: southern extension of Great Plains faunas and Gulf Coastal Plain endemism. Geological Society of America Special Paper 325:167-183.

Albright, L.B. III, M.O. Woodburne, T.J. Fremd, C.C. Swisher III, B.J. MacFadden, and G.R. Scott. 2008. Revised chronostratigraphy and biostratigraphy of the John Day Formation (Turtle Cove and Kimberly members), Oregon, with implications for updated calibration of the Arikareean North American Land Mammal Age. The Journal of Geology 116:211-237.

Dockery, D. T. III. 1996. Toward a revision of the generalized stratigraphic column of Mississippi. Mississippi Geology 17, 1:1-9.

Catahoula Quartzite

Fossil Palm

Hattiesburg Formation

- Hattiesburg Sandstone (Jefferson County)

- Hattiesburg Clay (Jefferson County)

Hattiesburg Formation

DELTA STATE UNIVERSITY

Implications of a palynology sample from Bowie River, Mississippi

Nina L. Baghai-Riding[1], Brian Axsmith[2], Kendal Davis[1], Raven Allison[1]

USA UNIVERSITY OF SOUTH ALABAMA

[1]Department of Biological Sciences Delta State University; [2] Biology Department, University of Southern Alabama

INTRODUCTION

The Hattiesburg Formation (early, middle Miocene) consists of sparsely fossiliferous, silty to fine-sandy clays and fine- to coarse-grained gravelliferous sands. The Hattiesburg Formation, and its stratigraphic equivalent, extends from Florida to east Texas (Starnes, 2017 personal communication). It represents the middle, alluvial portion, of the post-Vicksburg prograding deltaic wedge of the three-phased "Grand Gulf Group" (Foster and McCutcheon, 1941; Dockery and Thompson, 2016). These units collectively reach a down-dip thickness of approximately 5,000 ft. in Mississippi. Accurate geologic boundaries have not been established for much of the units in the Grand Gulf Group. No specific type section has been resolved for the Hattiesburg Formation and a definitive contact with the overlying Pascagoula Formation is elusive. Good outcrop exposures of the Hattiesburg Formation occur throughout southern Mississippi including Forrest, Covington, Jones, Greene, Perry, Lawrence, Lamar, and Franklin Counties (Starnes, 2017 personal communication).

A new megafossil leaf site, found at Bowie River, Forrest County, Mississippi has been attributed to the upper Hattiesburg Formation. This locale consists of pyritic, gray-gray-green colored, laminated to finely-bedded sediments with alternating clays, silts, and fine-grained sands. This strongly friable and repetitive sequence is slightly carbonaceous to highly lignitic, with well-preserved fossil leaves (Figs. 1-3) and leaf hash along partings and large, imbedded, lignitized logs. The Bowie River leaf locale is projected downdip to be not far below the gradational contact with the overlying Pascagoula Formation. Plant megafossil recovered include leaves of *Platanus*, *Morus*, *Sambucus*, *Quercus*, *Cercis*, *Cedrus*, *Cyperis*, *Taxodium*, *Salvinia*, *Woodwardia*, palm, seeds of *Sargentodoxa*, and fruits of *Carya*. One random palynological sample was collected from a clay lens associated with this megafossil locality. Palynomorphs recovered are diverse and abundant yet many are pyritized. Few Miocene terrestrial units exist in the southeastern United States America so the discovery of plant megafossils and microfossils makes this portion of the Hattiesburg Formation particularly significant in providing taphonomic and paleoclimatic implications.

METHODS

The palynological sample was processed by Global Geolab in Alberta, Canada using standardized techniques. Palynomorphs were photographed using JEOL JSM-6010Plus/LA scanning electron microscope and with an Olympus Q-Color 3 camera attached to an Olympus BX43 microscope. A 300 point count was conducted to determine a percentage of spores, pollen, dinoflagellate cysts, and algae. Identifications were made using published accounts from the literature and by consulting with other palynologists.

RESULTS

Palynomorphs acquired from the processed sample include angiosperm and conifer pollen, trilete and monolete spores, dinoflagellate cysts, fungal spores, and sponge spicules (Figs. 4-6). Many pollen and spores still need to be determined to the level of genus/species. Many palynomorphs are pyritized and difficult to identify. Nonmarine palynomorphs far outnumber marine palynomorphs. In a 300+ point count (Fig. 8) angiosperms represented 48.6%, conifers 25.2%, pteridophyte spores 1.8%, dinoflagellates cysts, acritarchs and freshwater algal forms 9.8%, and fungal spores 3.5% (Figure 7). Dominant pollen types include *Pinus*, *Tsuga*, *Cedrus*, *Alnus*, *Carya*, *Ilex*, *Juglans*, *Quercus*, *Ulmus*, *Tilia*, and unidentified Asteraceae (Figure 5). Common sporomorphs are assignable to *Sphagnum*, *Azolla* (aquatic fern), Anemiaceae, Lycopodiaceae, and Polypodiaceae (Figure 4). Miscellaneous peridiniacean dinoflagellate cysts represented the most common marine element (Figure 6).

DISCUSSION

The Middle Miocene age designation given to the Hattiesburg Formation is based on marine equivalents offshore and to a Teleoceras medicornutum tibia found as float in association with a fossil llama proximal phalanx on the Hattiesburg outcrop at the Middle Fork of the Homochitto River near Meadville in Franklin Co., Mississippi (Dockery and Thompson, 2016). Teleoceras medicornutum is a Barstovian, Middle Miocene Rhinoceros previously known from the Fleming Formation, Burkeville Fauna of the Gulf Coastal Plain of Texas (Prothero and Manning, 1987). The overlying Pascagoula Formation contains a Late Miocene vertebrate fauna in Stone Co., Mississippi that may be correlative to the Maurilla Fauna of South Alabama.

Age-diagnostic palynomorphs have not been noted yet. The palynomorph assemblage agrees rather well to the regional vegetation implied by the megaflora assemblage. Both assemblages possess ferns, *Taxodium*, *Quercus*, and *Carya*. The quantity and diverse assortment of pollen and spores implies that this region had a rich flora, although some of the amentiferous pollen probably blew in from surrounding areas. Overall, the palynomorph assemblage in this study is representative of a warm temperate, riparian, coastal vegetation forest that bordered the sea. Further study is needed to determine whether some palynomorphs may have exotic affinities. Fruits of the walnut and seeds of *Sargentodoxa* are exotic and appear to have modern affinities associated with western Asia/China (Figure 9).

ACKNOWLEDGEMENTS

Appreciation is extended to James Starnes with the MS Dept. of Environmental Quality for furnishing information about the geology of the Hattiesburg Unit and to Lucy Edwards of the U.S.G.S. for identifying dinoflagellate cysts.

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Foster, V. M. 1941. Geology 1-172 in Foster, V. M. and T. E. McCutcheon (ed.) Forrest County, Mineral Resources. Mississippi Geological Survey, Bulletin, 44, 87 p., geologic map.

Prothero, D. R. and Manning, E. M. 1987. Miocene Rhinocerotoidea from the Texas Gulf Coastal Plain. Journal of Paleontology, 61 (2): 388-423.

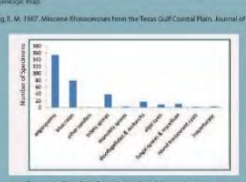


Figure 8. Results of a 300+ palynology point count

Figure 1. Bowie River fossil locality in Forrest Co., Mississippi

Figure 2. Fossil hash from the Hattiesburg Formation

Figure 9. Classic Tertiary Refugia map compiled by B. Axsmith

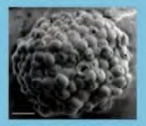


Figure 7. Possible fungi, scale bar = 10 micrometers

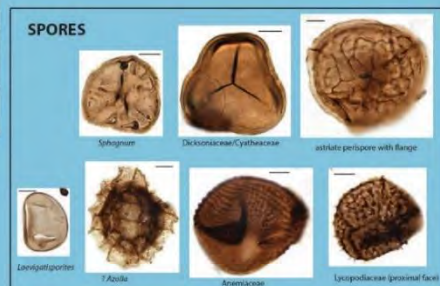


Figure 4. Spores noted in the palynomorph sample from the Bowie River sample, Hattiesburg Formation. Scale bars are 10 micrometers.

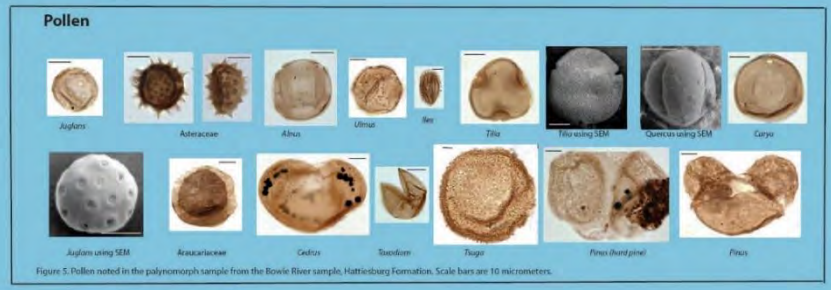


Figure 5. Pollen noted in the palynomorph sample from the Bowie River sample, Hattiesburg Formation. Scale bars are 10 micrometers.

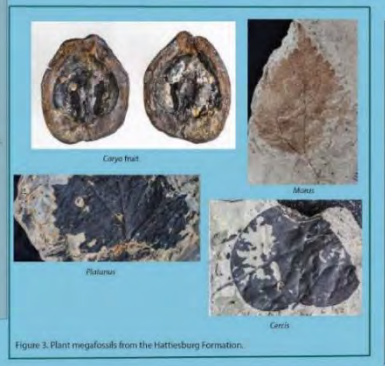


Figure 3. Plant megafossils from the Hattiesburg Formation.

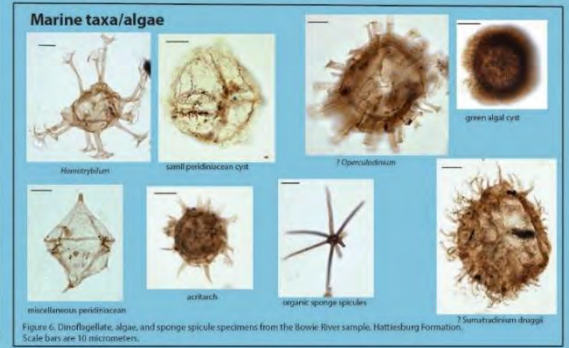


Figure 6. Dinoflagellate, algae, and sponge spicule specimens from the Bowie River sample, Hattiesburg Formation. Scale bars are 10 micrometers.

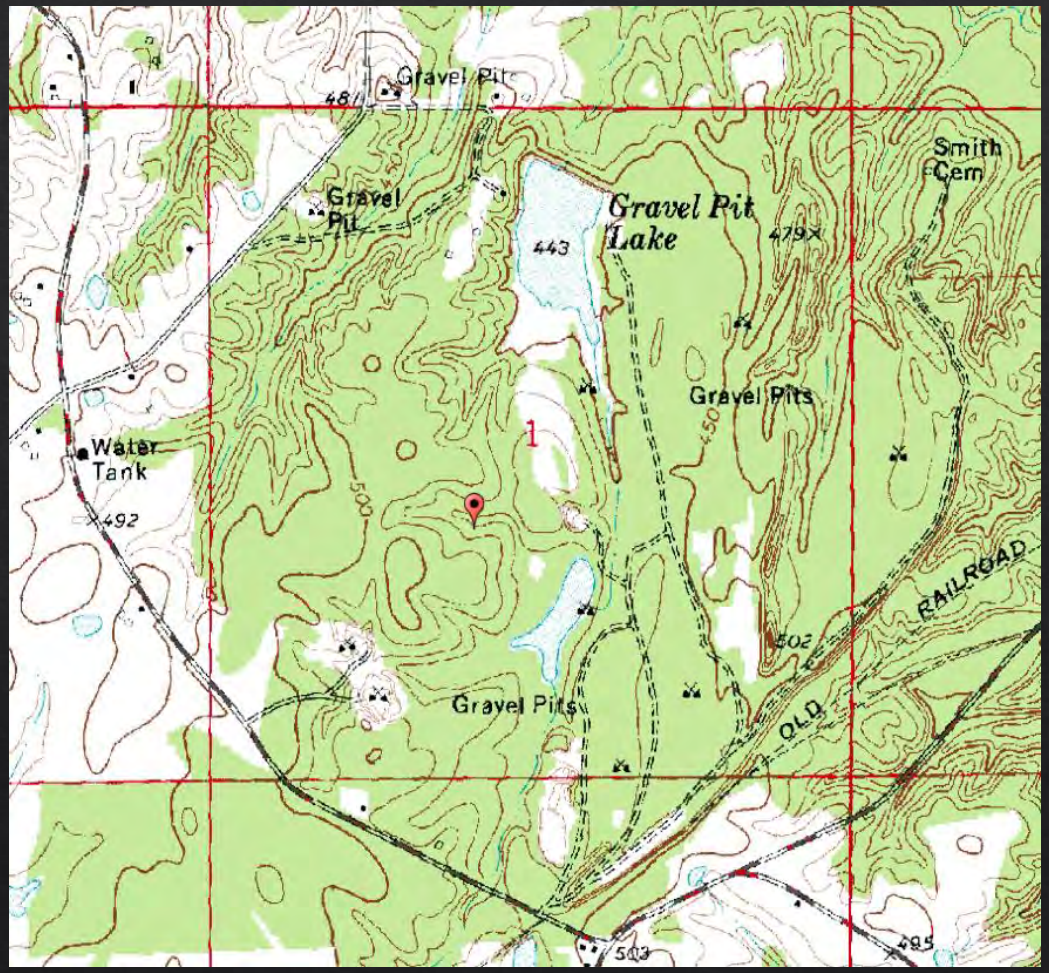
Hattiesburg Quartzite

Figure 930. Projectile point on left knapped by Ken Austin and preform on right knapped by James Starnes from a fine-grain quartzite in the Hattiesburg Formation southeast of Knoxville and north of the Homochitto River in the Homochitto Forest in the W/2, Section 48, T. 5 N., R. 1 E., Franklin County, Mississippi. Picture (digital; Image 1743) taken on November 29, 2010.

Catahoula/Hattiesburg Formation

Pascagoula Formation

Brookhaven Terrace



- Mississippi Surface Mining Permit P03-045A operated by Dickerson and Bowen, Inc.

Brookhaven Terrace

Brookhaven Terrace Deposits

Loess and Pre-Loess Terrace Deposits

Figure 1035. Slump in loess and underlying Miocene clays cutting into the foundation of the Keating house on Highway 61 at Cannonsburg in Jefferson County. The slump occurred when the toe of the hill was cut to expand the highway. Picture (color negative 536-20; Image 334) taken on November 16, 2004.

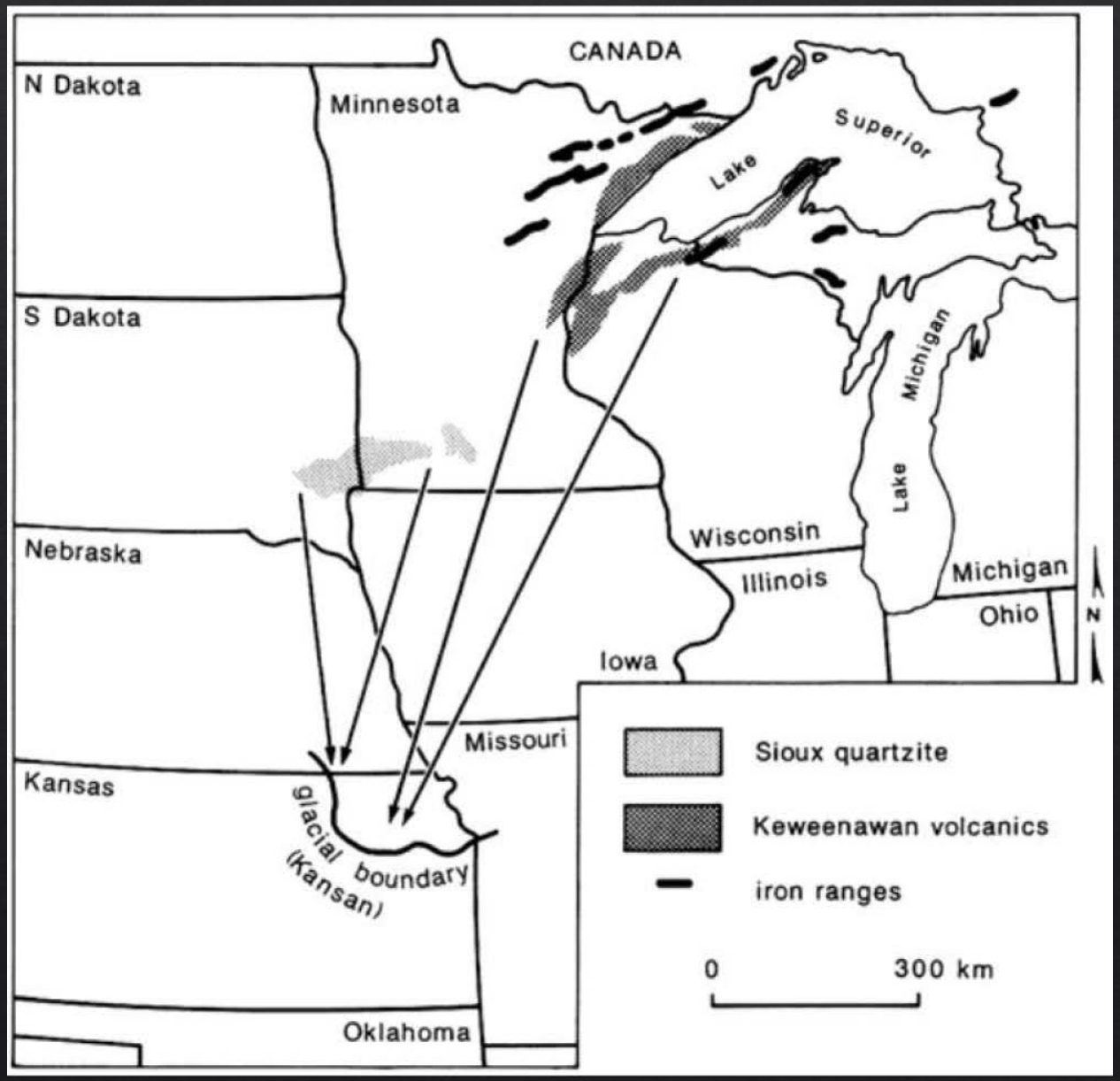
Loess

- Mastodon Tusks

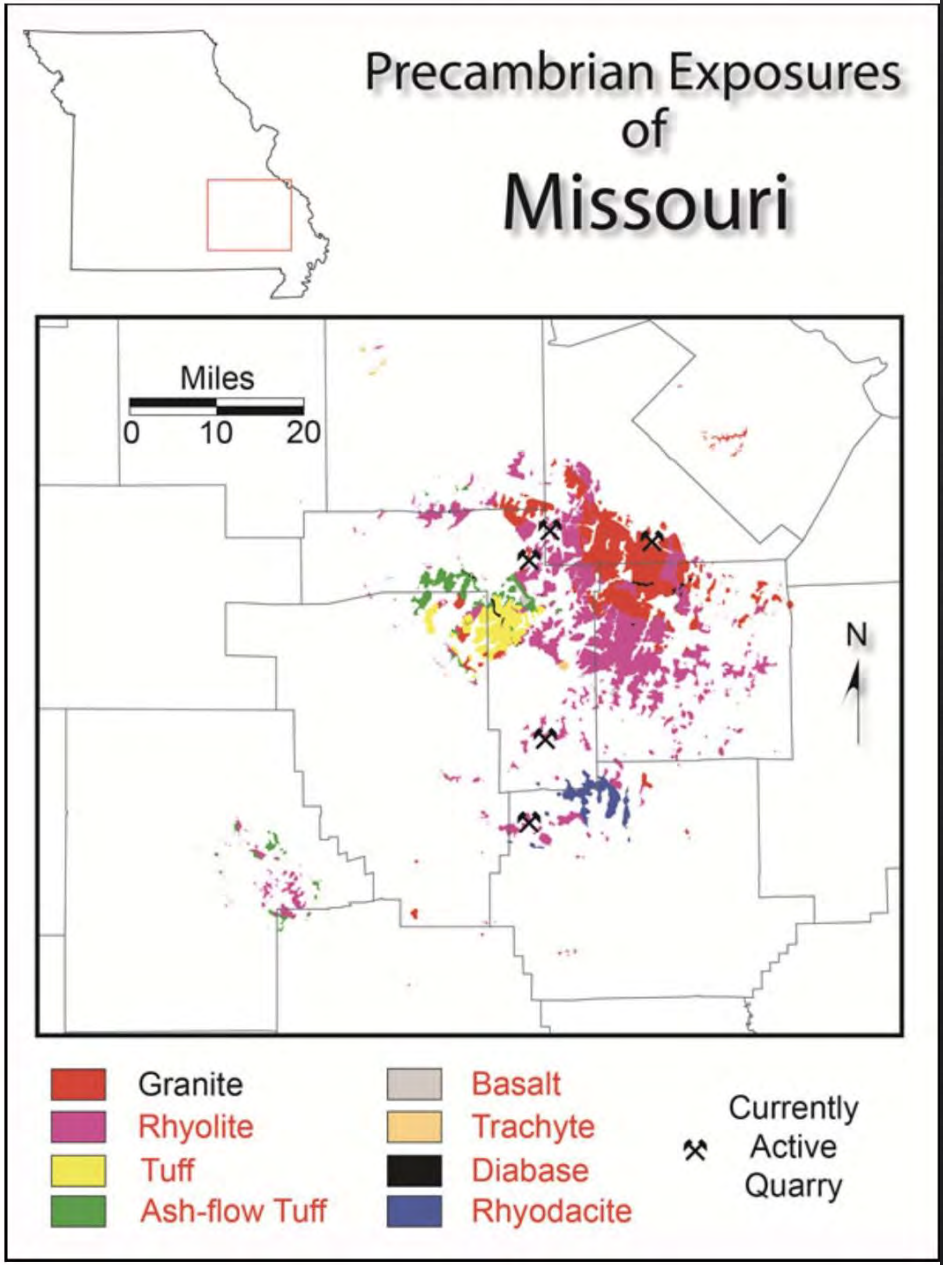
- Tapir Jaw

Pre-glacial Drainage

Re-routing of the Missouri River



Provenance Rock



- Mississippi Office of Geology Rhyolite Collections.

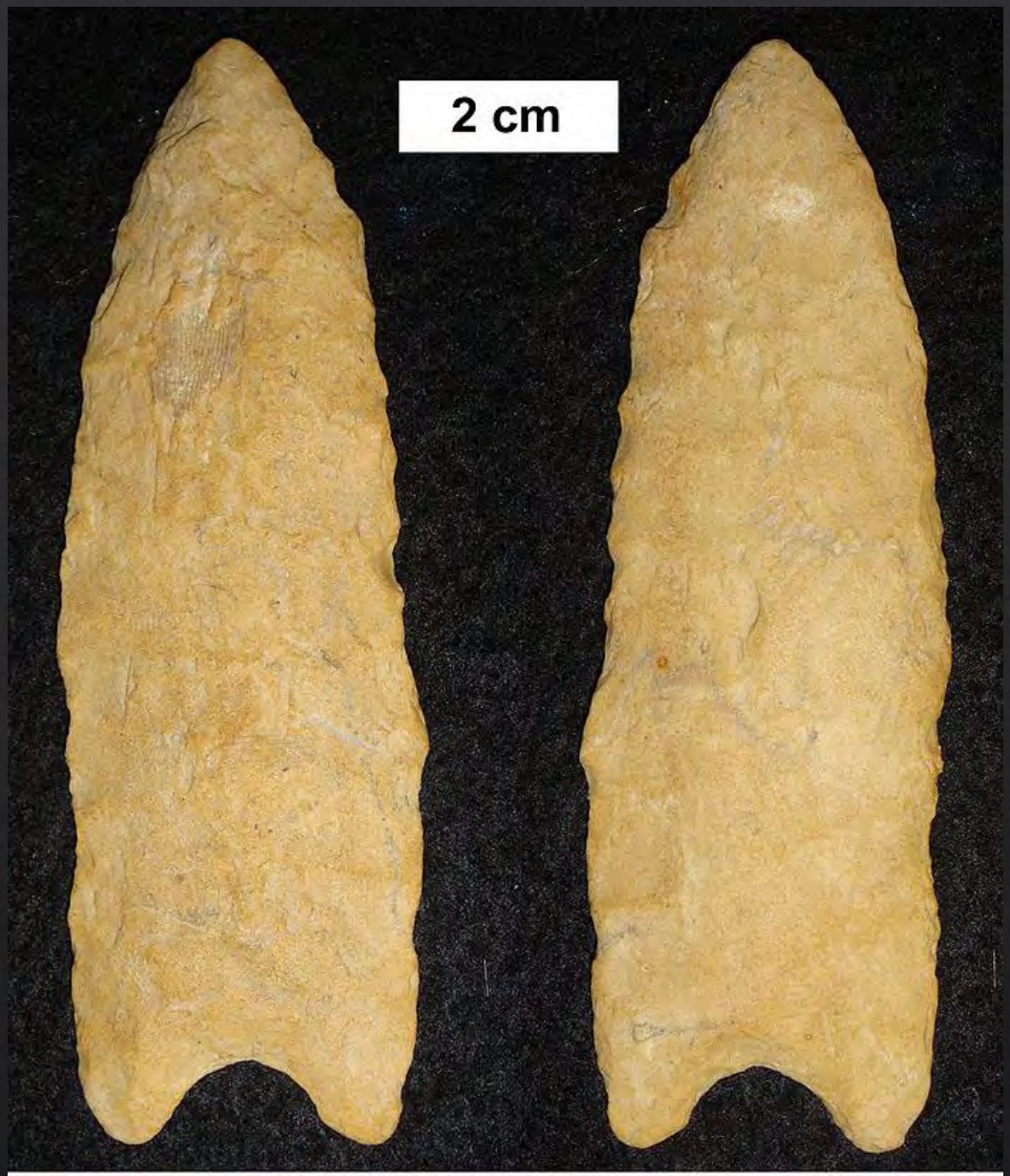
Ice-rafted “Erratics”

- Warren County, Near Flowers

- Hinds County, Near Edwards

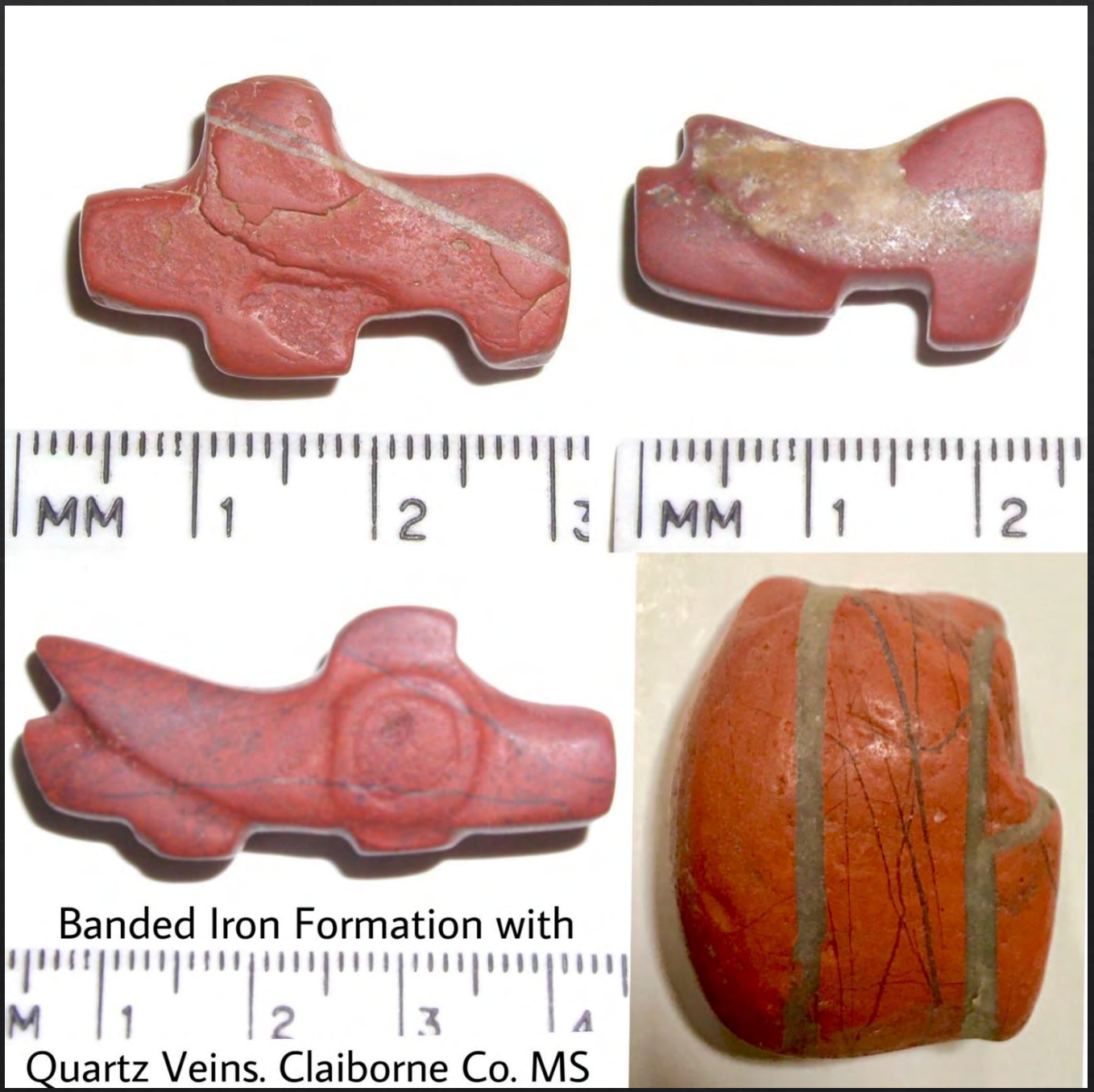
Glacially Facetted Cobbles


PHOTO
CM
1
2
3

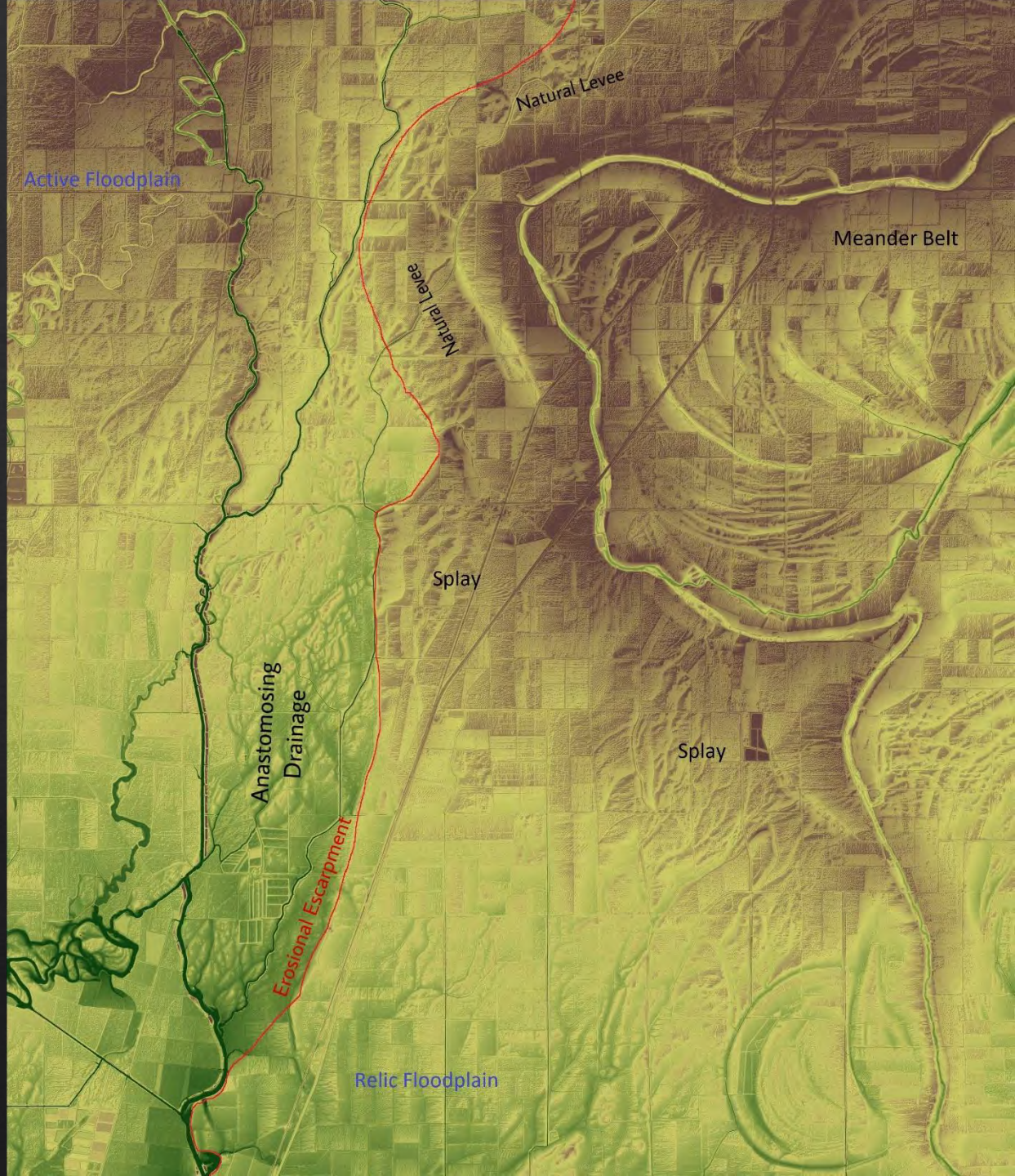


Paleo-Indian Projectile Point, Coll'd by
Paul Parrish March 2013, Yazoo Co., MS

Sioux Quartzite


MM 1 2 3
MM 1 2
M 1 2 3 4
Banded Iron Formation with
Quartz Veins. Claiborne Co. MS

- Mississippi River Valley Alluvium will be divided into:
  - Alluvial Fans
  - Stream Terraces
  - Stream Alluvium
  - Floodplain Clays (backswamp deposits)
  - Splays
  - Meander Belts



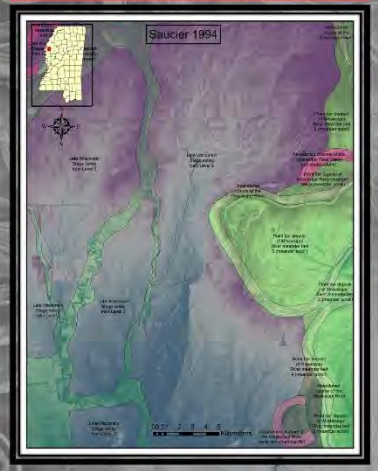
Geologic and Geomorphological Reassessment and the Implications of Paleoindian and Transitional Early Archaic Occupation of the Porter Bayou Meander Belt in the Mississippi River Alluvial Plain of Northwest Mississippi

Anna Reginelli, Curator L.B Jones Collections Trust at the Mississippi Museum of the Delta
James E. Starnes, RPG, MDEQ, Mississippi Office of Geology

Abstract

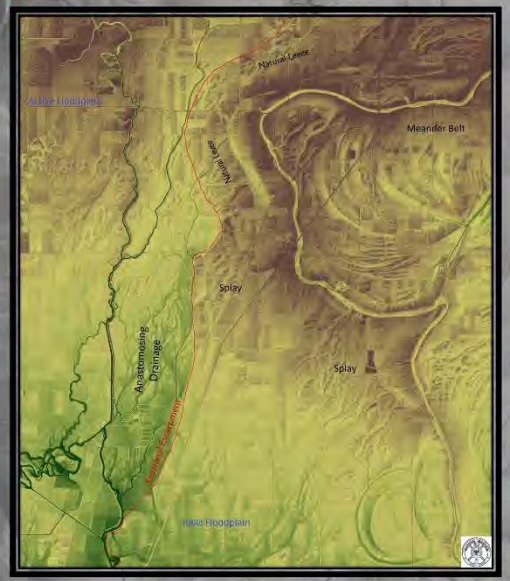
The back swamp created between the modern Mississippi River and abandoned Porter Bayou meander belts in northwest Mississippi forms the headwater basin for the Bogue Philia River. An intermittent anastomosing erosional system across a nearly level alluvial surface drains this back swamp and focuses headwaters of the Bogue Philia, a yazoo stream, along the base of a north-south trending erosional escarpment, starting along the western edge of the Porter Bayou levee system. The back swamp topography is composed of shallow anastomosing channels incised into thick floodplain clay deposits creating interfluve islands capped with a residuum of stoss, parabolic aggregated sands. This terrain was erroneously attributed to a larger braided stream system of a relic Pleistocene glacial valley train. Sand and gravel outwash deposits from glaciation exist within the greater alluvium but are buried well below the floodplain surface beneath the meander belt and back swamp deposits. Paleoindian component sites, as early as Clovis and Dalton through transitional Early Archaic, dot Porter Bayou's natural levee remnants, point bar ridges, and sandy splays perched along the escarpment overlooking the Bogue Philia basin. Detailed archaeological and geological field reconnaissance, coupled with enhanced geomorphological mapping utilizing bare-earth LIDAR has led to a necessary recharacterization. The cultural occupation of the ancient abandoned meander system (now occupied by Port Bayou) and the adjacent escarpment has important cultural resource and geological implications. Including new understandings of the earliest settlement patterns, mapping, and geologic history and evolution of the meander belts systems of the lower Mississippi River valley.

Previous Mapping Over New LIDAR



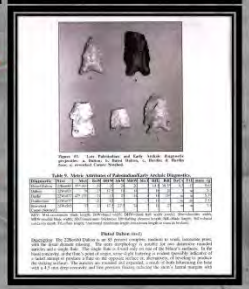
Paleoindian/Early Archaic Sites

New LIDAR Based Mapping Interpretation



Previous Investigations: J.P. Brain, 1971

Panamerican, 2004



References

Field Work and Geophysical Log Interpretation

Project Justification

Project 1: Jefferson County

- This project is a continuation of the geologic mapping completed previously in western Mississippi and lies South of prior mapping. The quadrangles chosen (Fayette, Gin Branch, and Union Church) will help in the delineation of the Hattiesburg/Pascagoula contact, and help to confirm a regional stratigraphic framework. Additionally, the mapping will concentrate on delineating ancestral Mississippi River Pre-loess Terrace Deposits and the western extent of the Brookhaven Terrace (formerly mapped as Citronelle Formation in Eastern Jefferson County).

- Terrace Deposits (Pre-loess & Brookhaven) contain important economic sand and gravel resources. The Loess is an important source of geohazards because of its susceptibility to erosion, mass wasting, soil-piping, and slope stability issues.

- The Miocene section in south Mississippi is an important source for groundwater and numerous aquifer sands are present throughout the interval. The terraces in the region also contain unconfined groundwater resources that are the primary water source for the headwaters of streams in the region. Proper placement of aquifers within the stratigraphic framework will assist in prediction/planning of groundwater resources. The development of quality, consistent cross-sections and geologic maps which highlight recharge areas will ensure that pertinent groundwater issues are addressed.

Project 2: Yazoo County

- This project is a new geologic mapping area proposed for STATEMAP with respect to the subcrop geology. Mapping was done by the MOG for the County in the late 1930's and was the catalyst for the State's first major oil boom. Intensive development of this major oil field occurred prior to environmental regulatory constraints and suffers from numerous, long-term, and unmitigated environmental issues.

- Pre-loess Terrace Deposits (once attributed to the Citronelle Fm. in previous mapping of the area) contain important economic sand and gravel resources. Mapping of these deposits fills a data gap in creating a depositional framework along the valley wall of Mississippi River. The Loess is an important source of geohazards because of its susceptibility to erosion, mass wasting, soil-piping, and slope stability issues.

- The Yazoo Clay section in western Mississippi is an important thick aquitard for the Loess/Pre-loess Terrace unconfined aquifer and the overlying aquiclude for the Cockfield aquifer. Proper structural placement of the Yazoo Fm. Across the Tinsley Structure will assist in prediction/mitigation planning of contamination of groundwater resources. The development of quality, consistent cross-sections and geologic maps will ensure that these pertinent groundwater issues are addressed.

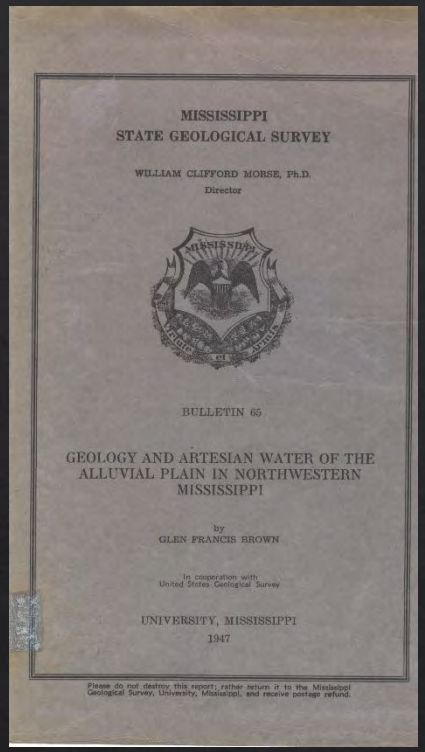
Project 3: Delta

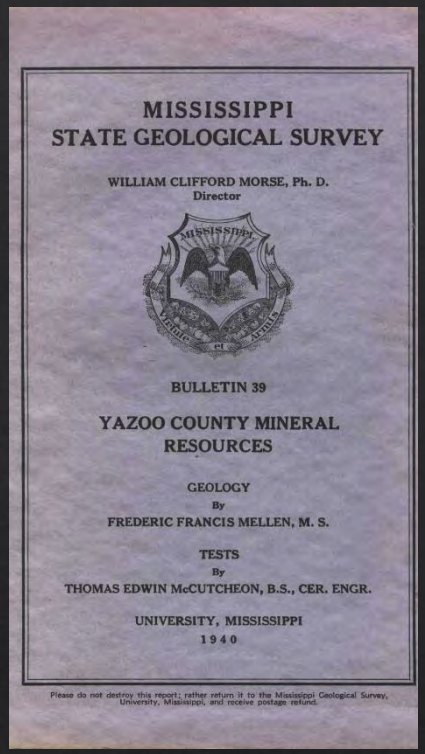
- This project is a re-evaluation of the geologic mapping completed previously by the USACE in the Mississippi River alluvial plain and a continuation of mapping in the adjacent uplands by the MOG. The 1:100,000 scale quadrangle area chosen for this project will delineate of the complex alluvial top stratum and help to design a regional stratigraphic framework for surface recharge of MRVA . Additionally, the mapping will concentrate on delineating ancestral Mississippi River Pre-loess Terrace Deposits, Tertiary subcrop along the western bluff line, and the Alluvial Fans along the base of the bluffline.

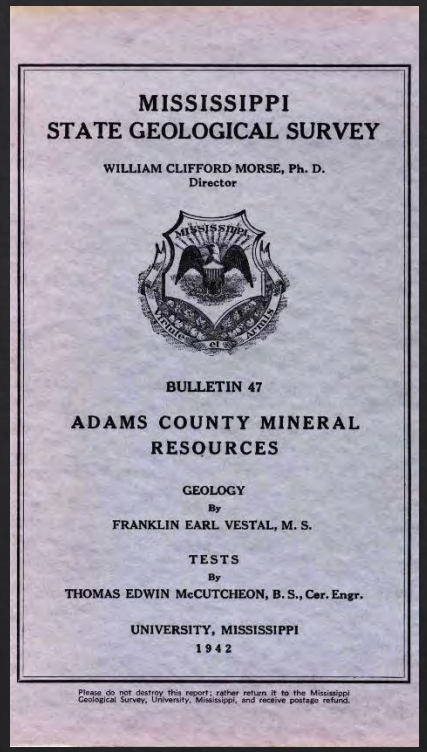
- Pre-loess Terrace Deposits contain important economic sand and gravel resources. The Loess is an important source of geohazards because of its susceptibility to erosion, mass wasting, soil-piping, and slope stability issues.

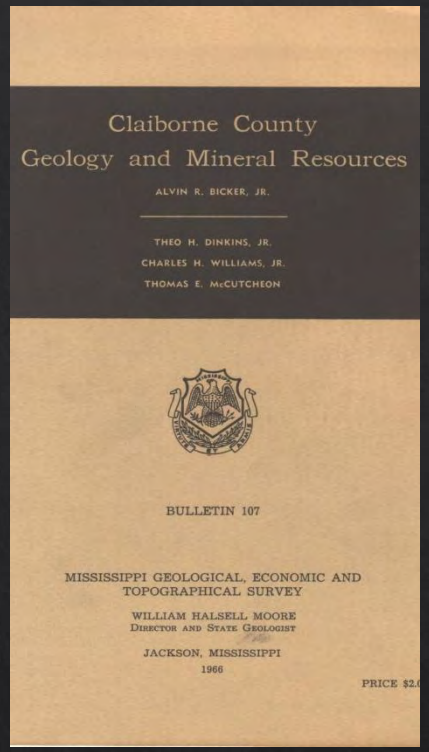
- Geoarchaeological recourses play is an important role in reconstructing the geochronological evolution and human habitation of the geomorphological features in the Mississippi River Alluvial Plain. Additionally, the alluvial fans typically contain a wealth of buried well-preserved, multi-component and largely unrecorded archaeological sites. New bare-earth DEM LIDAR tools coupled with focused stratigraphic testing opened an unprecedented window for a necessary geological mapping and re-interpretation of the area.

Methodology









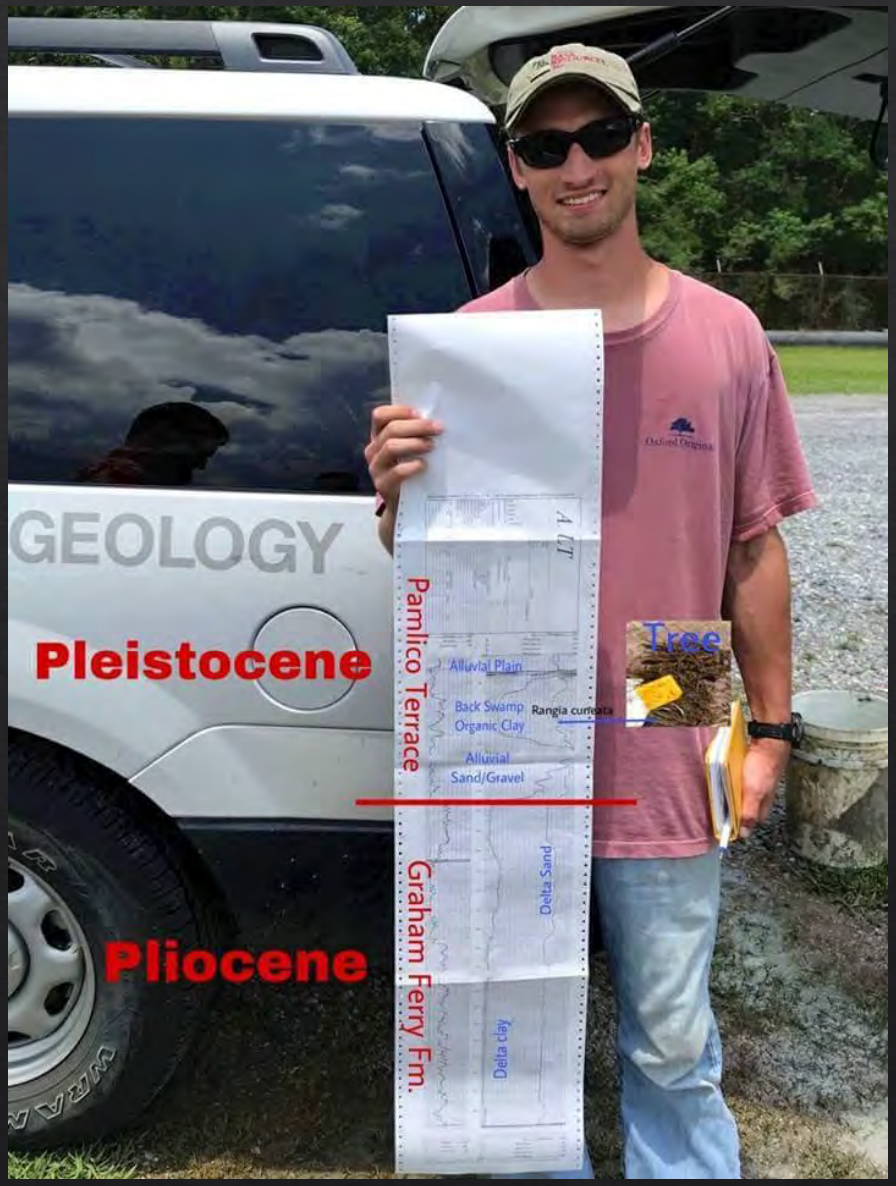
Literature Search

Geophysical Log Correlation

Test Hole Drilling

Sample Collection

New Geophysical Data



Sample Processing

40-50 - S/g/o Quartzose, Slightly Micaceous.

50-60 - fine-orange Sand, then Chert Black Angular Pea-gravel, then Khaki-Colored Kaolinitic Cly.

60-70 Cly. Stiff, Slightly Greenish-White colored

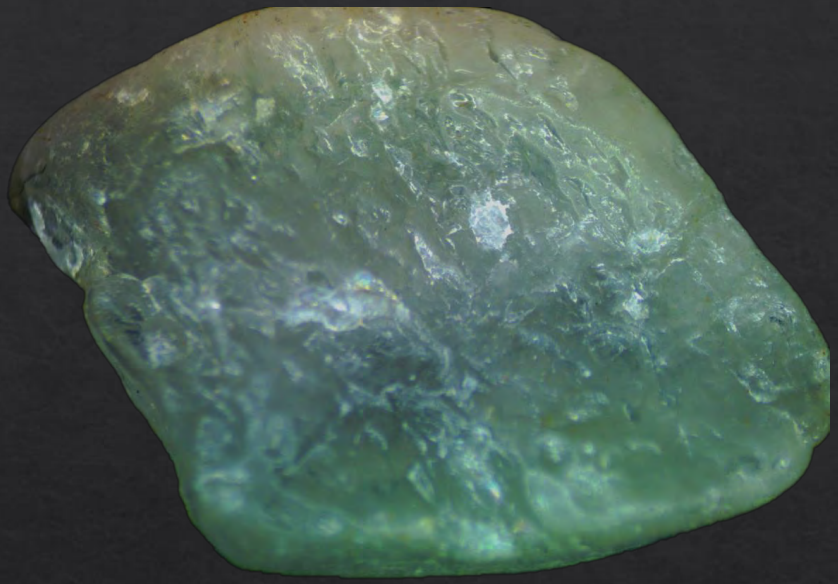
70-80 Top S/g/o. Blm coars-Quartz sand w/ Black Angular Chert Pea gravel

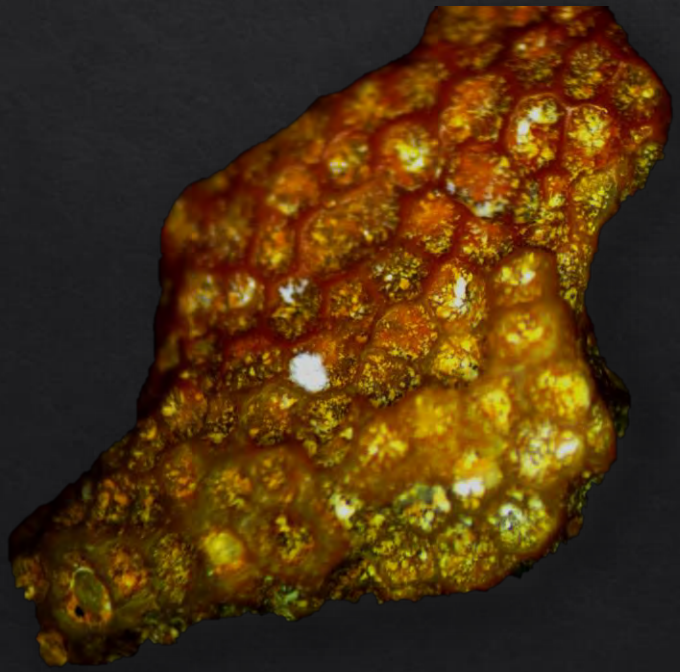
80-90 - 5' coars Quartz Sand & Black Angular Pea gravel. From ledge @ 5' the Stiff off-white Cly

90-100 - Stiff Cly. Ribbons well grading from Khaki-Colored to light grey

100-110 grey-green Stiff Cly

Microscope and Lab Work

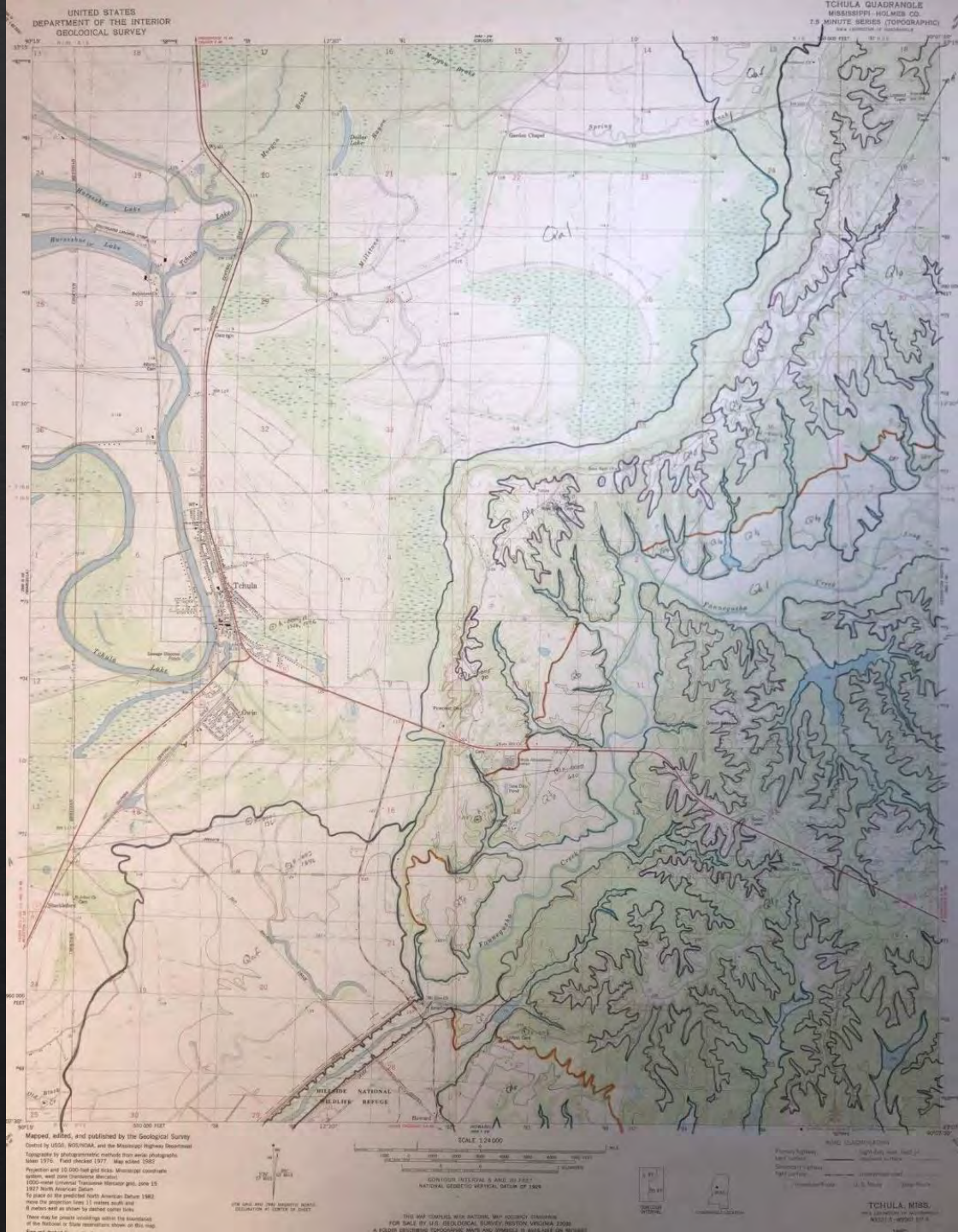




Microscope and Lab Work

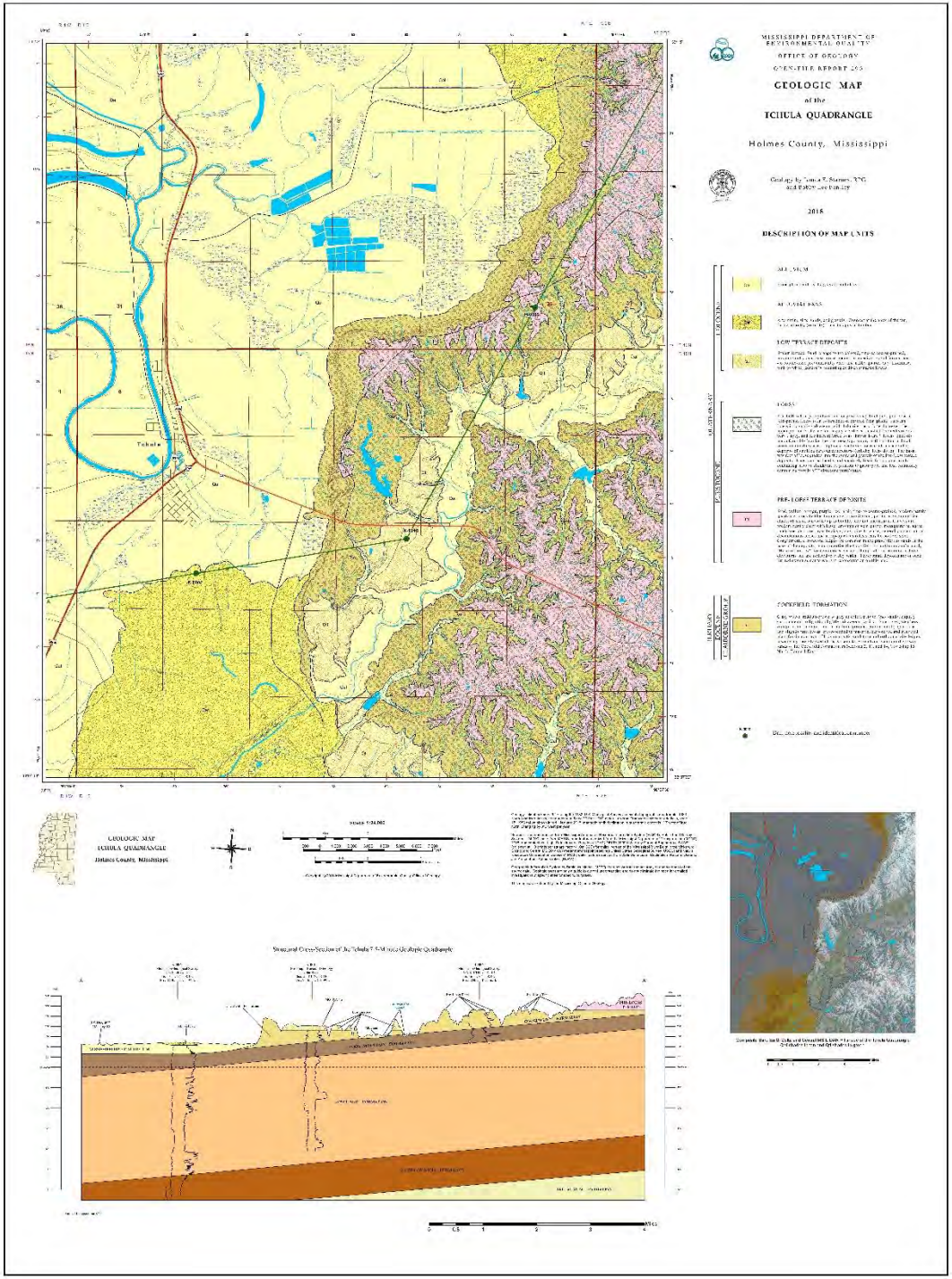
Map Drafting

- Maps are drafted onto the 7.5 minute USGS Topographic Quadrangle



Map Digitizing

- Maps and Cross Sections are digitized using ESRI ArcMap.



Questions?