THE DEPARTMENT OF NATURAL RESOURCES

mississippi geology

Bureau of Geology
2525 North West Street
Jackson, Mississippi 39216

Volume I, Number I
September, 1980

COAL RESOURCES OF THE PENNSYLVANIAN POTTSVILLE FORMATION IN NORTHEASTERN MISSISSIPPI

R. J. Tarbutton

Mississippi Bureau of Geology

The Black Warrior Basin is located in northern Mississippi and Alabama at the intersection of the Ouachita and Appalachian orogenic belts and is composed of sedimentary rocks that are Cambrian to Pennsylvanian in age (Weisenfluh, 1979, p. 518). This basin developed in association with the Appalachian orogeny and, characteristically, has deposits of coal in the Carboniferous strata (Ferm, 1974, p. 79). Of particular interest for coal occurrence is the Pottsville Formation, which formed in a fluvial-deltaic depositional setting that has several subenvironments favorable for peat accumulation and ultimately coal formation.

In the Black Warrior Basin the Pottsville Formation was eroded and truncated, resulting in a hiatus spanning from the early to middle Mesozoic and possibly earlier. Originally the formation extended to the Nashville Dome, but now pinches out irregularly in Itawamba, Lee, and Pontotoc Counties, Mississippi. The truncation of the Pottsville Formation has caused a reversal of dip and the formation now dips in the direction of its source area, the buried Ouachita Mountains in Mississippi. Until now, Mesozoic (Upper Cretaceous) and Tertiary cover has effectively inhibited coal exploration in the Black Warrior Basin in Mississippi.

In an eight-county area (Chickasaw, Clay, Itawamba, Lee, Lowndes, Monroe, Oktibbeha, and Pontotoc) located in northeastern Mississippi, the Pennsylvanian Pottsville Formation was examined for coal resources. Oil test electric well logs in combination with well cutting samples were used to make structure and net-sand isopach maps and environmental interpretations. Unfortunately, the coal seams rarely made a strong resistive "kick" on the electric well logs. The reduced resistivity may be due to these factors: the thickness of the seams is less than the minimum thickness that the electrodes can detect, or fractures within the seams allow infiltration of connate waters. Available oil test cuttings from the Bureau of Geology's sample library were used to make lithology logs that include the percentage of coal found in the samples.

In most sampled wells, coal was found in at least trace amounts and at depths as shallow as 260 feet (Itawamba County); for the most part the coal was found at depths of 900 feet and greater. Prolific occurrences of coal were found in the latitude of Townships 12 and 13 South in Monroe County (Bicker, 1979, p. 11), and Townships 15 and 16 South in Monroe, Clay, and Lowndes Counties. Occasional groups of coal seams were found in Township 19 North in Oktibbeha and Lowndes Counties. The well control is poor with few well cutting samples available for Chickasaw, Lee, and Pontotoc Counties, which may explain why no occurrences of coal were noted.

The areal extent of these coal seams cannot be determined at this time due to sparse well control, but classical depositional models for Appalachian Basin coals as depicted by Horne *et al.* (1978) and Ferm and Horne (1979) would indicate some of these seams have reserves that could prove to be economic. At this time these coal reserves are not economically feasible. However, as *in situ* coal gasification technology progresses these coals may become a valuable resource for northeastern Mississippi.

References Cited

Bicker, Alvin R., Jr., 1979, Identification of coal seams in the subsurface of Itawamba and Monroe Counties: Mississippi Mineral Resources Institute Grant No. 79-8F, 12 p.

Ferm, John C., 1974, Carboniferous environmental models in eastern United States and their significance, *in* Briggs, Garrett, ed., Carboniferous of the Southeastern United States: Geol. Soc. America Spec. Paper 148, p. 79-95.

Ferm, John C., and John C. Horne, eds., 1979, Carboniferous depositional environments in the Appalachian Region: Carolina Coal Group, Columbia, 760 p.

Horne, J. C., J. C. Ferm, F. T. Caruccio, and B. P. Baganz, 1978, Depositional models in coal exploration and mine planning in Appalachian Region: Am. Assoc. Petroleum Geologists Bull., Vol. 62, No. 12, p. 2379-2411.

Weisenfluh, Gerald A., 1979, The Warrior Basin, *in* Ferm, J. C., and J. C. Horne, eds., Carboniferous depositional environments in the Appalachian Region: Carolina Coal Group, Columbia, p. 518-527.

CALENDAR EVENTS 1980

Oct. 5-9 — Clay Minerals Society, ann. meeting, Waco, Tx., (James L. McAtee, Jr., Chemistry Department, Baylor University, Waco, Tx. 76703)

Oct. 13-18 — Gulf Coast Association of Geological Societies, ann. meeting, Lafayette, Louisiana (Marvin A. Muchrath, Box 52121, Lafayette, La. 70505)

Nov. 5-7 — Geothermal exploration and reservoir evaluation, short course, Reno (Sheila Roberts, Geothermal Resources Council, Box 98, Davis, California 05616)

Nov. 16-20 — Society of Exploration Geophysicists, ann. mtg., Houston (David L. Yowell, SExG, Box 3098, Tulsa, Oklahoma 74101)

Nov. 17-20 — GSA ann. mtg. in Atlanta (GSA Headquarters, 3300 Penrose Place, Boulder, Colorado 80301)

SELECTED LIST OF BUREAU OF GEOLOGY LIBRARY ACQUISITIONS FOR THE PAST YEAR

American Association of Petroleum Geologists. AAPG continuing education course note series: Nos. 1 - 12, 1978-1979.

Bates, R. L., and J. A. Jackson, eds., 1980, Glossary of Geology, 2nd ed.: Falls Church, Va., American Geological Institute, 749 p.

Ferm, J. C., and J. C. Horne, eds., 1979, Carboniferous depositional environments in the Appalachian Region: Columbia, S. C., Carolina Coal Group, Dept. of Geol., Univ. of South Carolina, 760 p.

Fetter, C. W., Jr., 1980, Applied hydrogeology: Columbus, Ohio, Charles E. Merrill Pub. Co., 488 p.

Halbouty, M. T., 1979, Salt domes; Gulf Region, United States and Mexico, 2nd ed.: Houston, Gulf Pub. Co., 561 p.

Harris, D. V., 1978, The geologic story of the national parks and monuments, 2nd ed.: Fort Collins, Colorado State Univ. Foundation Pr., 325 p.

Hatheway, A. W., and C. R. McClure, Jr., eds., 1979, Geology in the siting of nuclear power plants: Boulder, Colo., Geological Society of America, Reviews in Engineering Geology, Vol. IV, 256 p.

Leatherman, S. P., ed., 1979, Barrier islands from the Gulf of St. Lawrence to the Gulf of Mexico: New York, Academic Press, 325 p.

Loudon, T. V., 1979, Computer methods in geology: London, Academic Press, 269 p.

Petroleum Information Corp., 1980, The Tuscaloosa Trend: Denver, Petroleum Info. Corp., 99 p.

Raup, D. M., 1978, Principles of paleontology, 2nd ed.: San Francisco, W. H. Freeman, 481 p.

Reading, H. G., ed., 1978, Sedimentary environments and facies: New York, Elsevier, 557 p.

Sabins, F. F., 1978, Remote sensing: principles and interpretation: San Francisco, W. H. Freeman, 426 p.

Scholle, P. A., and P. R. Schluger, eds., 1979, Aspects of diagenesis: Tulsa, Okla., Society of Economic Paleontologists and Mineralogists, 443 p.

Thompson, M. M., 1979, Maps for America; Cartographic products of the U. S. Geological Survey and others: Washington, D. C., U. S. Govt. Print. Off., 265 p.

Tissot, B. P., and D. H. Welte, 1978, Petroleum formation and occurrence: New York, Springer-Verlag, 538 p.

Wilson, J. L., 1975, Carbonate facies in geologic history: New York, Springer-Verlag, 471 p.

Zimmerman, F. W., and C. W. Perry, 1979, Naturally occurring carbon dioxide sources in the United States: a geologic appraisal and economic sensitivity study of drilling and producing carbon dioxide for use in enhanced oil recovery: Washington, D. C., U. S. Dept. of Energy, 127 p.

COLOR PATTERNS OF SOME EOCENE MOLLUSCS

David T. Dockery III
Mississippi Bureau of Geology

Introduction

Color patterns of living mollusc shells are often a characteristic important in recognizing species as well as identifying new ones. The color is produced by organic complexes within the carbonate shell matrix which deteriorate upon death of the mollusc. On rare occasions the color pattern is preserved as an organic, brown stain.

Generally, Tertiary mollusc shells in Mississippi have their color patterns masked. Fortunately, the pattern can be enhanced by bleaching the shells in sodium hypochlorite (Chlorox) and photographing them under long wave ultraviolet light (a process used by Drs. Harold and Emily Vokes, Tulane University, New Orleans). The bleach oxidizes the latent color pattern so those portions of the shell having color will fluoresce.

Color Patterns in Some Eocene Volutes and Venerids

Living gastropods in the family Volutidae are often brightly colored in a variety of patterns that are consistent within a genus and species. Eocene shells of the extinct volute, *Caricella,* from the Moodys Branch Formation in Mississippi, are similar to that of the living *Scaphella*. *Caricella* differs from the latter genus in its depressed spire and generally more bulbous body whorl. Color patterns of *Caricella subangulata* Conrad and *Caricella polita* Conrad (Plate 1) consist of rows of rectangular dots with rounded or extended corners. A variety of *C. subangulata* (Plate 1, Fig. 6) from Techeva Creek in Yazoo County, Mississippi, has dot corners that are greatly extended toward the aperture, resulting in a zig zag pattern. A tendency toward this form can be seen in *C. polita* (Plate 1, Fig. 3, 9). The color pattern of some large forms of *C. subangulata* (Plate 1, Fig. 2) from Jackson, Mississippi, consists of regularly spaced rows of rectangular dots with broad interspaces. This pattern may have alternating rows of broad and narrow dots, and is similar to the pattern of *Scaphella junonia* (Lamarck), which inhabits the shallow waters (1 - 30 fathoms) of the Gulf of Mexico. The similar color patterns of these volutes reinforces a view of their close relationship as suggested by the shell morphology.

Athleta symmetrica (Conrad), an upper Eocene volute, has a color pattern consisting of narrow spiral lines (Plate 1, Fig. 10A). Fisher, Rodda, and Dietrich (1964) place this species as a subspecies of the middle Eocene form *Athleta petrosa* (Conrad). This placement was based on a statistical analysis of selected shell features. *Athleta petrosa,* however, has a different color pattern which consists of broad bands that may be broken into rectangular dots. The color pattern of the middle Eocene species *Athleta sayana mica* (de Gregorio) from the Gosport Sand of Alabama more closely agrees with that of *A. symmetrica.* A relationship between these species is not suggested, but a comparison of color patterns should be considered in future work on *Athleta* lineages.

Callista (Callista) annexa (Conrad), an Eocene pelecypod in the family Veneridae, has a color pattern consisting of rays that extend from the beak (Plate 2, Fig. 1B, 3C, 4, 7). These rays broaden toward the margin and are produced by color bands that follow growth rugae. *Callista (Costacallista) aequorea* (Conrad), also from Gosport Sand of Alabama (Plate 2, Fig. 8), has the same pattern. This color pattern resembles that of recent *Callista* and *Macrocallista* species.

Conclusions

Eocene molluscs of the Moodys Branch Formation exhibit color patterns that still persist in living representatives of the same family or genus. Color patterns in Tertiary molluscs may be a basis for establishing lineages and identifying new species or subspecies.

Acknowledgments

Drs. Harold and Emily Vokes photographed these various molluscs.

Reference Cited

Fisher, William L., Peter Ulisse Rodda, and John W. Dietrich, 1964, Evolution of *Athleta petrosa* stock (Eocene, Gastropoda) of Texas: Univ. Texas Pub. No. 6413, 117 p.

Plate 1

Figure

1,2,4, *Caricella subangulata* Conrad *in* Wailes, 1854
6,7. 1. Height 67 mm., width 42 mm.; locality 1.
2. Height 51 mm., width 30.5 mm.; locality 1. Photographed under ultraviolet light to show color pattern.*
4. Height 57 mm., width 37 mm.; locality 11.
6. Height 41.5 mm., width 27 mm.; Locality 11. Photographed under ultraviolet light to show color pattern.*
7. Height 52 mm., width 32 mm.; locality 1.

3.5.8. *Caricella polita* Conrad *in* Wailes, 1854
9. 3. Height 34 mm., width 16.5 mm.; locality 1. Photographed under ultraviolet light to show color pattern.*
5. Height 48 mm., width 25.5 mm.; locality 1. Photographed under ultraviolet light to show color pattern.*
8. Height 50 mm., width 26.5 mm.; locality 1.
9. Height 44 mm., width 24.5 mm.; loclaity 1. Photographed under ultraviolet light to show color pattern.*

10. *Athleta symmetrica* (Conrad *in* Wailes, 1854)
10. Height 66 mm., width 43 mm.; locality 1. Figure 10A photographed under ultraviolet light to show color pattern.*

Localities

1. Moodys Branch Formation; Town Creek, Jackson, Mississippi.
2. Moodys Branch Formation; Riverside Park, Jackson, Mississippi.
11. Moodys Branch Formation, Techeva Creek, Yazoo County, Mississippi.

* These are double negatives, which restores the original color pattern. The first negative gives a light pattern (the fluorescence) on a dark background.

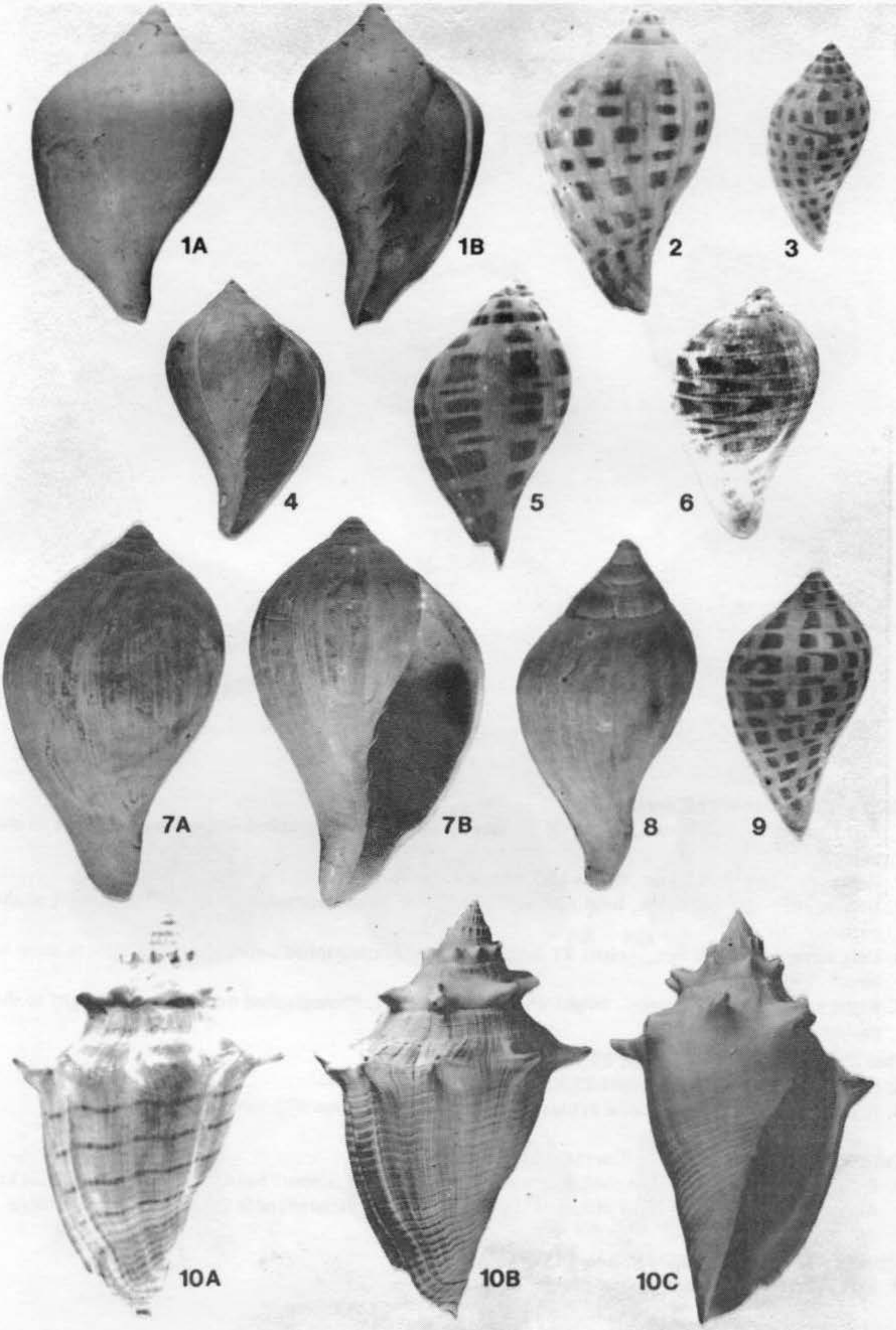


Plate 1.

Plate 2

Figure

1,2,3, 4,7 *Callista (Callista) annexa* (Conrad, 1865)

1. Right valve; length 38 mm., height 26.5 mm.; locality 1. Photographed under ultraviolet light to show color pattern.*
2. Right valve; length 21.5 mm., height 15.5 mm., locality 1.
3. Left valve; length 38.5 mm., height 27 mm.; locality 1. 3C photographed under ultraviolet light to show color pattern.*
4. Left valve; length 39 mm., height 27 mm.; locality 1. Photographed under ultraviolet light to show color pattern.*
7. Right valve; length 35.5 mm., height 25.5 mm.; locality 1. Photographed under ultraviolet light to show color pattern.*

5,6. *Pitar (Pitar) securiformis* (Conrad, 1865)

5. Left valve; length 37 mm., height 29 mm.; locality 2.
6. Right valve from same individual as illustrated in figure 5; thickness with valves together 25.5 mm.

8. *Callista (Costacallista) aequorea* (Conrad, 1833)

8. Right valve; length of broken shell 36.5 mm., height 33 mm.; Gosport Sand, Little Stave Creek, Clarke County, Alabama. Photographed under ultraviolet light to show color pattern*; note the similarity to *C. annexa.*

9. *Pitar (Katherinella) trigoniata* (I. Lea, 1833)

9. Left valve; length 34 mm., height 29 mm.; locality 11.

*See plate 1.

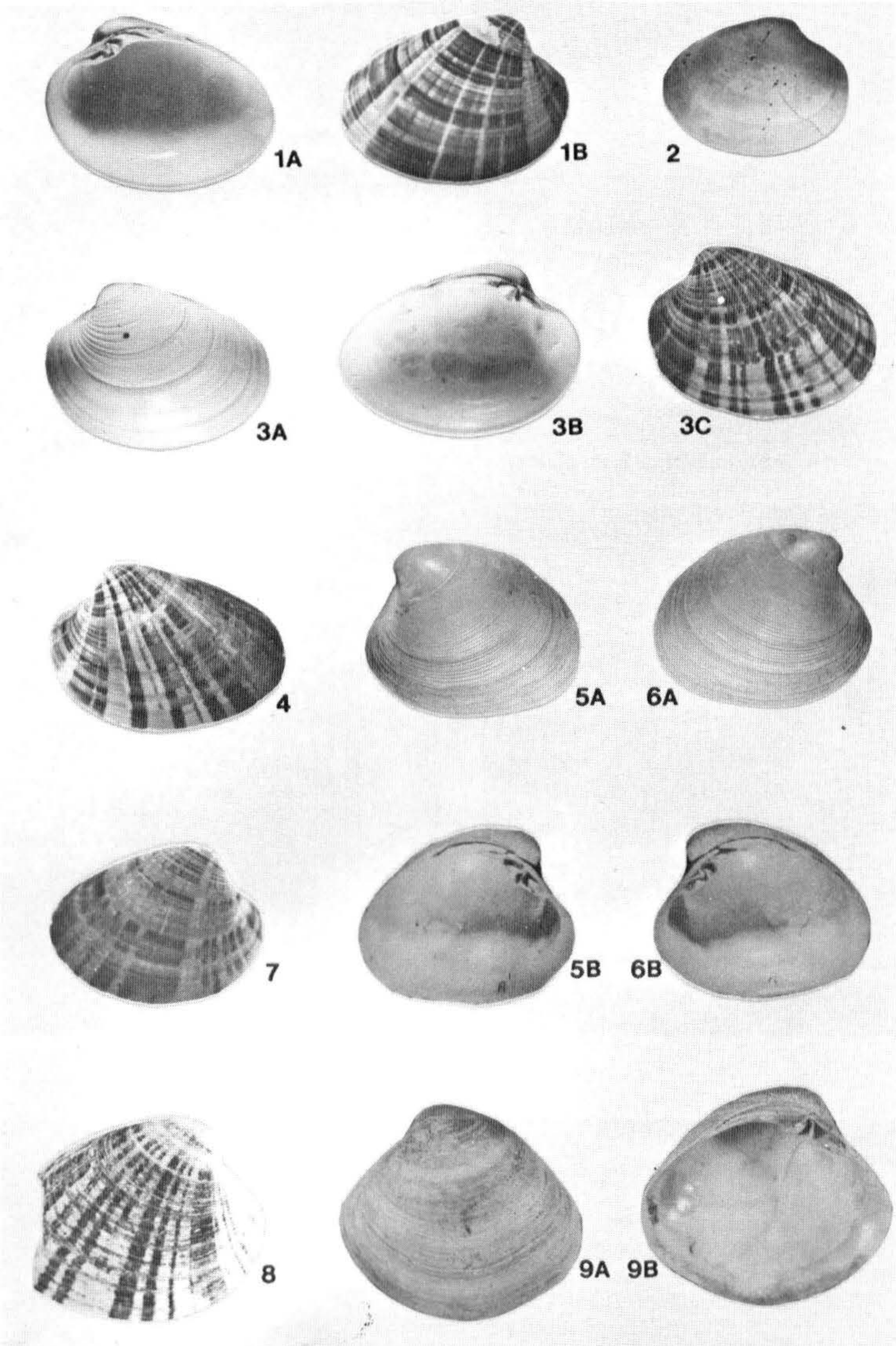


Plate 2.

The Bureau of Geology's Electrical Logging Program

Danny W. Harrelson, William D. Easom,
and Willis H. Johnson

Mississippi Bureau of Geology

Introduction

The Bureau of Geology (formerly the Mississippi Geological Survey) purchased its first electrical logging unit in 1953. The portable "Widco" logging unit has the capacity to log boreholes as deep as 950 feet, and is still in use today to log core and test holes drilled by the Bureau during geological investigations (Figure 1). The Widco is a "single-point" logger, recording a spontaneous potential (S. P.) and a resistivity curve simultaneously (Figure 4). The unit weighs 150 pounds, and has a 1" diameter tool attached to neoprene cable that is raised and lowered in the borehole manually.

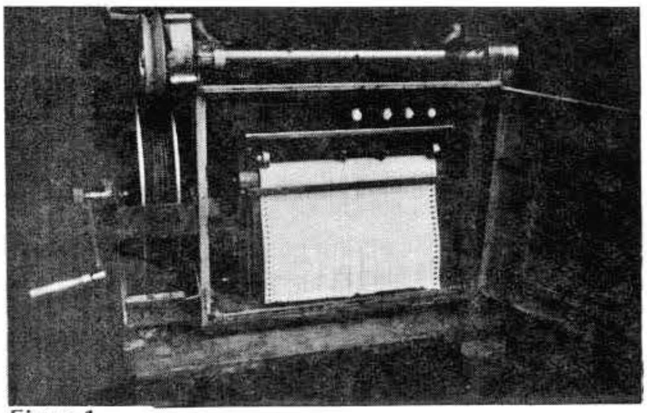


Figure 1.

In 1964 the Bureau initiated a full-scale logging program with the purchase of its second logger, a "Neltronic 3K" electrical logging unit (Figure 2). These two units enabled the Bureau to aid water well contractors in the completion of their water wells, while providing additional geological data for the Bureau's electrical log file. The Neltronic unit has natural gamma ray capabilities in addition to the capacity to log boreholes as deep as 3,300 feet. The 3K unit also has a 1" diameter tool, which is easier to work through "mudballs" and reach the total depth of the borehole. The tool is raised and lowered by a geared electric motor, enabling the operator to concentrate on quality logging.

To expand its logging program, the Bureau in 1974 purchased its third logging unit, a "Gearhart-Owen 3200" multi-point logger (Figure 3 and Figure 4). The electrical logs run with this unit provide extremely accurate information regarding formation resistivities and definitions of lithologies. This unit provides for normal resistance or

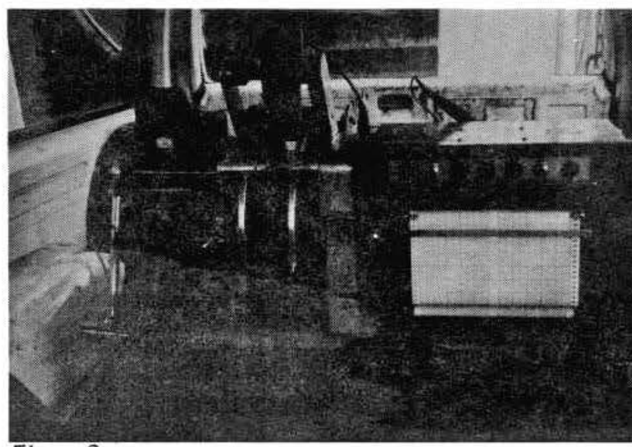


Figure 2.

natural gamma ray logging, and provides logs which can be interpreted for semi-quantitative calculations of total dissolved solids. This unit can log as deep as 3,500 feet, and record long normal, short normal, and S. P. curves simultaneously.

Logging Applications

The Bureau of Geology's three logging units are capable of producing electrical resistivity, spontaneous potential, and natural gamma ray logs. One of the more familiar and useful logs is the electrical resistivity log (Figure 4). This log is a measure of a formation's resistance to an electrical current passed between electrodes in the E-logging tool. Electrode spacing on the two single-point loggers is 24", while spacing is 16" and 64" for the two curves on the multi-point logger.

The spontaneous potential log run simultaneously with the resistivity log is a measurement of the natural electrical polarization of currents flowing between the drilling mud and the surrounding formations. The spontaneous potential curve is deflected to the left in a water-bearing sand with increasing total dissolved solids, and to the right for a fresh-water sand (Figure 4).

The natural gamma ray log is run separately from the resistivity and spontaneous potential logs, and measures the radiation emitted by radioactive elements. The radioactive elements are usually concentrated in clay beds, but can occur in radioactive sands and shales. Gamma ray logs are not affected by the resistivity of the drilling mud or changing water quality, and thus can be run in a dry or cased borehole.

Logging Policies

The Bureau of Geology will log free of charge all water wells and other boreholes that would not otherwise be logged by a commercial logging company. The logging program has two main objectives: 1) to supply the water well contractor with information useful in proper well construction, and 2) to gather geological information on a statewide basis to add to the Bureau's electrical log file. The logs recorded by the Bureau are public property, and are kept on file at the Bureau for public inspection. Logs of boreholes made by the Bureau in the course of an investigation are kept confidential until a report of that investigation is published.

The Bureau will assume responsibility for damage or loss of its equipment when logging a well, except through negligence or willful act of the contractor or representative. The Bureau assumes no liability for any damage that might result through irretrievable loss of logging equipment in the borehole. In cases where undue risk is taken, responsibility agreements for replacement costs of lost equipment may be required by the Bureau.

The Bureau's three logging units are available for operation from 8:00 a.m. to 5:00 p.m., Monday through Friday. When requesting the logging service, it is helpful to notify the Bureau a day or two in advance of when drilling will begin to inform Bureau personnel when the logger will be needed. If two or more requests for the logger occur on the same day, the request which was received first has priority.

After a well has been logged, the best recorded log is brought back to the Bureau for completion. A heading with all of the pertinent information is typed and attached to the log. The original field copy is kept in the Bureau's E-log file and copies of the complete log are then mailed out according to instructions supplied by the contractor. A small fee is charged to defray the cost of reproduction.

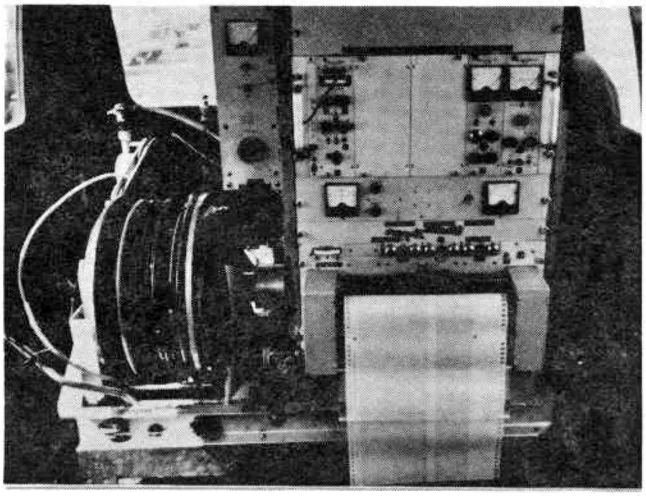


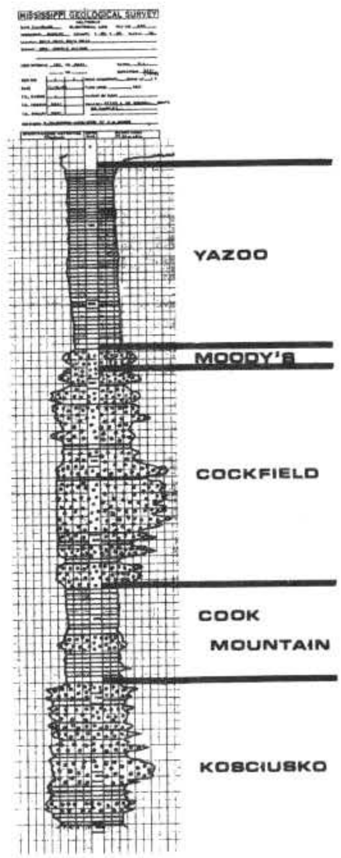
Figure 3.

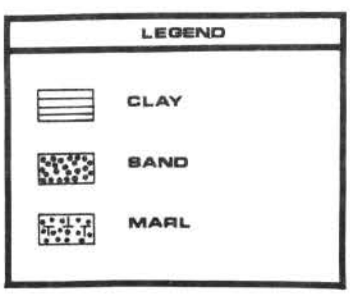
Conclusion

The Bureau's three electrical logging units have logged boreholes between 30 and 2,400 feet deep in Alabama, Tennessee, Louisiana, and all eighty-two Mississippi counties. The logging program has provided more than 4,700 electrical logs for the Bureau's files. The electrical logs obtained by the Bureau are public property, and are available for inspection by individual water well contractors, geologists, engineers, and others.

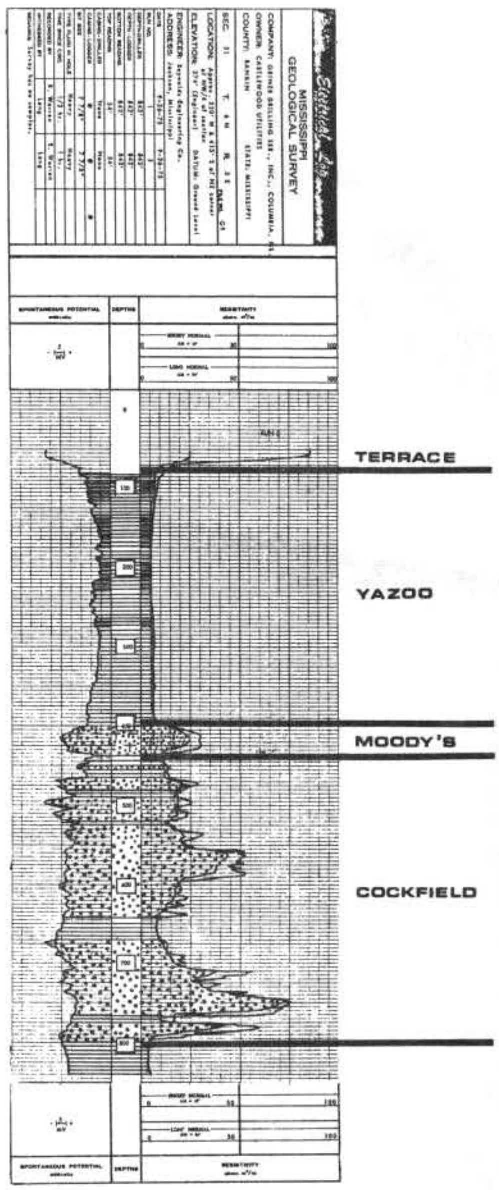
TYPES OF ELECTRICAL LOGS

SINGLE-POINT LOG





MULTI-POINT LOG



OIL AND GAS DRILLING ACTIVITY IN MISSISSIPPI AND NEIGHBORING STATES

	TOTAL NEW WELLS DRILLED									EXPLORATORY WELLS DRILLED						
	April 1980							Jan.-April 1980		April 1980					Total	AVERAGE
STATE OR DISTRICT	Oil	Gas	Dry	Serv-ice	Sus-pended	Total wells	Total footage	Total wells	Total footage	Oil	Gas	Dry	Sus-pended	Total wells	Jan.-April wells	RIGS RUNNING APRIL
Alabama . . .	3	3	8	. . . .	. . . .	14	106,908	64	418,750	2	1	3	. . . .	6	27	10.3
Arkansas . .	25	15	22	. . . .	. . . .	62	339,700	165	833,268	3	1	12	. . . .	16	46	24.2
Louisiana . .	72	148	101	3	35	359	2,275,947	1,352	9,199,631	5	8	42	10	65	302	417.7
Mississippi .	10	1	28	. . . .	. . . .	39	335,439	171	1,495,821	3	. .	18	. . . .	21	86	51.0
Tennessee . .	7	6	6	. . . .	. . . .	19	34,144	95	151,824	1	4	6	. . . .	11	38	0.0

CRUDE PRODUCTION, BY STATES
(Thousand barrels)

	DAILY AVERAGE FOR MONTH					TOTAL JAN.-APRIL			
STATE OR DISTRICT	April 1980	April 1979		% diff.	March 1980	1980	1979		% diff.
Alabama	59.0	52.7	+	12.0	58.5	6,589	6,357	+	3.6
Arkansas	53.0	52.3	+	1.3	53.0	6,393	6,277	+	1.8
Louisiana	1,356.0	1,369.1	-	1.0	1,355.3	156,933	162,442	-	3.4
Mississippi	105.9	106.0	-	0.1	102.5	12,282	12,797	-	4.0
Tennessee	1.1	1.4	-	21.4	1.1	136	167	-	18.6

(Taken from World Oil, 1980)

BUREAU OF GEOLOGY SAMPLE REPOSITORY

The sample and core repository, headed by Edwin E. Luper, is an integral part of the Bureau of Geology. Cores and samples are received from wells drilled in Mississippi or from adjoining counties of neighboring states. Within the past six months the following footage of drill cuttings and cores have been filed: Oil and Gas Test Holes – 335,897 ft.; Test Holes – 6,849 ft.; Water Wells – 3,150 ft.; Landfills – 741 ft.; and Cores – 348 ft.

The repository is open for public use. Examinations of the samples and cores can be done at the Bureau's offices at 2525 North West Street, Jackson, Mississippi. Fluoroscope, microscopes, micro-photographic equipment and a work area are made available. Also, thin sections can be made on the premises at a cost competitive with private industry.

For specific sample-core information call Edwin Luper at (601) 354-6228.

BUREAU OF GEOLOGY PUBLICATION SALES

January - June 1980

Publication	Total Sales
Topographic Maps 1:24,000 & 1:62,500	7,201
State Topographic Maps - 1:500,000	133
State Geologic Map - 1:500,000	63
State Geologic Map - 8½" X 11"	129
Bulletins	513
Environmental Geology Series	19
Information Series	83

Continued on page 12

Mississippi Geology is published quarterly in March, June, September, and December by the Mississippi Department of Natural Resources, Bureau of Geology. Contents include research articles pertaining to Mississippi geology, news items, reviews, and listings of recent geologic literature. Readers are urged to submit letters to the editor and research articles to be considered for publication; format specifications will be forwarded on request. For a free subscription or to submit an article, write to:

Editor, Mississippi Geology
Bureau of Geology
P. O. Box 5348
Jackson, Mississippi 39216

Editors: Michael B. E. Bograd and Dora Devery

Continued from page 11

PUBLICATION SALES

Within the past six months the sales of topographic maps have been brisk and prove to be the main source of information requested. Publications, other than maps, experiencing heavy sales are:

1. Information Series BGE-79-1 - Electrical Logs of Water Wells and Test Holes on File at the Bureau of Geology and Energy Resources
2. Bulletin 96 - The Tula Prospect, Lafayette County, Mississippi
3. Bulletin 105 - Hinds County Mineral Resources
4. Bulletin 112 - Economic Minerals of Mississippi
5. EGS No. 2 - Environmental Geology of the Jackson, Jackson SE, Madison and Ridgeland Quadrangles, Hinds County, Mississippi

MISSISSIPPI GEOLOGY
Department of Natural Resources
Bureau of Geology
Post Office Box 5348
Jackson, Mississippi 39216