Jasper County Mineral Resources

DAVID A. DeVRIES

WILLIAM H. MOORE
MARSHALL K. KERN
HUGH McD. MORSE
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BULLETIN 95

MISSISSIPPI GEOLOGICAL ECONOMIC AND
TOPOGRAPHICAL SURVEY

FREDERIC FRANCIS MELLEN
DIRECTOR AND STATE GEOLOGIST

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STATE OF MISSISSIPPI

Hon. Ross R. Barnett .... Governor

MISSISSIPPI GEOLOGICAL ECONOMIC AND TOPOGRAPHICAL SURVEY BOARD

STAFF

LETTER OF TRANSMITTAL

Office of the Mississippi Geological, Economic and

Topographical Survey

Jackson, Mississippi

May 11, 1963

Mr. Henry N. Toler, Chairman, and
Members of the Board,
Mississippi Geological Survey

Gentlemen:

I hand you herewith the manuscript of Bulletin 95, Jasper County Mineral Resources, the preparation and publication of which has been authorized by the Board.

The work on this report was begun by the principal author, Dr. David A. DeVries, in June, 1960. There have been numerous interruptions and delays in bringing the report to a conclusion. Dr. DeVries has been permitted to take time from his duties on the staff of the Gulf Coast Research Laboratory to complete his manuscript and illustrations. We acknowledge gratefully Dr. Gordon Gunter, Director of the Laboratory, in cooperating with the Survey in this manner.

The Survey appreciates the cooperation of the State Oil and Gas Board in authorizing the preparation of the Section on oil and gas production by its Supervisor, Mr. H. M. Morse.

Sections on ground-water geology and subsurface stratigraphy were very competently prepared by our staff members, M. K. Kern and W. H. Moore. Enormous reserves of fresh ground-water are indicated in the County. The drafting was done by our part-time illustrator, Mr. David S. Sherard.

Dr. Grover E. Murray has added a stratigraphic nomenclatural note of importance in Jasper County.

The Survey appreciates the financial assistance of the Jasper County Board of Supervisors and the town of Bay Springs and Heidelberg.

Bulletin 95 should be of impressive value in the development of the great natural resources of Jasper County. Our staff has worked diligently in its preparation and I commend each individual for his industry and integrity required in the organization and handling of the data.

Respectfully submitted,

Frederic F. Mellen
Director and State Geologist

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GROVER E. MURRAY

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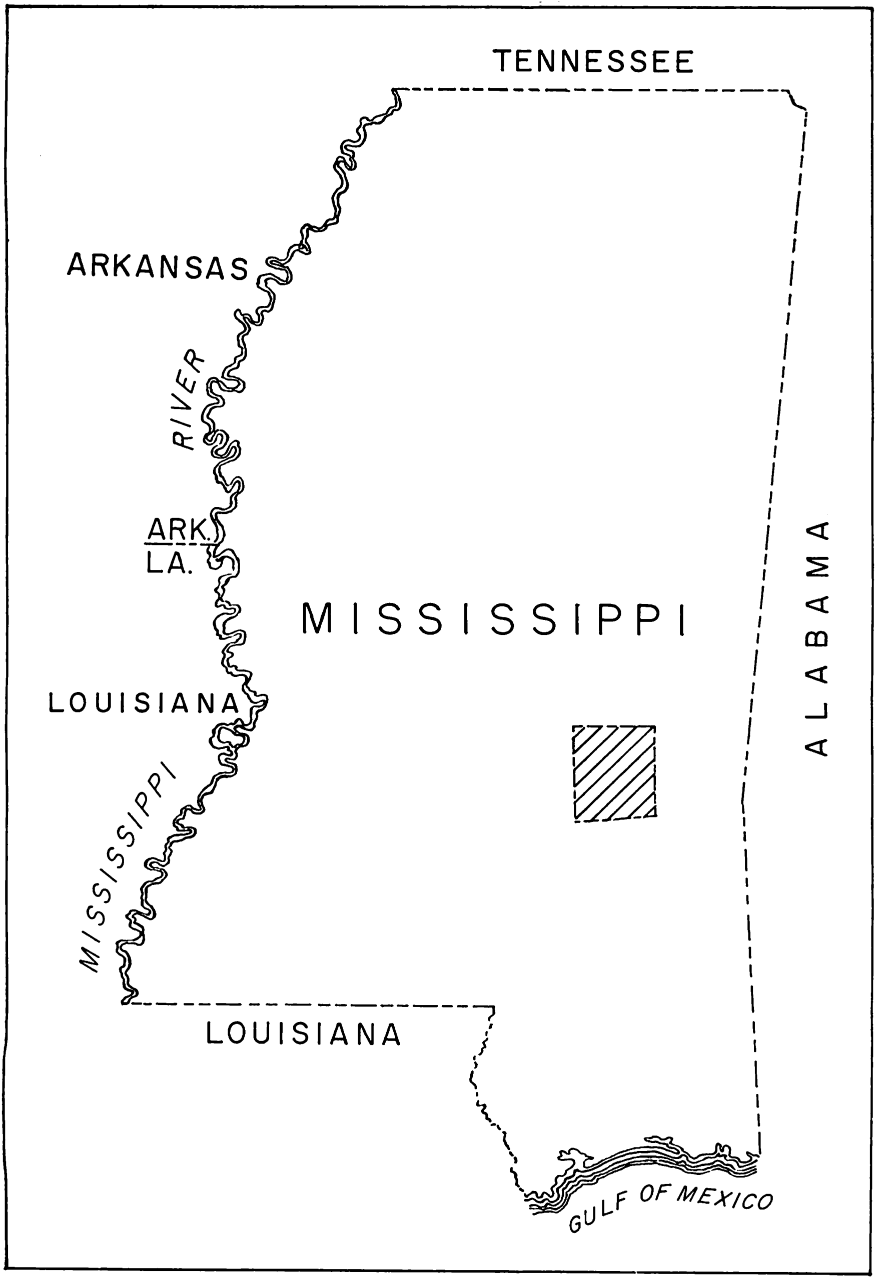

Figure 1.—Location of Jasper County, Mississippi.

JASPER COUNTY MINERAL RESOURCES

DAVID A. DeVRIES[1]

ABSTRACT

Jasper County is located in southeastern Mississippi and covers 667 square miles in area.

Strata exposed at the surface in Jasper County dip south-southwest at 31 feet per mile and range from upper beds of the Kosciusko (Sparta) formation of mid-Eocene age to terrace beds of the Holocene epoch.

A structural nose and one or more faults are indicated in the locality of Antioch (Turnerville), six miles northeast of Bay Springs. Faults of small magnitude are indicated elsewhere in the County.

Mineral resources of the County include petroleum, sand and gravel, clays and agricultural limestone. Bentonites are found at several stratigraphic levels, but none at the surface was of sufficient thickness for commercial use.

INTRODUCTION

Jasper County is located in the southeastern part of the State of Mississippi, in the second tier of counties west of the Alabama State line (Fig. 1). The County is 50 to 80 miles east-southeast of Jackson and 15 to 50 miles southwest of Meridian, Mississippi.

It covers an area of 667 square miles at elevations between (approximately) 230 and 670 feet above sea level. The average elevation is about 375 feet above sea level. The approximate relief is 440 feet.

Surface drainage is achieved by streams tributary to the Leaf and Chickasawhay Rivers.

Jasper County is endowed with the potential for considerable economic growth in terms of available transportation, water, electric power, manpower and undeveloped and undiscovered mineral reserves. An adequate network of county roads and highways is present, and a realistic program of county road construction and improvement is underway. Two railroads serve the County: the Gulf, Mobile and Ohio on the west, and the New Orleans and Northeastern on the east. Abundant supplies of surface and subsurface water are everywhere present. There is an adequate, and growing, electrical power system. There is

[1]. Geologist, Gulf Coast Research Laboratory Ocean Springs, Mississippi

SERIES	GROUP	FORMATION	MEMBER (surface)	MEMBER (shallow down-dip subsurface)	GENERALIZED LITHOLOGIC CHARACTER	THICKNESS
HOLOCENE		(Terraces)			Fluvial and colluvial, buff-red, brown sandy clays with minor gravel lenses.	
PLEISTOCENE		Citronelle			High-level fluvial deposits of red sands and gravels. Vari-colored lensitic, silty clays. Massive, cross-bedded, lensitic, lignitic, micaceous.	0'-112'
MIOCENE		Catahoula			Massive sands, silts and silty clays. Clays bedded or lensitic, vari-colored. Sands and silts occasionally indurated. Lignitic, micaceous.	0'-500'
		unconformity				
OLIGOCENE	VICKSBURG	Bucatunna fm.	sandy clays bentonitic clay	sandy clays bentonitic clay	Yellow sands and clays, and clays mottled gray and maroon. Bentonitic, lignitic.	0'-39'
		Byram marl	carbonaceous clays and marl	carbonaceous clays and marl	Green-gray fossiliferous, silty, sandy clays and dark-gray, lignitic, clayey silts.	0'-85'
		Glendon ls.	hard limestones and marls	limestones and marls	Interbedded, hard limestones and marls. Fossiliferous, sandy, glauconitic.	
		Marianna ls.	limestones	soft limestones and marls	Softer, fossiliferous, blue—gray chalk. Sandy, glauconitic, echinoids. Mint Spring marl member.	
		Mint Spring fm.	marl			
		unconformity				
		Forest Hill	deltaic sand and clay facies	lagoonal sand and clay facies	Up-dip: Massive or cross-bedded sands, interbedded silty clays, lignitic, micaceous, petrified wood. Down-dip: Green-gray, foss., glauc., micaceous sands.	0'-120'
		Red Bluff	deltaic to lagoonal clay facies	lagoonal clay facies	Up-dip: Mottled yellow and gray, unfossiliferous, silty, sandy clays. Carbonaceous, micaceous. Down-dip: Brownish-green, foss., glauc., silty clay.	7'-112'
		disconformity				
EOCENE	JACKSON	Yazoo	Shubuta clay	Shubuta clay	Light-green to greenish-gray silty clays, non-calcareous to calcareous. Fine-grained glauconite. Fossil wood and *Basilosaurus sp.* remains. Isolated calcareous lenses throughout section.	154'-260'
			Pachuta marl	Pachuta marl	Fossiliferous, clayey marl, glauconitic. Abundant *Pecten sp.*, bryozoans and common *O. trigonalis*.	
			North Twistwood Creek clay	North Twistwood Creek clay	Greenish-brown to gray, silty, sparingly fossiliferous. Locally sandy in part.	
		Moodys Branch	Upper marl	Upper marl	Interbedded marls and marly sands, fossiliferous. Very coarse (granular) glauconite.	16'-25'
			Lower member	Lower member	Less calcareous downward. Transitional with Cockfield. Lignitic.	
	UPPER CLAIBORNE	Cockfield			Massive to laminated silty clays and clayey sands. Zones of laminated, very lignitic silts, common. Sands increase towards base.	100'-208'
		Wautubbee	Gordon Creek clay	Gordon Creek clay	Green-brown clay-shale, carbonaceous. Basal bentonite.	90'-145'
			Potterchitto marl	Potterchitto marl	Sandy marls and clays, gray-green, *C. sellaeformis*.	
			Archusa marl	Archusa marl	Clay, clayey sand, laminated, glauconitic, some fossils.	
		Kosciusko* (Sparta)			Fluvial sands and clays, light-gray and dark brown silty clays, massive sands. Lignitic and carbonaceous.	185'-220'

* Kosciusko—as redefined by Thomas, 1941.

GENERALIZED GEOLOGICAL SECTION FOR JASPER COUNTY

Figure 2.—Generalized Geological Section for Jasper County.

abundant manpower to support new industry. The soil series distribution is varied and therefore suitable to a variety of land-use programs. Significant deposits of oil and gas as well as surface minerals await discovery or development.

ACKNOWLEDGMENTS

The writer expresses his thanks to Mr. Tracy W. Lusk who supervised field work and spent considerable time in the field with the writer. Thanks are also extended to Dr. Richard R. Priddy and Mr. Marshall K. Kern for their assistance with correlations in the field and helpful discussion of regional aspects of the stratigraphy. The writer is indebted to Mr. S. F. Thigpen and Mr. W. T. Smalley, both of Bay Springs, Mississippi, who directed the writer to several important outcrops during the early part of the field investigation of Jasper County. Mr. Henry N. Toler thoughtfully provided information and discussed stratigraphic problems. The writer is indebted to Mr. Frederic F. Mellen who spent time in the field with the writer, provided significant references from his personal library, supervised completion of this report and reviewed the manuscript. Thanks are extended to Dr. Gordon Gunter, Director, of the Gulf Coast Research Laboratory, Ocean Springs, Mississippi, who approved the writer's completion of this report as a cooperative effort with the Mississippi Geological Survey.

STRATIGRAPHY

INTRODUCTION

Strata exposed at the surface in Jasper County range from upper beds of the Kosciusko (Sparta) formation of mid-Eocene age to terrace beds of the Recent or Holocene epoch (Fig. 2).

Stratigraphic nomenclature used is in keeping, for the most part, with usage of the Mississippi Geological Survey.

Stratigraphic contacts and lithological details were mapped along all passable roads and, as time permitted, areas between roads were "walked out." Thicknesses and elevations were measured by hand-level, Paulin micro-altimeter, Widco electrical logs and from samples collected at two and one-half and five-foot intervals. Samples were collected from test holes drilled by the writer and an assistant, with a truck-mounted drilling rig, a George E. Failing "750," owned by the Survey.

Samples were retained, described briefly (where possible) and sacked. Most samples were later described under a binocular microscope.

Base maps used were the Jasper County Highway Map (1958 edition) by the Mississippi Highway Department, and a photographically enlarged topographical composite of NI 16-10 (Meridian) and NH 16-1 (Hattiesburg) sheets of the United States Geological Survey, 1:250,000 Series. The only standard topographical quadrangle map coverage, the Enterprise (Basic City) Quadrangle, touched only the northeast corner of Jasper County. The necessity for expanded quadrangle map coverage cannot be over-emphasized.

A detailed faunal analysis of the several stratigraphic units encountered would be most useful; however, time restrictions did not permit such a study within the scope of this report. Remarks relative to the distribution of the Marianna limestone within Jasper County are based primarily upon lithological and thickness considerations and therefore should be considered tentative.

EOCENE SERIES

CLAIBORNE GROUP

The type area for the Claiborne is in the vicinity of Claiborne Bluffs, Alabama, where the group has been subdivided into six formations. A history of the nomenclature of these mappable units was summarized by Thomas (1942, p. 13, and Fig. 1).

In Jasper County only the upper part of the Claiborne group is exposed, and it is represented by three formations. In ascending order they are the Kosciusko formation, the Wautubbee formation and the Cockfield formation. The thickness of that part of Claiborne at the surface in Jasper County ranges from 370 to 545 feet.

KOSCIUSKO FORMATION

The name Kosciusko (Sparta) formation is herein applied as re-defined by Thomas (1942, p.40), to strata above the Zilpha shale and below the Wautubbee formation.

The Kosciusko is non-marine and consists of fluvial sands, sandy shales and some siltstones. It is generally gray to buff on fresh exposure, but enclosed clay lenses may be of various colors. On outcrop the upper five to ten feet weather to dark red hues, but exposures more distant from the base of the Archusa member are a reddish-gray. The presence of glauconite in the upper part of the Kosciusko suggests marginal-marine conditions at the close of deltaic deposition. Depositional features include cross-bedding, cut-and-fill and reworked clays. On the outcrop, the various lithologies are extremely lenticular in nature. Finely divided lignite and mica are present in varying quantities. The upper few feet of the formation are very lignitic in the vicinity of Sec.13, T.4 N., R.13 E. (Fig. 3).

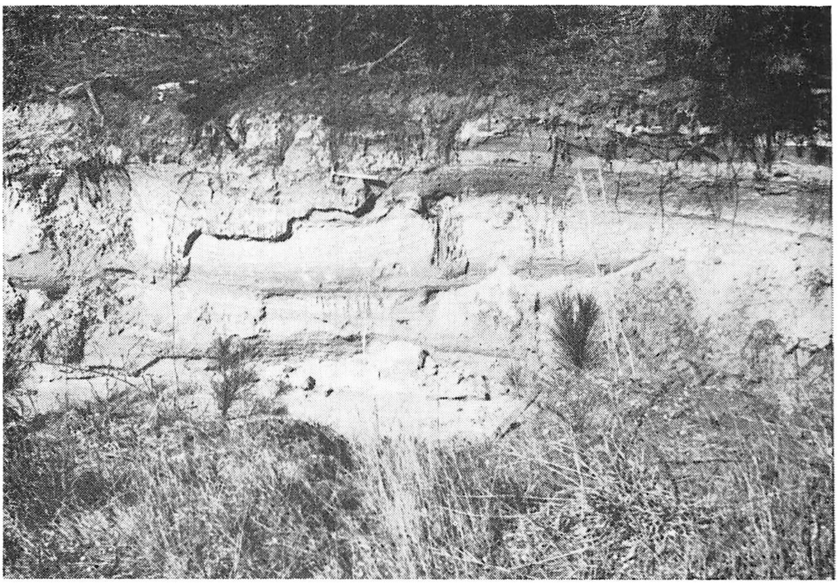

Figure 3.—Road-cut exposure of cross-bedded sand in the upper part of the Kosciusko formation: N.E.1/4, N.W.1/4 of Sec.24, T.4 N., R.13 E.

The Kosciusko formation in Jasper County increases in thickness, down the dip, from 180 to 220 feet. Approximately 90 feet, or the upper one-half of the interval, is exposed. The lower contact is not at the surface in the County.

In contrast with the hilly, dissected topographic expression elsewhere, the Kosciusko belt forms, along its strike, the broad, low valley of Souinlovey Creek, and the valley of Algood Creek farther updip to the northeast. The belt of outcrop averages three miles in width.

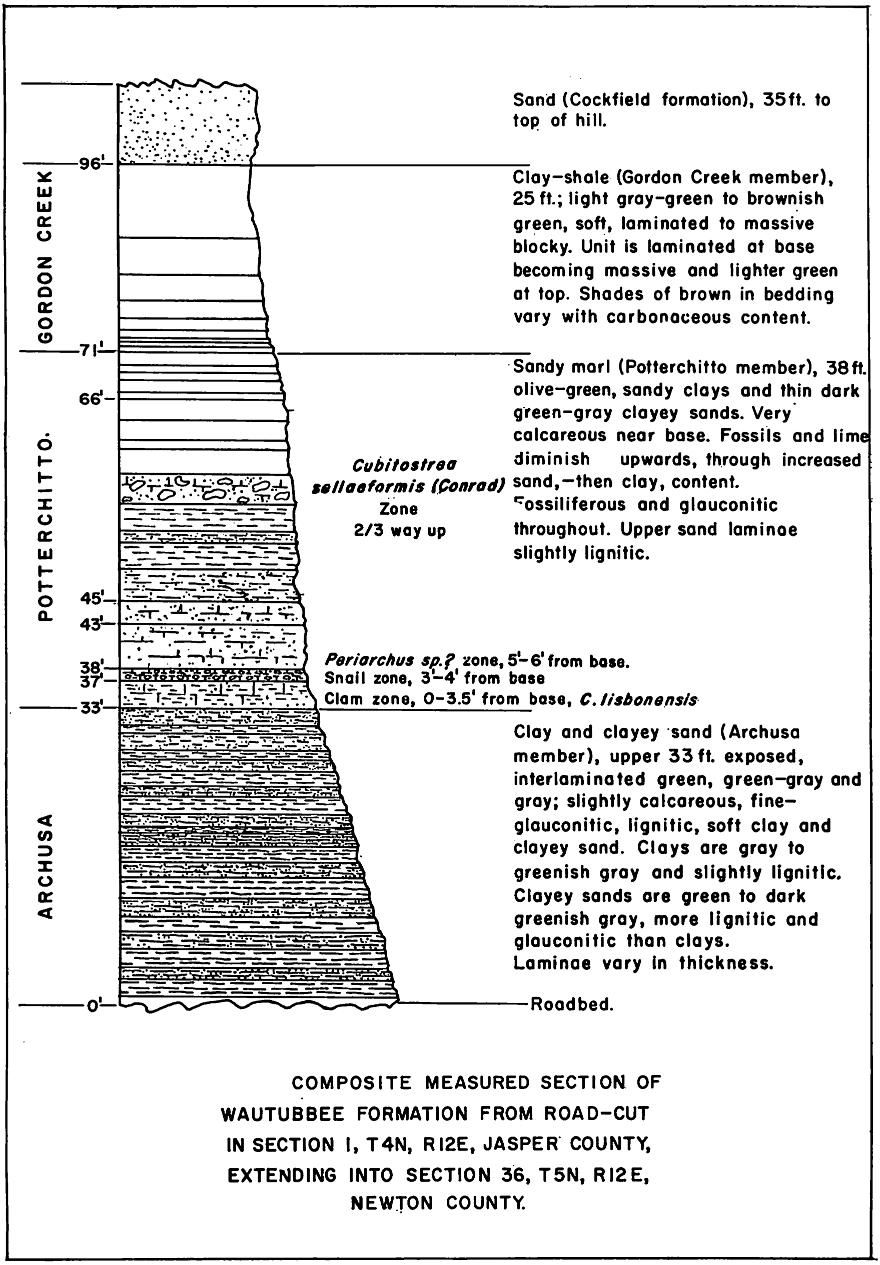

Figure 4.—Composite measured section of Wautubbee formation from road-cut in Sec.1, T.4 N., R.12 E., Jasper County, extending into Sec.36, T.5 N., R.12 E., Newton County.

Sandy, reddish-gray soils of the Ruston and Orangeburg series are developed on the Kosciusko formation. The Ruston soils occupy the steeper slopes.

WAUTUBBEE FORMATION

The Wautubbee formation overlies the Kosciusko and occupies the interval to the base of the Cockfield formation above it.

The name Wautubbee was first used by Lowe (1919, pp.75-76) for the upper marine beds of the Lisbon formation in Mississippi. Thomas (1942, pp.47-48) included the overlying carbonaceous shale interval with these marls, elevated the term Wautubbee to formational rank, and subdivided it into three subordinate units: the Archusa marl member, the Potterchitto member and the Gordon Creek clay member, respectively, from bottom to top. These members are useful, mappable units in Jasper County; however, they may be differentiated with ease only for a short distance to the northwest.

The thickness of the Wautubbee formation varies between 96 feet at the outcrop and 145 feet in the subsurface (Fig. 4).

ARCHUSA MARL MEMBER

The type locality for the Archusa marl member was designated by Thomas (1942, pp.49-50) for exposures in "a bluff beneath the south end of the bridge across the Chickasawhay River on U. S. Highway 45, two miles south of Quitman," in Clarke County, Mississippi. The exposed portion of the Archusa marl member, in a measured section at the type locality, consists of 48 feet of limestones, marls and a thin greensand.

In Jasper County, the Archusa appears considerably less calcareous than the facies which crop out in Clarke County. In Newton County near the town of Newton, which lies 9 to 18 miles northwest of exposures of Archusa marl in Jasper County, Lowe (1919, p.76) noted that "these marls pass vertically into clays or sands which are often lignitic and fossiliferous." Thomas (1942, p.62) traced the Wautubbee formation northwestwardly from Newton County and discovered the entire section to consist of carbonaceous shales in western Mississippi. He named the strata the Shipps Creek shale member.

The Archusa marl member consists of interbedded and interlaminated, soft clay-shales and argillaceous sands. The clay-shales are gray to greenish-gray, according to the quantity of fine-grained glauconite they contain. Colors of the argillaceous sands are green to dark gray-green. They contain variable amounts of marl, glauconite, lignite and mica. The upper part of the member is of lighter shades of greens and grays, perhaps resulting from variations in composition of calcareous laminae.

The Archusa member is about 45 to 55 feet in thickness on the outcrop and may be 70 feet thick in the subsurface.

The lower contact of the Archusa marl is disconformable. An interval of reworked sediments from the upper Kosciusko formation is deposited within a one-foot zone above the contact.

Potterchitto member

The name Potterchitto member was introduced by Thomas (1942, pp.53-54) for exposed beds along Potterchitto Creek in south-central Newton County in "a series of road cuts along the Newton-Decatur highway (State Highway 15) on the south valley wall of the Creek about 2 miles northeast of the town of Newton (NE.¼, Sec.26 and SE.¼, SE.¼, Sec.23, T.6 N., R.11 E.)"

Where exposed in Jasper County, the Potterchitto member is similar in lithological character to the section in the type locality. It is composed of sandy, fossiliferous marls, olive-green sandy clays, thin, dark gray-green argillaceous sands and greenish-brown, smooth clays. The basal part of the member is firm, sandy, argillaceous, glauconitic marl rich in macrofossils. This calcareous development is noticeably diminished upwards, being progressively replaced with sand near the middle part and clay towards the top. The Potterchitto is fossiliferous throughout and contains variable amounts of glauconite, lignite, mica and silt. Thinly-laminated sands in the upper part contain more lignite than was observed in lower sands of the unit.

The Potterchitto member measured 38 feet in thickness in a recently graded road cut in the NE.¼, NW.¼, Sec.1, T.4 N., R.12 E., in Jasper County and in the SE.¼, SW.¼, Sec.36, T.5 N., R.12 E., Newton County. A fossiliferous zone dominated by at least ten species of pelecypods, including *Cubitostrea lisbonensis* (Harris), occupies the basal 3.5 feet of the member. A preponderance of gastropods lies in a zone three to four feet above the base of the member, overlapping the clam zone by six inches. At least 15 species of gastropods in good preservation were observed. Five to six feet above the base of the Potterchitto is an horizon of excellent casts of a small echinoid. At this outcrop as well as at other exposures to the southeast, there is a zone of abundant, well preserved *Cubitostrea sellaeformis* (Conrad) located at a position approximately two-thirds the distance from the base to the top of the Potterchitto member. Although this large oyster is most abundant in the Potterchitto,

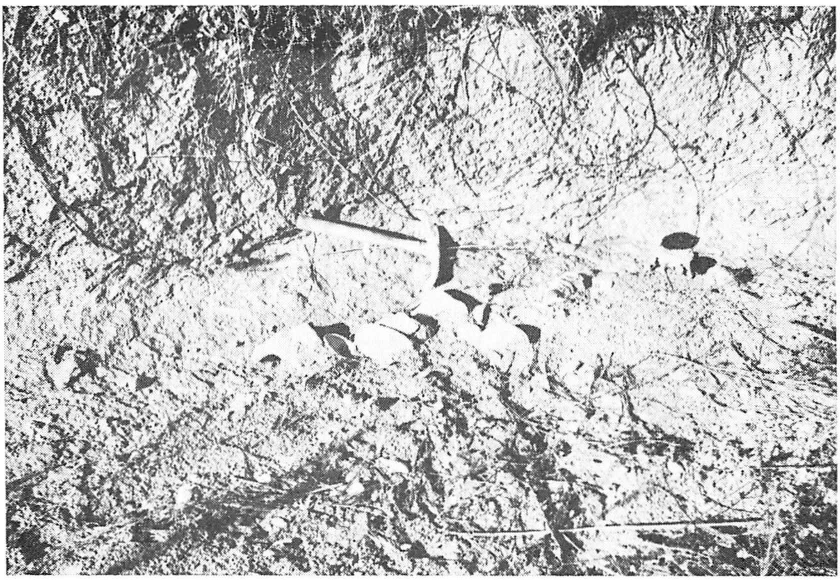

Figure 5.—Valves of **Cubitostrea sellaeformis** in place, in a road-side ditch in the Potterchitto member of the Wautubbee formation: N.W.1/4, N.E.1/4 of Sec.26, T.4 N., R.13 E.

isolated valves were seen in the Archusa member. The writer did not observe *Cubitostrea sellaeformis* above the transitional contact with the overlying Gordon Creek member (Fig. 5).

A gradational contact separates the Potterchitto member from the Archusa marl. The boundary is placed at the top of a zone of gradation between clay and argillaceous sand laminae, beneath, and calcareous strata, above.

Thomas (1942, p.56) believes that part of the type Potterchitto "is at least in part contemporaneous with the upper

Archusa in Jasper and Clarke Counties." The writer believes that this interpretation stems from the fact that upper Archusa lithofacies in Jasper and Clarke Counties lie in a position farther from shore than that of south-central Newton County, and would be expected to reflect affinities of a more calcareous depositional environment.

Weathered exposures of the Potterchitto-Archusa marls are characteristically dark reddish-brown to black. Oxidized iron of the glauconite gives rise to the deep reds in these and similar glauconitic rocks.

Soils developed along the outcrop belt of the Archusa and Potterchitto members are moderately calcareous, producing dark gray-brown soils of the Susquehanna series and the red-brown soils of the Orangeburg series. Orangeburg soils develop on the slopes where drainage is deep and lime-leaching has extended to a considerable depth.

Gordon Creek shale member

The name Gordon Creek shale member was proposed by Thomas (1942, p.57) for beds exposed along Gordon Creek which flows through Wautubbee Station, Clarke County, Mississippi, and is crossed by U. S. Highway 11, south of the Station. Here, at the type area, the member is a chocolate-brown to black or, more rarely, dark greenish-gray shale.

On the outcrop in Jasper County, the Gordon Creek member consists of carbonaceous clay-shales. Colors on fresh, moist exposures range from gray-green, brownish-green to a dark chocolate-brown. The brown hues are influenced by the amount of carbonaceous matter present. The clay-shales are laminated at the base of the member and are progressively more massive towards the top of the unit. Thin laminae of light-gray silt separate these beds of homogeneous clay-shale and effect the distinctive, bedded nature of the Gordon Creek shale. In places thin lenses of silt are found isolated within well-defined strata. A bed of bentonite six to eight inches thick is found at the base of the Gordon Creek member in Sections 26 and 27, T.4 N., R.13 E. The bentonite is pure at the base but is progressively admixed with clay, upwards into the carbonaceous clay-shale section. Bentonite at this horizon has been recognized in Clarke County;

moreover, thin bentonites have been mapped, elsewhere, in the Archusa and Potterchitto members, as well.

The Gordon Creek shale member varies in thickness from 18 to 25 feet at the surface and from 18 to 67 feet in the subsurface.

The lower contact of the Gordon Creek shale is conformable with the Potterchitto through a transition zone four to five feet thick. The top of the transition zone is considered to be the contact, for mapping convenience. Bergquist (1942, p.26) noted this transitional contact in Scott County as far north as the Scott-Leake County line, where the zone is only one foot thick.

Clay-shales of the Gordon Creek member weather to a light-gray and give rise to light-tan, silt-loam soils. These soft, clay-shales are best exposed where capped by the more resistant lower sands of the Cockfield formation.

The Wautubbee formation crops out in the valley walls of Souinlovey Creek and adjacent dissected uplands. The belt of outcrop is from three to five miles in width.

Cockfield formation

The name Cockfield was introduced by Vaughn (1895, p.220) for beds of Yegua age, at a locality in Grant Parish, Louisiana. Details of classification, nomenclature and correlation of the upper Claiborne are discussed in detail by Stenzel (1940, pp. 847-910).

The Cockfield formation consists of massive to laminated silty clays and clayey sands. Zones of laminated, extremely lignitic, micaceous silts are common through most of the unit. In general, sand content is greater in the lower one-third of the formation. The upper five to ten feet of the formation usually bears thin, discontinuous laminae of glauconitic sand. This suggests the initiation of marine transgression which continued through most of the Jacksonian stage. On the surface as well as in samples from test holes, lignite and mica are decidedly more abundant in the formation towards the northwestern part of the County. This was clearly noted in samples from test holes JR and JO, east and west, respectively.

Fresh samples of the Cockfield are tan, gray to dark-gray, and chocolate-brown in color (Figs. 6, 7).

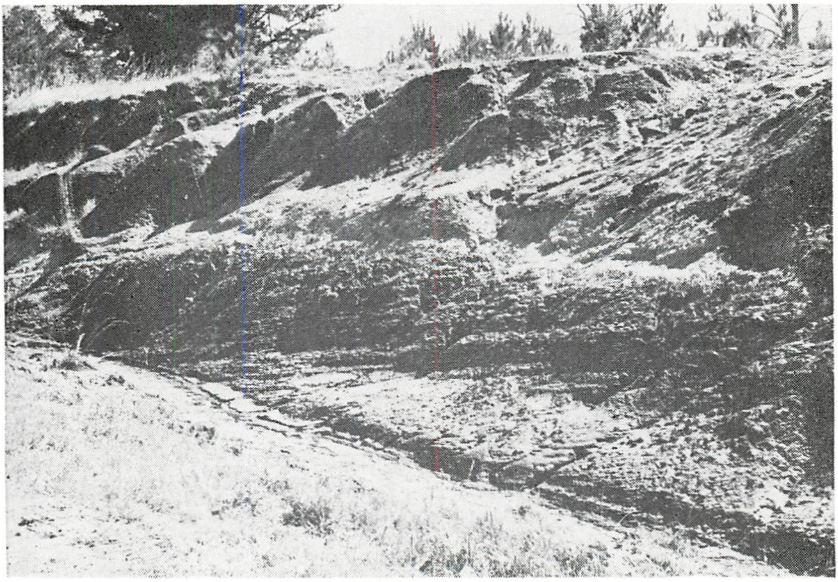

Figure 6.—Laminated, lignitic, argillaceous siltstones of the middle Cockfield formation, one half mile southeast of Rose Hill. Beds dip to the south at 11° at this exposure: S.E.1/4, S.W.1/4 of Sec.32, T.4 N., R.13 E.

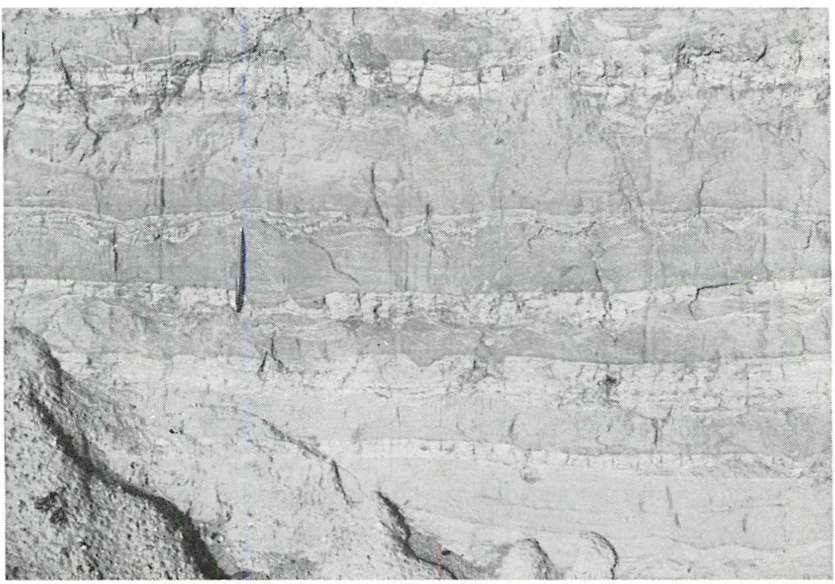

Figure 7.—Typical interbedded sand and silty clay of the upper Cockfield formation exposed in a road-cut three miles east of Garlandville. Note depositional structures which include crossbedding, reworked bedded clay and cut-and-fill: East-central edge of Sec.5, T.4 N., R.12 E.

Weathering of the formation imparts contrasting, banded or mottled colors which are peculiar to the Cockfield and, hence, facilitates identification of the unit. Typically, clay beds remain light-gray or turn a light-tan. The more previous sands and silts weather to an intense orange-brown. This mottled or striped aspect of the two contrasting colors persists even in fields which have been repeatedly cultivated. The thickness of the Cockfield formation ranges from 100 feet at the outcrop to 208 feet in the subsurface. The maximum thickness is in the southwest cornor of the County. Nine to twelve miles north of Jasper County, Priddy (1961, p. 41) mapped 105 feet of Cockfield along U. S. Highway 80.

The contact of the Cockfield formation with the underlying Gordon Creek shale member is conformable. The contact is sharp or, more commonly, passes through an interbedded, transition zone ten inches or less in thickness.

The belt of outcrop of the Cockfield formation forms a gentle cuesta, two to four miles in width, running diagonally across the northeastern part of the County. This cuesta serves as the northern boundary of the Jackson Prairie physiographic province, across the State of Mississippi. The North Central Highlands physiographic province is supported by the Cockfield, Wautubbee and Kosciusko formations and occupies the northeastern corner of Jasper County, immediately north of the Jackson Prairie.

Soils developed on the Cockfield formation belong to the Ruston and Orangeburg series.

JACKSON GROUP

Conrad (1855, pp. 257-263) first applied the term Jackson with reference to fossiliferous beds in the region of Jackson, Mississippi. Hilgard (1860, pp. 128-135) later applied Conrad's Jackson ("deposits") to a specific stratigraphic interval, the "Jackson Group."

MOODYS BRANCH FORMATION

The Moodys Branch was named by Lowe (1915, p. 80) for fossiliferous strata exposed along Moodys Branch, a short tributary to the Pearl River, in the city of Jackson, Mississippi.

In Jasper County, as elsewhere, the Moodys Branch formation is comprised of two distinct lithologic units, herein referred in the informal sense, the upper and lower members.

The upper member consists of beds of greenish-gray, argillaceous, fossiliferous, sandy marls and argillaceous, fossiliferous sands. An abundance of coarse-grained, dark green glauconite everywhere characterizes the upper member. The glauconite ranges up to granule size and imparts a vivid green cast to the unit, especially to the fossiliferous sand interbeds.

The lower member consists of stratified, lignitic, argillaceous, interpolated silts and sands with thinner interbeds of fossiliferous, glauconitic, marly sands. These marly sands comprise the dominant lithology of the upper member. Here, however, the lignitic, argillaceous silt beds of typical Cockfield lithology are predominant. Although these strata may change in composition laterally, as do facies variants of the Cockfield formation, the identity of the marly sand components maintains.

An interruption in deposition, or diastem, between the lower and upper members of the Moodys Branch formation serves to delineate the members. Marl-filled burrows penetrate into the upper surface of the lower member to a depth of two or more feet.

The lower member is interpreted as a transitional facies from probable pro-deltaic deposition in the Upper Claiborne stage, to off-shore, shallow marine deposition in the Lower Jacksonian.

Harris and Veatch (1899), and later Blanpied *et. al.* (1934, p. 3), considered the lower Moodys Branch to be late Claiborne in age, and referred this interval to "Transition Zone" in that it carried faunas common to the Claiborne and Jackson groups.* In the writer's practice, the lower contact of the Moodys Branch is considered to fall at the base of the lower member.

The Moodys Branch weathers a deep orange-brown to a dark red. Oxidation of iron-rich glauconite produces an intense red color and gives rise to the growth of abundant, pellet-size, limonitic concretions within the zone of surface weathering. These

*The Cockfield is not known to be fossiliferous on the outcrop in Mississippi. Ed.

limonitic pellets are characteristic of the weathered exposures of glauconitic, marly sands of the upper Moodys Branch formation and the Vicksburg group and have long been used to facilitate surface mapping.

The outcrop belt of the Moodys Branch formation in Jasper County is usually of low relief. The formation is weathered with greater ease than adjoining formations, and is commonly obscured by colluvium and terrace deposits.

Soils of the Houston or Susquehanna series develop upon calcareous strata of the Moodys Branch formation and comprise the northeastern margin of a belt of black "prairie" soils.

Yazoo formation

Lowe (1915, p. 79) first used the name Yazoo with reference to yellowish clays which crop out at bluffs along the Yazoo River at, and near, Yazoo City, Yazoo County, Mississippi. At the type area the formation consists of 154 to 260 feet of clays, silty clays and minor marl beds.

The Yazoo formation has been subdivided into four units (members or formations, determined by usage of Yazoo) which, in ascending order, are the following: North Twistwood Creek clay, Cocoa sand, Pachuta marl and Shubuta clay. (The Cocoa sand is absent or poorly developed in Jasper County.)

The Yazoo formation ranges in thickness from 70 feet on the east (Clarke County) to 600 feet on the west (Warren County), across the State.

North Twistwood Creek clay member

The name North Creek clay was first used by Murray (1947, p. 1839) "for an average of 40 feet of green or gray, slightly glauconitic, fossiliferous clay, underlain by the Moodys sand and overlain by the Pachuta marl or Cocoa sand. The type locality was designated to consist of exposures on the west side of North (Twistwood) Creek in the SW.¼ of Sec.1, T.3 N., R.12 E., Jasper County, Mississippi, two miles southwest of Rose Hill on the graveled state highway (State Highway 18) to Gridley and Turnersville."

Murray (1963, pp. 97-100) has formally renamed the "North Creek clay" the North Twistwood Creek clay.

In other localities of the County, the member also consists of greenish-gray to greenish-brown, fossiliferous, silty, calcareous, plastic clays and grayish-brown, sparingly fossiliferous, silty clays. The lower six to seven feet of the member usually contain abundant glauconite and may, upon cursory inspection, be mistaken for facies of the Moodys Branch formation, particularly when well cuttings are examined.

The Cocoa sand member, named by Cooke (1933, pp. 1387-1388), is traced as a mappable unit from western Alabama into Clarke County, Mississippi, and occupies the interval between the North Twistwood Creek member, beneath it, and the Pachuta member, above it. The writer was unable to distinguish this sandy, "marine wedge" as a lithic unit, either in outcrop or in drilling samples, within Jasper County; however, a sandy, greenish-tan, silty-clay facies is detected in the uppermost five to seven feet of the North Twistwood Creek clay as far to the west as Drill Site JR (Sec.10, T.3 N., R.12 E.). This facies is of lighter color and is less cohesive than the more typical, plastic clays below it, into which it imperceptibly grades. It may be a lateral counterpart of the Cocoa sand member to the east.

The North Twistwood Creek clay ranges in thickness from 19 to 43 feet on the outcrop and in the shallow subsurface.

A conformable contact separates the North Twistwood Creek member from the subjacent Moodys Branch formation.

The North Twistwood Creek clay weathers to a gray-and-tan mottled, silty clay. Irregular distribution of glauconite controls this mottled appearance. The member is much more resistant to erosion than the Moodys Branch marls beneath it, owing to the coherency and proportionately low content of calcium carbonate in the member. As streams progressively cut downward and southwestward, following the strike of the Moodys Branch sandy marls, the North Twistwood Creek member consistently forms the more abrupt (southwesterly) stream-valley wall. This explains both the relative frequency of fresh exposures of the North Twistwood Creek clay and the persistent, northwesterly lineation of drainage tributary to Penantly and Twistwood Creeks.

Pachuta marl member

The Pachuta marl member was named by Murray (1947, p. 1839) for "buff, gray or white, partially indurated, generally glauconitic, fossiliferous marl," up to 25 feet thick. His type locality "was designated to consist of exposures on the south side of Pachuta Creek, 1¼ miles south and southeast of Pachuta in the SW.¼ of Sec.8, T.2 N., R.14 E., Clarke County, Mississippi."

The Pachuta marl consists of tan to light greenish-gray, very fossiliferous, sandy, glauconitic, argillaceous marl. In the sandy, upper two or three feet of the member is an horizon rich in *Pecten* and bryozoan remains, the "Pecten-bryozoan fauna" of early workers. The large oyster, *Ostrea trigonalis* Conrad, is common or abundant in an interval three to eight feet beneath the *Pecten*-bryozoan bed. Bergquist (1942, p. 45) reported that, in Scott County to the northwest, "bryozoa associated with *Pecten perplanus* (Morton) were collected at two localities from material above the *Ostrea trigonalis* bed." Bergquist (1942, p. 35) also reported that the "consistent horizon marker" of *Ostrea trigonalis* Conrad is "about 48 to 50 feet above the base of the formation."* This fossil was not anywhere recognized above the top of the Pachuta marl member by the writer. Fragmentary remains presumed to belong to the whale-like cetacean *Basilosaurus cetoides* were seen in or beneath the *O. trigonalis* bed of the Pachuta marl at several localities, including the exposures in the SE.¼, NW.¼, and SE.¼, Sec.34, T.4 N., R.12 E. Similar fragmentary remains were seen well within the Shubuta clay outcrop, in two pastures near Montrose, and presumed to be in place. In Scott County, to the northwest, Bergquist (1942, p. 36) reported the bones of "Zeuglodon" (or *Basilosaurus*) in the Pachuta marl but stated that "most fossils of this animal have been found in the upper portion of the formation [Yazoo clay]."

The Pachuta member is from 15 to 22 feet thick. Its marine character increases to the southeast, where Turtelot and Morris (1944, p. 1) have mapped 20 to 50 feet of these marls.

The Pachuta marl weathers from a light yellow-tan to a dark gray-brown (Figs. 8, 9).

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*As Bergquist used Jackson as formation and Moodys Branch and Yazoo as members, the *O. trigonalis* bed is approximately 30 feet above the base of the Yazoo clay in Scott County. Ed.

Figure 8.—Outcrops of the Pachuta marl member in road-cut (foreground) and along a hill-side (background). "Badlands" erosion is characteristic of natural exposures of the Pachuta marl: Center of Sec.11, T.3 N., R.12 E.

Figure 9.—Road-cut exposure of weathered Pachuta marl showing fragments of **Pecten** sp. and bryozoans, an important marker horizon within the Yazoo formation: N.E.1/4, N.E.1/4 of Sec. 11, T.3 N., R.12 E.

Shubuta clay member

Murray (1947, p. 1839) named the Shubuta clay member "for 20 to 200 feet of clays and clayey marls, underlain by the Pachuta marl and overlain by the Forest Hill sand or Red Bluff clay of the Oligocene. Exposures on the east side of the Chickasawhay River, just north of the old U. S. Highway 45 bridge east of Shubuta, Clarke County, Mississippi, (SW.¼, Sec.3, T.10 N., R.16 E.) were designated as the type locality."

The Shubuta clay lithology of Jasper County includes light-green to greenish-gray, calcareous to non-calcareous, glauconitic, fossiliferous, silty clays. The top of the member is marked by one to four feet of light-green, fissile, clay-shale which contains a small variant of the wedge-shaped coral, *Flabellum* cf. *cuneiforme* Lonsdale. The small *Flabellum* proved an excellent horizon marker in shallow holes drilled through the fossiliferous facies of the Red Bluff and where the green, fissile clay-shale was absent or not distinguished. Since this coral was rarely discerned in cuttings in the lower Shubuta section, it is assumed that either they are uncommon there or those seen represent contaminants from the top of the Shubuta interval. Below the green shale facies the member grades downward through soft, greenish-gray, sparingly glauconitic, slightly silty clays. Isolated limey lenses of "caliche"-like material are present throughout the Shubuta interval, but may be more common near the center of the formation. Fossil wood is common and skeletal fragments referred to as *Basilosaurus cetoides* are present locally.

Measured sections of the Shubuta clay member interval ranged from 100 to 216 feet in thickness; however, these figures may not approach probable extremes of thickness of the member.

The lower contact of the Shubuta member is conformable with the Pachuta clay. The contact between lithologies, clay above and marl below, is sharp or it is transitional through a zone up to four feet thick.

The Shubuta weathers tan to yellowish-gray and shows a mottling of the two colors, or shades of them. Selenite (gypsum) crystals are formed as a by-product of weathering and are particularly prominent at exposures of the upper one-third of the Shubuta clay.

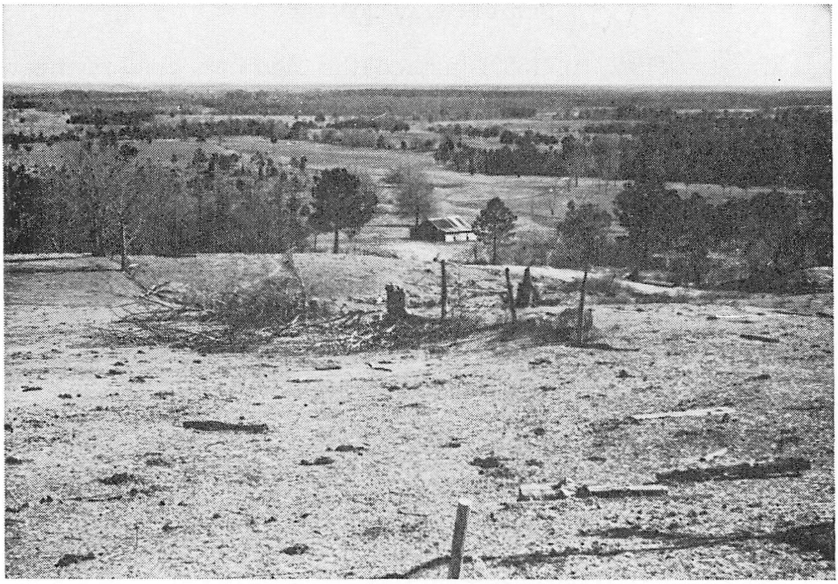

Figure 10.—Looking eastward from Moss Hill towards Rose Hill. Photograph was taken standing on the Citronelle formation with Shubuta clay in foreground, Pachuta marl at cabin, North Twistwood Creek clay in the valley flat, Moodys Branch formation at trees along stream drainage, and the Cockfield formation in the background: Photographed at N.E.1/4, N.W.1/4 of Sec.3, T.4 N., R.12 E.

The outcrop belt of the Yazoo and Moodys Branch formations comprises the comparatively low, gently rolling topography of the Jackson Prairie physiographic province. This fertile belt of prairie soils extends, roughly, from Montrose to Garlandville, on the northwest, to Vossburg and Orange, on the southeast (Fig. 10).

Lime-rich strata of the Yazoo and Moodys Branch formations produce the dark gray-brown to black, heavy, gumbo soils of the Houston and Susquehanna soil series.

OLIGOCENE SERIES

RED BLUFF FORMATION

Hilgard (1860, p. 135) introduced the name Red Bluff "group" for exposed, "irregular masses of fine-grained ferruginous rock, imbedded in a brownish or greenish clayey mass, both with well-preserved fossils ..... "at Red Bluff on the Chickasawhay River in the northeast quarter of Section 16, T.10 N., R.7 W., Wayne

County (Mississippi), approximately one and one-half miles south of Shubuta."

Two facies of the Red Bluff formation are known in Jasper County: 1) mostly non-marine, deltaic or inter-distributary clays and silty clays, and 2) marine, pro-deltaic or "lagoonal", fossiliferous clays and marly clays.

Non-marine (or marginal-marine) facies crop out in the central part of the County and to the north, and northwest, of this. This facies consists of yellow or light-gray, mostly unfossiliferous, micaceous, slightly lignitic, thin-to massive-bedded, clay-shales and silty clays. These clays contain more silt towards the northwest, where, in the vicinity of Montrose (in Sec.2, T.3 N., R.10 E.), it is difficult to distinguish the contact between the Red Bluff formation and the Shubuta clay member. These beds are interpreted as up-dip, marginal-deltaic and interdistributary equivalents of the marine facies of the Red Bluff formation.

Fossiliferous, marine counterparts of the deltaic facies, described above, extend southeastward from Bay Springs to the south-central part of the County, thence, northeastward and, finally, north-northeast through the Paulding area. This facies consists of dark greenish-gray, glauconitic, fossiliferous, silty clay, in most places containing small amounts of lignite and traces of mica. Stratification bands of color and texture originated from differences in vertical distribution of glauconite, silt, and sand. *Ostrea vicksburgensis* Conrad, *Spondylus dumosus* (Morton), and *Pecten anatipes* Morton were tentatively identified to comprise the bulk of the abundant molluscan fauna in the marine facies. Samples from the southwestern part of the County were the most fossiliferous (from Test Holes JC and JK).

Measured thicknesses of the Red Bluff formation ranged from 18 feet on the northwest (in Test Hole JO) to perhaps 120 feet (in Test Hole JC), one mile west of Bay Springs. All samples from Test Hole JC, in the interval between the Marianna formation and the Shubuta clay member, were regarded as typical of marine Red Bluff facies of other localities (Test Holes JP, JK, JL and JH). Because of loss of circulation in cavernous Glendon limestone (Test Holes JM and JN), the Red Bluffs was not sampled by means of drilling in the southeast part of the County near Heidelberg. With the exception of the thick interval in Test Hole JC, the Red Bluff formation measured 77 feet or less in thickness.

FOREST HILL FORMATION

The name Forest Hill sand was proposed by Cooke (1918, pp. 191-193) in place of the preoccupied name, "Madison sands" of Lowe (1915, p. 82).

In the type area, at several outcrops in the environs of Forest Hill, five and one-half miles southwest of Jackson, Mississippi, Cooke described the Forest Hill interval to consist "chiefly of cross-bedded or laminated, more or less ferruginous, sand and some clay," 50 to 70 feet in thickness.

In Jasper County, the Forest Hill formation consists of massive to cross-bedded or thin-bedded gray sands, argillaceous sands, and light-gray to yellow silty clays. Mica flakes and lignite are important constituents of the formation. Bits of silicified wood are contained in the coarses sands of the formation but are most notable around, and east of Montrose (T.3 N., R.10 and 11 E). Casts and carbonaceous films of leaves are found between bedding surfaces of the clays. Throughout massive sand units are found attenuated lenses of both silty and smooth clay. Intraformational conglomerates, pellets of reworked clay laminae, worm burrows and cut-and-fill structures are visible at many out-crops. Massive-bedded clays interrupted by thin, sand laminae are a prominent facies of the upper Forest Hill formation east of Bay Springs in the eastern half of T.2 N., R.11 E., and the western half of T.2 N., R.12 E.

The Forest Hill formation progressively gains characteristics of a marine depositional environment as these beds are traced in the subsurface to the southwest and south from central Jasper County. Steel-gray sands become greenish-gray as lignite and muscovite are displaced with fine-grained glauconite. It is postulated that sand, lignite and some of the clay were constituents of deltaic or fluviatile origin; whereas, interstitial green clay, glauconite and traces of calcareous matter were products of, and were contributed by, the marine environment on the south, into which the deltaic sediments were slowly introduced. Where this marine transition is first distinguished while drilling through beds at the Forest Hill stratigraphic position, it is consistently underlain by a marine, macrofossiliferous facies of the Red Bluff formation.

Blanpied, *et. al.* (1934, pp. 5-6), Thomas (1948, p. 19), and others held that the Red Bluff clay is marine tongue from the east which splits the Forest Hill formation from the Shubuta clay. Therefore, the Forest Hill formation has been assigned in the past to the Oligocene series on the grounds that, in places, it was underlain by the fossiliferous Red Bluff formation which contains faunas common to the Oligocene and Eocene series.

An interpretation of the substantially, time-stratigraphic equivalence of the Forest Hill-Red Bluff formation interval was first submitted by Cooke (1918, pp. 191-193) and later corroborated by MacNeil (1944, pp. 1323-1324), Hendy (1948, p. 27) and by subsurface work in Jones County by Monsour (1948, p. 8).

If the contact of the Forest Hill formation with marine facies of the Red Bluff formation is conformable (transitional), as so adjudged by the writer, differences in the two views concerning the physical relationship of the two formations are but a matter of degree; furthermore, all but the lowest and highest beds of the two formations are equivalent in time. The oldest beds would be the basal, chalky limestone strata of the Red Bluff to the southeast (eastern Wayne County); the youngest would be the upper Forest Hill sands of west-central Mississippi (Madison County) closer to the deltaic regimen.

Electrical logs and drilling samples show the inter tonguing of the Forest Hill and Red Bluff formations in western Jasper County: 1) in Test Hole JF, this interval consists of 91 feet of dark, gray-brown or greenish-brown, silty, sandy, glauconitic clays interrupted by two massive, clayey sand units 14 and 26 feet thick which contain lignite and glauconite. The clayey sand units, regarded as Forest Hill, are in the upper half of the Forest Hill-Red Bluff interval and are separated by 25 feet of glauconitic, clay. These are interpreted to be extensions of "deltaic tongues" into a pro-deltaic environment.

2) In Test Hole JK, farther "down-dip", 41 feet of dark gray, silty, glauconitic, microfossiliferous clay is underlain by 49 feet of sandy, micaceous, lignitic, microfossiliferous, glauconitic clay which in turn is underlain by 43 feet of limonite-stained, silty,

poorly sorted sand. Matrix material of the sand unit is an intense orange-yellow at the top, grading to gray-brown at the base; coarse sand grains are coated with orange-brown limonite films through the entire thickness of the sand unit. The sand rests in sharp, probably erosional, contact with hard, dark-green, fissile clay-shales of the uppermost Shubuta clay member.

3) On the New Home Dome and in the Soso Field, six and three miles south-southwest of Test Hole JK, respectively, electrical logs show that sand occupies the lower half of the Forest Hill-Red Bluff interval, as in Test Hole JK.

The writer does not imply that intertonguing of the Red Bluff and Forest Hill formations is restricted to Jasper and parts of Jones Counties; but rather, that the time-stratigraphic equivalency of the two formations is demonstrable over relatively short distances within the area of study. The presence of marine Red Bluff facies on three sides of a predominantly fluviatile facies suggests that a delta distributary system extended southward into central Jasper County.

Hendy (1948, p. 27), who regarded the Red Bluff clay as a member of the Forest Hill formation, has clearly summarized the depositional history of the two, as follows: "The Forest Hill shows very well the interfingering of fossiliferous clays, probably deposited during periods of slackened deposition, with sparingly to non-fossiliferous, coarser sediments deposited during times of increased outwash from the deltaic centers to the west."

The lower contact of the Red Bluff formation with the Shubuta clay member is conformable and transitional. The presence of an interbedded zone from one to nine feet thick was disclosed by differences in drilling characteristics (speed of penetration and "feel" of the drill) and the lithology of cuttings from each layer which were brought to the surface in the mud-stream.

This contact is probably conformable on a regional scale except for local diastemic interruptions, as is likely in Test Hole JK. Cheetham (1957, pp. 89-98) noted the transgression of the *Spondylus dumosus* (Morton) fauna across the Shubuta clay-Red Bluff contact in western Alabama. In western Mississippi (Warren County), where the Red Bluff formation is not developed, Mellen (1941, p. 15) states: "the Forest Hill appears to rest conformably upon the Yazoo clay member of the Jackson group."

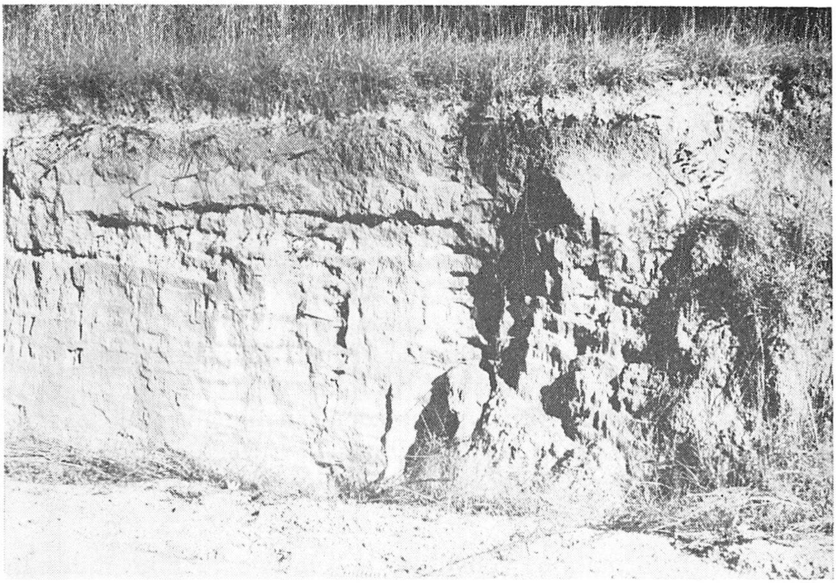

Figure 11.—Interbedded white and orange sand of a facies of the Forest Hill formation: Center of Sec.22, T.2 N., R.11 E.

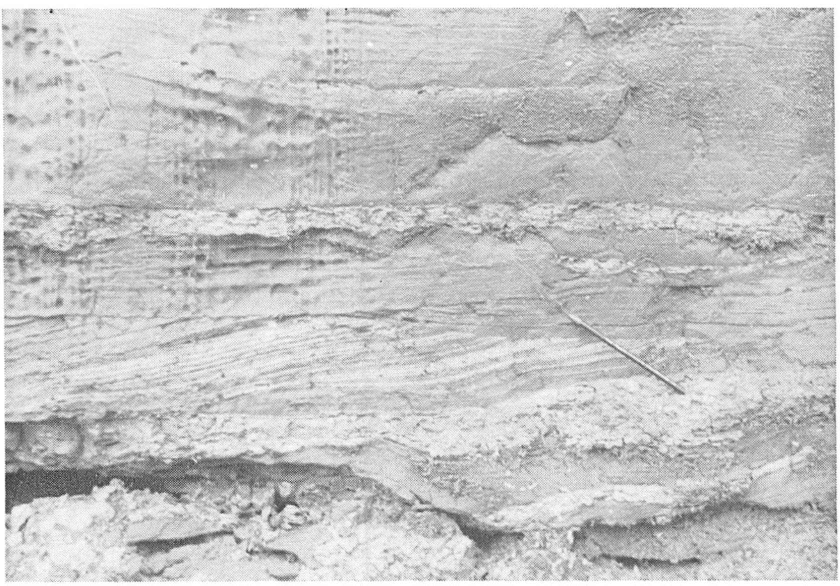

Figure 12.—Fluvial, interbedded sand and silty clay of the upper Forest Hill formation. Note cross-bedded, re-worked clay and the worm burrow (at point of pencil): N.W.1/4, N.E.1/4 of Sec.29, T.2 N., R.11 E.

Murray (1961, p. 392) implies that deposition was essentially uninterrupted through the traditional Eocene-Oligocene temporal boundary in this part of the Northern Gulf province. This temporal boundary, therefore, must everywhere lie within rock units except along a single, sinuous, linear surface in the Eastern Gulf province, along which lithic and time boundaries intersect.

Weathered exposures of the Forest Hill and Red Bluff formations vary from light-gray to tan, yellow to deep ochre, and orange-brown to deep red-brown. Variances in color and color intensities over short distances are controlled by minor changes in lithology, depth of weathering, depth to water table, and orintentation of outcrops relative to sunlight exposure. Extremes of color and texture conspicuous in the formations, notably the non-marine facies, complicate identification when they lie adjacent to the Catahoula (Miocene) formation or terrace beds (Figs. 11, 12, 13, 14).

The two formations constitute a belt two to nine miles in width of hilly, moderately dissected terrain, across the County.

Soils of the Ruston and Orangeburg series are developed upon the Forest Hill and Red Bluff formations.

Vicksburg group

The name Vicksburg was first applied by Conrad (1846, pp. 209-220, 395-405) to fossiliferous strata exposed at Vicksburg, Mississippi. The rather complex evolution of the usage of this term is summarized by Mellen (1941, pp. 25-27) and Murray (1961, pp. 394-395).

Mint Springs formation

The Mint Springs facies is a fossiliferous sandy marl which underlies the lowest limestone ledge of the Marianna limestone and rests with disconformity upon the Forest Hill or Red Bluff formations.

The Mint Spring formation was identified by the writer from auger hole cutting at the Smith County Lime Plant, at Highway 18 and the Leaf River (Center Sec.13, T.2 N., R.8 E., Smith County, Mississippi). It consists of 8 feet of tan, dark gray to black, coarse-grained, ocherous (glauconitic), argillaceous sand and sandy clay. Here the Mint Spring formation is soft

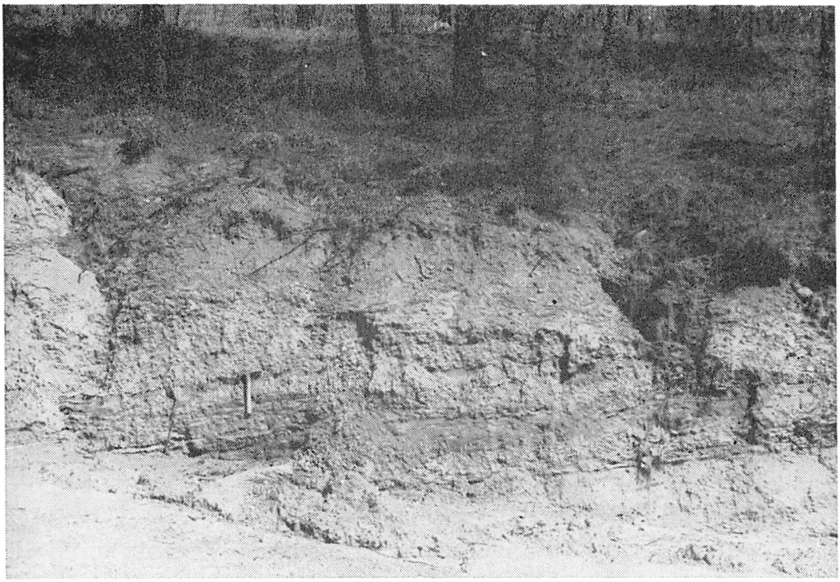

Figure 13.—Road-side exposure of interbedded sand and silty clay of the upper Forest Hill formation. Photograph taken facing eastward. Note local north dip development here: Location between drill sites JI and JJ in N.W.1/4, N.E.1/4 of Sec.31, T.3 N., R.11 E.

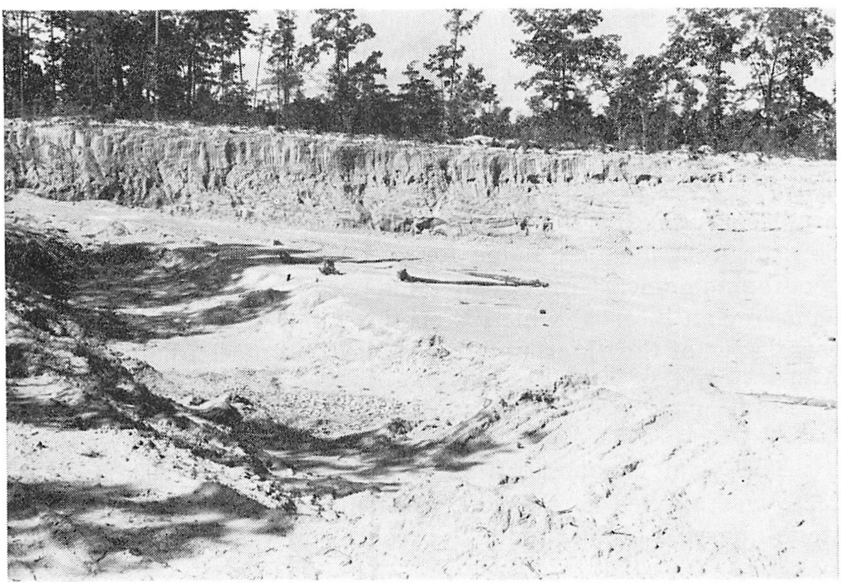

Figure 14.—Sand pit opened in the Forest Hill formation: S.E. corner of Sec.33, T.2 N., R.10 E.

and contains much deeply-weathered glauconite and which shows a striking contrast in color with the Marianna limestone. The Mint Spring formation was not recognized with certainty elsewhere in Jasper County, although it must be locally present. Coarse sand or sandy clay at the Mint Spring stratigraphic position was not distinguished above the much finer-grained sands and sandy clays of the upper Forest Hill formation. In addition, closely-spaced samples recovered from each of several test holes through the base of the Vicksburg limestone and marl interval showed no facies identified with the Mint Spring or separable from the Marianna-Glendon or Forest Hill lithologies. Eight to ten feet of the Mint Spring was mapped by Bergquist (1942, p. 54) in Scott County, to the northwest.

The Mint Spring has been interpreted by Mellen (1941, p. 27) as the "basal sand" or the lower, transgressive facies interval of limestone and marl deposition.

Cooke (1918, p. 195) named the Mint Spring "marl member" at an outcrop at Mint Spring Bayou, Vicksburg, Mississippi.

A disconformable contact separates the Mint Spring formation from the Forest Hill or Red Bluff formations.

The Mint Spring formation and the Marianna limestone are demonstrated to be facies of each other, through most of this vertical interval, when traced across the State.

The Mint Spring is considered of formational rank since it is an established, areally extensive, mappable unit of divergent lithic facies; and furthermore, the name Marianna (limestone) has been applied in the formational sense and may not correctly be used as a member name for a formation bearing the same geographic name. This obviates the necessity for a new member name for an interval which is on the whole the lithic and time-correlative of the "Marianna limestone" (formation) of southern Alabama and western Florida.

Marianna limestone

The term Marianna, first used by Johnson (1892, pp. 128-132), was applied to the soft, orbitoidal, "chimney rock" limestone quarried at Marianna, Jackson County, Florida.

In Jasper County, Mississippi, the Marianna limestone consists of beds of light bluish-gray, fossiliferous, sandy, glauconitic marl and soft limestone. *Lepidocyclina* and bryozoans are abundant, fragments of *Clypeaster rogersi* (Morton) are rare and *Ostrea vicksburgensis* Conrad are rare to common.

Identification of the Marianna limestone is difficult in the field and in drilling samples in this area. Lithological characteristics of the Marianna limestone of Wayne and Smith Counties were not recognized on outcrop in Jasper County, with the exception of a locality east of the East Tallahala Creek in the SE.¼, NE.¼, Sec.13, T.1 N., R.11 E. The writer believes that the Marianna limestone may be only locally represented at or close to the surface in the County.

Two miles north of Bay Springs, a thick section of limestone and marl is intermittently exposed, roughly parallel to the east-west section line common to Sec.7, 8, 17 and 18, T.2 N., R.10 E. Fresh exposures of the Glendon limestone are probably underlain by several feet of the Marianna limestone here; however, severe weathering and slumping in the lower part of the steep slopes, held up by the Glendon limestone, prohibit adequate examination of the section. Several augar holes drilled in the area presented no conclusive evidence for the presence of the Marianna limestone. In test holes JC and JK, moreover, lithologies and electrical logs suggest the subsurface extension of the Marianna limestone. It is to be noted in addition that the lower marl and soft limestone section was not present in test hole JP in Bay Springs or in any test holes east of this locality (where Vicksburg limestones were successfully penetrated).

Glendon limestone

The name Glendon limestone was first used by Cooke in an unpublished manuscript submitted to the Mississippi Geological Survey. The Glendon limestone was considered the upper member of the Marianna limestone. Hopkins (1917, p. 300) first published a description of the Glendon limestone, giving credit to Cooke for the description. The type locality is along the Southern Railroad at Glendon Station, southwestern Clarke County, Alabama, where up to 20 feet of dense, fossiliferous, crystalline limestones and interbedded marls crop out.

In Jasper County, the Glendon limestone consists of 3 to 42 feet of soft to dense, fossiliferous, slightly glauconitic and argillaceous, blue-gray limestones and interbedded fossiliferous sandy, glauconitic marls.

Particularly up-dip, the Glendon exposures are extremely variable in thickness. Where it is less than 10 or 15 feet thick, the Glendon limestone has overlapped the Mariana-Mint Spring interval and rests upon the Forest Hill formation.

The Glendon limestone fauna includes *Lepidocyclina* sp., at least three species of *Pecten, Ostrea vicksburgensis* Conrad, several species of *Bryozoa,* and a few specimens of fish vertebrae and shark teeth.

Figure 15.—Residual Glendon limestone overlain by a part of the Bucatunna clay and capped with Citronelle terrace: N.E.1/4, S.W.1/4 of Sec.8, T.2 N., R.11 E.

The Marianna limestone and Glendon formation weather variably to light-gray, dark yellow-brown, deep red-brown (limonite- hematite replacement) or black (Fig. 15).

In general, density and hardness of the Glendon and Marianna limestones decrease with depth of burial, independent of position relative to structural strike. This phenomenon is probably related to depth of the water-table and to depth of limited weathering. Above the "permanent" water table, partial intermittent dehydration has caused the crystallization of calcite, further cementing the rock and filling voids. The loss of drilling fluid into solution channels, or small interconnected "caverns" in the limestones, occurred only in these dense, tan-stained beds (less than 35 feet from the surface) where permineralized limestones and marls had sufficient strength to prevent collapse under the weight of overlying rocks.

In test hole JN, caveronous Glendon limestone was encountered at a depth of 247 feet, 10 feet into the Glendon limestone; however, this was in the down-faulted side of a fault (166 feet of throw at the Glendon limestone horizon. See Structure Contour Map, Plate II). An artesian flow of water from this hole, at approximately 30 gallons per minute, may have come across the fault surface nearby, from the Forest Hill formation. This test hole flowed water for three days before the hole collapsed (or "bridged") at a depth of 95 feet from the surface, opposite sands of the Catahoula (Miocene) formation.

The lower contact of the Glendon limestone is judged to be conformable with the underlying Marianna limestone.

Byram marl

The name Byram was first formally applied in the stratigraphic sense by Cooke (1918, pp. 186-198) for exposures along the Pearl River at Byram, Hinds County, Mississippi. The original definition encompassed strata from the top of the Marianna limestone to the base of the Catahoula formation or Miocene beds. Later, strata of probable youngest Oligocene age have been named the Chickasawhay marl by Blanpied (1934, pp. 10-11, 26-27). More recently, the term Byram has been applied as the Byram formation by the United States Geological Survey and others, and comprised, in ascending order, of the "Glendon limestone member," "marl member," and the "Bucatunna clay member." Since the unnamed "marl member" has been repeatedly referred to as the "Byram marl," the purposes of nomenclature might best be served by elevating the "marl member" to formational status, despite its apparent regional, conformable relationship over broad areas.

The Byram marl consists of dark-gray or dark green-gray, fossiliferous, sandy, argillaceous, glauconitic marls with an extremely fossiliferous zone in the lower one to three feet. *Ostrea* *vicksburgensis* Conrad was the most prominent macrofossil seen in the formation.

The Byram marl varies in thickness from zero to 30 feet and is usually absent beneath the Bucatunna formation along the outcrop in western Jasper County, as observed by MacNeil (1944, p. 1335). It is present, however, in eastern Smith County. The maximum thickness of Byram marl measured was in test hole JK, where 30 feet of fossiliferous, dark-gray, carbonaceous, glauconitic clay were recorded above the Glendon limestone. Two samples from the upper part of the formation yielded fish vertebrae. Absence of the Byram interval is attributed primarily to erosion. The writer concurs with Monsour (1948, p. 11) when he states that "in almost each instance the top few feet of the Byram at the contact with the overlying Bucatunna exhibited a leached character."

The outcrop belt of the Marianna, Glendon and Bucatunna formations forms a cuesta of moderate height across Jasper County and supports soils which are gray to reddish-brown in color. Prairie soils are developed where terrain is level and drainage is poorly developed. Owing to the higher sand content in the Vicksburg formation, lime in the soils is more deeply leached than in the prairie soils of the Yazoo formation to the northeast.

The lower contact of the Byram marl is conformable with the Glendon limestone.

Bucatunna formation

The Bucatunna formation was named by Blanpied (1934, pp. 7-8) for outcrops along Bucatunna Creek, north of Denham Post Office, "one-half mile upstream from Dyess Bridge, in Wayne County, Mississippi."

The Bucatunna of Jasper County consists of yellow and buff sands and sandy clays. Clays may be mottled maroon and gray and the lower or lowest part of the formation contains varying amounts of bentonitic clays which are commonly slightly lignitic.

The Bucatunna formation varies considerably in thickness on the outcrop and in the shallow subsurface, by reason of deposition upon the eroded surfaces of formations beneath it.

Without doubt, the Bucatunna formation is missing in places; but elsewhere, the close proximity of heterogeneous facies of terrace deposits above weathered Glendon limestone renders identification of the Bucatunna formation questionable. The maximum measured thickness of the Bucatunna formation was 39 feet.

Locally, where perhaps a full thickness of the Bucatunna formation is found, the lower one-half of the interval is occupied by dark-gray to black, massive to laminated, carbonaceous, sulfidic, argillaceous silt. This is the "mineral earth" of Jasper and Smith Counties. Where the carbonaceous facies of the Bucatunna is thick, at least part of the Byram marl is present beneath it.

An erosional unconformity at the base of the Bucatunna formation was documented by Blanpied *et. al.* (1934, pp. 7-9) at localities three to four and one-half miles north of Waynesboro, in Wayne County. MacNeil (1944, pp. 1332-1338) confirmed this unconformity at the same locality, attributing it to movement along faults during Byram time. He also states that (p. 1335) "The marl member is largely cut out in western Jasper County and the upper Bucatunna clays have not been recognized." MacNeil's inclusion of the Bucatunna beds with the marl member under the Byram formation is based, in part, upon his regarding the Bucatunna formation as absent in western Jasper County.

The Chickasawhay limestone was not recognized at the outcrop anywhere in Jasper County. In test hole JL a fine-grained, glauconitic, lignitic sand was penetrated at a depth of 130 to 152 feet. The base of this unit is 48 feet above the clay facies of the Bucatunna formation. This bed is interpreted as the lateral equivalent of the limestone facies of the Chickasawhay limestone of northwestern Wayne County. A search for the feather edge of the Chickasawhay limestone southeast of U. S. Highway 11 showed that thick terrace beds occupy the stratigraphic position of the Chickasawhay. Here, as at the west-central margin of Jasper County, extensive erosion concurrent with high-level (Citronelle) terrace deposition has fortuitously cut-out this interval and, locally, the Bucatunna bentonitic clay facies as well.

Miocene series

Strata of Miocene age are here undifferentiated under the Catahoula formation.

The Paynes Hammock sand of MacNeil (1944, pp. 1344-1357) containing the characteristic oyster *Ostrea blanpiedi* Howe was not identified within the County, either in outcrop or from drilling samples. In test hole JL, however, a 14-foot bed of coarse, micaceous, slightly lignitic sand lies 84 feet above the Glendon limestone. The 84-foot interval includes one foot of very fossiliferous Byram marl at the base and 46 feet of fine-grained sand containing glauconite and muscovite considered to be the upper Byram marl. This is overlain by 34 feet of interbedded light gray clay and fine-grained glauconitic sand and occasional thin, extremely lignitic, glauconitic sand strata. Although no fossil fragments were detected in samples of this 14-foot sand (within the volume of samples from a single test hole) this may prove to be the Paynes Hammock sand.

CATAHOULA FORMATION

The name Catahoula sandstone was proposed by Veatch (1905, pp. 84, 85, 90) for exposures of sandstones and clays in Catahoula Parish, Louisiana, which occupy the interval between the Vicksburg and Fleming groups. Veatch proposed the name Catahoula to replace and restrict the conflicting usage of the "Grand Gulf" of Wailes (1854, pp. 216-219). In Mississippi, the Catahoula formation includes Lower Oligocene strata which occupy the interval above the Vicksburg group (or above the Paynes Hammock sand, where present) and the base of the Hattiesburg clay.

The lower part of the Catahoula formation in Jasper County is comprised of fluviatile sand, clay, and sandy clay, all containing variable quantities of lignite and muscovite. Most strata vary considerably over short distances and demonstrate most sedimentary structures associated with deltaic depositional environments. Colors and textures of the numerous facies of the Catahoula formation are extremely variable, making them difficult to separate from Pleistocene and Holocene terraces.

The lower portion of the Catahoula formation is exposed over approximately one-fifth the area of Jasper County and lies at the southwestern corner of the County and along several divides at the southeastern margin of the County.

The Catahoula formation is approximately 500 feet thick at the southwestern corner of Jasper County.

Colors at weathered exposures of the Catahoula formation are varied although shades of red-orange and orange-yellow predominate, owing to iron oxidation.

Sandy soils of the Ruston series are typically developed upon the Catahoula formation.

The Catahoula formation underlies the northeastern margin of a topographical-pedalogical belt which crosses the State and is called the Piney Hills physiographic province.

CITRONELLE FORMATION (PLEISTOCENE)

A thick, high-level terrace sheet of remarkably uniform attitude and topographic continuity was spread over much of Jasper County. Late Pleistocene and Recent erosion has removed most of the terrace, leaving it preserved only upon isolated, high hills.

The terrace consists of thick, fluvial, massive or cross-bedded, red sands and gravels and discontinuous lenses of vari-colored silty clays. Limonitized logs are occasionally abundant just above the lower contact where the terrace lies lapped upon truncated rocks ranging in age from Shubuta-Eocene to Catahoula-Miocene.

A projection of structure contours by Doering (1958, p. 776, fig. 5) and the consideration of average structural dips of this terrace conforms well with the distribution of the Citronelle formation. A view for the Early Pleistocene (pre-Nebrasken) age, and the geological history of the Citronelle is advanced by Doering (1958, pp. 775-778, 783-784).

The average dip on the base of the Citronelle is approximately 12 feet per mile to the southwest. The strike, however, varies from a direction roughly parallel with the Vicksburg outcrop on the southern or lower edge of the terrace to a more northerly strike at the up-dip or higher edge of the terrace towards the northeast. The lower dip and unconformable relationship of the terrace is obvious when traced in a northwesterly direction from Vosburg, on the southeast, to Baxter Hill, to the northwest. At Baxter Hill and at two other high hills, Randall Hill (three miles west of Baxter) and Moss Hill (four miles west of Rose Hill), the easily-weathered Shubuta formation is held up or protected by a proportionately thin "cap-rock" of Citronelle terrace sand. The presence of good water at shallow depths was largely responsible for the early settlement of these "Citronelle hills," which are surrounded by the thick, heavy clays of the Jackson Prairie (Yazoo formation), in much of northern Jasper County.

A maximum thickness of 112 feet for the Citronelle formation was measured in Baxter Hill (Fig. 16).

Figure 16.—Large sand pit in the Citronelle formation at Baxter Hill. Contact with the Shubuta clay member is at floor of pit: N.W.1/4, S.W.1/4 of Sec.5, T.4 N., R.11 E.

RECENT TERRACES

Terraces of post-Citronelle age are present over most of the surface area in Jasper County and cover most hills of moderate elevation. They are stream-terraces, remnants of older courses and higher elevations of the modern streams and branches which drain the County. These terraces are consistently wider and better developed on the northeast stream-valley walls as stream incision has moved down regional dip, following weaker rocks. Recent terraces are weathered easily and are rather difficult to separate from colluvium with which they are associated. Unlike the Citronelle formation, Recent terraces consist of the coarser fraction of materials eroded from formations close at hand and often lend difficulty in distinguishing terrace from older strata of marine or deltaic deposition.

STRUCTURAL GEOLOGY

Jasper County is located near the northeast margin of the Mississippi salt basin.

Strata at the surface dip to the south-southwest with an average regional dip of 31 feet per mile. Dips range between 13 and 51 feet per mile. The general increase in dip towards the northeast corner of the County may have been produced by a "buttress effect," at depth, against the northeast flank of the Mississippi salt basin. The Pachuta fault is traced for six miles westward into the County but was not successfully traced farther west along the outcrop.

Faulted anticlinal structures at Heidelberg and Sharon fields are well known and are shown in some detail at the producing horizon by Mr. M. K. Kern in this Bulletin.

A gentle faulted structural nose (or anticline) with a dip or displacement of 25 feet is indicated between test holes JB and JA, at the upper contact of the Shubuta clay member; and 29 feet of west dip or displacement was measured between the holes at the upper contact of the Glendon limestone. The Bucatunna clays rest disconformably upon the Glendon limestone in this general region.

A fault trending east-northeast appears to intersect the surface at two places south and east of the townsite of Montrose. This fault is thought to crop out in the west-central part of Sec.7, T.4 N., R.10 E., and cross the County road about 150 yards west of the bridge over Tallahoma Creek. The Shubuta clay member is present south of the bridge with the Forest Hill formation mapped in the creek valley north of the bridge. Another displacement is indicated three-tenths of a mile east of Palestine Baptist Church in Sec.5 of the same township. The presence of one or more east-west trending faults down thrown on the north is verified by the fact that the top of the Shubuta clay in Montrose (across the fault), in test hole JO, is 25 feet lower than it is in test hole JJ which is four miles to the south-southeast of JO. Southwesterly (or regional) dips seem to maintain at outcrops between the two test holes. In test hole JO the Yazoo formation is at least 45 feet thinner than measured elsewhere in Jasper County.

The top of the Shubuta clay member is only 101 feet higher in test hole JR (at Missionary) than in test hole JJ, 9.7 miles west-southwest of JR. This constitutes a dip (apparent dip) of 10.4 feet per mile and is, in part, responsible for the exceptionally broad outcrop of the Yazoo formation in this region. Between test holes JR and JX, at a distance of three and one-half miles up-dip, the dip increases to 34 feet per mile. A fault trending northwest is postulated just south of test hole JR, with JR in the down-thrown block (Plate 1).

ECONOMIC GEOLOGY

SAND AND GRAVEL

Jasper County is endowed with an abundance of sand suitable for building and highway construction. These deposits are well distributed throughout the County and have been known and utilized for many years from scores of sand quaries. Commercial deposits of sand are found in several formations, which are, from southwest to northeast, the Catahoula, Forest Hill, Cockfield, and Kosciusko. Excellent, thick deposits of sand are found in the Citronelle formation, stretching in a southeast-northwest direction from Stafford Springs to Baxter and Randall Hill. Thinner deposits of sand are to be found in Recent terraces and in stream beds scattered about Jasper County.

Compared with supplies of sand, the known gravel deposits are thin and scarce in the County. Field investigation reveals that gravels are most often located near the base of the Citronelle formation although lenses if gravel may be found throughout the formation. These gravels always contain much sand and require screening and washing.

Sandy clays of the Forest Hill and Citronelle formation present potential supplies for the manufacture of common brick and drain tile.

CLAY

An abundance of clays of various mineralogical compositions and commercial use are to be found on the surface in Jasper County.

The Shubuta clay member, which is 100 to 150 feet thick, provides an inexhaustible supply of raw material for the manufacture of lightweight expanded clay aggregate. This aggregate, being much lighter than gravel and sand, makes possible its use in concrete products over a wide range of structural uses. An area most suitable for future establishment of a lightweight aggregate plant is the eastern one-third of T.4 N., R.10 E., north of Montrose and adjacent to the Gulf, Mobile and Ohio Railroad right-of-way.

Physical and chemical properties of sands and clays cited in Jasper County are similar to those of adjacent Scott County, which McCutcheon (1942, pp. 103-129) has analyzed and tabulated.

BENTONITE

No deposits of bentonite of sufficient thickness or purity for commercial use were discovered at the surface in Jasper County. Attention, however, is called to the presence of bentonite beds in the lower part of the Gordon Creek shale member of the Wautubbee formation (see Stratigraphy).

The presence of bentonite in the Glendon limestone (noted above) was discovered in test hole JL at a depth between 237 and 242 feet. This bed, five feet in thickness, lies 16 to 21 feet beneath the top of the Glendon limestone and may be the correlative of the commercially important bentonite bed in several places in Smith County.

LIMESTONE AND MARL

Numerous exposed and near-surface strata of agricultural limestone are found along the outcrop belt of the Vicksburg group in Jasper County. Although this supply has not been used in the last few years, this reserve in the County is of immediate commercial importance and sufficient to supply agricultural needs for at least a century. Although much of this limestone and marl contains coarse sand with it, causing the percent by weight of calcium carbonate ($CaCO_3$) to be slightly lower than the present AAA minimal standard, the coarse sand would augment measurably the tilth (air and water penetration properties) of the soil. Additional tonnages of limestone required would be compensated by reduced cost of quarrying, crushing and transportation.

Mellen (1942, pp. 10, 19-20) presents bulk or interval analyses of limestones from three localities in Jasper County which ranged between 74.31 and 87.00 volume-percent $CaCO_3$.

Three areas of thick limestone and marl outcrop in Jasper County are the following: 1) West. Secs.7, 8, and 18, T.2 N., R.11 E., one to two miles north and west of Bay Springs; 2) Central. Parts of Secs.6, 7, 8, and 18, T.1 N., R.12 E. and the eastern part of Sec.13, T.1 N., R.11 E. Exposures are along the eastern valley-wall of East Tallahoma Creek; 3) East. Southeast and east of Heidelberg on either side of U. S. Highway 11.

An economic survey of proposed quarry sites should include a coring program to determine the 1) thickness of overburden, 2) thickness of the limestone and marl interval, and 3) chemical analyses of a total bulk-sample plus analyses of several selected intervals comprising the total thickness.

REFERENCES CITED

Bergquist, R. H. (1942) Scott County; Part I, Geology: Miss. Geol. Survey Bull. 49.

Blanpied, B. W., *et. al.* (1934) Stratigraphy and Paleontological Notes on the Eocene (Jackson Group), Oligocene, and Lower Miocene of Clarke and Wayne Counties, Mississippi: Eleventh Annual Field Trip of the Shreveport Geological Society, Guide Book. (Steffey reprint).

Cheetham, Allan (1957) Eocene-Oligocene Boundary, Eastern Gulf Coast Region: *in* Trans., Gulf Coast Assoc. Geol. Societies, Vol. 7.

Conrad, T. A. (1846) Observations on the Eocene Formation of the United States, with Descriptions of Species of Shells, etc., occuring in it: Am. Jour. Sci., Ser. 2, Vol. 1.

Conrad, T. A. (1855) Observations on the Eocene Deposits of Jackson, Mississippi, with Descriptions of Thirty-four New Species of Shells and Corals: Acad. Nat. Sci. Phila. Proc., Ser. 1, Vol. 7.

Cooke, C. W. (1918) Correlation of the Deposits of Jackson and Vicksburg Ages in Mississippi and Alabama: Jour. Wash. Acad. Sci.

Cooke, C. W. (1933) Definition of Cocoa Sand Member of Jackson Formation: Bull. Amer. Assoc. Petrol. Geol., Vol. 17.

Doering, J. A. (1958) Citronelle Age Problem: Bull. Amer. Assoc. Petrol. Geol., Vol. 42, No. 4.

Harris, G. D., and Veatch, A. C. (1899) A Preliminary Report on the Geology of Louisiana: Louisiana State Expt. Sta., Geol. and Agri. La.

Hendy, W. J. (1948) Notes on the Stratigraphy of Northeastern Wayne County, Mississippi: *in* Sixth Field Trip Guide Book, Mississippi Geol. Society.

Hilgard, E. W. (1860) Report on the Geology and Agriculture of Mississippi.

Hopkins, O. B. (1917) Oil and Gas Possibilities of the Hatchetigbee Anticline, Alabama: U. S. Geol. Survey Bull. 661.

Johnson, L. C. (1892) The Chattahooche Embayment: Bull. Geol. Soc. Amer., Vol. 3.

Lowe, E. N. (1915) Mississippi: Its Geology, Geography, Soils, and Mineral Resources: Miss. Geol. Survey Bull. 12.

Lowe, E. N. (1919) Mississippi, its Geology, Geography, Soils, and Mineral Resources: Miss. Geol. Survey Bull. 14.

MacNeil, F. S. (1944) Oligocene Stratigraphy of Southeastern United States: Bull. Amer. Assoc. Petrol. Geol., Vol. 28, No. 9.

McCutcheon, T. E. (1942) Scott County Tests: Miss. Geol. Survey Bull. 49.

Mellen, F. F. (1941) Warren County Mineral Resources; Part I, Geology: Miss. Geol. Survey Bull. 43.

Mellen, F. F. (1942) Mississippi Agricultural Limestone: Miss. Geol. Survey Bull. 46.

Monsour, E. T. (1948) Generalized Stratigraphic Discussion of Post-Claiborne Sediments in Mississippi and Correlation with Equivalent Age Sediments in the Gulf Coast Province: *in* Sixth Field Trip Guide Book, Miss. Geol. Soc.

Murray, G. E. (1947) Cenozoic Deposits of Central Gulf Coastal Plain: Bull. Amer. Assoc. Petrol. Geol., Vol. 31, No. 10.

Murray, G. E. (1961) Geology of the Atlantic and Gulf Coastal Province of North America: Harper and Brothers, New York.

Murray, G. E. (1963) North Twistwood Creek Clay, Corrected Name for the North Creek Clay: *in* Miss. Geol. Survey Bull. 95.

Priddy, R. R. (1961) Geologic Study Along Highway 80 from Alabama Line to Jackson, Mississippi: Miss. Geol. Survey Bull. 91.

Stenzel, H. B. (1940) The Yegua Problem: *in* Texas Bureau Econ. Geol. Bull. 3945.

Thomas, E. P. (1942) The Claiborne: Miss. Geol. Survey Bull. 48.

Thomas, E. P. (1948) The Jackson (Eocene) and Younger Beds of West-Central Mississippi: *in* Sixth Field Trip Guide Book, Miss. Geol. Soc.

Tonti, E. C. (1955) Certain Disconformities and Lithology of the Vicksburg Stage of Southeastern United States: Ph.D. Dissertation, Louisiana State University.

Tourtelot, H. A., and Morris, J. A. (1944) Geology of the Quitman Fault Zone, Clarke and Wayne Counties, Mississippi, and Choctaw County, Alabama: U. S. Geol. Survey, Oil and Gas Investigations Preliminary Map 6, 1 sheet.

Vaughan, T. W. (1895) The Stratigraphy of Northwestern Louisiana: Amer. Geologist, Vol. 15.

Veatch, A. C. (1905) Report on the Underground Waters of Northern Louisiana and Southern Arkansas: Louisiana Geol. Survey, Bull. 1.

Wailes, B. L. C. (1854) Report on the Agriculture and Geology of Mississippi: Miss. Geol. Survey.

Wilmarth, M. G. (1938) Lexicon of Geologic Names of the United States: U. S. Geol. Survey Bull. 896. (Nomenclatural references.)

JASPER COUNTY SUBSURFACE STRATIGRAPHY

WILLIAM H. MOORE

ABSTRACT

The examination of cuttings and cores from many wells in Jasper County and correlation of electrical logs from these wells aid in establishing the thickness and variations in lithology of the stratigraphic units to be found in the Jasper County subsurface. The information obtained from these investigations indicates that Jasper County is a favorable area for additional discoveries in formations from which oil and gas are now being obtained. Certain parts of the County are also favorable areas for exploration into formations not now producing or producing only small amounts of hydrocarbons.

INTRODUCTION

A study of the subsurface stratigraphy of Jasper County was made to complement the study of the surface geology. This was not an attempt to carry descriptions and ideas on surface formations into the subsurface, but to concentrate on beds which have not been as fully discussed in the literature in an effort to present some data on their general lithologic thickness and facies differences.

This investigation consisted of the examination of cuttings and cores from many of the wells in Jasper County and comparison of this sample information with electrical logs of the wells.

The discussion of the subsurface stratigraphy also helps to understand the section in the bulletin covering oil and gas production by explaining the formation names used in the various production data. The structure map, which uses the top of the Eutaw formation as a datum, helps to locate structures and fields mentioned in the oil and gas section and this discussion of the subsurface stratigraphy.

GENERAL STRATIGRAPHY

The stratigraphic column applicable to the Jasper County subsurface follows the terminology that is presently in use in Mississippi, with a few exceptions in the Lower Cretaceous and Jurassic. This column with the range of thickness of the units is shown by Figure 1.

		THICKNESS
UPPER CRETACEOUS	SELMA	1000'–1400'
	EUTAW	450'–550'
	TUSCALOOSA	1150'–1350'
LOWER CRETACEOUS	WASHITA-FREDERICKSBURG	1000'–1500'
	PALUXY	800'–1500'
	MOORINGSPORT	250'–300'
	FERRY LAKE	100'
	RODESSA	700'–800'
	HOSSTON	1000'–2100'
JURASSIC	COTTON VALLEY	2500'–3300'
	HAYNESVILLE	700'–1400'
	SMACKOVER	500'–1400'
	NORPHLET	100'–200'

Figure 1.—Subsurface Pre-Tertiary stratigraphic sequence and thickness of units, Jasper County.

In the Jurassic stratigraphy, the name Haynesville is used for the limestone, anhydrite, sand and shale sequence between the base of the Cotton Valley and the top of the Smackover. The Haynesville interval contains the anhydrite and shale section called Buckner and is picked on the first limestone or anhydrite bed encountered below the Cotton Valley sands and shales.

In the Lower Cretaceous, the name Rodessa is applied to the section from the base of the Ferry Lake to the top of the Hosston; or in the absence of the Ferry Lake, from the base of the Mooringsport to the top at the Hosston. This unit is probably not all of Rodessa age and contains lithologic differences. The lower part of this unit is in need of a new formational name. The term Sligo is applied to this section in Mississippi; although, the original definition and later work by Nichols[1] state that the Sligo is a down-dip equivalent of the upper Hosston. A more encompassing work than this county report is needed to establish a good type section for this lower unit.

The name Washita-Fredericksburg is used for the beds between the base of the Tuscaloosa and the top of the Paluxy formation. This name is in preference to the term Dantzler. As originally defined, the Dantzler is a sequence of sand, red and gray shale with fossiliferous zones which is between the base of the Lower Tuscaloosa and the top of the Washita limestone. Later information has shown that the type Dantzler is applicable only to a mid-dip area in southern Mississippi. The term Dantzler has come to apply to the red bed section between the base of the Lower Tuscaloosa and the top of the Paluxy, but until it can be shown that this red bed section is younger than Washita-Fredericksburg, the name Dantzler seems less applicable, unless redefined to apply to the red bed facies of the Washita-Fredericksburg.

The Upper Cretaceous formation names Selma, Eutaw and Tuscaloosa are in general use and are applicable to Jasper County.

JURASSIC

NORPHLET FORMATION

The oldest stratigraphic unit encountered in Jasper County, other than the Louann salt, is the Norphlet. The wells which encountered the Norphlet did not penetrate the entire thickness

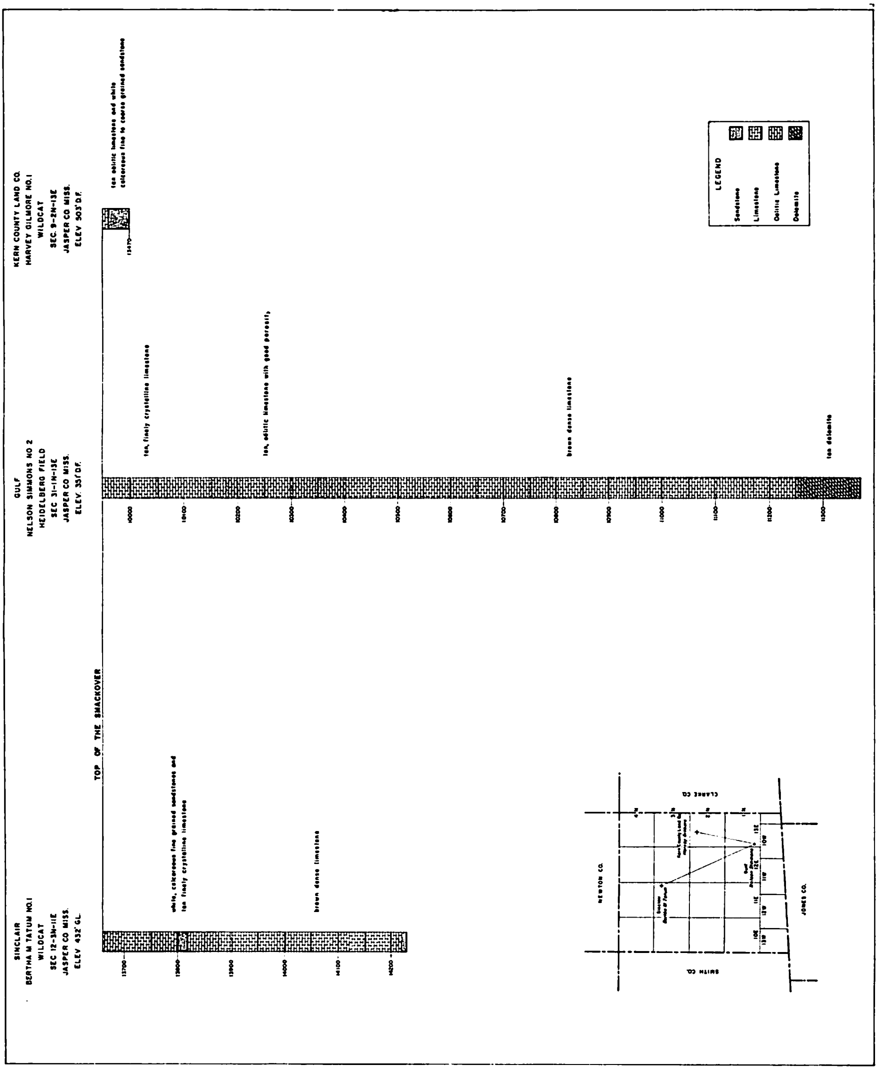

Figure 2.—Lithology of Smackover formation in three deep wells in Jasper County.

of the formation, but were still in the Norphlet at their total depths.

The lithology of the Norphlet is typified by the section in the Sinclair No. 1 Tatum. This well penetrated 110 feet of red shale and red, argillaceous, slightly calcareous, fine-grained sandstone. Other wells had 100 to 200 feet of the same lithology. No shows have been reported from the Norphlet formation.

SMACKOVER FORMATION

The Smackover formation has been penetrated in enough wells in Jasper County to give an idea of the lithologic variations to be found in the County. These variations are shown on Figure 2. The Sinclair No. 1 Tatum, in Sec.12, T.3 N., R.11 E., penetrated 500 feet of Smackover. The lithology of the formation in this well is tan, finely crystalline limestone in the upper part of the formation and brown, dense limestone in the lower part, with some white, calcareous sandstones in the upper few feet, in the middle of the formation and in the lower few feet. There is scattered porosity in the finely crystalline limestone at the top of the formation and the sandstones are slightly porous, but no show of oil or gas was reported and no staining is present on the cuttings.

The Smackover is 1400 feet thick in the Gulf No. 2 Nelson Simmons, Sec.31, T.1 N., R.13 E. The upper 450 feet of the formation is composed of tan finely crystalline limestone and tan oolitic limestone. The oolites are both large and small and are sometimes loosely cemented. Good porosity is developed in the oolitic limestone and some oil staining is noted. The next 850 feet of the formation is made up of tan and brown limestone with only scattered porosity. The bottom 100 feet of the formation is made up of brown and gray dolomite. This well is in the Heidelberg Field and several wells in this field have encountered good porosity and oil staining in the upper part of the Smackover.

The Kern County No. 1 Gilmore, Sec.9, T.2 N., R.13 E., bottomed in smackover after penetrating 45 feet of the formation. The lithology of the Smackover in this well is tan, sandy, oolitic limestone and white, calcareous, fine- to coarse-grained sandstone. No porosity or shows of oil and gas were noted in the Smackover.

The Smackover has not produced oil or gas in Jasper County, but numerous shows and good porosity developments in some areas make it attractive as an objective. The most favorable area for Smackover exploration is the southeastern portion of the County where desirable combinations of porosity, oil and gas shows, and feasible drilling depths are found.

The Sinclair No. 1 Tatum is the only well in the central portion of the County which penetrated the Smackover. As previously discussed, this well did not encounter favorable lithology. No wells in the southwestern portion of the County have reached the Smackover; although, one of them was drilled below 19,000 feet. A combination of unfavorable lithology and extreme depth to the formation makes these areas of the County less favorable; although, more well control is needed to firmly establish the lithology to be expected in central Jasper County.

HAYNESVILLE FORMATION

The top of the Haynesville formation is picked on the first limestone or anhydrite beds below the lower Cotton Valley sands and shales. The few wells in Jasper County that have penetrated the Haynesville show a varied lithology. The Gulf Tract 28-7 Soso Unit No. 1 in Sec.28, T.10 N., R.13 W., penetrated 1400 feet of Haynesville beds to its total depth. In this well, the upper portion of the Haynesville is made up of 200 feet of pink and white anhydrite with red and white fine-grained sandstones. The next 200 feet consist of gray, oolitic and pelletoid limestones with white anhydrite and white, limy, fine-grained sandstones. The rest of the formation is a sequence of gray shale, red shale and white and pink anhydrite with some beds of gray limestone. The wells at Heidelberg contain more limestone in the Haynesville section. No shows were reported in the Haynesville at Heidelberg or Soso. The Kern County No. 1 Gilmore in Sec.9, T.2 N., R.13 E., has more oolitic and pelletoid limestone in the Haynesville section and oil shows were reported from the middle Haynesville.

The Haynesville is 700 feet thick in the Sinclair No. 1 Tatum in Sec.12, T.3 N., R.11 E. The upper part of the formation is made up of white, limy, fine- to medium-grained sandstones and tan to gray limestone with some gray pelletoid limestone. The middle of the formation consists of white anhydrite, gray, dense limestones and white, fine-grained sandstones. The lower part of the formation is made up of red shale with white and pink, limy, fine-grained sandstones.

The more favorable areas for Haynesville exploration coincide with the favorable areas for the underlying Smackover formation.

COTTON VALLEY

In this discussion, the Cotton Valley is not divided into formations. There are variations in the Cotton Valley lithology, but the terms Bossier and Schuler formations used in Louisiana are not used nor is the term Ivy formation proposed by Dickenson[2] used. More control in the down-dip areas of the State is needed before it can be determined if these terms are valid in Mississippi.

The term Cotton Valley is applied to all beds between the base of the Hosston formation and the top of the Haynesville formation. The top of the Cotton Valley is picked on the first appearance of green, purple, ochre, buff and gray mudstones with siderite nodules and a change from the coarse-grained sandstones of the Hosston to the fine-grained sandstones of the upper Cotton Valley.

The Cotton Valley is up to 3300 feet thick in the southwestern corner of the County. In the southeastern part of the County, the thickness of the Cotton Valley is affected by the Heidelberg structure. Some of the wells in Heidelberg penetrated up to 2200 feet of Cotton Valley sediments. In the west central part of the County, the Skelly No. 1 Evans bottomed in Cotton Valley sediments after penetrating 1600 feet of them. In the east central portion of the County, the Kern County No. 1 Gilmore encountered a Cotton Valley section 2300 feet thick. The Sinclair No. 1 Tatum, in north central Jasper County, penetrated a 2500 foot section of Cotton Valley sedimentary rocks. The Lacy No. 1 Gandy, five miles northeast of the Tatum well, bottomed in Cotton Valley after penetrating 2200 feet of Cotton Valley section. Just across the line in Newton County, the Sun No. 1 Wall encountered only 300 feet of Cotton Valley sedimentary rocks. This thinning shows the pronounced effect of the Paleozoic ridge in the area of the Sun No. 1 Wall. In the wells in this area, beds of Jurassic age lie on limestones of Ordovician age.

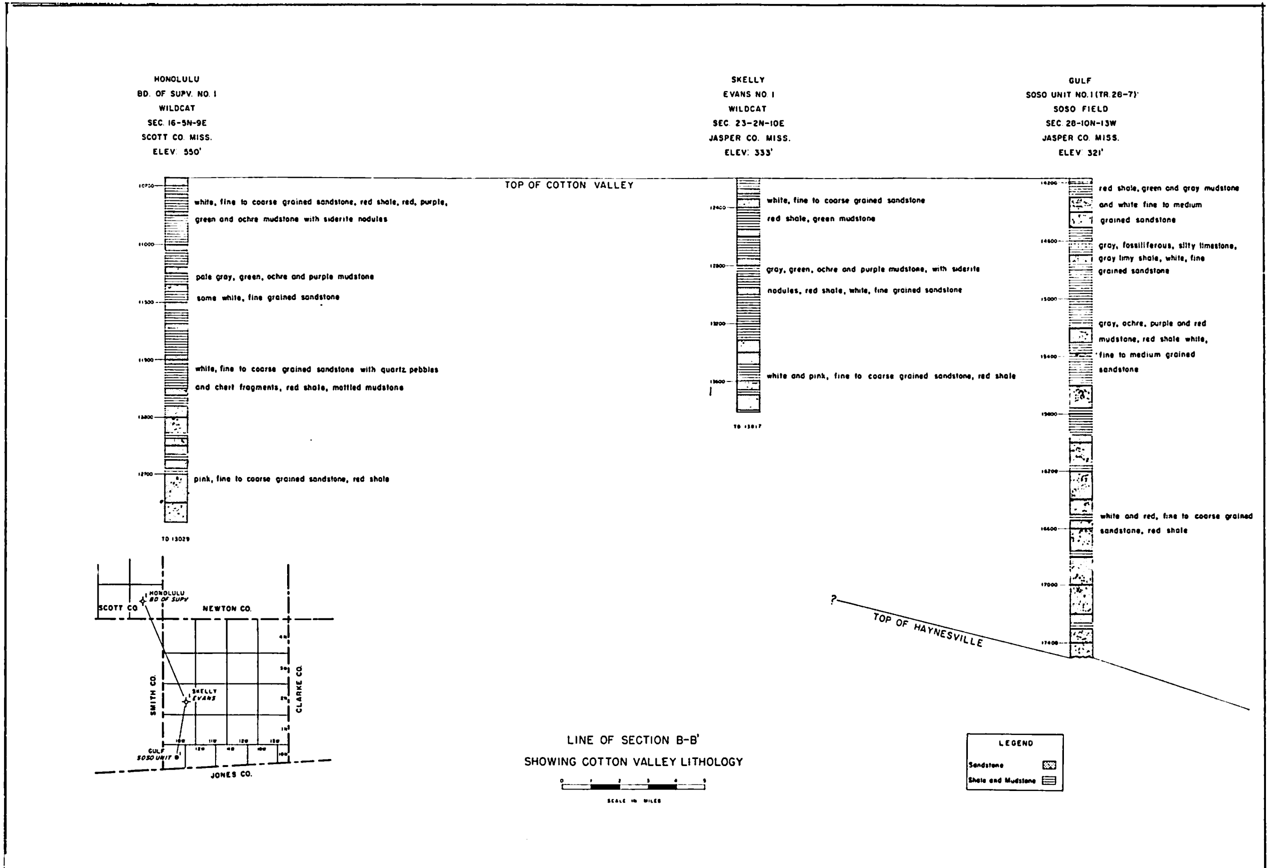

Figure 3.—Lithology of Cotton Valley formation in three deep wells along line of section B-B′.

In general, the upper part of the Cotton Valley is made up of green, ochre, gray, purple, buff and red mudstones with siderite nodules; red shale with nodular limestone, and white, fine-grained sandstone. There are a few red sandstones in the upper Cotton Valley in some wells. The middle Cotton Valley consists of red shale, nodular limestone, white, fine- to coarse-grained sandstone with some quartz pebbles and some red, fine- to coarse-grained sandstone. The lower Cotton Valley has a predominance of red sandstones and the sandstones are mostly fine- to medium-grained. In the Lacy No. 1 Gandy in Sec. 23, T.4 N., R.12 E., the upper Cotton Valley contains much varicolored, nodular limestone and some tan limestone which might be bedded limestone. The upper Cotton Valley in the Sinclair No. 1 Tatum in Sec. 12, T.3 N., R.11 E., also contains much nodular limestone.

In most of Jasper County, the Cotton Valley appears to be of continental origin, but in some wells in southern Jasper County beds of marine or brackish origin are present. The change from entirely continental beds to lithology that contains some marine or brackish beds is shown by Figure 3. In the Honolulu No. 1 Board of Supervisors in Sec. 16, T.5 N., R.9 E., of Scott County, the Cotton Valley is made up of white and red, fine- to coarse-grained sandstones with quartz pebbles and associated beds of red shale and purple, green and ochre mudstone. The Skelly No. 1 Evans in Sec.23, T.2 N., R.10 E., has a similar lithology with the sandstones being slightly finer-grained overall. The Gulf Tract 28-7 Soso Unit No. 1 in Soso Field contains over 100 feet of gray limestone, limy, fossiliferous siltstone, gray shale and mudstone. In the Heidelberg Field, some wells contain a few feet of gray, limy shale in the upper Cotton Valley. The Cotton Valley is productive at Soso and Heidelberg Fields and the southern part of Jasper County is a favorable area for Cotton Valley exploration.

LOWER CRETACEOUS

HOSSTON

The Hosston formation is the oldest stratigraphic unit of the Lower Cretaceous in Jasper County. Its lithology is fairly consistent in all wells studied, and the Hosston thins from southwest to northeast. The top of the Hosston is placed below the lowest mudstone sequence of the Rodessa and there usually is an increase in grain size in the sandstones of the Hooston along with the appearance of chert fragments in these sandstones.

The Hosston is around 2100 feet thick in the southwestern portion of the County. It thins to 1000 feet in the Sinclair No. 1 Tatum in Sec.12, T.3 N., R.11 E., and just across the line in Newton County, the Hosston is only 600 feet thick in the Sun No. 1 Wall in Sec.28, T.5 N., R.13 E.

The Hosston lithology is made up of red shale, limestone nodules, white, gray and red, fine- to very coarse-grained sandstones, with quartz pebbles and chert fragments. Tht lower part of the formation is more coarse-grained, and the entire formation shows an increase in quartz pebbles and chert fragments in wells in the northern portion of the County.

The Hosston is productive at Soso, Heidelberg and Bryan Fields and from studies of the lithologic character of the formation, the southern portion of the County appears to be the most favorable area for Hosston production.

RODESSA FORMATION

In this report, the Rodessa includes all beds from the base of the Ferry Lake to the top of the Hosston; or in the area where the Ferry Lake is not present, all beds from the base of the Mooringsport to the top of the Hosston.

The Rodessa is 700 to 800 feet thick over most of the County, thinning slightly in the northern part. In most of the wells in the County, the upper part of the formation is made up of red shale, limestone nodules, some green, gray and ochre mudstone and white, fine- to coarse-grained sandstones with quartz pebbles. There are beds of red, fine- to medium-grained sandstone in some wells. The lower part of the Rodessa is a distinctive section with much gray, purple and ochre mudstone along with red shale, limestone nodules and white, fine- to medium-grained sandstone. The sands of the Rodessa are more micaceous than those of other formations with some thin laminae composed entirely of mica.

The Rodessa is one of Jasper County's most prolific oil producers. It is productive at Soso, Heidelberg and Bryan

Fields. It is productive from many zones in the formation and the favorable area for Rodessa exploration extends over nearly all of Jasper County. The production from the fields and zones is discussed in the chapter on oil and gas production.

FERRY LAKE

The Ferry Lake is present in wells in the southwestern corner of the County. All other portions of the County are above the sub-crop limit of the Ferry Lake. The formation is approximately 100 feet thick in the area around Soso Field, and the lithology consists of dark gray shale, gray, finely crystalline limestone and white anhydrite.

MOORINGSPORT

The top of the Mooringsport is picked on the presence of gray shale, gray, green and ochre mudstone and a lack of coarse-grained sandstones and red sandstones found in the overlying Paluxy formation. The base of the Mooringsport is easily picked in the southwestern corner of the County where the base is placed at the first contact with the limestones or anhydrites of the Ferry Lake. In other parts of the County, the Ferry Lake is not present, and the base of the Mooringsport is picked on a general lithologic change to the more coarse-grained Rodessa beds.

The Mooringsport is 300 feet thick in southwestern Jasper County and is made up of gray shale, red shale, gray mudstone, some gray limestone and rare white, fine-grained sandstone. The formation is about 300 feet thick in the central portion of the County and thins to about 250 feet in the north portion. The lithology of the Mooringsport in these areas is gray shale, red shale, varicolored mudstone, limestone nodules and white, micaceous, fine-grained sandstones.

The Mooringsport produces a small amount of oil from two wells at Soso Field.

PALUXY

In Jasper County, it is difficult to place the formation boundary between the Washita-Fredericksburg and the Paluxy. The top of the Paluxy is usually placed at the base of a shale section, in contact with a coarse-grained and gravelly sandstone section. This does not seem to be a desirable pick in a clastic section, such as the Lower Cretaceous of Jasper County but, if these conditions are accompanied by a general increase in grain-size in the section below, an increase in the number of red sandstones and an absence of mudstones, then a lithologic break is better established.

The Paluxy is about 1500 feet thick in southern Jasper County. It thins to 800 feet in the north central portion of the County around the Sinclair No. 1 Tatum in Sec.12, T. 3 N., R.11 E., and thickens to 1000 feet in the Lacy No. 1 Gandy in Sec.23, T.4 N., R.12 E., before thinning to 900 feet in the Sun No. 1 Wall, just across the line in Newton County.

The lithology of the Paluxy is fairly consistent in most wells. It is made up of red and bright red shale, limestone nodules, red sandstones and white sandstones, fine- to coarse-grained with some quartz pebbles. In the Lacy No. 1 Gandy, the Paluxy section is very coarse-grained. An unusual feature of the Paluxy is the absence of mudstones. Most of the Lower Cretaceous formations have abundant varicolored mudstones. In the area of the Soso Field, in the extreme southwestern corner of the County, the Paluxy contains a few pale green mudstones.

Jasper County is slightly north of the area most favorable for Paluxy production. The Paluxy is productive at Soso Field, and the most favorable area for Paluxy exploration is the southwestern corner of the County.

WASHITA-FREDERICKSBURG

The unit with the highest stratigraphic position of the Lower Cretaceous formations is the Washita-Fredericksburg. This formation is over 1500 feet thick in the southern part of the County and thins to 1000 feet in the northern part. The top of the Washita-Fredericksburg is picked on the presence of red shale and nodular limestone and on a change in character of the sands. In some wells red shales are present in the Lower Tuscaloosa so that the presence of nodular limestone is the best criterion for establishing a top. These limestone nodules appear to be secondary in origin and are probably a product of leaching. They are not present above the top of the Lower Cretaceous but are common in all Lower Cretaceous formations except the Ferry Lake and are also present in some Jurassic formations.

The lithology of the Washita-Fredericksburg is fairly consistent in all sections of the county. It consists of an upper section of varicolored mudstones, red shale and limestone. This section is usually 50 to 100 feet thick. The rest of the formation is a sequence of red shales and white, fine- to medium-grained sandstones. Limestone nodules are present throughout the formation and some green, ochre and red mudstone is found. There are a few beds of coarse-grained sandstone and rare red sandstones in some wells.

The Washita-Fredericksburg is almost entirely of continental origin in Jasper County, and there has been no production from this formation in the County and no shows have been reported.

UPPER CRETACEOUS

TUSCALOOSA GROUP

In this discussion, the Tuscaloosa is divided into the Upper Tuscaloosa and the Lower Tuscaloosa. The top of the Tuscaloosa is picked on the presence of varicolored mudstones with siderite nodules or sandstones with siderite nodules below the gray shales and glauconitic sandstones of the Eutaw. The top of the Lower Tuscaloosa is placed at the top of a varicolored mudstone section below the basal Upper Tuscaloosa sandstone, which is a coarse-grained sandstone with quartz pebbles and chert fragments.

The Tuscaloosa group is about 1350 feet thick in most of Jasper County and thins to about 1150 feet in the northern part of the County. The lithology of the Tuscaloosa is consistent throughout the County.

The Upper Tuscaloosa is made up of green, red, brown and purple mudstone with siderite nodules and white, fine- to coarse-grained sandstones with some siderite nodules or inclusions. Upper Tuscaloosa sandstone is white, fine- to coarse-grained with quartz pebbles and orange and white chert fragments. The average thickness of the Upper Tuscaloosa in Jasper County is about 550 feet.

The upper part of the Lower Tuscaloosa is made up of varicolored mudstones with some siderite nodules. The middle portion of the Lower Tuscaloosa consists of gray shale and white glauconitic fine- to medium-grained sandstones with some micaceous, lignitic sandstones. The basal section of the Lower Tuscaloosa is made up of medium- to coarse-grained sandstone with orange, white and red chert fragments and thin beds of varicolored mudstone and red shale.

The Tuscaloosa produces some oil at Heidelberg Field. The majority of the production is from Upper Tuscaloosa sandstones, but some production is obtained from the basal Lower Tuscaloosa. Jasper County is usually considered to be north of the most favorable area for Tuscaloosa production, but when the thick porous sands of the Tuscaloosa are found in association with favorable structural conditions, such as the Heidelberg structure, the Tuscaloosa is an objective.

EUTAW

The Eutaw was the first formation to produce oil and gas in Jasper County. The Eutaw produces oil and/or gas at Heidelberg, Soso and Sharon Fields. This production is discussed in the section on oil and gas production. The Eutaw is still a good objective for oil and gas exploration in Jasper County.

The thickness of the Eutaw formation varies in the County from 450 to 550 feet. No trend of thinning to the north is observed and variations in thickness seem to be due to local conditions. Some wells encountered faulting in the Eutaw section which causes the formation to be thinner than normal.

The top of the Eutaw is picked on the appearance of the first glauconitic sandstones below the Selma chalk. The Eutaw is made up of gray, glauconitic, limy, micaceous, fine- to medium-grained sandstones, gray shale and gray carbonaceous shale. Some of the sandstones are fossiliferous and the middle and lower parts of the Eutaw contain much sideritic material in the form of cementing material in the sandstones.

SELMA GROUP

The Selma Group includes all beds from the base of the Clayton formation to the top of the Eutaw formation. For practical purposes the Clayton formation could be included in this interval, as it is lithologically similar to the Selma and is sometimes difficult to separate from the Selma on electrical logs. The Clayton is distinguished from the Selma by faunal differences. The Clayton formation is only 10 to 20 feet thick in Jasper County. The thickness of the Selma in unfaulted wells varies from about 950 feet to almost 1400 feet. In general the Selma thins to the northeast, but the thinning is not uniform due to the prominent structures present in southern Jasper County. The Selma thins to about 1200 feet over the Soso structure and thickens to 1370 feet 3 miles to the north. The faulting at Sharon Field causes variations in thickness from 1178 feet on the high side of the fault to 937 feet on the low side. The thickness of the Selma at Heidelberg Field is from about 1000 feet to almost 1400 feet depending on the location in relationship to the complicated faulting on the Heidelberg structure.

The lithology of the Selma is consistent over the County. The upper part of the Selma is made up of light gray to white chalk with some zones of gray argillaceous chalk. The lower part of the Selma consists of gray argillaceous chalk with some gray, limy shale. The Selma section is fossiliferous, containing both foraminifera and fragments of larger fossils such as *Inoceramus* prisms.

The Selma produces gas from one well at Sharon Field. Several wells at Heidelberg have had good shows of gas. One well "blew out" from a gas accumulation in the Selma. A few wells have reported oil staining in the Selma at Heidelberg. Most of the gas shows have occurred in wells where faults have cut the upper Selma. The upper Selma is a high-carbonate chalk and is more likely to have porosity developments.

SUMMARY

Jasper County is one of the more important oil and gas producers in Mississippi, and continued geologic study is needed to insure the discovery of new fields and additions to the reserves in old fields. The first oil and gas production in Jasper County was from the Eutaw, and this formation continues to be an objective in wells drilled in all parts of the County. The Lower Cretaceous formations, the Paluxy, Mooringsport, Rodessa and Hosston have become prime objectives in recent years.

Other formations need a thorough investigation of their productive possibilities. The Selma now produces only minor amounts of gas but as the search for oil and gas becomes more difficult, this stratigraphic unit could become more important. Cotton Valley oil was discovered at Soso in 1958, and with favorable lithologic conditions and feasible drilling depths in southern Jasper County, all wildcats in this area should test the Cotton Valley. The Haynesville and Smackover formations do not produce oil or gas in Jasper County but there have been shows in these formations and porous horizons are present under a large portion of the County.

These favorable conditions in the Haynesville and Smackover along with the Cotton Valley objectives make deep prospecting in Jasper County more attractive.

REFERENCES

1. Nichols, J. L., Sligo stratigraphy of North Louisiana, Arkansas and East Texas: Reference report on certain oil and gas fields, Vol. IV; Shreveport Geol. Soc. 1958.

2. Dickenson, K. A., Upper Jurassic stratigraphy of southern Mississippi and Alabama: A thesis (PhD) submitted to the Faculty of the Graduate School, University of Minnesota, 1962.

JASPER COUNTY GROUND-WATER RESOURCES

MARSHALL KEITH KERN

ABSTRACT

Considering the rapid industrial development and increased mineral production in Mississippi, no geologic report would be complete without some treatment of the ground-water resources to expedite the planning and development of other resources.

Through a study of electrical surveys run in oil test wells in Jasper County, invaluable knowledge has been gained as to the existence of undeveloped fresh-water artesian sands which will afford abundant supplies of water for industrial and municipal use.

The four primary aquifers in the County are the basal Ackerman sand of the lower Wilcox group and the Meridian, Kosciusko and the Cockfield sands of the Claiborne group. These units have an average aggregate thickness of 600 to 700 feet of fresh-water sands which extend down-dip to depths of approximately 3,000 feet.

With the exception of the Cockfield, which has lenses and stringers of silt and very fine-grained sand, these aquifers are comprised of medium- to coarse-grained sand with good porosity and permeability.

Few areas in the nation can boast of a more plentiful supply of ground water!

INTRODUCTION

Water is life! It feeds, cleanses, carries, cools, warms and protects. For water, in our everyday usage, there is no substitute.

An adequate supply, with which Mississippi and the Southeastern United States are so richly blessed, is one of the prime natural resources that is attracting industry to our region.

It has been said that by 1980 the nation's demand will be twice the present daily needs of almost 300,000,000,000 gallons.

To the thirsty, water is precious. Let us use it wisely!

PURPOSE AND SCOPE

The two-fold nature of this report is: 1) to accumulate, study and record data on existing municipal and industrial wells and ground-water supply being utilized; and 2) to investigate and report on the potential of undeveloped aquifers underlying Jasper County.

In order that the layman may better understand the report, the writer thinks it suitable to explain "ground water" and some of the geologic and hydrologic terms and processes.

Table 1 is a record of the wells on which data were collected. This is comprised of physical data such as depth, diameter, water level, use of water, method of lift, water-bearing unit and yield. This information was supplied, for the most part, by the owners or in some instances by the drillers. The information herein utilized is considered the most reliable that is available, but only as reliable as the records or the memory of the individuals supplying the data.

GEOLOGIC AND HYDRAULIC CHARACTERISTICS OF THE AQUIFERS

Precipitation accounts for all ground water though much water from rainfall and snow is carried off in surface streams and evaporation and the process of plant transpiration. Where soil conditions are favorable some of the water percolates down through the porous earth to the water table. The water table is the level below the surface where the ground becomes saturated. It is below this level that water is stored in porous and permeable beds and from which a supply may be drawn. A water-bearing unit of this nature is termed an aquifer.

The area where an aquifer is exposed at the surface is referred to as the catchment area or area of replenishment. (See index map on Plate 1). Here the water is taken into the aquifer and migrates down the dip under a combination of atmospheric pressure and the weight of the water (hydrostatic pressure).

When a well is drilled into the aquifer at a point where the aquifer is lower in elevation than the catchment area, the hydrostatic head will push the water up in the drill hole or well to a level where the pressure is equalized. A well of this type is referred to as an artesian well. Some artesian wells are so located in respect to the catchment area that the hydrostatic head will force the water above ground level causing a flowing well.

Some aquifers afford larger yields, storage and recharge than others. These aquifer conditions are controlled by the factors of porosity and permeability, areal extent and thickness on the outcrop and in the subsurface, and the geologic structural attitude.

As stated above, an aquifer is a unit below the zone of saturation which is capable of both storing and yielding water in usable quantities. A clay bed below the water table contains water but it is rather difficult to extract this water for large supplies. Two requirements for an aquifer are lacking. These are porosity and permeability.

Porosity is simply the void or space between particles, such as that found between sand grains or gravel pebbles. These particles make up the rock unit but because of their size and shape all the space between them is not filled. In an aquifer, this is the storage space or reservoir.

When the pore space between one group of particles is connected to the pore space between another group, this is called permeability. Permeability allows the fluid to flow from one pore space to the other.

The areal extent of the catchment area is a controlling factor in the amount of water that is absorbed during the rainy season and the subsurface extent and thickness determine the size of the reservoir.

USE OF ELECTRICAL LOGS FOR RECOGNITION OF FRESH-WATER SANDS

Electrical surveys are made in most oil test wells. The primary purpose of the surveys is to determine the presence of oil and gas and the characteristics of the reservoir. Also, though no complete qualitative analysis can be made from them, electric logs can be used acceptably to distinguish between fresh water and saline water.

A good discussion of this subject is presented by Priddy[1] (1955):

> ". . . . electrical logs . . . ., can be interpreted to show what porous and permeable sands might be expected, their probable thickness, and finally, the nature of their fluid content."

Jasper County has experienced considerable activity by the oil industry and numerous test wells have penetrated the fresh-water sands in all areas of the county. Although many of these wells have been abandoned as "dry holes", they afford an abundance of information for further geologic study and particularly for ground-water resources.

An electrical survey is a rather involved and complex method of measuring and recording the behavior of a known electrical current which is induced into the various lithologic strata in the bore hole. From the curves recorded on the graph the characteristics of the rocks and their fluid content are determined (Plate 1).

WATER-BEARING UNITS

Fresh-water aquifers underlying Jasper County range from Eocene Wilcox to Miocene Catahoula in age. Smaller supplies are also available in Plio-Pleistocene terrace deposits.

WILCOX — BASAL ACKERMAN

Perhaps the most important aquifer in the county is the basal Ackerman sand of the Wilcox group. This sand can be encountered at depths of 1200 to 1300 feet in the northeastern and 2800 to 2900 feet in the southwestern portion of the County. This is a very wide spread sand. It is a source of municipal and industrial supply extending from the city of Memphis, Tennessee[2] south and southeast through Mississippi as far as Newton and Lauderdale Counties.

In the city of Memphis there are 19 municipal and one industrial wells supplying water from this stratum[3]. Some of these wells are capable of producing up to 1400 gallons per minute and in 1946 the average daily pumpage from this sand in Shelby County, Tennessee exceeded 8,000,000 gallons[4].

Water analyses in that area show that the average hardness is 9.5 parts per million (as $CaCO_3$). This is considered very soft. An average iron content of 0.86 parts per million is considered objectionable. However, the iron content can be reduced by aeration and filtration.[5]

In the town of Philadelphia, Mississippi, one of three municipal wells is completed in the basal Ackerman sand and the analysis of this water shows an iron content of 6.3 parts per million and a hardness ($CaCO_3$) of 24 parts per million[6]. A simple process of aeration and filtration reduces the iron content to a negligible amount.

No known wells have been completed in this stratum in Jasper County. Numerous oil test wells have penetrated this stratum, and the electrical surveys from these tests indicate a highly permeable and porous aquifer. Also, the high electrical resistivity (Plate 1) of the sand indicates a good quality of water north and east of the fresh water-salt water interface shown on Plate 2.

As exhibited on Plate 1 the catchment area for this aquifer is located in a good watershed in northeastern Lauderdale and central Kemper Counties.

The thickness of this sand ranges from 250 feet in the northeastern part of the County to approximately 400 feet in the Bay Springs area (Plate 2). It is generally a massive, medium- to very coarse-grained sand.

Several other good aquifers are in the upper section of the Wilcox group, but these appear to have no advantages over several of the shallower sands.

CLAIBORNE — MERIDIAN SAND

The Meridian sand underlies Jasper County with a thickness of 50 to 100 feet. This sand is massive to cross-bedded and medium- to coarse-grained. Plate 3 is an isopach map of the combined thicknesses of the Meridian sand the first Wilcox sand. In many places, however, the Meridian was deposited on clay of Wilcox age. Where the first Wilcox sand is overlain by the Meridian they are considered the same aquifer as they are very likely to have hydrologic connection.

This aquifer has not been utilized in Jasper County but is a very good water-bearing unit throughout much of north-central Mississippi.

The town of Carthage in Leake County gets its water supply from this stratum. Chemical analyses show the water to be of very good quality with an iron content of 0.32 parts per million and a total hardness ($CaCO_3$) of one part per million[7].

Table 1—Water Well Records

Well: Well designations correspond to those on Figure 1 which shows well locations and Table 2 which shows chemical analyses of selected wells. On Figure 1, the letter indicates a grid area and the numeral refers to the individual well number within the grid area.

Water-bearing units: Pt, Terrace; Mc, Catahoula; Ov, Vicksburg; Of, Forest Hill; Ejm, Moodys Branch; Ec, Cockfield; Ek, Kosciusko, Em, Meridian; Ewa, Basal Ackerman.

Altitude of lsd: Altitude of land surface datum determined from contour maps or aneroid barometer.

Water Level: Levels shown in feet are reported by owner or driller; those recorded in feet and tenths were measured on the dates given.

Method of lift: A, airlift; C, cylinder, F, natural flow; J, jet; M, manual; N, none; P, pitcher; T, turbine; S, submersible.

Use of Water: D, domestic; I, industrial; P, public supply; S, stock.

Remarks: Pertinent remarks are given concerning the use and yield of water. Most wells are rotary drilled—the exceptions are noted.

Well No.	Owner	Driller	Date Completed	Depth of Well (ft.)	Diameter of Well (in.)	Water-bearing Unit	Altitude of lsd (ft.)	Water Level: Above (+) or below lsd (feet)	Water Level: Date of measurement	Method of lift	Use of water	Remarks
D-1	L. W. Davis	Terry Drlg. Co.	1954	265	4″	Ek	—	— 70′	@ Comp.	S	D	Residence & Service Sta.
D-2	L. W. Davis	Terry Drlg. Co.	—	265	3″	Ek	—	— 70′	″	C	D	
E-1	Town of Louin	Maxey Well Co.	3-'55	431	4″	Ec	—	— 80′	″	T	P	Yield less than 50 gpm, new well planned
E-2	J. L. Barefoot	Maxey Well Co.	1957?	408	2″	Ec	—	— 50′	″	A	D	Supplies residence & chicken houses

Table 1.—(Continued)

Well No.	Owner	Driller	Date Completed	Depth of Well (ft.)	Diameter of Well (in.)	Water-bearing Unit	Altitude of lsd (ft.)	Water level: Above (+) or below lsd (feet)	Water level: Date of measurement	Method of lift	Use of water	Remarks
J-1	Town of Bay Springs	Lane Central	9-1944	600	4"x 8"	Ec	—	— 71'	"	T	P	Used only as standby
J-2	Town of Bay Springs	Carlos Drlg. Co.	1949	1014	6"	Ec	—	—150.5'	"	T	P	Pump cap. 140 gpm
J-3	Town of Bay Springs	Layne-Central	5-1955	617	6"	Ec	—	— 112'	"	T	P	Pump cap. 220 gpm
J-4	Town of Bay Springs	Layne-Central	9-1961	642	6"x10"	Ec	—	— 112'	"	T	P	Pump cap. 210 gpm
J-5	Pine View Lake Resort	Maxey Drlg. Co.	—	—	—	—	—	— —	—	A	D	Cafe, Serv. Sta., Swimming pool
K-1	T. R. Green	Barnes Well Drlg.	2-1959	341	2"	Ec	—	— 40'	@ Comp.	C	D	Residence, chicken houses, stock
L-1	J. J. Sims	Fowler Butane	1952?	410	4"	Ec	—	— 20'	"	J	D	Supplies 6 families, store, service sta. & sawmill
N-1	Stringer Processing Plant	Barnes Well Drlg.	1956?	126	2"	Mc?	—	— 18'	"	J	I	Meat Processing & slaughter house
Q-1	Town of Heidelberg	Layne-Central	1-1949	864	6"x10"	Ek	—	— 60'	"	T	P	Abandoned
Q-2	Town of Heidelberg	Paulk-Bros.	2-1953	360	10"	Ec	—	— 56'	"	T	P	Pump cap. 185 gpm
Q-3	Town of Heidelberg	Ratcliff Well Co.	1957	386	10"	Ec	—	— 63'	"	T	P	Pump cap. 200 gpm
U-1	Tenn. Gas Trans. Co.	Ratcliff Well Co.	9-1959	560	10"	Ec	—	— 140'	"	T	I	Pipeline compressor sta.

TABLE 2

ANALYSES OF WATER SAMPLES BY THE MISSISSIPPI STATE BOARD OF HEALTH
(CHEMICAL CONSTITUENTS IN PARTS PER MILLION)

Well No.	Owner	Date Analyzed	Water-bearing Unit	Depth of Well (feet)	Turbidity	Color	Temperature (°F)	Total Solids	Total hardness ($CaCO^3$)	Alkalinity (M)	Calcium (Ca)	Magnesium (Mg)	Iron (Fe)	Carbon Dioxide (CO^2)	pH	Fluoride (F)	Chloride (Cl)	Sodium (Na) & Potassium (K) calculated as Sodium	Silica (SiO^2)	Sulfate (SO^4)
D-1	L. W. Davis	12-6-62	Ek	265	<2	—	—	187.36	147.2	153	42.14	10.21	1.0	33	7.0	0.1	6	14.74	4.0	16.95
D-2	L. W. Davis	12-6-62	Ek	265	<2	—	65°F	204.62	145.6	147	40.06	11.08	0.5	32	7.0	0.2	6	31.46	12.4	14.32
E-1	Town of Louin	8-30-61	Ecf	404	<2	—	—	528.23	168.4	238	34.81	7.68	0.1	5	8.0	0.1	73	128.11	14.4	101.89
J-1	Town of Bay Springs	11-4-60	Ecf	600	<2	5	76.5°	382.06	23.6	192	5.60	2.33	0.3	10	7.6	0	44	139.84	4.0	17.27
J-2	Town of Bay Springs	11-4-60	Ecf	1014	<2	10	77°	407.13	15.6	200	3.45	1.70	0.3	14	7.5	0.1	47	151. 8	5.2	77.04
J-3	Town of Bay Springs	11-4-60	Ecf	617	<2	5	77°	372.85	23.8	180	5.28	2.57	0.3	20	7.3	0.1	47	135.24	4.4	69.47
J-4	Town of Bay Springs	12-6-62	Ecf	642	<2	—	75°	390.77	22.4	189	6.25	1.67	0.3	3	8.1	0.1	41	140.65	8.8	78.19
J-5	Pine View Lake Resort G. P. Harper	12-6-62	—	—	<2	—	—	473.12	163.6	236	41.02	14.87	0.3	5	8.0	0.1	44	114.77	5.2	110.62
K-1	T. R. Green	12-6-62	Ecf	341	<2	—	—	366.07	177.2	198	42.62	17.21	0.1	34	7.1	0.1	41	70.15	4.4	70.95
*Q-1	Town of Heidelberg	4-15-52	Ek	864	<2	100	—	354.76	0	290	0	0	0	0	8.7	0.1	5	154.41	—	8.23
Q-2	Town of Heidelberg	11-2-60	Ecf	360	<2	10	—	428.05	14.0	252	3.44	1.31	0	0	8.7	0.4	34	165.83	8.4	48.38
Q-3	Town of Heidelberg	11-2-60	Ecf	386	<2	0	—	338.89	10.0	245	2.88	0.68	0	0	8.2	0.4	32	137.54	0.4	18.13
U-1	Tenn. Gas Trans. Co.	12-6-62	Ecf	560	<2	—	69°	397.31	8.8	260	3.52	0	Tr.	0	8.4	0.1	26	160.08	2.8	46.91

*Abandoned

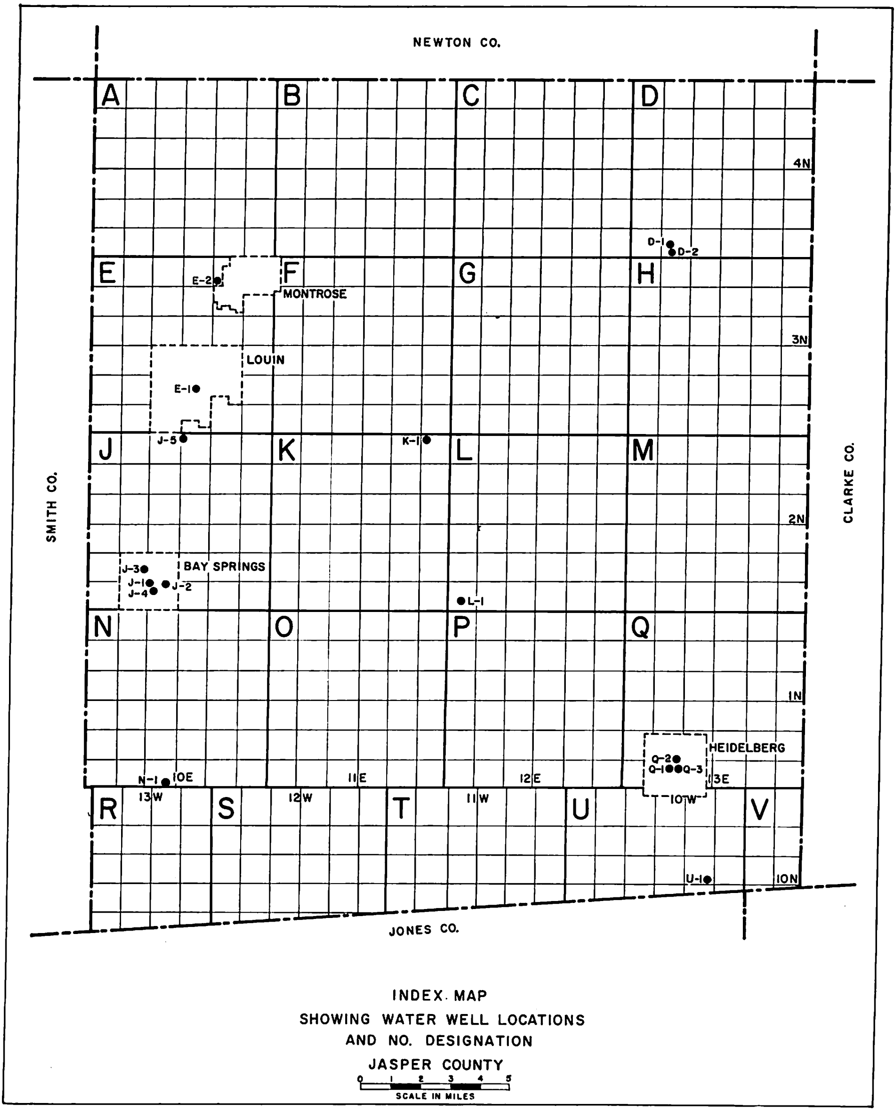

Figure 1.—Index map showing water well locations and number designations, Jasper County.

The depth of this aquifer ranges from 500 feet in the northeast corner of the county to 1600 feet in the Bay Springs area.

CLAIBORNE — KOSCIUSKO FORMATION

Plate 4 is an isopach map of the Kosciusko sand (Sparta) of the Claiborne group. The total thickness of the unit is 200 to 400 feet across the county with water-bearing sands developing an aggregate thickness of 100 to 200 feet. The depth ranges from surface outcrop to 1300 feet in the southwestern part of the County. It is an excellent aquifer, yielding moderate to large supplies in the west-central part of the state. The water is generally of high quality requiring little or no treatment[8]. The sand is usually massive to lenticular and is fine- to coarse-grained. A few domestic wells in the northeastern part of the county are supplied by this aquifer. (Tables 1 and 2).

The replenishment area for the Kosciusko sand extends from the northwest through central Newton County across the northeastern-most corner of Jasper County, southeasterly through north-central Clarke County.

CLAIBORNE — COCKFIELD FORMATION

The Cockfield is of considerable subsurface extent and its outcrop belt reaches from west-central Mississippi, where it is 18 to 20 miles wide, southeasterly, across northeastern Jasper County, to the Alabama line in Clarke County where the belt is only two to four miles in width.

Most of the municipal supplies in Jasper County are furnished by this aquifer. The water is of reasonably good quality but frequently the wells yield turbid water, particularly when pumped for unusually long periods. This is due to the fact that the Cockfield sand includes lentils of very fine sand and silt[9]. Over a period of a few years it becomes necessary to clean the well screens as they become clogged with these fine particles.

The subsurface thickness of the Cockfield formation varies from 100 to 110 feet in the northeastern portion of the County, to 150 feet in the Stringer area. The water-bearing sands of this unit range up to 100 feet but are generally less than 75 feet and at many places are less than 50 feet (Plate 5). Plate 1 exhibits a rate of dip on the Cockfield of approximately 30 feet per mile. The depth ranges from the outcrop in the Rose Hill area to 900 or 1000 feet in the Mossville area.

SHALLOWER AQUIFERS

Throughout the county numerous shallow bored and dug wells furnish ample supplies of water for farm and domestic uses. Of course, in the dry season some of these wells become very low in water and some even dry up until the rainy season begins to replenish the supply. This condition exists in cases where the well is made in a perched water table. That is, where a sand is deposited on a hill above the ground-water level and can store only a very limited volume of water. Several wells of this type are found in the Turnerville, Ras, Paulding and Moss Hill communities, where the high areas are covered by Plio-Pleistocene terrace material.

Locally, good water for domestic supply is found in the Moodys Branch formation of the Jackson group; Forest Hill formation, Mint Spring formation and Glendon formation of the Vicksburg group; and the Catahoula formation.

Numerous springs issue from the Mint Spring member over the southern portion of the County. One of these springs is located just east of the town of Heidelberg on Highway 11. This is an old resort known for its "mineral water." The chief mineral present in the water is iron that is precipitated as the water percolates through the carbonate rock. Some of the shallow water in the County contains just as much iron as does the water from these springs.

CONCLUSIONS

1. Large supplies of ground water are available throughout most of Jasper County from the basal Ackerman, Meridian, Kosciusko and Cockfield sands at depths to approximately 3,000 feet.

2. These four primary aquifers aggregate a total thickness of 600 to 700 feet of fresh-water sand.

3. Inasmuch as several of the deeper aquifers have not been utilized, no accurate statement can be made as to the quality of their waters. However, from information on these aquifers in

other parts of the state, the writer believes that they will be generally acceptable for many uses with little or no treatment.

4. The dip of the formations is to the southwest at a rate of approximately 30 feet per mile, increasing the drilling depths by that amount progressively down the dip. The water is replenished in the outcrop areas to the northeast and moves down the dip where it is found under artesian pressure.

5. Perhaps better well completions can be made in the aquifers comprised of coarser sands than those aquifers presently in use.

6. Use of electrical logs provide an acceptable method for recognizing fresh-water sands. Water quality can be determined only after drilling test wells and securing water samples.

ADDENDA

Plates 6 and 7 were prepared largely to assist in the interpretation of, and to supplement, the other parts of this Bulletin. The large amount of data available as to the surface of the Winona is indicative (Plate 7) that faulting may play an important role in the movement of groundwaters in the thinner aquifers — in a manner similar to the role that the faults at greater depths (Plate 6) have played in the accumulation of commercial oil and gas deposits.

Plate 6, a structure contour map using the Eutaw datum, is based entirely upon deep oil and gas exploratory and development wells.

Plate 7, a structure map contoured using the Winona datum, is based not only upon the test holes drilled by DeVries during his field investigations, but also upon the many oil test wells which did not set surface casings through the top of the Winona. In addition, Superior Oil Company furnished the log of its one core hole and Pan American Petroleum Corporation furnished logs on its 34 core holes in the County. These 35 logs will be placed in the Survey's open files upon publication of this Bulletin. Finally, Skelly Oil Company permitted the examination in its office of the dozens of core hole electrical logs represented on Plate 7 by the prefix designation "F-". These data contribute to an unusual amount of shallow structural information.

REFERENCES

1. Priddy, R.R., Fresh water strata of Mississippi as revealed by electrical log studies: Miss. Geol. Survey Bull. 83, pp. 10-13, 1955.

2. Schneider, Robert and Cushing, E.M., Geology and water-bearing properties of the "1400 foot" sand in the Memphis area, U.S. Geol. Survey Circ. 33, Oct., 1948.

3. Schneider, Robert and Cushing, E.M., op. cit., p. 2.

4. Schneider, Robert and Cushing, E.M., op. cit., pp. 8, 11.

5. Schneider, Robert and Cushing, E.M., op. cit., p. 8.

6. Lang, Joe W. and Boswell, Ernest H., Public and industrial water supplies in part of Northern Mississippi: Miss. Geol. Survey Bull. 90, p. 78, Dec., 1960.

7. Lang, Joe W. and Boswell, Ernest H., op. cit., pp. 70, 98.

8. Lang, Joe W. and Boswell, Ernest H., op. cit., p. 27.

9. Priddy, R.R., Geologic study along Highway 80 from Alabama line to Jackson, Mississippi: Miss. Geol. Survey Bull. 91, pp. 41, 42, 1961.

JASPER COUNTY OIL AND GAS FIELDS

HUGH McD. MORSE[1]

ABSTRACT

Oil and gas production currently yields by far the greatest percentage of income from minerals in Jasper County. As a matter of fact, oil and gas leasing, exploration, drilling and production have become a major segment of Jasper County's economy.

Oil was discovered at Heidelberg in the Eutaw formation in 1944, and gas was discovered in the Eutaw formation at Soso and Sharon in 1949. Since those discoveries the total production through 1961 amounts to 77,400,876 barrels of oil and 41,479,098,000 cubic feet of gas. Among the counties of Mississippi, Jasper ranked 4th in the production of oil for 1961.

INTRODUCTION

This section deals primarily with the location, basic reservoir data and production by years through December 31, 1961, of the following fields: East Heidelberg, Heidelberg-Central Segment, West Heidelberg, Soso, Sharon and Bryan fields. Sharon and Bryan fields extend into Smith and Jones Counties, respectively.

The Christmas Gas Pool and the Stanley Gas Pool of the Soso field and the Eutaw Gas Pool of the Sharon field are developed on a spacing pattern of 320-acre units. The spacing pattern is 40-acre units for all other pools.

The writer expresses his appreciation for the help received from the staff of the Oil and Gas Board, the free use of all the records in the Oil and Gas Board and to the companies which furnished the basic information.

EAST HEIDELBERG FIELD

EUTAW OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The Eutaw Oil Pool of the East Heidelberg Field is located in T.10 N., R.10 W., and in T.1 N., R.12 E. and 13 E., Jasper County. The type of structure is a faulted dome. The discovery well, the Helen Morrison No. 1 was drilled by the Gulf Oil Corporation

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in Sec.30, T.1 N., R.13 E. and was completed on January 27, 1944. The elevation of the well is 353 feet above sea level. Producing depths of the pool vary from 4,509 to 5,061 feet, producing section is approximately 39 feet thick, average porosity is 27.9 percent, average permeability is 767 millidarcies, connate water is 33 percent, formation volume factor is 1.110 and the bottom hole temperature was measured at 151 degrees Fahrenheit. The gravity of the oil varies from 19 to 26.4 degrees API. The original gas in solution was 119 cubic feet per barrel of oil and the specific gravity of the gas was from 0.89 to 0.925. The current gas-oil ratio has risen slightly to 176 cubic feet per barrel. The original reservoir pressure (sub-sea datum 4647) was 2,133 pounds per square inch and the current pressure is 1,770 pounds per square inch. The approximate developed area is 4,640 acres.

UPPER TUSCALOOSA OIL POOL

LOCATION AND BASIC RESERVOIR DATA

This oil pool of the Upper Cretaceous is located in T.1 N., R.13 E. The structure is a faulted dome. The W. H. Husband No. 2, the discovery well, was drilled by Graham and Lewis and was completed June 1, 1945. The average elevation is 334 feet. The producing depths vary from 4,844 to 5,020 feet with an average producing section of 55 feet. Average porosity is approximately 28.8 per cent, permeability ranges from 0 to 2670 millidarcies, connate water averages 30.0 per cent, and the bottom hole temperature is 151 degrees Fahrenheit. The gravity of the oil is 23.4 degrees API and the reservoir viscosity of the oil is 10.08 centipoise at 1900 pounds and 152 degrees Fahrenheit. The original gas in solution was 105 cubic feet per barrel of oil, original water-oil contact was 4671 feet sub-sea, original gas-oil ratio was 77 cubic feet per barrel. The current gas-oil ratio is 85 cubic feet per barrel of oil. In this pool the developed acreage is 520.

HOSSTON OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The Hosston Oil Pool of the East Heidelberg Field is located in Sec.4, T.10 N., R.10 W., Jasper County. Like the Eutaw Oil Pool and Upper Tuscaloosa Oil Pool of the East Heidelberg Field this pool is a faulted dome. The discovery well, McCormick No.

1, drilled by Broadhead and Stack was completed August 30, 1960. The range of producing depths varies from 10,600 to 10,730 feet, producing section averages approximately 26 feet, porosity averages 14 per cent, permeability range is from 5 to 85 millidarcies, connate water is 18 to 22 per cent and the bottom hole temperature is 202 degrees Fahrenheit. The gravity of the oil is 28.2 degrees API. The original gas-oil ratio was 150 cubic feet per barrel of oil and the current ratio is nil. The reservoir pressure has declined from 4943 pounds per square inch to 1735 pounds per square inch.

HEIDELBERG OIL FIELD — CENTRAL SEGMENT

EUTAW — MASONITE OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The Eutaw-Masonite Oil Pool is in Sec.36, T.1 N., R.12 E., Jasper County. Drilled on a graben or fault closure by R. Merrill Harris the discovery well, Masonite Corporation No. A-2, was completed on February 26, 1957. The producing depths range from 4,874 to 4,884 feet, porosity of the producing section averages 29.5 per cent, permeability range is from 200 to 1200 millidarcies, connate water is about 50 percent and the bottom hole temperature is 120 degrees Fahrenheit. The gravity of the oil is 24 degrees API. The original water-oil contact was 4,790 feet subsea and it has remained at this depth as far as is known. Approximately 40 acres have been developed.

EUTAW OIL POOL

LOCATION AND BASIC RESERVOIR DATA

Just as the Eutaw-Masonite Oil Pool of the Heidelberg Oil Field Central Segment was a graben or faulted closure so is the Eutaw Oil Pool. It is located in Secs. 25 and 36, T.1 N., R.12 E. R. Merrill Harris drilled the discovery well, the Masonite Corporation No. 1 and it was completed on February 19, 1954. The producing depths range from 4956 to 5147 feet, average producing section is 21 feet thick, porosity is 29.6 per cent, permeability ranges from 2 to 3115 millidarcies, connate water is 50 per cent and the bottom hole temperature is 122 degrees Fahrenheit. The original water-oil contact was 4790 feet sub-sea.

WEST HEIDELBERG FIELD

HISTORICAL DATA

It might be well to note here that all of the pools in the West Heidelberg Field are faulted domes and all but one, the Massive Tuscaloosa Oil Pool were drilled by the Gulf Oil Corporation. The Massive Tuscaloosa Oil Pool was drilled by the Southport Petroleum Company.

BAILEY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The Bailey Oil Pool, located in Sec.36, T.1 N., R.12 E., Jasper County varies in producing depths from 8,984 to 9,206 feet. The discovery well, Mrs. L. P. Thornton 36-13 Well No. 1 was completed March 29, 1959. The average producing section is 30 feet, porosity of the sand is 22.8 per cent, permeability average is 445 millidarcies. The gravity of the oil is 35.0 degrees API, reservoir viscosity is 1.35 centipoise at 3668 pounds and 199 degrees Fahrenheit and the saturation pressure is 857 pounds at 199 degrees Fahrenheit. The original gas in solution was 144 cubic feet per barrel of oil but it is now 178 cubic feet per barrel of oil. The developed area of this pool is 280 acres.

COTTON VALLEY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The Cotton Valley Oil Pool is located in Sec.36, T.1 N., R.12 E., Jasper County. The discovery well, known as Mrs. L. P. Thornton 36-13 Well No. 1, was completed April 1, 1959 at an elevation of 415 feet from producing depths between 11,238 and 11,320 feet with a producing section of 60 feet. Porosity is 16.4 per cent, permeability is 328 millidarcies, and the bottom hole temperature is 221 degrees Fahrenheit. The gravity of the oil is 20.9 degrees API and the reservoir viscosity is 6.05 centipoise at 5030 pounds pressure and 221 degrees Fahrenheit. The gas in solution was 122 cubic feet per barrel of oil. The original gas-oil ratio was 108 cubic feet per barrel but it has increased to 119.

EUTAW OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The Eutaw Oil Pool of the West Heidelberg Field is in T.1 N., R.12 E., and T.10 N., R.10 W., and 11 W., Jasper County.

The discovery well, drilled in Sec.35, T.1 N., R.12 E. was the John Morgan No. 1 completed on June 16, 1944. The producing depths vary from 4,772 to 5,318 feet, average producing section is 31 feet, average porosity is 28.8 per cent, permeability ranges from 240 to 1,000 millidarcies, connate water varies from 33.4 to 37 per cent and the bottom hole temperature is 150 degrees Fahrenheit. The gravity of the oil is from 19.1 to 32.9 degrees API. In the original hole the gas in solution was 207 cubic feet per barrel of oil. Water-oil contact was 4,780 feet sub-sea and the gas-oil ratio was 72 cubic feet per barrel of oil. This gas-oil ratio has changed to 244.

MASSIVE TUSCALOOSA OIL POOL

LOCATION AND BASIC RESERVOIR DATA

As was stated at the beginning of the discussion of the West Heidelberg Field this is the only pool in Jasper County that was not drilled by the Gulf Oil Corporation and it was drilled by Southport Petroleum Company. This discovery well, the C. C. McDonald No. 1, is located in Sec. 35, T.1 N., R.12 E. It was completed on July 3, 1945 at producing depths varying from 6,256 to 6,266 feet with a net effective sand section of 20 feet. Average porosity is 29 per cent, and the bottom hole temperature is 150 degrees Fahrenheit. The gravity of the oil is 34.2 degrees API, gas-oil ratio was 100 cubic feet to a barrel of oil and reservoir pressure (sub-sea datum 5,931 feet) originally was 2.743 pounds per square inch. On December 31, 1961 the gas-oil ratio was 58 cubic feet per barrel of oil. The developed area is 120 acres.

MIDDLE HOSSTON OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The Middle Hosston Oil Pool of the West Heidelberg Field is in Sec.35, T.1 N., R.12 E. The discovery well, Mrs. L. P. Thornton 36-13 Well No. 1, was completed March 29, 1959 at depths of 9,330 to 9,690 feet and has a net producing section of 22 feet. Average porosity is 233 per cent, permeability ranges from 0 to 80 millidarcies, connate water is 21.4 per cent and the bottom hole temperature is 209 degrees Fahrenheit. The original gas-oil ratio was 147 cubic feet of gas to a barrel of oil, and the current ratio is 145 cubic feet per barrel. The gravity of the oil is 23.7 degrees API. The developed area is 280 acres.

LOWER HOSSTON OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The Lower Hosston Oil Pool of the West Heidelberg Field is in Sec.36, T.1 N., R.12 E., Jasper County. The discovery well, the Mrs. L. P. Thornton 36-13 Well No. 1, was completed on March 29, 1959 from depths of 9,730 to 10,200 feet with the producing section being 12 feet. Average porosity is 19.6 per cent, permeability range is 0 to 540 millidarcies, connate water is 20.9 per cent, gravity of the oil is 24 degrees API and the original gas-oil ratio was 43 cubic feet per barrel of oil. The current ratio is 102 cubic feet per barrel. One hundred sixty acres have been developed.

SOSO FIELD

In Docket No. 271-56-16 Order No. 332-56 the Oil and Gas Board gave approval to the forming by a majority of the owners of the oil, gas and other minerals for approval of that certain "Operating Parties Agreement" also Unitization Agreement and said "Agreement with Regard to Reservations of Production Unitized Zone A" dated 19th day December 1956 signed by William H. Maynard, Vice Chairman.

In Docket No. 16-57-16 Order No. 82-57 Special Field Rules Soso Field Jasper, Jones and Smith Counties of Mississippi were adopted on the 17th day of April 1957 Order signed by James McClure, Chairman.

It is interesting to compare the structures of this field with those of the East Heidelberg Field, the Heidelberg—Central Segment and the West Heidelberg Fields. In the Heidelberg fields the structures were either faulted domes, grabens or faulted closures but the structures of the Soso field are anticlines.

The Gulf Oil Company was the driller of all the discovery wells in Jasper County in the Soso Field.

11,701-FOOT BAILEY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

This oil pool, the 11,701-foot Bailey Oil Pool, located in T.10 N., R.13 W. and 11 W., Jasper County extends into Jones and Smith Counties. The discovery well, J. W. Bailey No. 1 was completed August 14, 1953 in Jones County in Sec. 27, T.10 N., R.13 W. The producing depths vary from 11,966 to 11,990 feet and have an average producing section of 20 feet. Porosity is 17.4 per cent, permeability 272.7 millidarcies, connate water is 16.4 per cent and the bottom hole temperature is 234 degrees Fahrenheit with the gravity of the oil being 43.4 degrees API. The gas-oil ratio was 751 cubic feet per barrel and it is now 633.

11,804-FOOT BAILEY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The 11,804-foot Bailey Oil Pool is in T.10 N., R.13 W., Jasper County. The discovery well, drilled by Union Producing Company on Tract 28-3-1, Sec. 28, T.10 N., R.13 W. was Buckley No. 2. It was completed on February 13, 1955. The average elevation is 353 feet above sea level. Ranges of 12,123 to 12,136 feet are the producing depths and the average producing section is 10.5 feet. Porosity is 18.7 per cent, permeability is 211.1 millidarcies, connate water is 17.6 per cent and the bottom hole temperature is 239 degrees Fahrenheit. The gravity of the oil is 43.2 degrees API. At present the gas-oil ratio is 505 cubic feet per barrel of oil but the original gas-oil ratio was 525.

11,910-FOOT BAILEY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

In Jasper County the 11,910-foot Bailey Oil Pool is in Sec. 28. T. 10 N., R.13 W. The discovery well was completed on February 11, 1955 as Tract 28-7 Well No. 1. Producing depths vary from 11,947 to 11,973 feet, the net effective thickness of the sand is 9 feet, porosity is 14.7 per cent, permeability is 39.1 millidarcies, connate water is 25.2 per cent, bottom hole temperature is 242 degrees Fahrenheit, and the gravity of the oil is 43.7 degrees API. Originally the gas-oil ratio was 610 cubic feet of gas per barrel of oil but the current ratio is 457. The developed area is 40 acres.

11,090-FOOT RODESSA OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The 11,090-foot Rodessa Oil Pool is in Secs. 22 and 27, T.10 N., R.13 S., Jasper County. On Tract 22-14 Well No. 1 was completed on May 25, 1957 as the discovery well. The producing depths vary from 11,352 to 11,361 feet, average producing section is approximately 4 feet, porosity is 16.8 per cent, permeability average is 175.7 millidarcies, and the connate water averages 17.7 per cent. The gravity of the oil is 42.1 degrees API. Bottom hole temperature is 233 degrees Fahrenheit and the gas-oil ratio was 1230 cubic feet of gas to a barrel of oil and has decreased to 1223 cubic feet.

11,151-FOOT RODESSA OIL POOL

LOCATION AND BASIC RESERVOIR DATA

This is another pool in the Soso Field that extends from Jasper County into Jones and Smith Counties. In Jasper County the 11,151-foot Rodessa Oil Pool is in T.10 N., R.13 W. The average elevation is 359 feet. Well No. 1 on Tract 36-3-1 (W. W. Welborn No. 1) was completed on July 25, 1954 as the discovery well. The producing depths vary from 11,444 to 11,517 feet and the producing section of net effective sand is 9.6 feet. Average porosity is 16.1 per cent, permeability average is 215.4 millidarcies, connate water is 16.9 per cent and the bottom hole temperature is 240 degrees Fahrenheit. The gravity of the oil is 47 degrees API. The original gas-oil ratio was 354 cubic feet per barrel of oil but the current gas-oil ratio has increased to 1323 cubic feet per barrel. The number of developed acres is 520.

11,180-FOOT RODESSA OIL POOL

LOCATION AND BASIC RESERVOIR DATA

Like the pool just discussed, the 11,151-foot Rodessa Oil Pool, the 11,180-foot Rodessa Oil Pool extends into Jones and Smith Counties. It is located in T.10 N., R.13 W., Jasper County. The discovery well was completed on August 14, 1953 on Tract 27-15 Well No. 1 (J. W. Bailey No. 1). The average elevation is 338 feet above sea level. Varying from 11,425 to 11,517 feet are the producing depths with an average producing section of 8 feet. Average porosity is 16.8 per cent, permeability average is 171 millidarcies, connate water is 17.9 per cent and bottom hole temperature is 228 degrees Fahrenheit. The gravity of the oil is 45.1 degrees API and the original gas-oil ratio was 1,451 cubic feet per barrel of oil. It is now 1,230 cubic feet per barrel.

11,385-FOOT RODESSA OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The discovery well was completed on February 26, 1955 on Tract 28-5 Well No. 2. The location of this oil pool is in Sec. 28, T.10 N., R.13 W. at an elevation of 362 feet above sea level. Producing depths in the pool range from 11,691 to 11,720 feet with a net effective sand of 7 feet. Porosity is 17.3 per cent, permeability is 146.2 millidarcies, connate water is 18.6 per cent and the bottom hole temperature is 240 degrees Fahrenheit. The gravity of the oil is 45.5 degrees API and the original gas-oil ratio was 1,071 cubic feet to a barrel of oil. This ratio is now 888. Eighty acres have been developed.

11,513-FOOT RODESSA OIL POOL

LOCATION AND BASIC RESERVOIR DATA

This particular pool is located in Sec.28, T.10 N., R.13 W., in Jasper County. The discovery well was completed on Tract 28-8 Well No. 2 on March 3, 1955 at an elevation of 356 feet above sea level. The producing depths vary from 11,787 to 11,804 feet and the producing sand is 6 feet. Porosity is 17.2 per cent, permeability is 94.9 millidarcies, connate water is 20.4 per cent and the bottom hole temperature is 244 degrees Fahrenheit. The gravity of the oil is 42.7 degrees API and the original gas-oil ratio was 918 cubic feet per barrel of oil. The current ratio is 928 cubic feet per barrel. The number of acres developed is 120.

12,134-FOOT HOSSTON OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The location of the 12,134-foot Hosston Oil Pool is in Sec.27, T.10 N., R.13 W., Jasper County. On January 16, 1959 the discovery well was completed, on Tract 27-10, Well No. 1 "ZB." The elevation averages 290 feet above sea level. There is a producing section of 9 feet from producing depths 12,384 to 12,398 feet. Porosity is 15.1 per cent, permeability is 121.3 millidarcies, connate water is 12.4 percent and the bottom hole temperature is 242 degrees Fahrenheit. Originally the gas-oil ratio was 942 cubic feet to a barrel of oil but it is now 549 cubic feet per barrel. The developed area is 40 acres.

12,303-FOOT HOSSTON OIL POOL

LOCATION AND BASIC RESERVOIR DATA

Located in T.10 N., R.13 W., Jasper County is the 12,303-foot Hosston Oil Pool. The discovery well of this pool was completed on May 13, 1958 on Tract 28-7 Well No. "ZB". Average elevation of the pool is 321 feet. Producing depths vary from 12,598 to 12,617 feet with a producing section of 19 feet. Porosity is 15.1 per cent, permeability is 122.6 millidarcies, connate water is 21.1 per cent and bottom hole temperature is 256 degrees Fahrenheit. The gravity of the oil is 41.8 degrees API and the original gas-oil ratio was 681 cubic feet to a barrel of oil. This ratio is now 449.

12,896-FOOT HOSSTON OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The 12,896-foot Hosston Oil Pool is in Sec.27, T.10 N., R.13 W., Jasper County. The discovery well was completed on January 16, 1959. Producing depths vary from 13,145 to 13,158 feet and the producing section is 13 feet. The elevation is 290 feet above sea level. Porosity is 15.0 per cent, permeability is 119.9 millidarcies, connate water is 12.5 per cent, the bottom hole temperature is 250 degrees Fahrenheit, and the gravity of the oil is 42.4 API. Originally the gas-oil ratio was 467 cubic feet to a barrel of oil but the current ratio is 427.

14,935-FOOT COTTON VALLEY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

At an elevation of 329 feet above sea level the discovery well of the 14,935-foot Cotton Valley Oil Pool was completed May 12, 1958 on Tract 28-7 Well No. 1 "ZB" in T.10 N., R.13 W., Jasper County. Porosity is 14.5 per cent, permeability is 49.8 millidarcies, connate water is 11.6 per cent, bottom hole temperature is 256 degrees Fahrenheit, and the gravity of the oil is

37.1 degrees API. The gas-oil ratio was 252 cubic feet to a barrel of oil and has increased to 400 cubic feet.

9,151-FOOT PALUXY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The 9,151-foot Paluxy Oil Pool is located in Secs. 21, 27 and 28, T.10 N., R.13 W., Jasper County and the discovery well was in Section 21. The average elevation is 321 feet. The discovery well was completed on June 15, 1957 on Tract 21-16. The producing depths are between 9,393 and 9,435 feet and the net effective thickness of the sand is 12.5 feet. Porosity is 21.7 per cent, permeability is 686 millidarcies, connate water is 17.0 per cent, and the bottom hole temperature is 212 degrees Fahrenheit. The gravity of the oil is 32.2 degrees API. The current gas-oil ratio is 101 cubic feet per barrel of oil.

9,227-FOOT PALUXY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

This oil pool is located in Sec.27, T.10 N., R.13 W., Jasper County. On August 23, 1954 the discovery well was completed on Tract 27-5 Well No. 1 at an elevation of 335 feet above sea level. It has producing depths from 9,536 to 9,541 feet and the effective thickness of the sand is 10 feet. Porosity is 20.8 per cent, permeability is 470 millidarcies, connate water is 18.2 per cent and the bottom hole temperature is 21.3 degrees Fahrenheit. The oil has a gravity of 18.8 degrees API and the gas-oil ratio is 310 cubic feet to a barrel of oil. One hundred-twenty acres have been developed.

9,274-FOOT PALUXY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The discovery well for the 9,274-foot Paluxy Oil Pool was completed March 16, 1958 on Tract 28-7 No. 2. The average elevation is 311.5 feet above sea level. The pool is located in Sec.27, T.10 N., R.13 W., Jasper County. Producing depths vary from 9,556 to 9,571 feet and the net effective sand thickness is 5 feet. Porosity is 19.5 per cent, permeability is 321.8 millidarcies, connate water is 19.5 per cent and the bottom hole temperature is 213 degrees Fahrenheit. The gravity of the oil is 23.4 degrees

API. The original gas-oil ratio was 277 cubic feet to a barrel of oil and has decreased to 260.

9,411-FOOT PALUXY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The 9,411-foot Paluxy Oil Pool is in Sec.28, T.10 N., R.13 W., Jasper County. The discovery well was completed September 19, 1954 on Tract 28-8 Well No. 1 at an elevation of 316 feet above sea level. The net effective sand is 20 feet and is at producing depths which vary from 9,643 to 9,650 feet. Porosity is 18.5 per cent, permeability is 278 millidarcies, connate water is 20.0 per cent and the bottom hole temperature is 214 degrees Fahrenheit. The gravity of the oil is 11.1 degrees API and the gas-oil ratio was 496 cubic feet of gas to a barrel of oil. The ratio is now 375. The developed acreage is 120.

9,417-FOOT PALUXY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

The well completed November 3, 1953 on Tract 27-9, Well No. 1, was the discovery well of the 9,417-foot Paluxy Oil Pool in Sec. 27, T.10 N., R.13 W., Jasper County. The average elevation was 323 feet above sea level. Producing depths are from 9,699 to 9,761 feet and the producing section is approximately 4 feet. Porosity is 18.9 per cent, permeability is 785 millidarcies, connate water is 16.7 per cent and the bottom hole temperature is 214 degrees Fahrenheit. The gravity of the oil is 24.5 degrees API. Originally the gas-oil ratio was 12,113 cubic feet to a barrel of oil and it is now 31,500 cubic feet per barrel.

10,425-FOOT PALUXY OIL POOL

LOCATION AND BASIC RESERVOIR DATA

This pool, the 10,425-foot Paluxy Oil Pool is in Sec.28, T.10 N., R. 13 W., Jasper County. On September 30, 1958, the discovery well was completed on Tract 28-1 Well No. 1. The average elevation is 353 feet above sea level. The producing depths are 10,765 to 10,774 feet and the thickness of the producing section is 9 feet. Porosity is 16.7 per cent, permeability is 174.8 millidarcies, connate water is 21.4 per cent and the bottom hole temperature is 234 degrees Fahrenheit. The gravity of the oil is 41.8 degrees API. The original gas-oil ratio was 382 cubic feet per barrel of oil and the current ratio is 358.

CHRISTMAS GAS POOL

LOCATION AND BASIC RESERVOIR DATA

This is another pool that extends into Jones County as well as being in Jasper County. The pool is located in T.9 and 10 N., R.12 and 13 W. Jasper and Jones Counties. The discovery well was completed March 1, 1945, the Edwards-Bailey Unit No. 1, in Sec. 27, T.10 N., R.13 W. The average elevation of the pool is 321 feet above sea level. Producing depths vary from 6,590 to 6,732 feet with an average producing section of 15 feet. Porosity is 28.8 per cent, permeability varies from 0 to 6,750 millidarcies, connate water is 14 per cent and the bottom hole temperature is 177 degrees Fahrenheit. The gravity of the oil is 66.4 degrees API and the gas-oil ratio is 96,006 cubic feet of gas to a barrel of oil. Originally the ratio was 36,704 to 1.

STANLEY GAS POOL

LOCATION AND BASIC RESERVOIR DATA

Extending into both Jones and Smith Counties and also being in Jasper County is the Stanley Gas Pool. It is located in T.9 N., and 10 N., R.12 and 13 W., Jasper, Jones and Smith Counties. The discovery well in Sec.33, T.9 N., R.13 W. was completed on December 20, 1947 on the Idell Knight et al Unit Well No. 1 at an elevation of 338 feet above sea level. The producing depths are 6,444 to 6,538 feet and the average net effective sand is 14 feet. Porosity is 25.5 per cent, permeability varies from 0 to 1375 millidarcies, connate water is 44 per cent and the bottom hole temperature is 177 degrees Fahrenheit. The gravity of the oil is 61 degrees API and the gas-oil ratio was 160,000 cubic feet to a barrel of oil. The ratio is now 40,679. The number of developed acres is 7,360.

SHARON FIELD

EUTAW GAS POOL

LOCATION AND BASIC RESERVOIR DATA

There is only one pool in the Sharon Field that is located in Jasper County and it is also in Jones County. This is the Eutaw

Gas Pool. It is located in T.10 N., R.11 W., Jasper and Jones Counties and the structure for the pool is a fault closure. The average elevation is 310 feet above sea level. Red Wing Drilling Company completed the discovery well on October 7, 1949 as the Torrey Smith No. 1 Well in Sec.32, T.9 N., R.11 W., Jones County. The producing depths are from 5,490 to 5,605 feet with a producing section of 33 feet. Porosity is 28 per cent, permeability varies from 0 to 984 millidarcies, connate water is 72 per cent and the bottom hole temperature is 162 degrees Fahrenheit. The gravity of the oil is 52 degrees API and the gas-oil ratio was 176,000 cubic feet to a barrel of oil. At present this ratio is 265,000. The developed area is 1,920 acres.

BRYAN FIELD

RODESSA OIL POOL

LOCATION AND BASIC RESERVOIR DATA

A low relief anticline is the structure for the Rodessa Oil Pool which is located in Secs.14, 23, 24, 25, 26, 35 and 36 of T.10 N., R.10 W., Jasper and Jones Counties. The discovery date was February 1959 and the well drilled by the Lone Star Producing Company was the W. H. Gatlin No. 1 located in Sec.25, T.10 N., R.10 W., Jones County. The average elevation of the pool is 325 feet above sea level. The producing depths are from 10,200 to 10,275 feet. Porosity varies from 14 to 20 per cent, permeability varies from 10 to 1,000 millidarcies, connate water is 30 per cent and the bottom hole temperature is 210 degrees Fahrenheit. The gravity of the oil ranges from 32 to 40 degrees API and the gas-oil ratio was 180 cubic feet of gas to a barrel of oil. Now this ratio is 580.

BRYAN FIELD

SLIGO RESERVOIR

LOCATION AND BASIC RESERVOIR DATA

Just as the structure for the Rodessa Oil Pool in Jasper and Jones Counties is a low relief anticline so also is the Sligo Reservoir. It is located in Sec.23, T.10 N., R.10 W. of Jasper County. Lone Star Producing Company was the driller of the discovery well which was completed in September 1958 as the Masonite No. 2 at an elevation of 325 feet above sea level. The producing depths vary from 10,700 to 10,920 feet and the net effective sand thickness is 8 feet. Porosity is 23 per cent, permeability ranges from 2 to 900 milladarcies, connate water is 34 per cent and the bottom hole temperature is 218 degrees Fahrenheit. The gravity of the oil is 38 to 40 degrees API and the gas-oil ratio has remained 210 cubic feet to a barrel of oil. The developed acreage is 900.

SUMMARY

Jasper County is one of the most important oil and gas producing counties in Mississippi. In 1961 Mississippi ranked 9th in the production of oil and 7th in the production of natural gas. Jasper County has four producing structures: Heidelberg, discovered in 1944; Soso, discovered in 1949; Sharon, discovered in 1949; and Bryan, discovered in 1958. Of the three major oil fields in Mississippi, fields whose ultimate reserves will exceed 100 million barrels of oil, Jasper County's Heidelberg is one of them, and the different segments of the Heidelberg structure have contributed most of the oil production in Jasper County. Among the counties of the State, Jasper County ranked 4th in 1961. During the eighteen years in which Jasper County has been a producer of oil and gas, the cumulative production has been as follows:

TOTAL ALL SEGMENTS

	Water	Oil	MCF Gas
Heidelberg Field	82,428,169	62,202,347	5,236,874
Soso Field	3,024,220	14,785,294	22,439,071
Sharon Field	500,740	147,206	13,789,488
Bryan Field	8,082	266,029	13,665
Total for County— All Fields	85,961,211	77,400,876	41,479,098

Aside from a revenue produced for the operators, the 6% severance tax of the State of Mississippi, part of which is returned to the County, and Municipal governments, the production of oil and gas furnished royalty income to many hundreds of individuals throughout the County, the State and the Nation.

NORTH TWISTWOOD CREEK CLAY

CORRECTED NAME FOR NORTH CREEK CLAY

GROVER E. MURRAY[1]

ABSTRACT

The name "North Twistwood Creek clay" is proposed as the corrected name replacing "North Creek clay," a unit of the Jackson group in Central and Eastern Mississippi.

DISCUSSION

During the course of surface geological mapping in eastern Mississippi and western Alabama for the Magnolia Petroleum Company in 1941-1943, I distinguished at the outcrop and utilized in the field four lithic units of the Jacksonian stage in that region. Subsequently, these units were traced into the subsurface and have proven to be useful, mappable lithic units in the area from their outcrop, and downdip, westward from approximately the Tombigbee River in Alabama, to the general longitude of Jackson, Mississippi.

Names were applied to these units in a report by the writer to the Magnolia Petroleum Company dated June 24, 1944, (Surface Geology of the Jackson group in Central and Eastern Mississippi):

Shubuta (clay) member (top)
Pachuta (marl) member
"North Creek (clay) member"
Moodys Branch (marl) formation

The name "North Creek" was, unfortunately, selected without a ground check from a map utilized by me during preparation of the aforementioned report. Later, the same names were formally proposed in a footnote in a paper on Cenozoic deposits of the central Gulf Coastal Plain (Murray, 1947, p. 1839).

In that paper, the name "North Creek" was formally applied to about 40 feet of green-blue to gray, partly glauconitic, fossiliferous clay, underlain by the Moodys Branch formation and overlain by the Cocoa sand or Pachuta marl. The type

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Baton Rouge, Louisiana

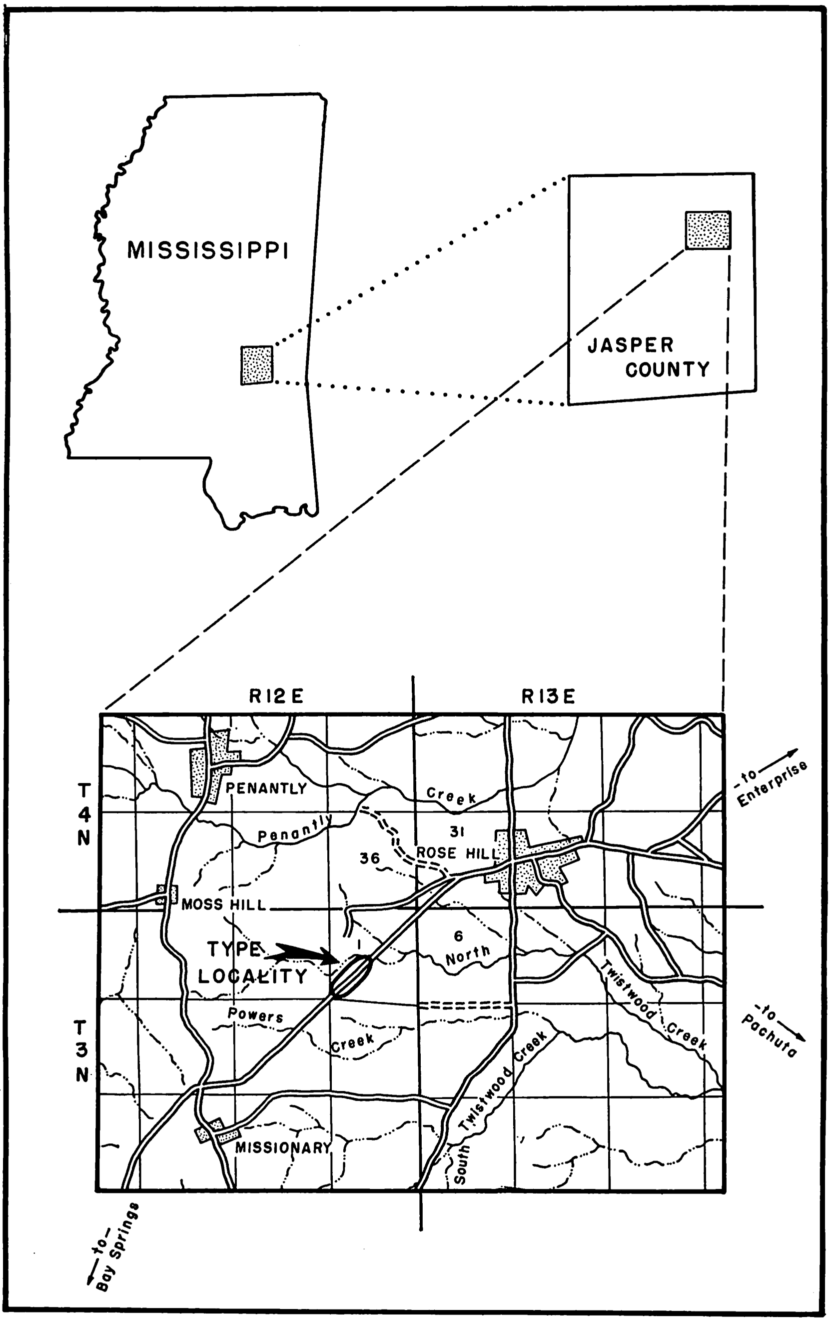


Figure 1.—Location map of type locality of North Twistwood Creek clay.

section was designated to consist of exposures on the west side of "North Creek" in the SW.¼ of Sec.1, T.3 N., R.12 E., Jasper County, Mississippi, 2 miles southwest of Rose Hill on the state highway to Gridley and Turnersville.

Since 1947, these names have been widely employed in communications, verbal and written, dealing with the geology of Mississippi and Alabama (e.g., Mississippi Geological Society, 1948; Murray, 1950; Toulmin, LaMoreaux & Lanphere, 1951; Toulmin & LaMoreaux, 1953; Toulmin & McGlamery, 1955; Wilson, Sando & Kopf, 1957; Murray, 1961; Gulf Coast Section, S.E.P.M., 1962.)

In mid-1950, I realized that the correct name of the stream along which the type exposures were located was North Twistwood Creek rather than North Creek. At that time I judged a change in name to North Twistwood Creek would be more confusing than clarifying. However, preparation of a report on the Geology of Jasper County by the Mississippi Geological Economic and Topographical Survey focused attention on the impropriety of the name "North Creek." Correspondence with Frederic F. Mellen, Director, Mississippi Geological Economic and Topographical Survey, and George V. Cohee, Chairman, U.S.G.S. Committee on Geologic Names, resulted in the conclusion that proper stratigraphic procedure required renaming of the "North Creek clay" of Murray (1947), even though the name North Creek is well entrenched in Alabama-Mississippi literature. Accordingly, I propose that this unit formally be designated in subsequent communications as the North Twistwood Creek clay. The type section is the same as that originally designated for the "North Creek clay" (Murray, 1947, p.1839, and above) consisting of about 40 feet of green-blue to gray clays above the Moodys Branch formation and below the Cocoa sand or Pachuta marl, on the west side of North Twistwood Creek, in the SW.¼, Sec.1, T.3 N., R.12 E., Jasper County, Mississippi, 2 miles southwest of Rose Hill along the state highway to Bay Springs (Figure 1).

Status of the unit as a member or formation should be based upon judgment of the Yazoo clay, of which it is a subdivision, as a member, as a formation, or as a group (Murray, 1950, 1961; Holland, Hough and Murray, 1952; Puri, 1957; Cheetham, 1957; Puri and Vernon, 1959).

REFERENCES

Cheetham, Alan H., 1957, Eocene-Oligocene boundary, eastern Gulf Coast region: Trans., Gulf Coast Assoc. Geol. Soc., vol. 7, p. 89-97.

Holland, Wilbur C., Hough, Leo W., and Murray, Grover E., 1952, Geology of Beauregard and Allen Parishes: La. Geol. Survey, Geol. Bull. no. 27, 224 p.

Mississippi Geological Society, 1948, Guidebook, Sixth Field Trip, June 18, 19, 20, 1948, Upper Eocene, Oligocene and Lower Miocene of central Mississippi: Miss. Geol. Soc., 74 p.

Murray, Grover E., 1947, Cenozoic Deposits of central Gulf Coastal Plain: Bull. Amer. Assoc. Petr. Geologists, vol. 31, pp. 1825-1850.

Murray, Grover E., 1950, (abstract), Lithologic facies of Jacksonian stage, central and eastern Gulf Coast: Oil & Gas Jour., vol. 48, p. 123, 172.

Murray, Grover E., 1961, Geology of the Atlantic and Gulf Coastal Province of North America, Harper Bros., New York, N. Y., 692 pp.

Puri, Harbans S., 1957, Stratigraphy and zonation of the Ocala group: Florida Geol. Survey Bull. no. 38, 248 p.

Puri, Harbans S. and Vernon, Robert O., 1959, Summary of the geology of Florida and a guidebook to the classic exposures: Florida Geol. Survey, Spec. Pub. no. 5, 255 pp.

Toulmin, Lyman D., Jr. and McGlamery, Winifred, 1955, Coastal Plain geology in west-central Alabama: *in* Russell, R. J., ed. Guides to southeastern Geology, p. 460-490.

Toulmin, Lyman D., Jr., 1962, Geology of the Hatchetigbee anticline area, southwestern Alabama: Guidebook, Little Stave Creek — Salt Mountain limestone, Jackson, Alabama: Gulf Coast Section, Soc. of Econ. Pal. and Min., 12th Annual Meeting, Gulf Coast Assoc. Geol. Soc., pp. 1-47.

Toulmin, Lyman D., Jr., LaMoreaux, Philip E., and Lanphere, C. R., 1951, Geology and ground-water resources of Choctaw County, Alabama: Geol. Survey of Ala. Special Rept. 21, 197 p.

Toulmin, Lyman D., Jr. and LaMoreaux, Philip E., 1953, Profile showing geology along State Highway 17, Choctaw County, Alabama: Geol. Survey of Ala. Map 8.

Wilson, D., Sando, W. J. and Kopf, R. W., 1957, Geologic names of North America introduced in 1936-1955: U.S.G.S. Bull. 1056-A, 405 p.

STATEMENT OF POLICY IN STRATIGRAPHIC NOMENCLATURE

The Mississippi Geological Survey has many requests for "official statements" on geologic nomenclature. At the present time we do not recognize that we have any "official nomenclature." Geologic knowledge is accrual: therefore, geologic conclusions and the nomenclature of geology are subject to review and to revision.

The rules of stratigraphic nomenclature are understood by us, by the geologists of the Surveys of our sister States, by those of the U. S. Geological Survey and by most other geologists. They are most recently expressed by American Commission on Stratigraphic Nomenclature in its "Code of Stratigraphic Nomenclature," A. A. P. G. Bull. Vol. 45, *No.* 5, *pp.* 645-665, *May,* 1961.

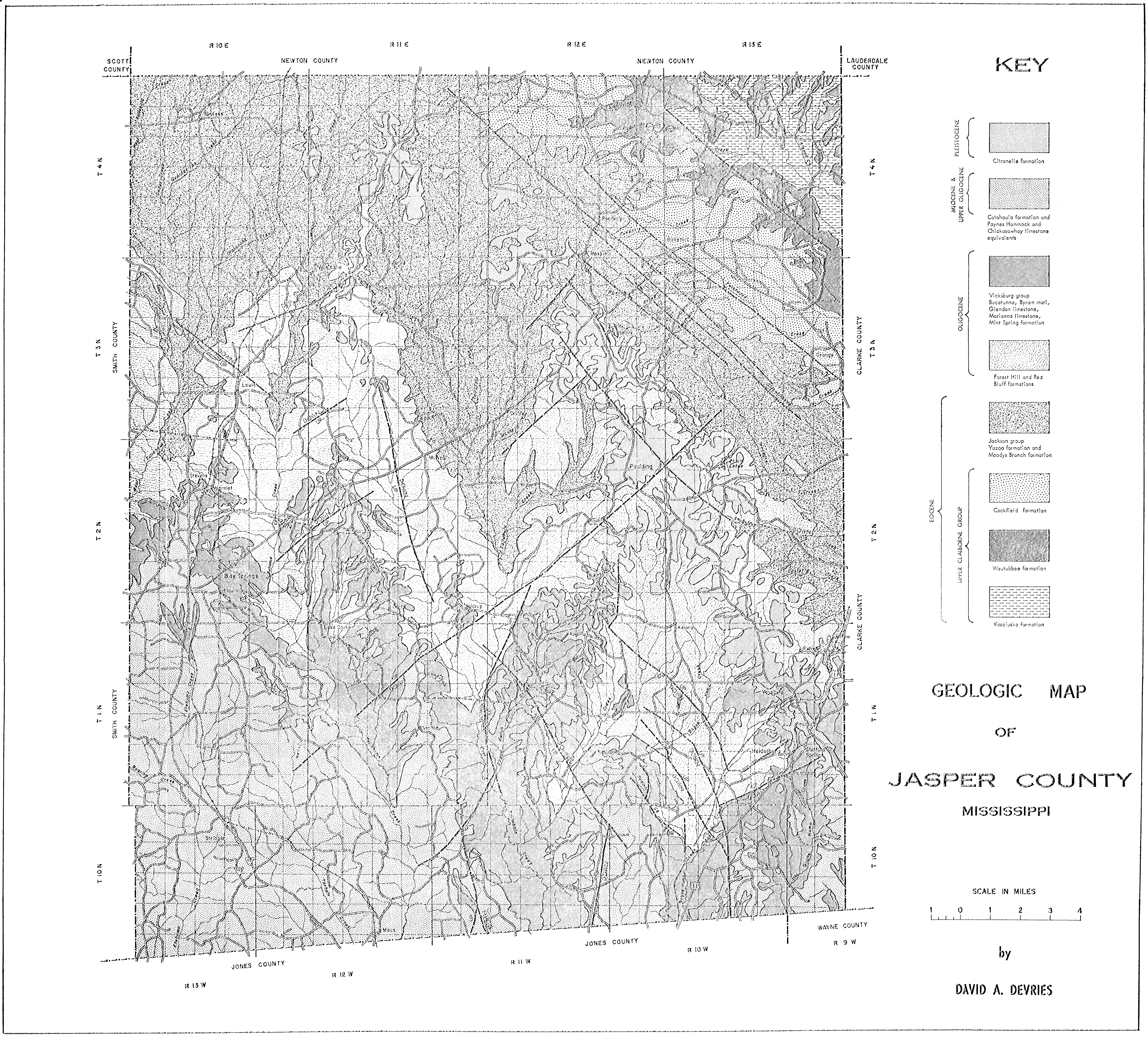
The problems being studied continually by us are those of stratigraphic nomenclature and taxonomy as they affect our economic investigations. Ranking of stratigraphic units appears to change as the detail of geologic knowledge unfolds. Is this advisable, desirable, or necessary? At what degree should "usage" take precedence over "priority?" These are some of the questions that concern us.

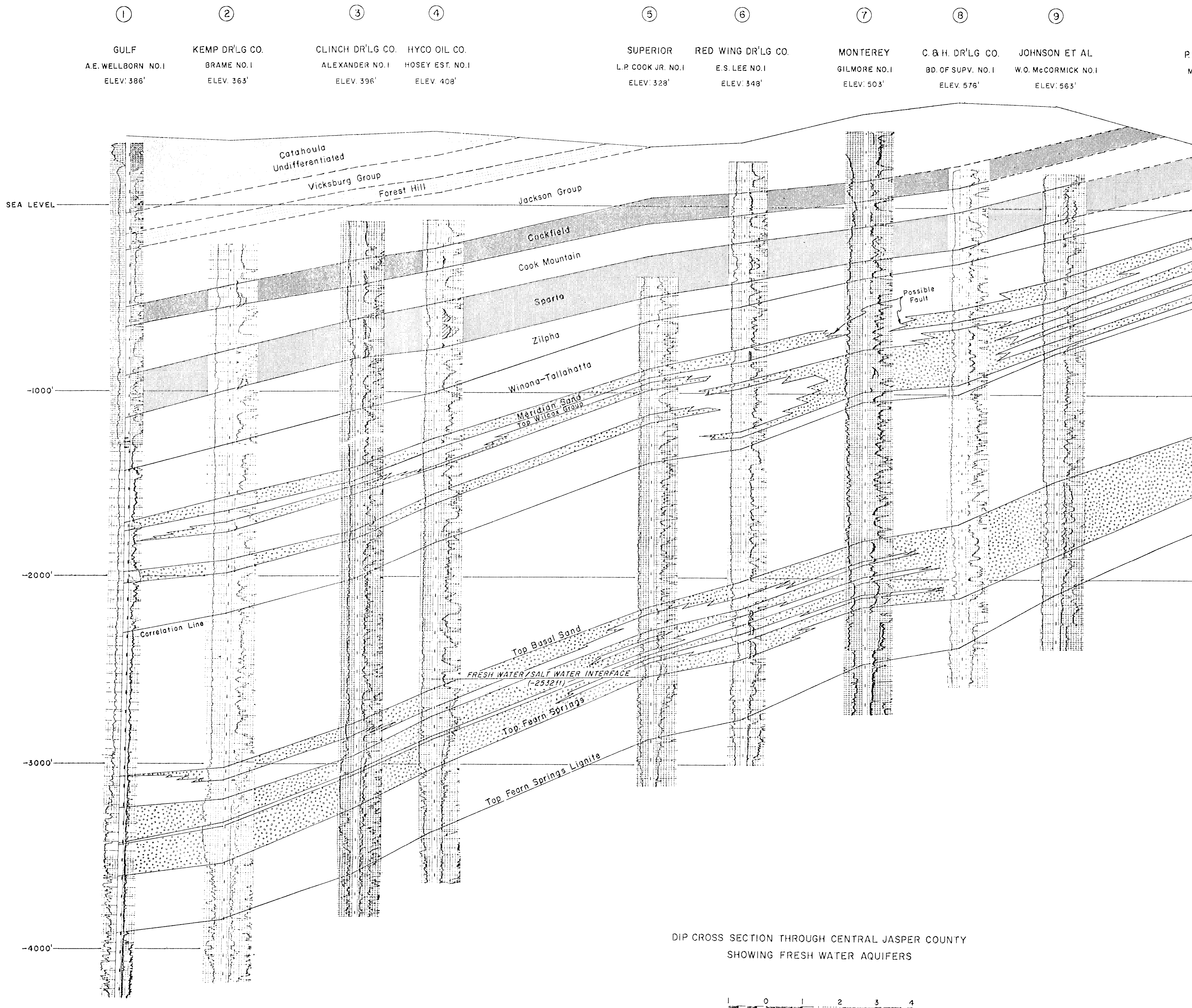
We are definitely working in the direction of standardization of nomenclatural usages. We are anxious to cooperate with other departments, geologists and organizations in the simplification and better definition of our nomenclature. We feel that it is a bit too early to announce "official nomenclature," for we, too, are trying to work out of a maze of duplication, poor descriptions and misunderstandings. The geologists writing our reports consult constantly with us and with others in their selection of names, and those names used in these reports are deemed most appropriate and valid by the individual on the basis of his consultations and information available to him at the time. It has been our policy to consult with and to inform the Geologic Names Committee, U. S. Geological Survey, of which George V. Cohee is Chairman. Such matters deal with opinions on stratigraphy, clearing and reservations of new names, and advice on revisions in nomenclature or rank.

The Staff

Mississippi Geological Survey

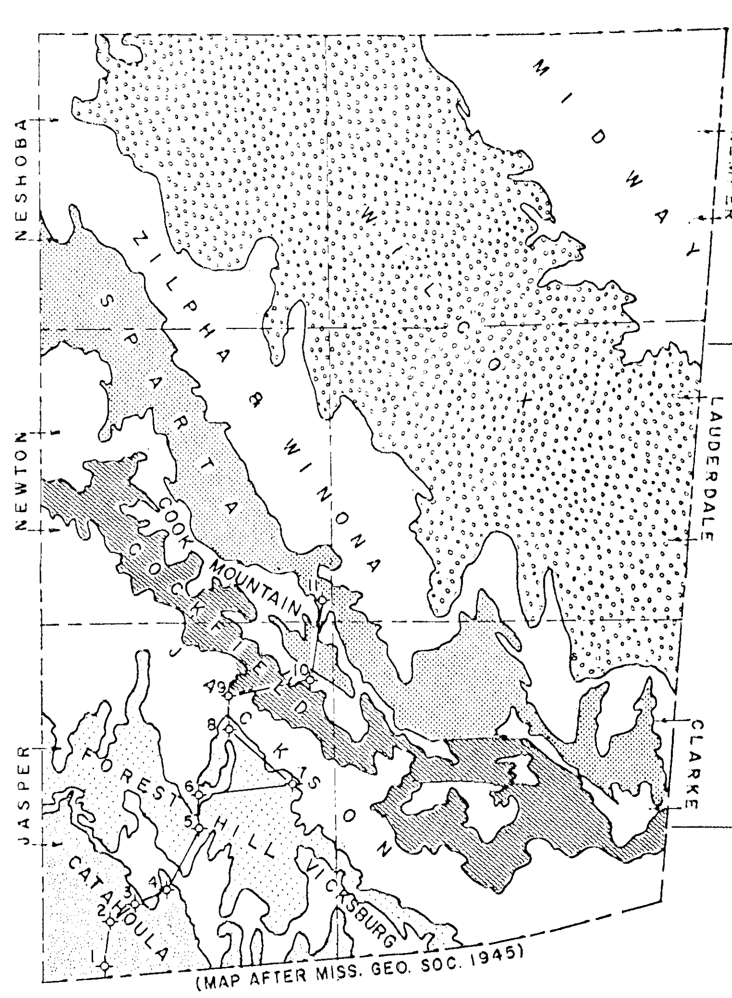
March 1, 1963


R 10 E
R 11 E
R 12 E
R 13 E
SCOTT COUNTY
NEWTON COUNTY
NEWTON COUNTY
LAUDERDALE COUNTY
T 4 N
T 3 N
T 2 N
T 1 N
T 10 N
SMITH COUNTY
SMITH COUNTY
CLARKE COUNTY
CLARKE COUNTY
JONES COUNTY
JONES COUNTY
WAYNE COUNTY
R 13 W
R 12 W
R 11 W
R 10 W
R 9 W
Bay Springs
Paulding
KEY
PLEISTOCENE
Citronelle formation
MIOCENE & UPPER OLIGOCENE
Catahoula formation and Paynes Hammock and Chickasawhay limestone equivalents
OLIGOCENE
Vicksburg group Bucatunna, Byram marl, Glendon limestone, Marianna limestone, Mint Spring formation
Forest Hill and Red Bluff formations
EOCENE
Jackson group Yazoo formation and Moodys Branch formation
UPPER CLAIBORNE GROUP
Cockfield formation
Wautubbee formation
Kosciusko formation
GEOLOGIC MAP
OF
JASPER COUNTY
MISSISSIPPI
SCALE IN MILES
1 0 1 2 3 4
by
DAVID A. DEVRIES



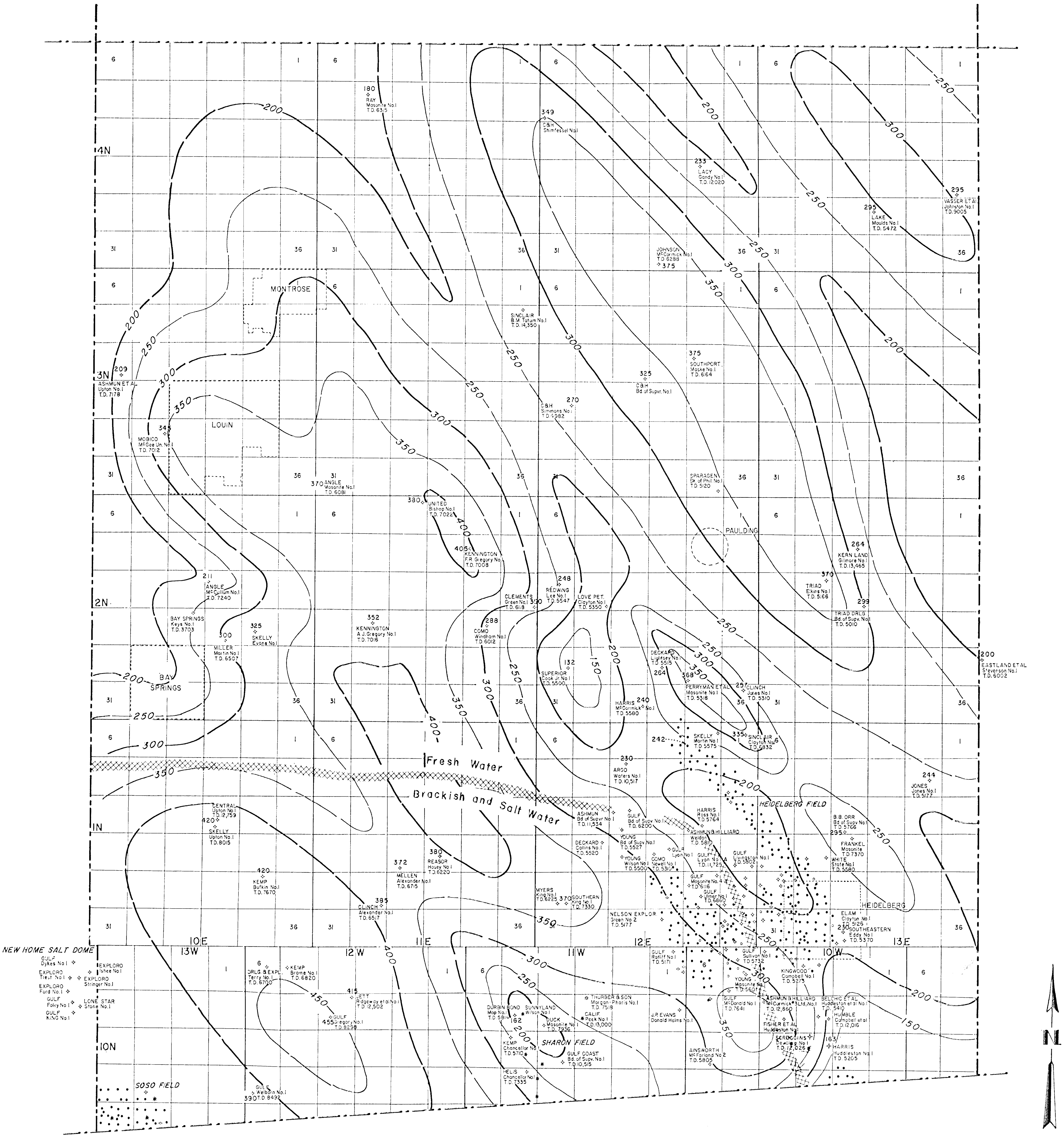
DIP CROSS SECTION THROUGH CENTRAL JASPER COUNTY
SHOWING FRESH WATER AQUIFERS

1 0 1 2 3 4
SCALE IN MILES



SURFACE OUTCROP MAP
EXHIBITING CATCHMENT AREAS
FOR JASPER COUNTY AQUIFERS
AND LINE OF SECTION

5 0 5 10 15 20
SCALE IN MILES



ISOPACH MAP – BASAL ACKERMAN AQUIFER

GEOLOGY BY MARSHALL KEITH KERN

CARTOGRAPHY BY DAVID S. SHERARD

CONTOUR INTERVAL = 50 ft.

JASPER COUNTY MISSISSIPPI

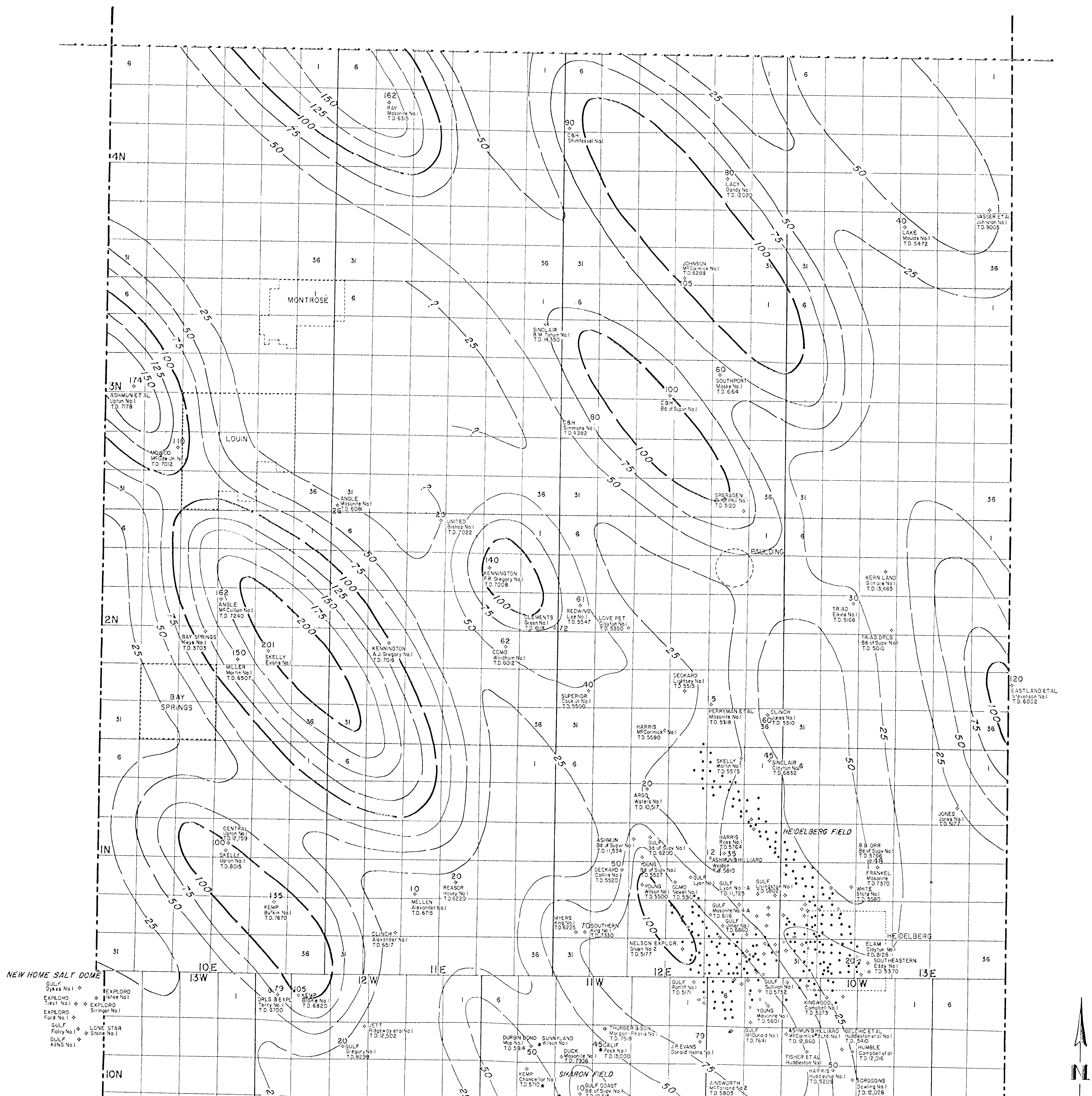
SCALE IN MILES

0 1 2 3

MISSISSIPPI GEOLOGICAL ECONOMIC AND TOPOGRAPHICAL SURVEY

JACKSON MISSISSIPPI

NOVEMBER 1962



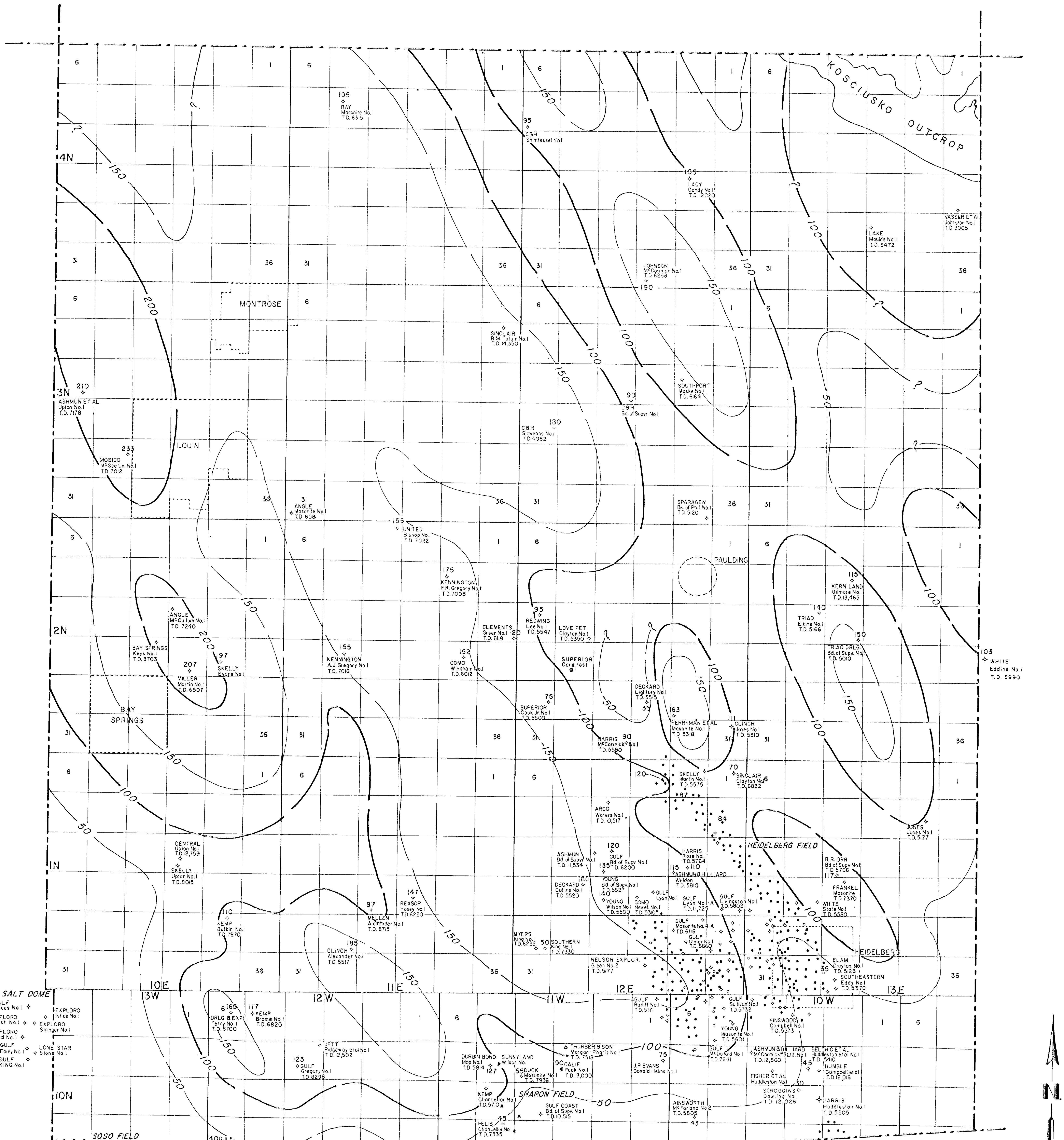
ISOPACH MAP-MERIDIAN AND FIRST WILCOX AQUIFERS

GEOLOGY BY MARSHALL KEITH KERN
CARTOGRAPHY BY DAVID S. SHERARD
CONTOUR INTERVAL = 25 ft.

JASPER COUNTY
MISSISSIPPI

SCALE IN MILES

MISSISSIPPI GEOLOGICAL ECONOMIC AND TOPOGRAPHICAL SURVEY
JACKSON MISSISSIPPI
NOVEMBER 1962



ISOPACH MAP – KOSCIUSKO AQUIFER

GEOLOGY BY MARSHALL KEITH KERN

CARTOGRAPHY BY DAVID S. SHERARD

CONTOUR INTERVAL = 50 ft.

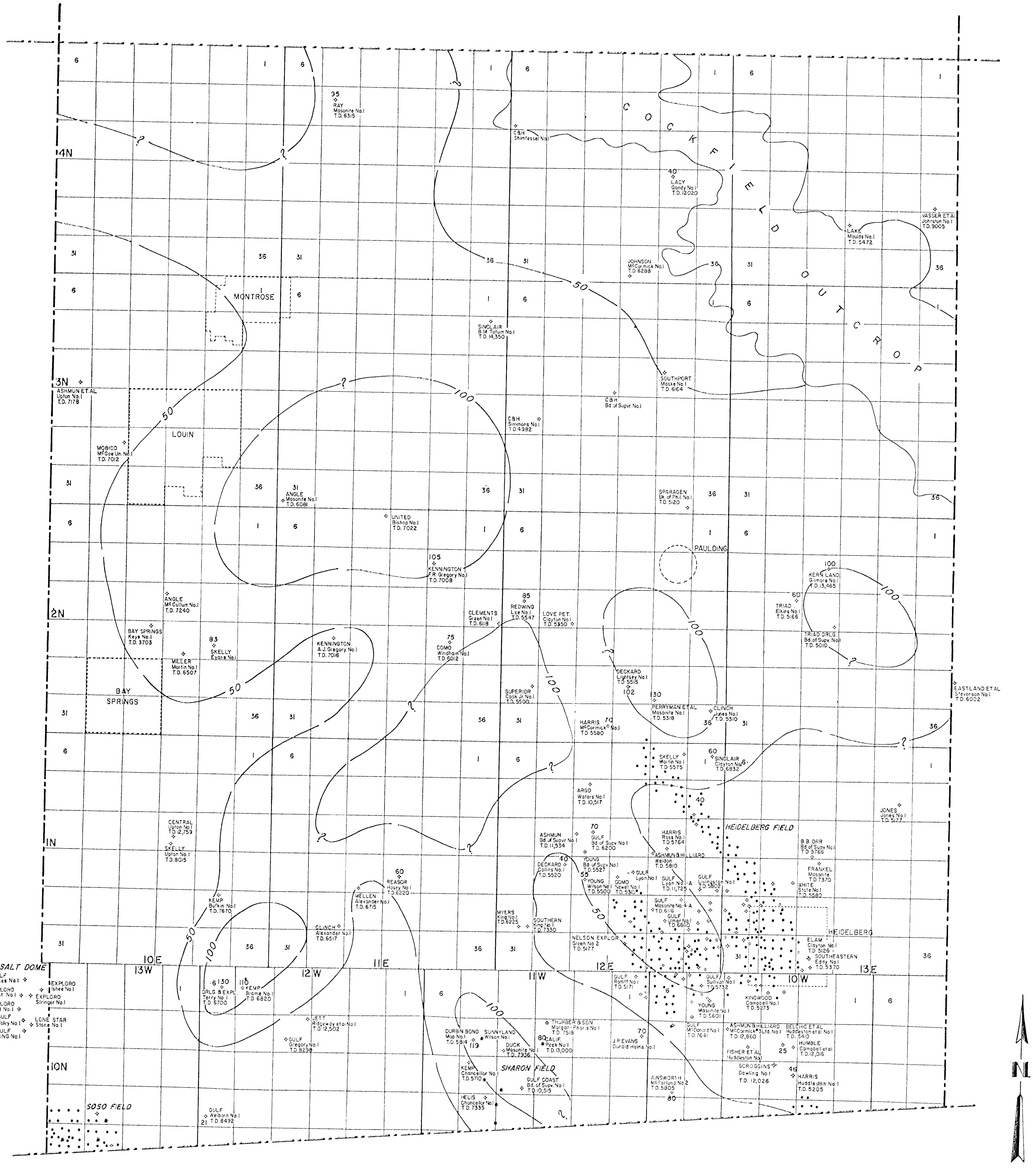
JASPER COUNTY
MISSISSIPPI

SCALE
IN MILES
1 0 1 2 3

MISSISSIPPI GEOLOGICAL ECONOMIC AND TOPOGRAPHICAL SURVEY

JACKSON MISSISSIPPI

NOVEMBER 1962



ISOPACH MAP—COCKFIELD AQUIFER

GEOLOGY BY MARSHALL KEITH KERN

CARTOGRAPHY BY DAVID S. SHERARD

CONTOUR INTERVAL = 50 ft.

JASPER COUNTY MISSISSIPPI

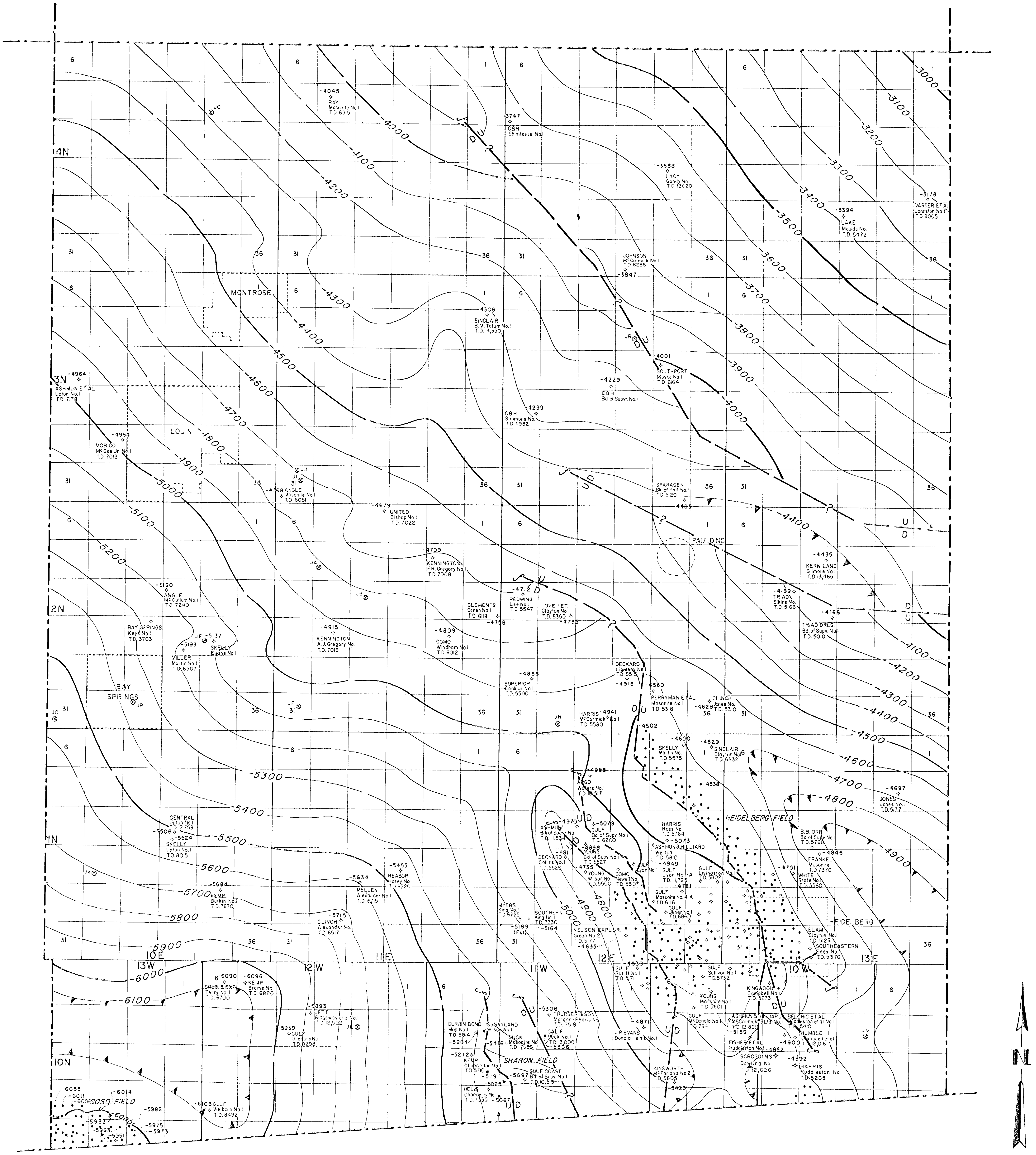
SCALE IN MILES

1 0 1 2 3

MISSISSIPPI GEOLOGICAL ECONOMIC AND TOPOGRAPHICAL SURVEY

JACKSON MISSISSIPPI

NOVEMBER 1962



⊗ LOCATION OF CORE HOLE DRILLED DURING SURVEY

STRUCTURE MAP—TOP OF EUTAW

GEOLOGY BY MARSHALL KEITH KERN

CARTOGRAPHY BY DAVID S. SHERARD

CONTOUR INTERVAL = 100 ft

JASPER COUNTY MISSISSIPPI

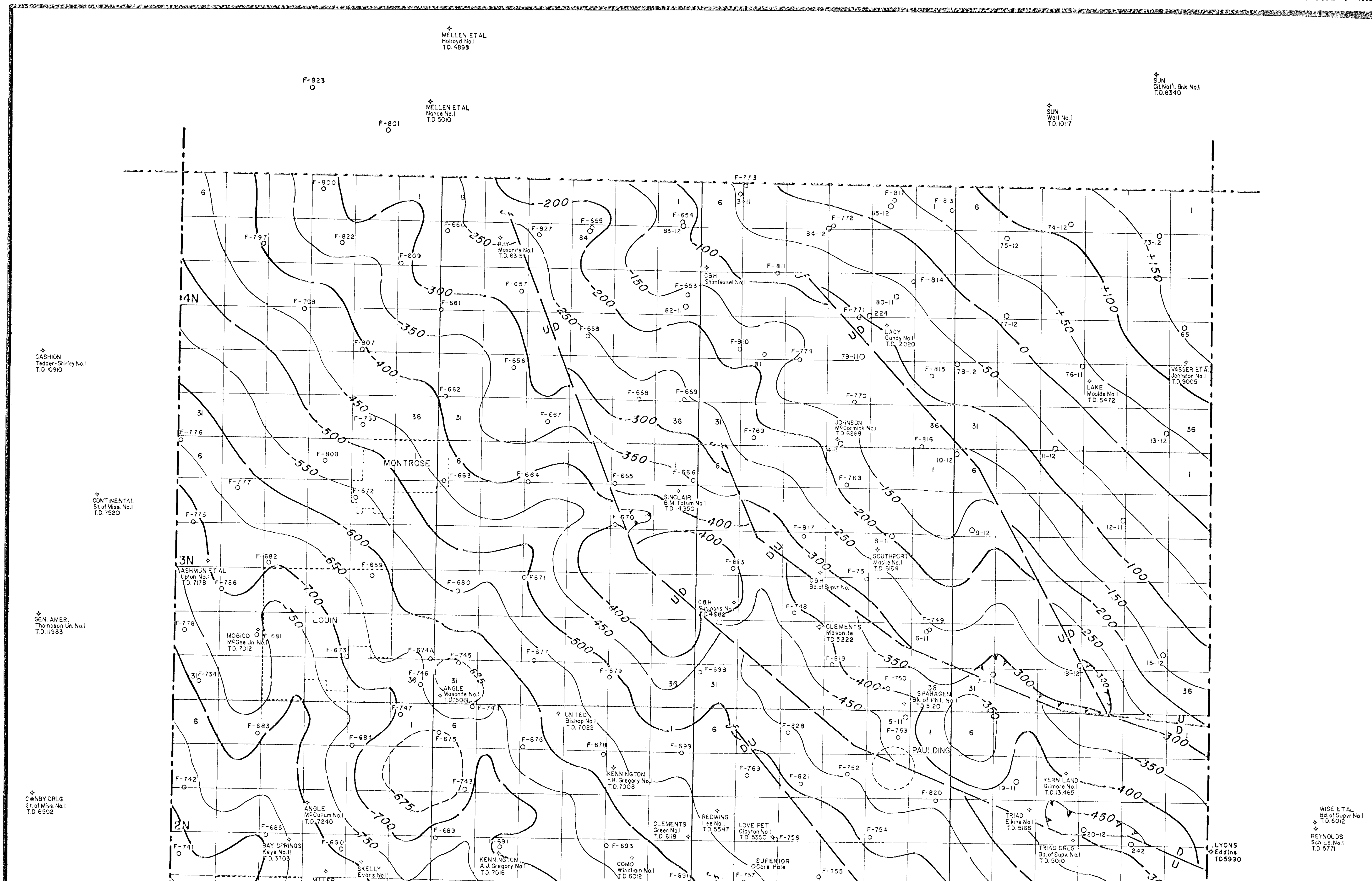
SCALE IN MILES

1 0 1 2 3

MISSISSIPPI GEOLOGICAL ECONOMIC AND TOPOGRAPHICAL SURVEY

JACKSON MISSISSIPPI

NOVEMBER 1962



STRUCTURE MAP
DATUM TOP WINONA

GEOLOGY BY MARSHALL KEITH KERN
CARTOGRAPHY BY DAVID S. SHERARD
CONTOUR INTERVAL = 50 ft.

MISSISSIPPI GEOLOGICAL ECONOMICAL AND TOPOGRAPHICAL SURVEY
JACKSON MISSISSIPPI
1963

JASPER COUNTY
MISSISSIPPI

SCALE
IN MILES
0 1 2 3