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AGE OF THE UPPER YAZOO FORMATION IN CENTRAL MISSISSIPPI

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INTRODUCTION

The Yazoo Formation is the upper of two formations recognized in the Jackson Group (upper Eocene) in Louisiana, Mississippi, and western Alabama. This formation contains four members in eastern Mississippi and western Alabama which include in ascending order: (1) the North Twistwood Creek Clay Member, (2) the Cocoa Sand Member, (3) the Pachuta Marl Member, and (4) the Shubuta Clay Member. These members grade westward into a thick undifferentiated sequence of clay in central and western Mississippi. In Louisiana the Yazoo Formation contains the following units in ascending order: (1) the Tullos Member, (2) the Union Church transition phase, (3) the Verda Member, and (4) the Danville Landing Member.

Members of the Yazoo Formation in eastern Mississippi and western Alabama contain a rich marine microfauna but a poor or modest invertebrate macrofauna with a low diversity. The calcareous nannoplankton of these members has been studied by Bybell (1982) and Siesser (1983). They vary in age according to the calcareous nannoplankton zonation of Martini (1971) from NP17 - NP21. The NP21 assignment given to the Shubuta Clay Member by both Bybell (1982) and Siesser (1983) is of particular interest as this zone continues into the lower part of the Vicksburg Group in eastern Mississippi and western Alabama, and thus crosses the Eocene - Oligocene boundary.

The Vicksburg Group in Mississippi has a very rich and diverse molluscan macrofauna that is distinct from that of the Jackson Group. This fauna first occurs in the basal part of the lowest unit of the Vicksburg Group, the Red Bluff Formation. In central and western Mississippi the Red Bluff marine interval is replaced by deltaic sediments of the lower Forest Hill Formation. Here the earliest Vicksburg marine fauna occurs in the Mint Spring Formation, which in this

region is assigned by Siesser (1983) to Martini's calcareous nannoplankton Zone NP22. The Shubuta Clay Member which underlies the Red Bluff Formation in Wayne County is sparsely fossiliferous in regard to macrofossils. For this reason, it is not possible to determine if the Shubuta molluscan fauna is closer to that of the lower Jackson Group (Moodys Branch Formation) or to that of the Vicksburg Group. The upper part of the undifferentiated Yazoo Formation in Hinds County does contain a diverse molluscan fauna and seems to be the stratigraphic equivalent of the Shubuta Clay.

Samples from the upper Yazoo Formation in central Mississippi and the Danville Landing Member in Louisiana were examined for calcareous nannoplankton by the junior author for the purpose of correlating them with members of the formation in eastern Mississippi. Of particular interest is the sequence of the upper Yazoo Formation exposed in the Miss Lite clay pit at Cynthia, Mississippi (figures 1-3). The upper Yazoo at this locality contains a diverse molluscan fauna which is very similar to the upper Eocene fauna of the Danville Landing Member in Louisiana. Five important Paleocene - Eocene molluscan genera make their last appearance in North America in the Danville - Cynthia clay pit horizon. These are the bivalve (1) *Venericardia (Venericor),* the gastropods (2) *Calyptraphorus,* (3) *Pseudoliva,* (4) *Athleta,* and the cephalopod (5) *Belosaepia.* Though not occurring in the Oligocene of North America, *Athleta* does occur in the Oligocene of Europe.

GEOPHYSICAL CORRELATIONS OF THE YAZOO FORMATION

Members of the Yazoo Formation in eastern Mississippi can be easily distinguished on test hole electric logs. Cross sections of the Jackson and Vicksburg groups across Mississippi from Wayne to Warren counties by Dockery (1982, p. 12-13) show the electric log characteristics of these members and their westward extent. The Cocoa Sand Member pinches out in the western part of Wayne County, where the Pachuta Marl Member separates the North Twistwood Creek Clay and Shubuta Clay members. The Pachuta Marl pinches out in Rankin County, so that there is no division of the Yazoo clay sequence in Hinds County.

The Yazoo Formation thickens from 175 feet thick in eastern Wayne County to 515 feet thick in Warren County. This increase in thickness, as indicated by electric log correlations, is entirely within the Shubuta interval. The North Twistwood Creek - Pachuta interval thins westward in Wayne County as the Cocoa Sand Member pinches out. This decrease is from 150 feet thick in the eastern part of the county to 60 feet thick in the western part. The North Twistwood Creek - Pachuta interval then thins only slightly to a thickness of 55 feet in Rankin County. However, the Shubuta interval thickens from 25 feet thick in eastern Wayne County to 295 feet thick in eastern Rankin County. If the North Twistwood Creek - Pachuta equivalent section in Warren County comprises only the lower 55 feet of the undifferentiated Yazoo clay, then the Shubuta interval would account for the upper 460 feet of this sequence or 89% of the total Yazoo section as opposed to only 14% in eastern Wayne County. It would seem almost certain from these correlations that the upper Yazoo Formation at the Cynthia clay pit in north-central Hinds County and the Danville Landing Member in Louisiana are equivalent to the Shubuta Clay Member in eastern Mississippi and also fall into Martini's calcareous nannoplankton Zone NP21. The only problem with geophysical correlations of this nature is that they depend on lithologic units being synchronous throughout their extent. There is the possibility that lithologic units in the Yazoo Formation may be diachronous as are some in the Vicksburg Group such as the Mint Spring Formation and Marianna Limestone. For this reason it is necessary to corroborate the geophysical data with biostratigraphic data.

THE UPPER YAZOO FORMATION AT THE CYNTHIA CLAY PIT

The upper part of the undifferentiated Yazoo Formation is quarried in a large pit at Cynthia, Mississippi, by the Miss Lite Division of the Jackson Ready-Mix Concrete Company for the manufacture of light weight aggregate. A measured section along a quarry road up the west side of the quarry showed the following units in ascending order: (1) 44-foot thick, fossiliferous, blocky, bluish-gray clay, (2) 4-foot thick, very calcareous, fossiliferous, partially indurated, light bluish-gray clay that weathers to a very light gray color, (3) 27-foot thick, very fossiliferous, gray clay with numerous 2 or 3-inch thick beds of shell hash, and (4) 19-foot thick, weathered, brown clay with veins of gypsum. The second unit of this section is a partially lithified zone that separates two slightly dissimilar clay units. This lithified zone is probably responsible for the upper of two sharp resistivity kicks occurring in the upper Yazoo Formation on test hole and well electric logs within the region (see Figure 4). Cross sections of the Jackson and Vicksburg groups by Dockery (1982, p. 12-13) show that these kicks can be correlated across a large portion of central Mississippi.

There is no well data available at the Cynthia pit site,

Figure 1. View of the south quarry wall of the Cynthia clay pit (MGS locality 15) in the SE/4, SW/4, Section 25, T. 7 N., R. 1 W., Hinds County, Mississippi. The highly calcareous clay bed of unit 2 in the measured section can be seen as a narrow white band along the upper part of the quarry wall. This unit is displaced and tilted at junctions between slump blocks. Photograph taken on May 16, 1984.

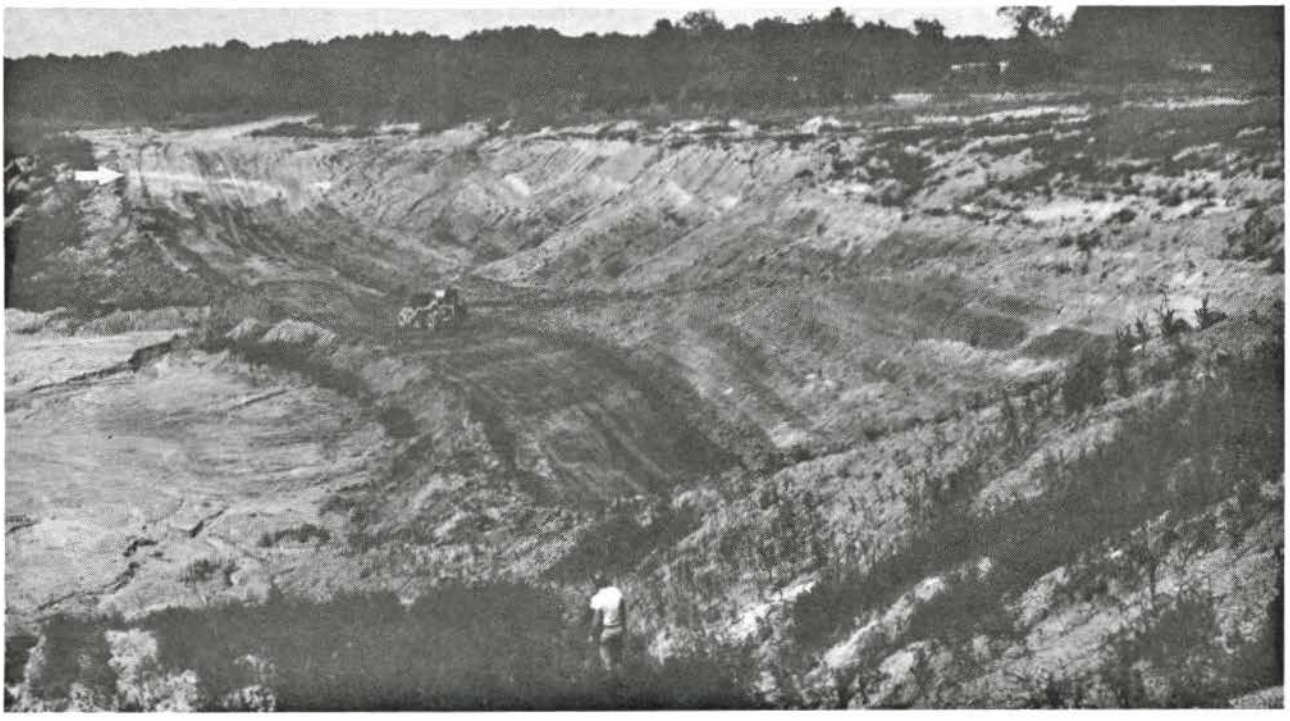

Figure 2. Scott Snyder standing next to an exposure of unit 2 on the west quarry wall of the Cynthia clay pit. An arrow indicates the position of unit 2 on the east wall. Photograph taken on May 16, 1984.

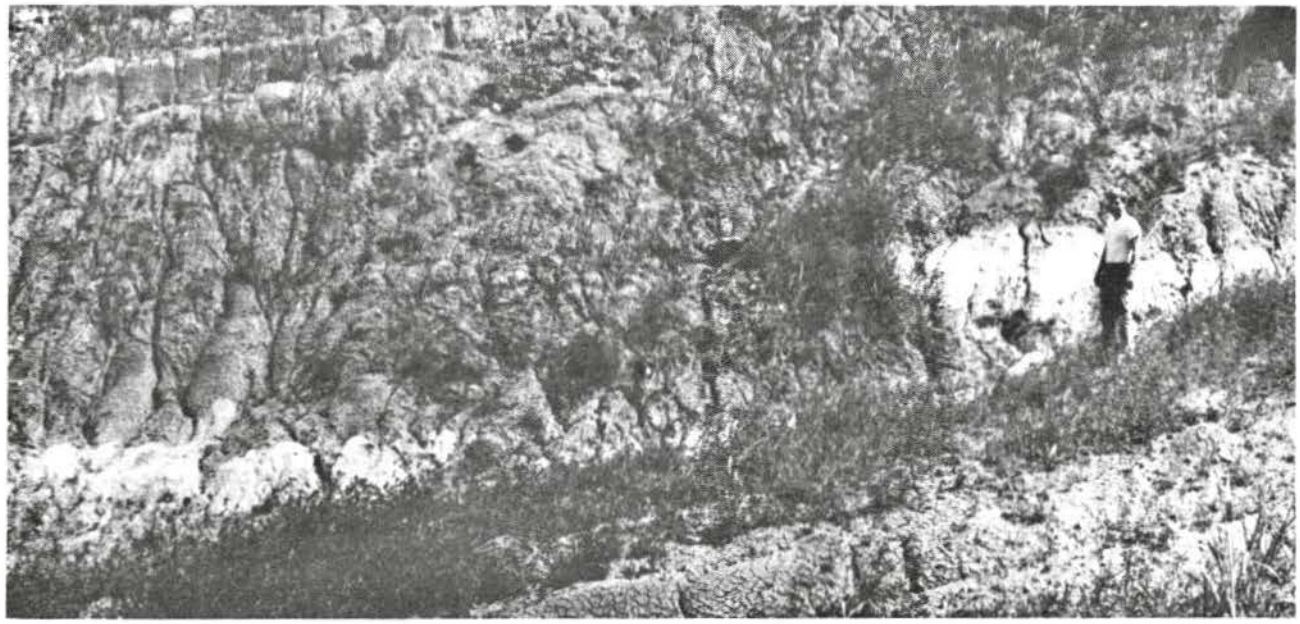

Figure 3. Scott Snyder standing next to unit 2 in the south quarry wall of the Cynthia clay pit at a point where the unit is displaced at the junction of slump blocks. Photograph taken on May 16, 1984.

but an extrapolation of data from nearby wells on the top of the Moodys Branch Formation indicates that this datum occurs at 40 feet below mean sea level or 290 feet below the quarry floor. Based on this extrapolation, the quarry section is correlated with and indicated on the electric log of a nearby test hole shown in Figure 4. This test hole shows the entire thickness of the Yazoo Formation. The upper of two sharp resistivity kicks in the upper clay sequence on the test hole's electric log corresponds to the position of the lithified zone (unit 2) of the measured section at Cynthia.

Invertebrate macrofossils at the Cynthia clay pit consist largely of mollusks though the solitary corals *Flabellum* and *Endopachys* are common. Fossils seem to be randomly dispersed in the lower clay unit, but, in unit 3, they are more abundant and are concentrated in 2 to 3-inch thick shell beds that occur throughout the unit. Notable mollusks in unit 3 include the large bivalve *Nemocardium (Nemocardium) nicolletti* (Conrad, 1841) and the gastropod *Turritella arenicola danvillensis* Stenzel and Turner, 1940. The following is a list of mollusks collected from the Cynthia clay pit. Each species name is followed by MB if it also occurs in the Moodys Branch Formation, DL if it occurs in the Danville Landing Member of the Yazoo Formation, and V if it occurs in the Vicksburg Group.

GASTROPODA

Architectonica (Architectonica) bellistriata Conrad *in* Wailes, 1854 MB, DL

Architectonica (Granosolarium) meekana subsplendida Palmer, 1947 MB, DL

Turritella perdita jacksonensis Cooke, 1926 MB

Turritella arenicola danvillensis Stenzel and Turner, 1940 DL

Turritella sp.

Cirsotrema (Coroniscala) danvillense Palmer, 1947 MB, DL

Niso sp.

Natica permunda Conrad *in* Wailes, 1854 MB, DL

Polinices weisbordi Palmer, 1937 MB

Hexaplex (Hexaplex) supernus (Palmer, 1947) MB, DL

Tritiaria albirupina (Harris, 1894) MB

Pseudoliva vetusta perspectiva Conrad *in* Gabb, 1860 MB, DL

Siphonalia sullivani ouachitae Palmer, 1947 DL

Pyramimitra sp.

Cantharus sp.

Levifusus spiniger (Conrad, 1848) V

Tritonoatractus montgomeriensis (Vaughan, 1896) MB, DL

Tritonoatractus pearlensis danvillensis Palmer, 1947 DL

Mazzalina inaurata oweni (Dall, 1890) MB

Athleta sp.

Caricella howei Palmer, 1947 MB, DL

Conomitra hammakeri (Harris, 1894) MB, DL
Coronia nodulina ouachitensis (Harris, 1937) DL
Coronia conjuncta (Casey, 1904) DL
Coronia montgomeryensis (Harris, 1937) DL
Sinistrella americana (Aldrich, 1885) MB, DL
Pleurofusia danvicola Harris, 1937 DL
Turricula plutonica weisbordi Harris, 1937 DL
Eucheilodon crenocarinata Heilprin, 1880 MB, DL
Pseudotoma heilprini (Aldrich, 1885) var. MB, DL
Cochlespira bella polita Harris, 1937 MB
Cordieria ludoviciana (Vaughan, 1896) MB
Infracoronia ludoviciana normani Harris, 1937 var.?
Asthenotoma danvitexa Harris, 1947 DL
Cymatosyrinx palmerae Harris, 1947 DL
Ringicula sp.
Scaphander sp.
Abderospira oviformis (Meyer, 1886) MB
Mnestia meyeri (Cossmann, 1893) MB

BIVALVIA
Nucula sp.
Nuculana sp.
Yoldia (Calorhadia) reginajacksonis (Harris, 1897) MB, DL
Limopsis sp.
Atrina sp.
Chlamys danvillensis Weisbord *in* Tucker-Rowland, 1936 DL
Ostrea falco Dall, 1896 MB
Venericardia (Rotundicardia) diversidentata Meyer, 1885 MB
Venericardia (Venericor) apodensata Gardner and Bowles, 1939 MB
Nemocardium (Nemocardium) nicolletti (Conrad, 1841) MB, DL
Pitar (Pitar) securiformis (Conrad, 1865) MB, DL
Caestocorbula wailesiana (Harris *in* Dall, 1898) MB, DL
Corbula (Carycorbula) willistoni Meyer, 1885 MB, DL

SCAPHOPODA
Dentalium danvillense Palmer, 1947 MB, DL
Cadulus sp.

CEPHALOPODA
Belosaepia sp.

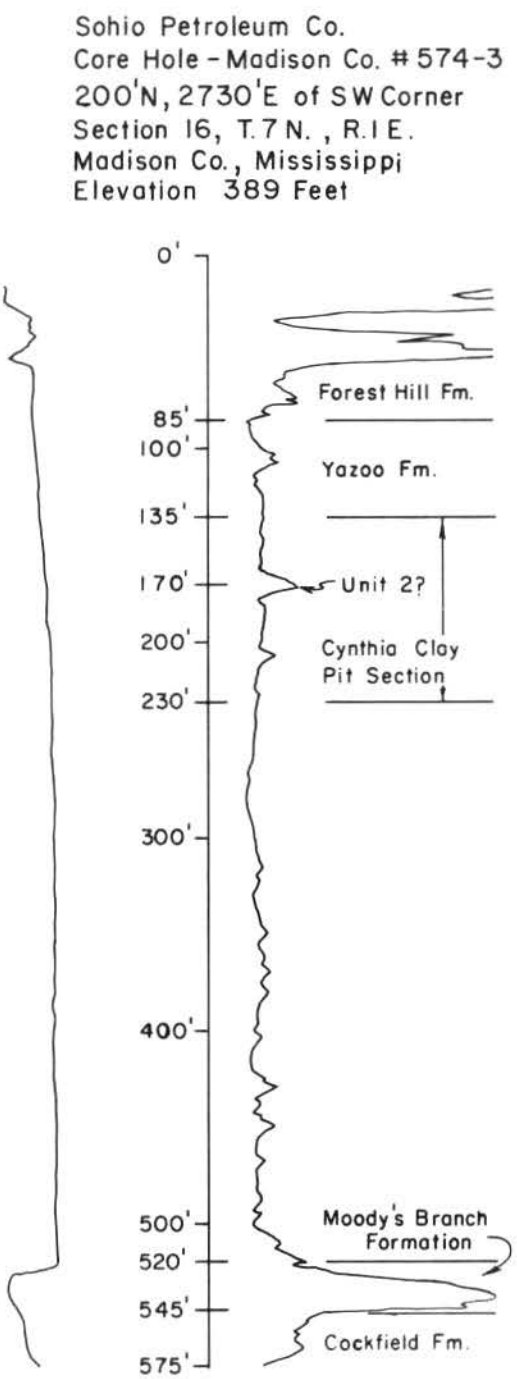

Figure 4. Electric log of the Sohio Petroleum Company Core Hole #574-3 in Madison County near the Cynthia clay pit. The interval of the upper Yazoo Formation exposed in the pit is indicated on the log. This interval's position was determined by a correlation on the top of the Moodys Branch Formation to the pit site with the use of several electric logs from wells and test holes in the region. The floor of the Cynthia clay pit was calculated to be 290 feet above the Moodys Branch Formtion and is so placed on the log.

The previous list cites 56 molluscan species from the Cynthia clay pit, of which 18 or 32% occur in both the Moodys Branch Formation and Danville Landing Member, 10 or 18% occur only in the Moodys Branch Formation, 11 or 20% occur only in the Danville Landing Member, 1 or 2% occurs in the Vicksburg Group, and 14 or 25% are unnamed species that occur only at Cynthia. This list indicates that the Cynthia fauna is very similar to both that of the Moodys Branch Formation and the Danville Landing Member and seems to be intermediate between the two. However, the Cynthia fauna is very different from that of the Vicksburg Group with which it has only one species in common. If the Cynthia fauna is of equivalent age to the Shubuta Clay Member in eastern Mississippi and is also in the calcareous nannoplankton Zone NP21, then a major crisis is indicated for benthic Eocene molluscan faunas of the Gulf Coastal Plain during that time. Few Eocene species occur in the lower Oligocene faunas of the Vicksburg Group (Dockery, 1982, and MacNeil and Dockery, 1984).

CALCAREOUS NANNOPLANKTON BIOSTRATIGRAPHY

Several samples from the upper Yazoo Formation were examined for calcareous nannoplankton. These include one sample from the type locality of the Danville Landing Member at Danville Landing on the Ouachita River in Catahoula Parish, Louisiana, and six samples from the Cynthia clay pit. The Danville sample consisted of a screened microsample supplied by James E. Allen of Alexandria, Louisiana, that was collected before the type locality was flooded by a reservoir. Six sediment samples were collected from the Cynthia clay pit along the same quarry road used in the measured section. The lithologic unit and elevation above the quarry floor of each sample is as follows: Unit 1, sample 1 at quarry floor, sample 7 at +26 feet; Unit 2, sample 10A at +45 feet; Unit 3, sample 12 at +54 feet, sample 15 at +70 feet, and sample 16 at +74 feet. A core of the upper few feet of the Yazoo Formation at the Forest Hill Formation type locality (Mississippi Bureau of Geology core no. 549) was also examined, but calcareous nannoplankton were not found. Calcareous nannoplankton species found in the Danville Landing and Cynthia samples are listed in Tables 1 and 2 and illustrated on Plate 1.

CYNTHIA CLAY PIT

Calcareous nannoplankton are abundant and well preserved in most of the samples collected in this section (Table 2). *Discoaster binodosus* ranges from NP 10 to NP 21, *Cyclococcolithus formosus* from NP 11 to NP 21 and *Isthmolithus recurvus* from NP 19 to NP 22 (Martini, 1971). The range overlap among these species indicates a zonal range of NP 19 to NP 21. Based on what is missing, we believe the section can be assigned to NP 21. *Discoaster saipanensis, D. barbadiensis* and *Reticulofenestra reticulata* all become extinct at the top of Zone NP 20 (Martini, 1971; Muller, 1978). These three species are common in stratigraphically lower samples of the Yazoo clay examined by Siesser (1983), and their presence would be expected if this section were older than NP 21, especially in light of the abundance and generally good preservation of the nannoplankton assemblage throughout the section. Despite a long search, no specimens of *D. saipanensis* or *R. reticulata* were found in any of the samples collected from this section, and only a single specimen of *D. barbadiensis* was found. We therefore assign this section to NP 21.

DANVILLE LANDING

This sample contains the same general assemblage as the Miss. Lite Clay section, although specimens are not as abundant or quite as well preserved (Table 2). The range overlap of *Isthmolithus recurvus* and *Cyclococcolithus formosus* indicates a zonal range of NP 19-NP 21. The complete absence of *D. saipanensis, D. barbadiensis,* and *R. reticulata* suggests a more restricted assignment to NP 21 is possible. The abundance of the Braarudosphaerid family indicates nearshore conditions for all these samples. *Discoaster* and other warm-water taxa are present in moderate amounts, but not in "tropical" abundances. *Isthmolithus recurvus* is also present in moderate amounts throughout the section, and this species is an indicator of cooler waters. We suggest warm-temperate surface-water conditions during NP 21 at these localities.

CONCLUSIONS

The upper Yazoo Formation exposed in the clay pit at Cynthia, Mississippi, and the Danville Landing Member of Louisiana are in Martini's calcareous nannoplankton Zone NP21 and are equivalent to the Shubuta Clay Member of eastern Mississippi and western Alabama. The North Twistwood Creek Clay - Pachuta Marl sequence of the Yazoo Formation in eastern Mississippi thins westward as the Shubuta Clay interval thickens. In central and western Mississippi, the Shubuta Clay is equivalent to more than half of the undifferentiated Yazoo clay sequence. A major crisis is indicated for Eocene benthic

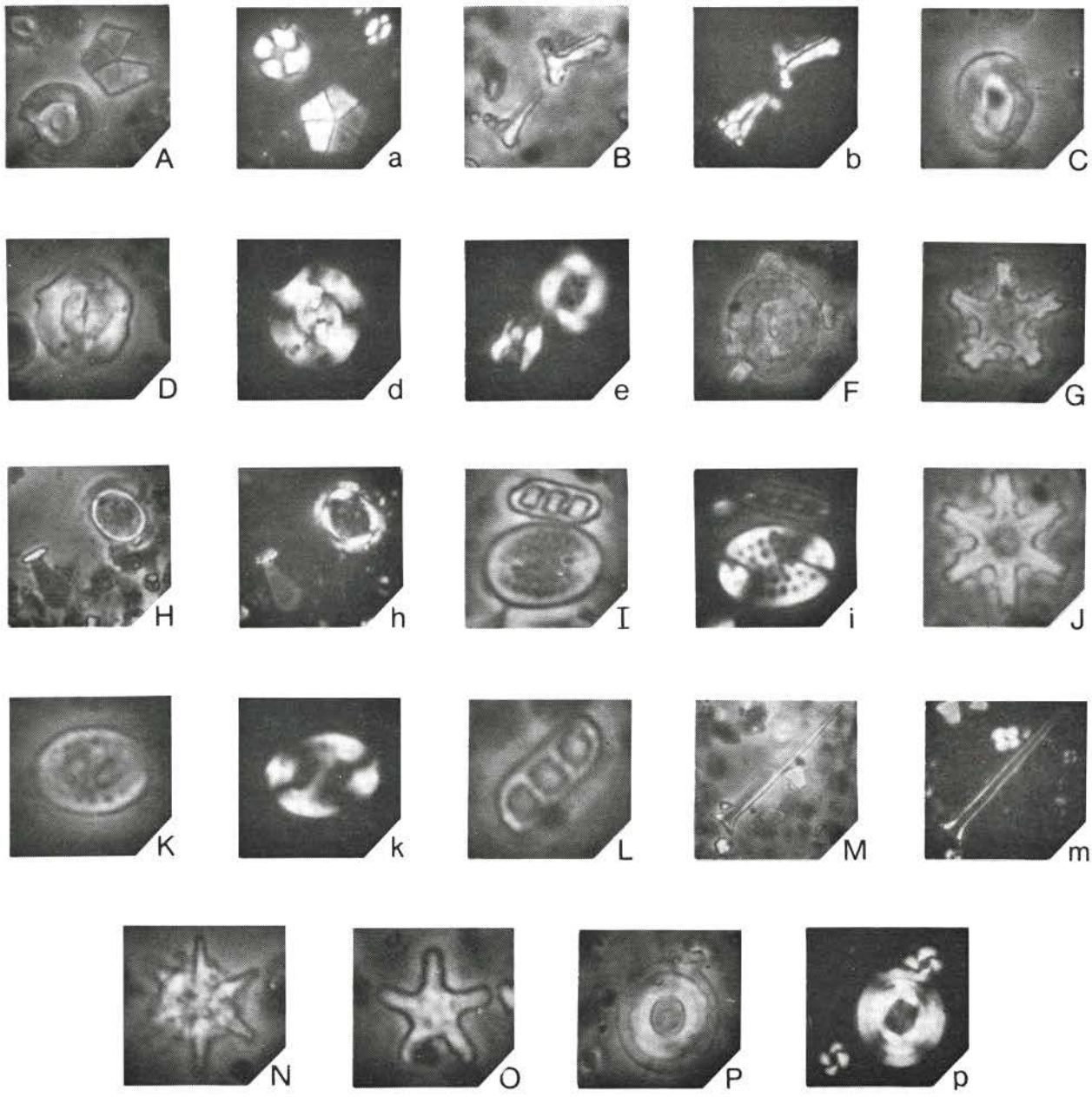

Plate 1. Calcareous nannoplankton in the Yazoo Clay. Phase-contrast illumination indicated by upper-case letters; cross-polarized illumination by lower case. Sample numbers are in parentheses—DL (Danville Landing), MS (Miss. Lite Clay). A,a, **Braarudosphaera bigelowii** (pentagonal form), **Cyclococcolithus formosus** (large circular form) and **Coccolithus pelagicus** (small elliptical form) (MS 10A); B,b, **Zygrhablithus bijugatus** (two specimens) (MS 10A); C, **Helicosphaera compacta** (MS 10A); D,d, **Dictyococcites bisectus** (MS 10A); e, **Reticulofenestra daviesi** (upper right) and **Lanternithus minutus** (lower left) (MS 10A); F, **Coccolithus eopelagicus** (MS 10A); G, **Discoaster nodifer** (MS 1); H,h, **Syracosphaera labrosa** (upper right) and **Bramletteius serraculoides** (lower left) (MS 10A); I,i, **Pontosphaera multipora** (lower) and **Isthmolithus recurvus** (upper) (MS 10A); J, **Discoaster nodifer** (MS 15); K,k, **Transversopontis obliquipons** (MS 10A); L, **Isthmolithus recurvus** (DL); M,m, **Blackites spinosus** (MS 10A); N, **Lithostromation simplex** (DL); O, **Discoaster tanii** (MS 10A); P,p, **Reticulofenestra umbilica** (large form) and **Cyclicargolithus floridanus** (two small forms) (MS 10A). Approximate magnifications: 1000X, except A, a, B, b, e, F, H, h (800X) and L (1200 X).

TABLE 1

CALCAREOUS NANNOPLANKTON IN THE YAZOO CLAY

Micrantholithus aequalis Sullivan 1964
Discoaster barbadiensis Tan Sin Hok 1927
Braarudosphaera bigelowii (Gran & Braarud) Deflandre 1947
Zygrhablithus bijugatus (Deflandre) Deflandre 1959
Discoaster binodosus Martini 1958
Dictyococcites bisectus (Hay, Mohler & Wade) Bukry & Percival 1971
Helicosphaera compacta Bramlette & Wilcoxon 1967
Reticulofenestra daviesi (Haq) Haq 1971
Discoaster deflandrei Bramlette & Riedel 1954
Reticulofenestra dictyoda (Deflandre & Fert) Stradner *in* Stradner & Edwards 1968
Coccolithus eopelagicus (Bramlette & Riedel) Bramlette & Sullivan *in* Bramlette & Wilcoxon 1967
Helicosphaera euphratis Haq 1966
Cyclicargolithus floridanus (Roth & Hay) Bukry 1971
Cyclococcolithus formosus Kamptner 1963
Thoracosphaera heimi (Lohmann) Kamptner 1920
Syracosphaera labrosa Bukry & Bramlette 1969
Cyclococcolithus luminis Sullivan 1965
Lanternithus minutus Stradner 1962
Sphenolithus moriformis (Bronnimann & Stradner) Bramlette & Wilcoxon 1967
Pontosphaera multipora (Kamptner) Roth 1970
Discoaster nodifer (Bramlette and Riedel) Bukry 1973
Transversopontis obliquipons (Deflandre) Hay, Mohler & Wade 1966
Lithostromation operosum (Deflandre) Bybell 1975
Pemma papillatum Martini 1959
Pontosphaera pectinata (Bramlette & Sullivan) Sherwood 1974
Coccolithus pelagicus (Wallich) Schiller 1930
Pontosphaera plana (Bramlette & Sullivan) Haq 1971
Micrantholithus procerus Bukry & Bramlette 1969
Isthmolithus recurvus Deflandre *in* Deflandre & Fert 1954
Thoracosphaera saxea Stradner 1961
Bramletteius serraculoides Gartner 1969
Lithostromation simplex (Klumpp) Bybell 1975
Blackites spinosus (Deflandre & Fert) Hay & Towe 1962
Discoaster tanii (Bramlette & Riedel) 1954
Blackites tenuis (Bramlette & Sullivan) Bybell 1975
Reticulofenestra umbilica (Levin) Martini & Ritzkowski 1968
Rhabdosphaera vitrea (Deflandre) Bramlette & Sullivan 1961

TABLE 2

	Danville Landing	Cynthia Clay Pit					
		1	7	10A	12	15	16
Micrantholithus aequalis			R		R		
Discoaster barbadiensis				S			
Braarudosphaera bigelowii	R	R	F	C	F	R	
Zygrhablithus bijugatus	R	R	R	R	F	R	R
Discoaster binodosus		R	R	R	R	R	
Dictyococcites bisectus	R	R	R	F	F	R	R
Helicosphaera compacta			R	R	R	R	R
Reticulofenestra daviesi	R	F	F	R	R	R	
Discoaster deflandrei			R	R	R		R
Reticulofenestra dictyoda	R			R	R		
Coccolithus eopelagicus				R			
Helicosphaera euphratis		R	R			R	
Cyclicargolithus floridanus	R	C	C	C	C	C	C
Cyclococcolithus formosus	R	R	F	C	C	F	
Thoracosphaera cf. heimi					R		
Syracosphaera labrosa				R	R		
Cyclococcolithus luminis	R	R			R		
Lanternithus minutus				R			
Sphenolithus moriformis	R					R	
Pontosphaera multipora	R			R	R	R	
Discoaster nodifer		R	R	F	R		
Transversopontis obliquipons	R	F		R	R	R	
Lithostromation operosum		R			R		
Pemma papillatum				R	R	R	
Pontosphaera pectinata				R			
Coccolithus pelagicus	R	F	F	C	C	C	C
Pontosphaera plana	R						
Micrantholithus procerus				R			
Isthmolithus recurvus	R	C	F	C	C	F	F
Thoracosphaera saxea				R			
Bramletteius serraculoides				R			R
Lithostromation simplex	R		R		R		
Blackites spinosus	R	R		F	F	F	F
Discoaster tanii				R	R		
Blackites tenuis	R	R		F	F	R	R
Reticulofenestra umbilica	R	R	R	F	F	C	C
Rhabdosphaera vitrea				R			

molluscan faunas within Martini's calcareous nannoplankton Zone NP21 at the contact of the Jackson and Vicksburg groups.

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NEW U.S. GEOLOGICAL SURVEY PUBLICATION

A SELECTED BIBLIOGRAPHY OF WATER RESOURCES PUBLICATIONS FOR MISSISSIPPI

U.S.G.S. Open File Report 84-062

by
G.G. Parker, Jr., Debbe Walker,
and Carol Moss

ABSTRACT

The first edition of the Mississippi water resources bibliography lists publications that come from a broad spectrum of sources and vary greatly in content. Many of the reports are U.S. Geological Survey publications that interpret and summarize the results, or present the basic data collected in the cooperative programs that are jointly funded with State, local, and other federal agencies. The bibliography also includes selected reports published by State and local agencies in Mississippi and adjoining states, and other federal agencies. The basic criteria used for inclusion of a publication were that the report: (1) contain data or interpretative information related to water resources or (2) the report be useful in developing additional data or interpretative studies related to water resources. To allow easy entry and retrieval, the bibliography is organized into four appendices titled Master List, Disciplines, River Basins, and Geographical Areas.

MISSISSIPPI GEOLOGICAL SOCIETY DONATION TO BUREAU OF GEOLOGY LIBRARY

The Mississippi Geological Society recently made a generous donation in support of the Mississippi Bureau of Geology Library. The Society funded the acquisition of $500 worth of geological literature, as listed below. The society presentation group was made up by this year's officers: Charles H. Williams (President), Kipp Ferns (1st VP), Ron Tisdale (2nd VP), Dora Devery (Secretary), Steve Walkinshaw (Treasurer), and Neil Barnes (Program Chairman). The gift was accepted for the Bureau by Carolyn Woodley, Librarian.

A.A.P.G.

Seismic expression of structural styles, A.W. Bally, ed., A.A.P.G. Studies in Geology, no. 15, v.3, 1983. $42.00

The COCORP seismic reflection traverse across the Southern Appalachians, F.A. Cook, et al., A.A.P.G. Studies in Geology, no. 14, 1983. $18.00

ACADEMIC PRESS

Lithostratigraphic analysis of sedimentary basins, C.E.D. Conybeare, 1979. $55.00

Nature and origin of Cretaceous carbon-rich facies, S.O. Schlanger and M.B. Cita, eds., 1983. $39.00

EARTH ENTERPRISES, INC.

Jurassic of East Texas, Mark Presley, ed., East Texas Geological Society, 1983. $35.00

Upper Cretaceous lithostratigraphy and biostratigraphy in Northeast Mississippi, Southwest Tennessee, and Northwest Alabama, shelf chalks and coastal clastics, Spring Field Trip, Gulf Coast Section, S.E.P.M., 1983. $20.00 (total for 2 copies)

Mesozoic-Paleozoic producing areas of Mississippi and Alabama, v.II, complete with supplements 1-8 (1963-1980), Mississippi Geological Society. $50.00

PENNWELL BOOKS

U.S.A. Oil Industry Directory, 23rd edition, Pennwell, 1984. $75.00

Drilling: a source book on oil and gas well drilling from exploration to completion, J.A. Short, 1983. $60.00

Fundamentals of formation evaluation, Donald P. Helendar, 1983. $56.00

Essentials of modern open-hole log interpretation, John Dewan, 1983. $39.95

NEW TOPOGRAPHIC MAP PRICES

Topographic maps provide a detailed record of a land area. Manmade features such as buildings, roads, levees, and section lines are accurately depicted, as are natural features including hills, valleys, rivers and streams, lakes, and coastlines. The Bureau of Geology stocks for sale all topographic maps available for the state of Mississippi, selling 10,000 maps or more annually. The maps are prepared to very high standards of accuracy by the U.S. Geological Survey. As a result of the recent price increase by U.S.G.S., the Bureau of Geology began charging the following prices effective March 7, 1984:

7.5′ quadrangle, scale 1:24,000 - $2.50
15′ quadrangle, scale 1:62,500 - $2.50
1° × 2° sheets, scale 1:250,000 - $4.00

For mail orders of 1 to 3 maps add 35¢ per map; for 4 to 10 maps add $1.50 and 5¢ for each map thereafter.

Also available are the following:

Mississippi topographic map, scale 1:500,000 - $4.00 plus $1.25 postage

Southern Mississippi Valley map - $3.00 plus $1.25 postage

U.S. base map - $3.00 plus $1.25 postage.

Call for Papers

Mississippi Academy of Sciences
1985 Annual Meeting

The 1985 annual meeting of the Mississippi Academy of Sciences will be held on February 20-22 at the Holiday Inn - Downtown, Jackson. Please help insure another successful Geology and Geography Division session by planning to attend. Encourage your colleagues to participate, perhaps by giving a paper.

The program will consist of 15- to 20- minute presentations by Academy members on topics of interest to geologists and geographers in Mississippi. I hope many of you will use this opportunity to share the results of your work with an interested audience. Abstract forms will be mailed to the membership in the Academy's October newsletter. Additional forms will be available from me or from the Mississippi Academy of Sciences office, 520 N. President St., Jackson, MS 39201; telephone 9am to 1pm, 353-6527. Abstracts of all presentations will be published in the Academy's *Journal* supplement, which will be mailed to the membership before the annual meeting.

Please note, the deadline for submission of abstracts to the Division Chairman is November 5, 1984.

I will be happy to answer any questions and accept any comments or suggestions regarding the upcoming meeting. We will have a good session only if you participate, so please plan to attend and send your abstracts to me by November 5.

Michael B.E. Bograd, Chairman
Geology and Geography Division
Mississippi Academy of Sciences
my address:
Mississippi Bureau of Geology
P.O. Box 5348
Jackson, MS 39216
telephone: 354-6228

EDUCATION OPPORTUNITIES

JACKSON ENGINEERING GRADUATE PROGRAM
1855 Eastover Drive
Jackson, Mississippi 39211
Phone 601/982-6229

The Jackson Engineering Graduate Program is a joint program of Mississippi State University and the University of Mississippi. Credit earned for graduate engineering courses taken in this program is "on campus" credit. The Master of Science or Master of Engineering degree may be earned entirely here in Jackson through either MSU or UM without the necessity of going to the main campus for residence credit or thesis work. Courses may also be taken for continuing education.

The minimum requirements for a Master of Science degree are 24 hours of course work and 6 hours of thesis. A non-thesis option is available through UM which requires a minimum of 27 hours of course work and 3 hour design project. The Master of Engineering degree is available through MSU and requires 30 hours of course work and a 3 hour design project. On the job thesis or design project work will be arranged if possible. Research may be conducted in the Engineering Laboratory at the Universities Center.

Structured programs are currently being offered in Chemical, Civil, Electrical, Geological, Industrial and Mechanical engineering. Additional programs will be developed based on student interest. Classes normally meet once a week from 6 to 9 p.m.

For more information please call or write.

Ms. Linda Cornell,
MChE, PE, Director

A Review

PETROLEUM POTENTIAL OF THE NIOBRARA FORMATION IN THE DENVER BASIN: COLORADO AND KANSAS

This thesis of Megan Leonard Hann was accepted toward an M.S. degree by Colorado State University in 1981. It contains 260 pages, including illustrations, plus xv. A copy of this thesis is in the Library of the Mississippi Bureau of Geology.

This intensive study was funded by Amoco Petroleum Company and the American Association of Petroleum Geologists. It had broad support from commercial, governmental, and academic geological researchers, and it utilized the most modern and technically acceptable techniques and ideas applicable to the economic geology of the vast "chalk" deposits of the Western Interior. Ideal Cement Company cooperated; their Boettcher Quarry in Larimer County, Colorado, 5 miles in length, yielded much of the data for this thesis.

"The formation (Niobrara) consists of massive limestones, chalky shales, and shaly chalks. These lithologies are persistent laterally within the study area where they can be traced from exposures at the Boettcher Quarry through the subsurface, to outcrops in West-Central Kansas. The nature of these lithologies and their widespread distribution suggest a relatively stable offshore marine setting with greater depth of water during Smoky Hill (lower Niobrara) deposition."

"Natural gas of the Niobrara Formation is produced from the upper chalk bench (the Beecher Island zone) of the Smoky Hill Member in eastern Colorado and western Kansas. Production from these areas is directly related to structural closures."

"The Niobrara Formation, at the Boettcher Quarry, is very kerogen rich....*Ideal Cement Factory is presently acquiring one-half of its energy needs from these kerogen rich units.*" (emphasis reviewer's)

Perhaps the most important part of this thesis for natural gas exploration is the 36 pages (151-187) dealing with log evaluation. Another valuable section is the list of 76 references.

Paleontological, lithological, and depositional similarities of the Cretaceous of the Western Interior with the Cretaceous of the Gulf Coast suggest that increased studies of the extensive "chalk" sediments of Mississippi and adjoining states can utilize the technologies and principles used in the Hann thesis. This unpublished comprehensive work is a valuable reference to researchers interested in resource development (oil, gas, "hard" minerals, storage or disposal) in the Mississippi Cretaceous.

Frederic F. Mellen
August, 1984

"Never guess, unless you have to—there's enough uncertainty in the universe."

Dr. Who

"Every acquisition won by investigation is merely a step to the attainment of higher things in the eventful course of human affairs."

Alexander von Humboldt

CALENDAR OF EVENTS
1984 October - December

October 17-20 - American Association of Stratigraphic Palynologists, annual meeting, Arlington, Virginia, and field trip (Oct. 17) to classic Coastal Plain localities. (Norman Frederiksen, MS 970, U.S. Geological Survey, Reston, Virginia 22092. Phone: 703/860-7745).

October 24-26 - Gulf Coast Association of Geological Societies, annual meeting, Shreveport, Louisiana. (James M. Forgotson, 509 Marshall St., Suite 1200, Shreveport, La. 71101. Phone: 318/222-1126).

October 26-27 - Appalachian thrust belt in Alabama, field trip. (T.L. Neathery, Geological Survey of Alabama, Box 0, University Station, Tuscaloosa, Alabama 35486).

October 29-November 2 - Advanced remote sensing and spatial data analysis for exploration geology, workshop, Sioux Falls, South Dakota. (Training and Assistance Office, USGS/EROS Data Center, Sioux Falls, South Dakota 57198. Phone: 605/594-6114).

November 5-8 - Geological Society of America, annual meeting, in Reno, with associated societies: Cushman Foundation, Geochemical Society, Geoscience Information Society, Mineralogical Society of America, National Association of Geology Teachers, Paleontological Society, Society of Economic Geologists. (Jean M. Latulippe, GSA headquarters, Box 9140, Boulder, Colorado 80301. Phone: 303/447-2020).

November 13-14 - Modern and ancient deep-sea fan sedimentation, short course, Houston. (Society of Economic Paleontologists and Mineralogists, Continuing Education Dept., Box 4756, Tulsa, Oklahoma 74159. Phone: 918/743-2498).

November 14-15 - Coastal Zone and Continental Shelf Conflict Resolution, meeting, Cambridge, Massachusetts. (T.Z. Henderson, M.I.T. Sea Grant Information Center, 77 Massachusetts Ave., Bldg. E38-301, Cambridge, Mass. 02139. Phone: 617/253-7041). Topics: oil spill superfund, incinerator ship emissions, offshore leasing, effluent and oil pipelines, deep-ocean mining, boundary disputes.

December 2-5 - Gulf Coast Section, Society of Economic Paleontologists and Mineralogists, annual meeting, Austin, Texas. (Don G. Bebout, Texas Bureau of Economic Geology, University of Texas, Box X, University Station, Austin, Texas 78712. Phone: 512/471-7721).

December 2-6 - Society of Exploration Geophysicists, annual meeting, Atlanta. (Marvin R. Hewitt, Amoco Production Co., Box 591, Tulsa, Oklahoma 74102. Phone: 918/660-3377).

"...—and some rin up hill and down dale, knapping the chucky stanes to pieces wi' hammers, like sae mony roadmakers run daft—they say it is to see how the warld was made!—..."

Sir Walter Scott
St. Ronan's Well, 1894

"It is of great importance that the general public be given the opportunity to experience, consciously and intelligently, the efforts and results of scientific research. It is not sufficient that each result be taken up, elaborated, and applied by a few specialists in the field. Restricting the body of knowledge to a small group deadens the philosophical spirit of a people and leads to spiritual poverty."

Albert Einstein

MISSISSIPPI OIL AND GAS STATISTICS, FIRST QUARTER 1984

Oil

	Bbls. Produced	Severance Tax	Average Price Per Bbl.
January	2,253,260	$ 3,693,201.42	$27.32
February	3,554,578	5,398,538.52	25.31
March	806,221	1,606,059.04	33.20
Totals	6,614,059	$10,697,798.98	$26.96

Gas

	MCF Produced	Severance Tax	Average Price Per MCF
January	14,149,007	$3,113,768.55	$3.67
February	20,283,262	4,211,632.34	3.46
March	9,803,606	2,343,653.31	3.98
Totals	44,235,875	$9,669,054.20	$3.64

Source: State Tax Commission

MISSISSIPPI GEOLOGY
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Bureau of Geology
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