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A BRIEF CONTRIBUTION

TO THE

GEOLOGY AND PALEONTOLOGY

OF

NORTHWESTERN LOUISIANA

BY

T. WAYLAND VAUGHAN

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DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., March 21, 1896.

SIR: I take pleasure in transmitting herewith a manuscript entitled "A brief contribution to the geology and paleontology of northwestern Louisiana," by T. Wayland Vaughan. This paper embraces the valuable results of Mr. Vaughan's observations in an important region of the United States, and I recommend that it be published as a bulletin of the Survey.

Very respectfully,

ROBERT T. HILL,
Geologist.

Hon. C. D. WALCOTT,
Director United States Geological Survey.

A BRIEF CONTRIBUTION TO THE GEOLOGY AND PALEONTOLOGY OF NORTHWESTERN LOUISIANA.

By T. WAYLAND VAUGHAN.

PREFATORY NOTE.

The following short paper gives the results of some studies that I have made on the geology and paleontology of northwestern Louisiana. This contribution is necessarily of a fragmentary nature, partly on account of the conditions under which the studies have been prosecuted and partly from an entire lack of topographic maps of the area discussed. In the American Geologist for April, 1895, I published a paper entitled "The stratigraphy of northwestern Louisiana." The greater part of that paper, with some verbal changes, is republished here as a stratigraphic introduction.

In the lists of the species, references to the publications where they were first described are omitted, because in Prof. G. D. Harris's report on the Tertiary geology of southern Arkansas[1] numerous references are given. Professor Harris has written a "Monograph of the Tertiary Mollusca of Texas" (not yet published), and Mr. C. W. Johnson, curator of the museum of the Wagner Free Institute of Science, of Philadelphia, is engaged in making a catalogue, with bibliographic references, of the species in the Isaac Lea memorial collection of Eocene fossils. These publications will contain references to practically all of the species listed in the present paper.

Dr. William H. Dall has prepared a paper, which will probably appear in the Eighteenth Annual Report of the Survey, dealing with the nomenclature and correlation of the Tertiary beds of the United States. In this contribution Dr. Dall has shown that the Vicksburg and the Grand Gulf and the beds hitherto denominated Lower Miocene should be considered Oligocene, the first belonging to the Lower Oligocene and the second to the Upper Oligocene. Through the courtesy of Dr. Dall, I have utilized that classification in the present paper.

I am under obligations to Dr. William H. Dall, Prof. Angelo Heilprin, Mr. H. A. Pilsbry, Dr. C. E. Beecher, and Prof. R. P. Whitfield for access to the collections under their charge. Dr. Dall has permitted

[1] Annual Report of the Geological Survey of Arkansas for 1892, Vol. II, 1894.

me to catalogue the material from Louisiana in the United States National Museum. In the summer of 1892 I was assistant to Dr. Otto Lerch during his survey of the hills of northern Louisiana, and he submitted to me for study the collection of the Louisiana survey. Prof. G. D. Harris has given me much assistance in identifying many of the fossils. Mr. Robert T. Hill, during the field season of 1894, gave me the opportunity to return to Louisiana to study further the Eocene of that State. Through his kindness I have been allowed time to continue my study of the fossils during the season of office work.

STRATIGRAPHY OF THE REGION.

AREA DEFINED.

The area here described is that portion of Louisiana bounded in a general way by the Arkansas and Texas State lines, by the Ouachita River as far south as Harrisonburg, by a line running thence to Alexandria on the Red River, and thence northeast to a point west of Mansfield on the Sabine River. This area has been the subject of study by several geologists. Conrad, as early as 1834,[1] announced the existence of the Eocene in it from fossils sent him. Later Hilgard, Hopkins, Johnson, Lerch, Harris, and McGee have done field work there. The publications of these geologists will be alluded to as reference to their work becomes necessary.

THE CRETACEOUS.

The existence of Cretaceous strata in Louisiana was first indisputably established by Hilgard in 1869.[2] Subsequently Hopkins, Johnson, and Lerch have noted the occurrence of Cretaceous in the State. Dr. Lerch gives a list of the localities of these rocks in his preliminary report[3] upon the geology of the hills of Louisiana. Cretaceous outcrops have been found in northern Louisiana, in the parishes of Webster, Bienville, Natchitoches, Winn, and Rapides.

Hilgard observed that these outcrops when mapped form a line trending from northwest to southeast.[4] Associated with them are salt deposits; hard limestone, sulphur, and gypsum are not infrequent. On secs. 31 and 32, T. 10 N., R. 4 W., near Atlanta, in Winn Parish, there outcrops a hard blue limestone, which is traversed by minute fissures. In these fissures a small amount of gold occurs.

In these rocks *Exogyra costata* has been found. As this fossil is characteristic of the Glauconitic division of the Upper Cretaceous, the strata in Louisiana bearing it must be considered as of Glauconitic age.

[1] Jour. Acad. Nat. Sci. Phila., Vol. VII, 1834, p. 120.

[2] Preliminary report of a geological reconnoissance of Louisiana: De Bow's New Orleans Review, September, 1869, p. 11.

[3] A preliminary report upon the hills of Louisiana: Bulletin of the Louisiana Experiment Station, 1893, Part II, p. 72.

[4] Op. cit., p. 11.

Hilgard[1] mentions *Gryphæa pitcheri* also; but he is without doubt mistaken in his identification, as *G. pitcheri* is a Comanche series fossil, and does not occur in the Upper Cretaceous.

The relations of the Eocene to the Cretaceous, as conceived by Hopkins,[2] are shown in a section across the State, published in his first report. He indicates that there are knobs of Cretaceous, around which the Eocene was deposited, but does not state explicitly the relations existing between the two series.

Dr. Lerch[3] gives the following explanation:

> If we connect the above localities we obtain an irregular line with a northwesterly trend, revealing the distribution of the Cretaceous deposits in north Louisiana as far as explored over 1,000 feet in thickness. Nowhere outside of the outcrops have bores reached the Cretaceous, not even in the nearest vicinity; wells of considerable depth have penetrated the shales of the Lower Lignitic and Marine Claiborne which surround these islands. It is most probable, however, that at Shreveport the artesian bore, 1,100 feet in depth, has penetrated the Tertiary strata, and that the water flows from the Upper Cretaceous sands. Judging from the bores and exposures of this substructure of Louisiana, and excluding the overlying later deposits, it represents a ridge with steep hillsides and occasional high peaks with almost perpendicular declivities. The *Exogyra costata* and the *Gryphæa pitcheri*, found in close proximity in these outcrops, as well as the Eocene directly overlying and resting against the Cretaceous, seem to prove that at the close of Mesozoic time enormous plutonic forces convulsed, fractured, faulted, and folded the Cretaceous strata, throwing up mountain chains of vast extent and raising them far above the waters of the Gulf. It seems to us more than possible that these grand disturbances involve the whole of the Southern Cretaceous, and that the enormous downthrow along the Balcones and the basaltic outbreaks along that fault are contemporaneous with the origin of the mountain chain in the Tertiary of that State and of Louisiana. In the basins and embayments formed the Eocene strata were deposited, the very existence of which proves that there was no interval of a land period between the Cretaceous and Tertiary in this State, and if we could remove the covering mantle we would see the chains and peaks of limestone ranges formed at the close of the Middle Ages of our planet altered somewhat by later erosion and denudation.

I am not prepared to agree with Dr. Lerch as to the correlation of the disturbance in Louisiana succeeding the close of the Cretaceous deposition, with the times of the Balcones faulting and the Pilot Knob volcanic activity.[4] I will emphasize the following facts, however. The Cretaceous outcrops in the area under discussion have a general southeast and northwest trend, with knobs or peaks projecting along the line, and around these knobs the Eocene has been deposited. The occurrence of many of these projecting peaks would indicate a period of erosion intervening between the close of the Cretaceous and the beginning of the Eocene. Furthermore, the Cretaceous at the Winn Parish marble quarry is almost horizontal, the limestone rising as a

[1] Preliminary report of a geological reconnoissance of Louisiana, p. 11.

[2] First Annual Report of the Geological Survey of Louisiana, p. 78, in the Louisiana State University Report for 1869, published 1870.

[3] A preliminary report upon the hills of Louisiana: Bulletin of the Louisiana Experiment Station, 1893, Part II, p. 72.

[4] The Pilot Knob volcano was probably active during late Cretaceous time, whereas the Balcones, faulting took place much later.

butte-like mass into the Eocene. If there had been a mountain chain, as Dr. Lerch maintains, with the Eocene deposited immediately thereafter, before erosion had degraded the limestone, the Cretaceous rock at this place should represent either a dome or an anticline, but such is not the case. Apparently the most logical explanation of the relation of the Cretaceous to the Eocene is that a land period followed the close of the deposition of the rocks belonging to the former series.

THE TERTIARY.

THE EOCENE, ITS CHARACTERS AND DISTRIBUTION.

The Eocene of Louisiana has been the subject of more or less study ever since Conrad, in 1834, announced the existence of strata of that age in the State. These beds are composed of lignitic clays and sands, the sands often cross bedded, with the interstratification of beds bearing a littoral fauna; the fossiliferous beds are occasionally impure limestone. Apparently beds in one place bearing marine fossils may in other places be represented by beds of the same age devoid of animal remains; therefore it is not at present possible to subdivide and correlate with accuracy all of the strata belonging to the Eocene period found in Louisiana.

The following are approximately the limits of the area occupied by the strata belonging to this period in Louisiana: On the north and west the Eocene of this State is continuous with that of Arkansas and Texas, on the south the boundary is formed by the Grand Gulf Oligocene. This Oligocene parting runs from a few miles south of Rosefield, in Catahoula Parish, by Centerville, in the same parish, crossing Little River 5 or 6 miles below Georgetown, reaching the Red River 5 miles north of Colfax, in Grant Parish, and the Sabine River near the mouth of Bayou Negrut.[1]

Dr. Lerch has divided the Eocene as follows:

Vicksburg.	
Jackson.	
Arcadia clays.	Provisional names.
Upper Lignitic.	
Marine Claiborne.	
Lower Lignitic.	

The following scheme is used in this paper:

Oligocene (Lower) Vicksburg.
(Intervening Lignitic clays.)
Eocene:
- Jackson.
- Cocksfield Ferry beds (equivalent, in a general way, to the Claiborne sands of Alabama).
- Lower Claiborne, including *Ostrea sellæformis* beds, Lisbon beds, and Buhrstone.
- Lignitic.

[1] Some of the above data are taken from Hopkins: First Annual Report of Louisiana State Geological Survey, p. 99, for 1869, published 1870.

LIGNITIC STAGE.

If this formation occurs in Louisiana, it is only in the northwestern corner of Caddo Parish and probably at Shreveport. I have seen at Port Caddo Landing, in Harrison County, Tex., which adjoins Caddo Parish, strata that I consider Lignitic.[1] If this point is connected with the point where Mr. Harris's Lignitic-Claiborne parting, as shown on his map of southern Arkansas, reaches the Arkansas-Louisiana State line, it will be seen that the northwestern corner of Caddo Parish is most probably Lignitic. I have not been able to examine that area.

LOWER CLAIBORNE STAGE.

This stage covers by far the largest area of any of the subdivisions of the Eocene in Louisiana, extending south from the Arkansas line to Georgetown, on Little River, to St. Maurice, at the mouth of Saline Bayou, on the Red River, and to Provencal, on the Texas and Pacific Railway. Lower Claiborne fossils have been found in Bossier, Webster, Claiborne, Bienville, Jackson, Winn, Natchitoches, and Grant parishes.

In Alabama[2] the Lower Claiborne is divided into—

Ostrea sellæformis beds.
Lisbon beds.
Buhrstone.

In Mississippi Dr. Hilgard[3] divides the Claiborne, below the Lignitic bed at the base of the Jackson, into—

Calcareous.
Siliceous Claiborne.

Smith[4] writes:

> From the section given in Hilgard's report, it seems that the middle part of what we have called the Claiborne series, containing the great number of *Ostrea sellæformis*, are the beds of the Calcareous division best developed in that State.[5]

The Siliceous Claiborne represents in large part the Buhrstone of Alabama. This formation in Alabama and Mississippi receives its name from the peculiar lithologic characters of its constituent rocks, which find no counterpart in Louisiana. As the Buhrstone in these two States is not characterized by well preserved fossil organisms, it is not possible to make any precise correlation in the Louisiana section.

The region in which Lower Claiborne fossils have been found has already been indicated. The following are the general lithologic characters presented by the stage in Louisiana. In Caddo and De Soto parishes and in Natchitoches Parish[6] as far south as Victoria this for-

[1] Am. Geologist, Vol. XVI, pp. 304–309, November, 1895.
[2] G. D. Harris: Am. Jour. Sci., April, 1894. See also Smith and Johnson: Bull. U. S. Geol. Survey No. 43, 1887.
[3] Agric. and Geol. of Miss., 1860, p. 108.
[4] Bull. U. S. Geol. Survey No. 43, 1887, p. 25.
[5] The author is not altogether certain about Smith's correlation.
[6] This part of the Lower Claiborne is Hilgard's Mansfield group.

mation is represented by lignitic sands and clays devoid of marine fossils, but lignitiferous strata occur throughout the whole area of the Lower Claiborne. In Bossier, Claiborne, and Bienville parishes fossils are found as casts in sandstone and as ferruginous replacements. In Webster, Bienville, and Jackson parishes the fossils are usually obtained in glauconitic sands, although in the two last parishes they are occasionally present in yellowish clay. Farther south, in the extreme southern portion of Bienville Parish and in Natchitoches and Winn parishes, the fossiliferous beds are very calcareous and are rich in fossils, which are usually poorly preserved. *Ostrea sellæformis* is often extremely abundant. There are slight paleontologic differences to be found in the fauna contained in the calcareous clays or clayey limestones of northwestern Winn Parish and of Natchitoches Parish, as compared with the fauna found in the glauconitic sands to the northwest; but both faunas are beyond doubt Lower Claiborne, and they are very closely related. From the southeast dip of the Eocene of Louisiana it appears very probable that the calcareous beds above alluded to represent a horizon a little higher than the glauconitic beds to the north. Within the calcareous area at St. Maurice, Robertsville, and Georgetown Lower Claiborne fossils were obtained from glauconitic sands or greenish clays. These beds, from the close resemblance of their fossils to those found in the calcareous beds, in all probability represent local lithologic differences in the horizon to which the calcareous beds belong.

The Lower Claiborne formation rests conformably upon the Lignitic, and passes conformably into the Cocksfield Ferry beds above.

Of Dr. Lerch's division the following belong to the Lower Claiborne:

Jackson (in part).
Arcadia clays.
Upper Lignitic (in part).
Marine Claiborne.
Lower Lignitic (at least in part).

The sections shown in figs. 1,[1] 2, 3, 4, 5, and 6, Pl. I, indicate the general characters of the stage.

It is difficult to decide whether the strata exposed at Shreveport should be considered Lignitic or Lower Claiborne, although they are probably Lignitic.

The Mansfield group of Hilgard should in all probability be referred to the Lower Claiborne. There is in the Mansfield group, so far as we know, a complete absence of animal remains, the formation being composed of lignitiferous sands and clays. The characters of the strata, however, are lithologically the same as those of the lignitiferous beds that occur within the northern part of the Lower Claiborne area between the Ouachita and Red rivers. The marine fossils found between these two rivers are always both overlain and underlain by lignitic strata. The Mansfield area lies south, southwest, and west of

[1] Fig. 1 is probably Lignitic.

a part of the Lower Claiborne area, in which marine fossils have been found. Making an approximate determination of the strike of the former beds, which is either north or northeast, the fossiliferous Lower Claiborne of Bossier, Webster, Claiborne, and Bienville parishes would be along the strike line of the Mansfield. Lower Claiborne fossils have been found in Harrison County, Tex.,[1] northwest of the outcrops of the Mansfield; they are found north, northeast, and east[2] of the outcrops of the formation under discussion in parishes already mentioned, and to the south the Mansfield in Natchitoches Parish dips under the Lower Claiborne at Victoria. The opinion has been expressed that the beds bearing marine fossils, found in the vicinity of Victoria, Provencal, Natchitoches, St. Maurice, etc., are stratigraphically above the fossiliferous beds found in Bossier, Webster, Claiborne, and Bienville parishes.

West of the outcrops of the Mansfield, in Texas, according to L. C. Johnson,[3] is Claiborne. As the topography of the Mansfield does not represent a basin,[4] such as would suggest that the Lower Claiborne had been eroded off and the Lignitic exposed, it seems to the writer that the Mansfield is only a portion of the Lower Claiborne devoid of marine fossils.

The presence of such mollusks as *Ostrea divaricata*, *O. sellæformis*, *Anomia ephippoides*, *Borsonia biconica*, *Latirus moorei*, *Fusus mortoni* var. *mortoniopsis*, etc., in the Claiborne strata of Louisiana, leaves no doubt as to what the homotaxial equivalents in Mississippi, Alabama, and Texas are. The corals are, if possible, even more decisive than the mollusks; but as only a few of the species have been described, and as I wish to publish descriptions of them in my paper on the "Eocene corals of the United States," their names are not here cited.

The age of these beds has already been pointed out by Johnson,[5] Lerch,[6] and Harris,[7] but all three have erred in making the Lower Claiborne area too small and the Jackson area too large.

Lower Claiborne fossils were collected by the Louisiana Geological Survey at Georgetown, on the railroad from Monroe to Alexandria, near Little River. This shows the existence of Lower Claiborne strata farther south than has hitherto been recorded. Some of the species are:

Volutilithes petrosus Con.
Latirus moorei Gabb.
Lunatia eminula Con.
Venericardia planicosta Con.
Corbula sp.

[1] Lawrence C. Johnson, The Iron Regions of northern Louisiana and eastern Texas: Ex. Doc. No. 195, H. of R., 50th Congress, 1st session, p. 21, 1888. Map.

[2] The Lower Claiborne is east of the Mansfield in Natchitoches, Winn, and Grant parishes.

[3] Ibid., see map.

[4] The average altitude along the Texas and Pacific Railway from Shreveport, after passing out of the river bottom, to Provencal, is 281 feet; along the Vicksburg, Shreveport and Pacific Railroad from Shreveport, after leaving the Red River bottom, to Calhoun, it is 247 feet. These elevations are taken from the respective railroad profiles.

[5] Ibid., p. 20.

[6] A preliminary report upon the hills of Louisiana, Part II, 1893, p. 82.

[7] Tertiary Geology of Southern Arkansas, 1894, p. 177, Professor Harris erred in accepting the previous work of Johnson on the areal distribution.

I regard the *Latirus moorei* as indicative of the age of the beds.

Four questions need further discussion: First, the Arcadia clays; second, the small prairies or meadows in Bienville, northern Winn, and Natchitoches parishes; third, the Upper Lignitic of Dr. Lerch; fourth, the red clays in the vicinity of Mount Lebanon and Arcadia.

The Arcadia clays.—Dr. Lerch has described a series of gray clays, typically exposed in the vicinity of Arcadia, and which he considered as resting upon the eroded surface of the Claiborne strata. To these clays in his second report the name "Arcadia clays" was given, and they were considered of Jackson age.

I was first led to doubt the existence of an unconformity for paleontologic reasons. The Lower Claiborne attains a fine development in Louisiana. In Winn and Natchitoches parishes the Lower Claiborne beds, as already noted, become very calcareous, and *Ostrea sellæformis* is often found in the greatest abundance. These features are characteristic of Hilgard's Calcareous Claiborne in Mississippi, which has been correlated with the *Ostrea sellæformis* beds of Alabama by Smith. The *Ostrea sellæformis* beds in Alabama are separated from the Jackson by scarcely 30 feet of strata. Whether the Calcareous beds of Winn and Natchitoches parishes are the exact equivalent of the *Ostrea sellæformis* beds of Alabama or not, the fact remains that they are not far from the base of the Jackson, and it seems improbable that a long period of dry land surface could have intervened. Furthermore, G. D. Harris,[1] in Arkansas, discovered beds "Uppermost Claibornian, or perhaps transitional between that and the Jackson," a fact to my mind making it still more improbable that there could have been in Louisiana an erosion period between the two stages.

In order to study this supposed unconformity further, in November, 1894, I went to Arcadia to examine again some sections in that vicinity. Fig. 3, Pl. I, represents a section made in the first railroad cut west of that town. The gray or Arcadia clays were found resting conformably on the black clays. The dip of both the gray and black clays was the same in both direction and amount, and the stratification was absolutely continuous from one clay to the other. From the distribution of the color one would at first be inclined to think that there was an unconformity, but in a layer not thicker than one's finger I have seen the stratum in the length of about a foot light gray or blue, then chocolate and at last black (or almost black) where it passes into the black nucleus of the cut. Fig. 4, a section made on the Louisiana and Northwestern Railway, 6½ miles south of Gibbsland, represents the same phenomena.

I believe that the appearance of these sections is simply the result of weathering, and that the black clays represent an unweathered nucleus.

In some cases the difference between the gray and blackish clays may be due to different lithologic constitution, but I have never seen any evidence that an erosion period intervened between the "Arcadia clays" and the Lower Claiborne beds.

[1] Tertiary Geology of Southern Arkansas, 1894, p. 93.

On only one of the hilltops above the "Arcadia clays" did I find fossils and that was on the Louisiana and Northwestern Railway, between 5 and 6 miles south of Gibbsland. Here gray and mottled clays grade upward into red clays which contained a cast of *Venericardia planicosta*. As this species is found in both the Jackson and lower Eocene beds, it does not fix the age of the beds, but on Hammetts Branch, SW. ¼ of sec. 30, T. 18 N., R. 6 W., in a gray joint clay numerous Lower Claiborne fossils, such as *Anomia ephippoides* and *Flabellum cuneiforme* var. *pachyphyllum*, were found. Dr. Lerch says:[1]

A paucity of fossils characterizes these deposits, and so far only near the line of contact with the underlying greensand marine shells have been found which prove to be the same as those found in the underlying Claiborne formation.

I believe that the name "Arcadia clays" must be abandoned and the clays for which the name stands be referred to the Lower Claiborne.

The small prairies of Winn and Natchitoches parishes.[2]—Unfortunately, from lithologic and topographic resemblance, much of the Lower Claiborne of Louisiana has been confused with the Jackson. Johnson says:[3]

The boundary of this formation [the Jackson] was traced by prairies and wells along the left bank of Bayou Saline and from the SW. ¼ of sec. 20, T. 10 N., R. 5 W., northeastward to Gansville, near the borders of Jackson and Winn parishes, and probably runs diagonally through Jackson Parish in the direction of Monroe, Ouachita Parish. The formation probably occupies high points still farther north on Bayou Saline.

Dr. Lerch[4] gives a section in White Oak Creek, 10 miles northwest of Winnfield which he considers to be the contact between the Jackson and his Upper Lignitic. He says:[5]

A similar section is seen in No. 7 (fig.) of foregoing pages. The characteristic bald prairies are abundant in the neighborhood, and in the dumps of wells with undrinkable water large selenite crystals and Jackson fossils have been collected.

Both of these authors have erred as to the age of these beds, as the following list of some of the more characteristic fossils from one of these prairies, 10 miles northwest of Winnfield, will show. This collection was made by the Louisiana geological survey and was submitted to me for study. Thanks are due to Prof. G. D. Harris for assistance in determining some of the mollusks.

Pleurotoma sancti-mauritii, sp. nov.
Fusus mortoni Lea.
Pseudoliva vetusta Con.
Cassidaria planotecta Mey. and Ald.
Rimella texana Harris.
Turritella apita De Greg.
dutexata Harris.
Calyptræa trochiformis Lam.
Dentalium minutistriatum Gabb.
Ostrea divaricata Lea.
alabamiensis Lea.
Pecten claibornensis Con.
Limopsis aviculoides Con.
Crassatella texalta Harris (?).
Corbula oniscus Cŏn.
Protocardia gambrina Gabb.
Two undescribed corals, both typically Lower Claiborne, to which I have given the names *Flabellum lerchi* and *Paracyathus bellus*.

[1] A preliminary report upon the hills of Louisiana, Part I, p. 11.
[2] Until the author had studied the fossils found in these prairies he thought some of the Lower Claiborne was Jackson.
[3] Iron Regions of northern Louisiana and eastern Texas, 1888, p. 16.
[4] A preliminary report upon the hills of Louisiana, 1893, Part II, p. 89.
[5] The section was made on White Oak Creek, sec. 14, T. 11 N., R. 5 W.

There is not a characteristic Jackson fossil in the above assemblage, while many are strictly Lower Claiborne.

Limestone of similar character to that in which the above fossils occur as casts, and containing the same fossils, is found in Natchitoches Parish, between Provencal and Robertsville, and 1¼ miles south of Provencal.

In the vicinity of Victoria, Provencal, Natchitoches, and in southern Bienville Parish are beds of *Ostrea sellæformis*, which usually form small prairies. On page 90 of his second report, in discussing the Jackson-Vicksburg groups, section No. 14, Dr. Lerch says:

About 1 mile southwest of Victoria the following section was observed, showing well the position of the limestone of this formation:

1. Red sandy clays.
2. Limestone with Ostrea, 2 feet.
3. Gray clay.
4. Laminated black Lignitic shales with sand partings to base.

The foregoing exposure is 100 feet in vertical height. As this is the last section northward along this line, we refer the above limestone to the Jackson beds till the fossils have been studied.

In November, 1894, I visited the locality at which this section was made, and found the limestone composed of *Ostrea sellæformis* and *Anomia ephippoides*, which of course put it into the Lower Claiborne; and as the gray clays are conformably just below the limestone, they must also be referred to the Lower Claiborne.

The "Upper Lignitic" of Dr. Lerch.—This author has described a series of lignitic clays, which he states overlie his "Marine Claiborne," and to which he has given the name of "Upper Lignitic." Part of his Upper Lignitic, as exposed 10 miles northwest of Winnfield, undoubtedly belongs in the Lower Claiborne, for it is there overlain by strata bearing Lower Claiborne fossils. But I am not certain that the strata in other localities presenting the same lithological appearance, and designated by Dr. Lerch as the Upper Lignitic, occupy the same stratigraphic position. At Columbia the lignitic strata probably are not Lower Claiborne, but represent what I have called the Cocksfield Ferry beds. The lignitic strata about 3 miles south of Rosefield[1] lie at the base of the Vicksburg, and most probably are intermediate between the Jackson and that stage.

The red clays and red sandy clays in the vicinity of Mount Lebanon and Arcadia.—In northern Louisiana many hills are capped by deposits of red sandy clays, which in the vicinity of Mount Lebanon, Homer, and Arcadia contain fossils that are, excepting one species, identical with those of the underlying Lower Claiborne. The exception is the new *Cardium*, to which I have given the name of *C. harrisi*. Among the species found in these deposits are:

Volutilithes petrosus Con.
Ostrea divaricata Lea.
Venericardia planicosta Lam.
Cardium harrisi sp. nov.[2]
Pteropsis conradi Dana.

[1] Lerch, A preliminary report upon the hills of Louisiana, 1893, Part II, p. 98.

[2] Professor Harris has examined the specimens submitted to me, and writes me that he found the same species at Walnut Bluff, Ouachita River, Arkansas. On page 142 of his Arkansas report the species is referred to as *Cardium* sp.

In many places in northern Louisiana the red sandy clays or sands rest unconformably on the Eocene, and doubtless belong to the Lafayette of McGee.

As it appears that there has been some confusion of "Lafayette," "Orange sand," etc., with residual deposits, the reasons for considering the superficial clays around Mount Lebanon and Arcadia residual are given at some length, as follows:

Two hypotheses for the presence of the Lower Claiborne fossils in the superficial deposits under discussion present themselves: First, they may have been transported; second, they may be in place. The latter hypothesis I regard as the correct one for the following reasons:

1. In Mount Lebanon, and north and east of that place, many of these fossils are found as casts in ferruginous sandstone or as ferruginous replacements. One mile north of Mount Lebanon, in a well, many Lower Claiborne fossils were collected from a yellowish sand. In Mount Lebanon Lower Claiborne fossils were found in greenish clays or in sands thrown out of a well. Sections in these wells and the vicinity show that superficial strata rests directly upon the subjacent Eocene.

2. The transition from the Eocene to the superficial deposits can be traced. In fig. 2, Pl. I, the glauconitic sands pass by oxidation into the yellow sands, and the yellow clay passes by oxidation into the red. The yellow clay has frequently on its surface blotches of red which have been produced by oxidation. The transition from the Eocene to the surface red clays is seen at Arcadia, 6½ miles south of Gibbsland, on the Louisiana and Northwestern Railroad, and between 5 and 6 miles south of Gibbsland, on the same road. At the latter place in the red clay *Venericardia planicosta* was found, as already noted.

3. Fossils found in the well 1 mile north of Mount Lebanon, embedded in indurated glauconitic sand, are so similar in occurrence to those in the red sandy clays as to suggest that, were the sands further oxidized and the calcareous shells dissolved out, there would result exactly what is found in the surface sands.

4. There are in the specimens from the superficial deposits no indications of their having been waterworn. In the type specimen, a cast, of *Cardium harrisi* the angles are very sharp, so that if it had been transported it must have been embedded in rock. As the specimen is large, a powerful current would have been required, and there are no indications of such.

For the above reasons the red clays and red sandy clays on the hills in the vicinity of Mount Lebanon and Arcadia must be considered as oxidized Eocene.

Eocene fossils as casts in ferruginous sandstone have been found in Lincoln, Claiborne, and Bossier parishes, and the beds from which they come are undoubtedly Lower Claiborne Eocene.

THE COCKSFIELD FERRY BEDS.

Conformably above the fossiliferous Lower Claiborne at St. Maurice, fig. 6, Pl. I, are laminated nonfossiliferous clays or laminated sand

and clay, dipping slightly south. These beds present different lithological phases, sometimes containing more clay and little or no sand. The same beds are well exposed at Cocksfield Ferry, about halfway between St. Maurice and Montgomery, fig. 7, Pl. I.

At Montgomery, immediately below the Jackson,[1] beds lithologically like those found in the upper part of the St. Maurice section and like those at Cocksfield Ferry are found. The section at Montgomery is represented in fig. 8, Pl. I. The dip at Montgomery is somewhat steeper than at St. Maurice.

For these beds between St. Maurice and Montgomery, coming between the Lower Claiborne and the Jackson, I propose the local name of "Cocksfield Ferry beds." In a general way they represent the Claiborne sands of Alabama, but it is not possible to limit precisely the Lower Claiborne above or the Jackson below, and one can not state exactly how much or what part of these beds represent the Claiborne sands. No beds bearing marine fossils and equivalent to the latter beds have been found in Louisiana.

THE JACKSON AND VICKSBURG[2] STAGES.

As pointed out by Dr. Lerch, the Jackson and Vicksburg pass conformably into each other and resemble each other so closely lithologically that they can be distinguished only by paleontologic characters. Both stages are largely characterized by Calcareous clays. At the base of the Vicksburg are lignitic strata, as can be seen in the section about 3 miles south of Rosefield, in Catahoula Parish. Dr. Hilgard[3] has noted a similar occurrence of lignitic clays and lignite at the base of the Vicksburg at Vicksburg and north of Brandon in Mississippi. On account of the lithological similarities of these two stages the area occupied by them must for the present be treated as a unit. On the north the area is limited by the Claiborne series of beds, the known Jackson outcrops being at Montgomery on the Red River, at Tullos and 2 miles north of Rosefield in Catahoula Parish, at Bunker Hill in Caldwell Parish, and at Grand View on the Ouachita River.

Mr. Harris[4] says:

> The exact point at which the Jackson stage reaches the Ouachita River is still unknown. In 1834 Dr. Harlan described the genus *Basilosaurus* (*Zeuglodon*) before the American Philosophical Society, giving as its locality a point on the Ouachita River, 50 miles by land below Monroe. This means, doubtless, a locality not far from Grand View.

Hopkins[5] says that the Jackson reaches the Ouachita River at Grand View, and as he makes no reference to Harlan's work, I am certain from his statement, which is accompanied by a section, that he had visited

[1] Dr. Hilgard notes Lignitic beds beneath the Jackson in Mississippi: Agriculture and Geology of Mississippi, pp. 108, 123, 127, 128.

[2] Discussed with the Jackson because of their close lithologic similarity.

[3] Agriculture and Geology of Mississippi, 1860, p. 108.

[4] Report on the Tertiary Geology of Arkansas, p. 182.

[5] First Report Louisiana Geological Survey for 1869, published 1870, p. 86.

that locality. By the crooked road south from Monroe, Grand View is very near the locality referred to by Harlan. I have Jackson fossils, submitted to me by the Louisiana geological survey, that came from 2 miles north of Rosefield, a point about 5 miles southwest of Grand View. Hopkins mentions Zeuglodon bones having been found "where the Harrisonburg and Columbia road crosses the Catahoula and Caldwell Parish line."[1] This place corresponds very closely with that whence were obtained the Louisiana survey fossils.

Mr. Harris further states:

> Dr. E. W. Hilgard[2] has interpreted Harlan's locality for Zeuglodon remains as "about halfway between Columbia and Monroe." It is very difficult to see how this construction can be put on Harlan's statement.

I agree with Mr. Harris, and think Dr. Hilgard made a lapsus pennæ.

North of the line indicated by the above localities for Jackson fossils none have so far been reported by competent paleontologists.

West of the Red River so far no Jackson fossils have been authoritatively reported.[3] When at Provencal in November, 1894, I drove 8 miles south of that place searching for Jackson outcrops. In the banks of Santa Barba Creek (called by the inhabitants Sandy Burg) a greenish blue clay containing calcareous nodules resembling considerably in lithologic appearance the Jackson at Montgomery was seen. The river has a wide valley opposite Montgomery; so Dr. Lerch had no chance to find Jackson fossils while making his section along the Texas and Pacific Railway from Alexandria to Mansfield. Along the Claiborne-Jackson contact the Sparta sands obscure the older geology.

One point on the northern boundary needs a little further discussion. At Georgetown, in the valley of Little River, Lower Claiborne fossils were obtained from a well. Jackson fossils, Zeuglodon, were found in a railroad cutting at Tullos, a few miles east of Little River. The probable explanation is, that the stream has eroded away the Jackson and has thus brought the Lower Claiborne near to the surface.

The southern boundary of the Jackson-Vicksburg has been very well traced by Hopkins from the Ouachita to the Red River. It runs from a point 3 miles south of Rosefield, near Centerville, crosses Little River 5 miles below Georgetown, and reaches the Red River 5 miles north of Colfax.

Fossils of the Vicksburg stage were collected at only one locality by the Louisiana geological survey, viz, 3 miles south of Rosefield.

Dr. Hilgard[4] mentions *Orbitoides*, *Pecten poulsoni*, and *Ostrea vicks-*

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[1] First Report Louisiana Geological Survey for 1869, published 1870, p. 92.

[2] Geological Reconnoissance of Louisiana, 1869, p. 8.

[3] At Sabinetown, Tex., on the Sabine River, Hilgard, on page 20 of his Supplemental and Final Report of a Geological Reconnoissance of Louisiana, mentions having found Jackson fossils. Mr. E. T. Dumble, in Vol. II, No. 6, of the Journal of Geology, on page 566, referring to the Eocene of Texas, writes: "None of the beds of the Eocene having yielded fossils characteristic of horizons higher than the Lower Claiborne, the deposits referable to that series are confined to its basal portion." On a map of the Eocene of eastern Texas, by W. Kennedy, the beds at Sabinetown are represented as marine beds, which are, according to Mr. Dumble, Lower Claiborne.

[4] Am. Jour. Sci., 2d series, Vol. XLVIII, 1869, p. 340.

burgensis, from the heads of Bear Creek, between Dugdemona Bayou and the Red River. He[1] afterwards refers to this same locality as "7 miles (west) from Little River Ferry." Later the same writer mentions[2] *Orbitoides*, *Arca mississippiensis*, and *Pecten poulsoni* from Bayou Funne Louis.

We possess the following data regarding Vicksburg rocks west of Red River. Dr. Hilgard says:[3]

> At the base of the Grand Gulf rocks we find, on Bayou Taureau, a seam of shell limestone with Vicksburg fossils.

He also mentions[4] *Arca mississippiensis* from this locality.

OLIGOCENE: THE GRAND GULF GROUP.

The Upper Oligocene of Louisiana is represented by the Grand Gulf group of Hilgard. These rocks have been described by Hilgard, Hopkins, Johnson, and Lerch. They are composed of clays, sands, claystones, sandstones, and quartzites. So far no fossils, except a few plants,[5] have been collected and determined from them, but they are referred to the Upper Oligocene because they are without doubt the same as the Grand Gulf of Mississippi, the age of which has been fixed.[6]

The Northern boundary of the Grand Gulf has already in part been outlined in this paper. It runs north from Harrisonburg, flanking the bottom of Ouachita River, to a point about 3 miles south of Rosefield. The line from this point to the Red River has already been indicated. West of the Red River there are excellent exposures at Chopin. Thence the line has been traced to the Sabine River by Hopkins. After crossing the Red River, Hopkins says:

> Reappearing in the Cloutierville and Kisatchie hills, it ranges almost due west to the "Bad Hill," 7 miles south of Many, in De Soto Parish, and reaches Sabine, near the mouth of Bayou Negrut.[7]

The relation of the Grand Gulf to the Vicksburg is a perplexing question, and is one not satisfactorily settled. Pumpelly[8] and Dall and Stanley-Brown[9] have shown that in Florida the Upper Oligocene rests unconformably on the Vicksburg. We have in Louisiana the Vicksburg and the Upper Oligocene, but their relations have not been studied.

The topographic features of the Grand Gulf are interesting. The northern boundary is, when not covered by the subsequent deposits, a

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[1] Supplemental and Final Report of a Geological Reconnoissance of Louisiana, p. 33.
[2] Am. Jour. Sci., 3d series, Vol. XXX, 1885, p. 269.
[3] Am. Jour. Sci., 2d series, Vol. XLVIII, 1869, p. 339.
[4] Supplemental and Final Report of a Geological Reconnoissance of Louisiana, p. 19.
[5] Knowlton: Proc. U. S. Nat. Mus., Vol. XI, 1888, pp. 89-91.
[6] Dall and Stanley-Brown: Bull. Geol. Soc. America, Vol. V, 1894, pp. 164, 167; Smith: Am. Jour. Sci., 3d series, Vol. XLVII, p. 296, April, 1894; Smith: Chart to Geological Map of Alabama, 1894. Dall: Seventeenth Annual Report U. S. Geol. Survey, 1896.
[7] Hopkins: First Annual Report, Geological Survey of Louisiana for 1869, published 1870, p. 99.
[8] Am. Jour. Sci., 3d series, Vol. XLVI, p. 445 et seq., 1893.
[9] Bull. Geol. Soc. America, Vol. V, 1894, p. 162.

rather steep escarpment, facing inland, underneath which the Vicksburg dips.

SPARTA SANDS: AGE UNDETERMINED.[1]

Extending across the central portion of Louisiana are deep quartz sands, whose northern extent is as follows: They reach to T. 16 N., on the Louisiana meridian; the boundary from there passes 2 miles south of Gansville, thence northwest to Sparta. From Sparta the boundary runs south to the northwest corner of Natchitoches Parish, and thence it is formed by Black Lake Bayou and Black Lake, to the mouth of that lake. West of the Red River the line runs from Victoria by Fort Jessup and south to the mouth of Bayou Toreau.[2] Except a narrow strip along the Ouachita River, nearly all of the region between the fluviatile deposits of the Red and Ouachita rivers is covered by these sands. I have not examined the southern boundary west of the Red River. These sands overlap both the Lower Claiborne and the Grand Gulf, extending entirely across the Jackson and Vicksburg.

The material of these deposits is usually almost pure quartz sands, sometimes with reddish coloring matter. In Grant Parish there is a great deal of quartz gravel. In the southern gravelly portion transported fossils have been found.[3]

The topography of this formation is interesting. The rocks are easily eroded, and the hills rise very steeply to a height of 75 to 100 feet above their bases. They are clothed with a forest of long-leaf pines (*P. palustris*), between which there is no undergrowth, so that when one stands on a hilltop his view is obstructed only by the multiplication of trunks in the distance. The whole area is covered with these trees, except in a few places where the Lower Claiborne, Jackson, or Vicksburg forms small Calcareous prairies, and in the "hollows" between the hills. It is a magnificent lumber region.

The sands and gravel of this formation range in thickness from a trifling veneer to 60 and sometimes to 100 feet. Along the contact with the Eocene, as seen near Provencal, there is some clay at the base (see fig. 9, Pl. I). These deposits rest with a distinct unconformity upon the older rocks.

For these sands and gravel the name "Sparta sands" is proposed, because they are well developed near Sparta, in Bienville Parish.

The gravels between Daucheat and Black Lake bayous and west of Black Lake Bayou.—Occupying the divide between Daucheat and Black Lake bayous, and forming the banks of Daucheat in many places, are gravel deposits to which several writers have made reference. They

[1] These sands and gravels have been called drift by Hopkins and Lerch. In order not to venture an opinion as to their age, and not to attempt a correlation of all the superficial upland sands and gravels of northwestern Louisiana, I have proposed a local name, and desire to include under it deposits of whose homogeny and contemporaneity there can be no reasonable doubt.

[2] See Lockett's Topographical Map of Louisiana, 1882. I have seen this line all through the territory except along Black Lake Bayou and Black Lake, and from Victoria to the Sabine River.

[3] Lerch: Preliminary Report upon the Hills of Louisiana, Part II, 1893, p. 104.

are also found west of the Black Lake Bayou at Taylor on the Vicksburg, Shreveport and Pacific Railroad. They can be traced south, and, from what I have seen in southern Bienville Parish, I am inclined to think that they pass into the Sparta sands. Dr. Otto Lerch[1] has described a similar gravel deposit accompanying the Ouachita River.

Sands at Mansfield.—Overlying the Eocene at Mansfield are white sands[2] with small bits of white clay intermingled. Near Burk Place in Bienville Parish I have seen angular bits of white clay in the lower part of a section of the Sparta sands. I do not attempt to correlate the sands at Mansfield, but call attention to this similarity to the Sparta sands.

PLEISTOCENE AND RECENT.

THE SECOND BOTTOMS AND ALLUVIAL VALLEYS.

Lower topographically than the Sparta sands, accompanying the larger streams, are broad flats which occupy an elevation considerably higher than the present alluvial valleys. These flats are especially noticeable along the Red and Ouachita rivers. They have been well described by Dr. Lerch.

Later than the second bottoms and occupying a lower topographic level are the present alluvial valleys.

THE GEOLOGIC SECTION OF NORTHWESTERN LOUISIANA.

The following is the section presented by northwestern Louisiana, as I have made it out:

Recent			Alluvium.
Pleistocene			Second bottoms.
Age undetermined			Sparta sands.
Tertiary.	Oligocene	Upper Oligocene	Grand Gulf group.
		Lower Oligocene	Vicksburg stage.
	Eocene		Jackson stage.
			Cocksfield Ferry beds.
			Lower Claiborne stage.
			Lignitic stage.
Cretaceous			Glauconitic division.

I have not given estimates of the thickness of the Eocene, because the dip is too slight and variable to furnish reliable data, and no records of borings are available.

SUMMARY OF CONCLUSIONS.

1. The Cretaceous of Louisiana belongs to the Glauconitic division, and it seems probable that its deposition was followed by an erosion period.

[1] A preliminary report upon the hills of Louisiana, Part I, 1892, p. 25; Part II, 1893, p. 103.

[2] McGee, in his map of the United States published in Johnson's Cyclopædia, represents these sands as Neocene.

2. (*a*) In Louisiana we find strata probably representing the Lignitic of Alabama in the extreme northwestern corner and at Shreveport. (*b*) The Claiborne of Louisiana, bearing marine fossils, represents the Lower Claiborne stage of Alabama, and it occupies an area more extensive than has hitherto been recognized. In the southern part of the area the beds are much more calcareous than in the northern and northwestern part. The Calcareous strata are probably stratigraphically above the more glauconitic beds to the north and northwest. (*c*) The Mansfield group of Hilgard. (*d*) Dr. Lerch's "Arcadia clays." (*e*) The small prairies or meadows in southern Bienville, northern Winn, and Natchitoches parishes. Subdivisions *c*, *d*, and *e* are Lower Claiborne in age. (*f*) The Upper Lignitic of Dr. Lerch represents beds belonging to two or more different horizons. (*g*) The red clays and red sandy clays in the vicinity of Mount Lebanon and Arcadia are Lower Claiborne in age.

3. Intervening between the Lower Claiborne and Jackson are lignitiferous sands and clays, here called the Cocksfield Ferry beds, which in a general way represent the Claiborne sands of Alabama.

4. The Jackson and Vicksburg stages form a strip of territory between the Red and Ouachita rivers. They resemble each other in lithologic characters so closely that they can be distinguished only by their fossils. Apparently coming between the two stages is a lignitic bed such as is found in Mississippi. West of the Red River Jackson fossils have not been authoritatively reported.

5. The Grand Gulf of Louisiana is Upper Oligocene. Its relations to the Vicksburg are not known.

6. Covering the southern part of the Lower Claiborne area and all of the Jackson and Vicksburg, excepting small spots, and extending over the Grand Gulf are deep quartz sands, sometimes with gravel, which bear a growth of long-leaf pine. These sands rest unconformably on the lower terranes. The name "Sparta sands" is proposed for them.

7. Accompanying the larger streams, occupying lower levels than the Sparta sands, are wide second bottoms. Topographically still lower are the present alluvial valleys.

ANNOTATED BIBLIOGRAPHY OF PAPERS DEALING WITH THE EOCENE PALEONTOLOGY OF LOUISIANA.

ALDRICH, TRUMAN H. Preliminary report on the Tertiary fossils of Alabama and Mississippi.

Bull. No. 1, Ala. Geol. Survey, p. 35, pl. 3, fig. 1, 1886.

Describes *Haminea grandis* from Bunker Hill, La., and refers it to the Jackson group.

CONRAD, TIMOTHY ABBOTT. Observations on the Tertiary and more recent formations of a portion of the Southern States.

Jour. Acad. Nat. Sci., Phila., Vol. VII, p. 116, 1834.

CONRAD, TIMOTHY ABBOTT—Continued.

Makes allusion to "some large Saurian vertebræ" and *Corbula oniscus* from near Monroe. Erroneously speaks of Ammonites being found in the same vicinity. From the presence of *Corbula oniscus* Conrad correctly inferred the existence of Eocene strata in Louisiana. This constitutes the earliest recognition of that fact.

———. Fossil shells of the Tertiary formations of North America.

Reprint Part 3, 1835.

On page 35 allusion is made to the occurrence of Basilosaurus (Harlan) near Monroe. Conrad evidently at that time considered the fossil Cretaceous.

———. Lower Tertiary fossils.

Proc. Acad. Nat. Sci., Phila., p. 33, 1841.

Describes *Cardium nicoletti* from "Washita River, Monroe County," La.

DALL, WILLIAM H. Contributions to the Tertiary fauna of Florida.

Trans. Wagner Free Inst. Sci. Phila., 1890-1892.

Refers to species of Eocene mollusks from Louisiana.

HARLAN, Dr. RICHARD. Notice of fossil bones found in the Tertiary formation of Louisiana.

Trans. Am. Phil. Soc., Vol. IV, p. 397 et seq., 1834.

Announces the discovery of Basilosaurus near Monroe.

———. A notice on the discovery of the Basilosaurus and Batrachiosaurus.

Proc. Geol. Soc. Lond., Vol. III, pp. 23-24, 1839.

———. A letter from Dr. Harlan, addressed to the president, on the discovery of the remains of the Basilosaurus or Zeuglodon.

Read January 9, 1839, Trans. Geol. Soc. Lond., Vol. VI, pp. 67-68, 1842.

HARRIS, GILBERT D. The Tertiary geology of southern Arkansas.

Ark. Geol. Survey, Ann. Rpt. 1892, Vol. II, published 1894.

On pages 177-183 much paleontologic and some stratigraphic data concerning Louisiana are given.

———. Tertiary paleontology of Texas.

Proc. Acad. Nat. Sci., Phila., pp. 45-88, April, 1895.

Allusion is made to a good many fossils from Louisiana.

HEILPRIN, ANGELO. The Tertiary geology of the Eastern and Southern United States.

Jour. Acad. Nat. Sci., Phila., Vol. IX, pp. 150-151, 1884.

Refers to some Vicksburg and Jackson fossils, his remarks being based upon the work of Hopkins and Hilgard.

HILGARD, E. W. Preliminary report of a geological reconnoissance of Louisiana.

Extracted from September number of De Bow's New Orleans Review, p. 8, 1869.

States that Dr. Harlan found the Zeuglodon about halfway between Columbia and Monroe. Hilgard is almost certainly mistaken in regarding this place as the locality whence Harlan obtained the Zeuglodon.

———. Summary of results of a late geological reconnoissance of Louisiana.

Am. Jour. Arts and Sci., Vol. XLVIII, November, pp. 340, 1869.

HILGARD, E. W.—Continued.

Mentions besides Zeuglodon several species from the Vicksburg group, to wit: *Orbitoides, Pecten poulsoni,* and *Ostrea vicksburgensis.* Hilgard says: "In fact, the only locality in Louisiana known to me as distinctly of Jackson age is that already mentioned as the source of the Zeuglodon bones, described by Dr. Harlan, about halfway between Columbia and Monroe, on the Washita." Harlan almost certainly did not mean this locality.

———. Supplementary and final report of a geological reconnoissance of the State of Louisiana.

Made in 1869. (1873.)

On page 29 *Rostellaria velata* is mentioned from Sabinetown, Tex. From this fossil and subsequent collections Hilgard referred these beds to the Jackson group. On page 33 he mentions that about 7 miles west from Little River Ferry we find outcrops of whitish, heavy, concretionary clay marl, with *Orbitoides mantelli, Pecten poulsoni,* and *Ostrea vicksburgensis.*

———. Old Tertiary of the Southwest.

Am. Jour. Arts and Sci., Vol. XXX (new series), p. 269, 1885.

Refers to *Orbitoides, Arca mississippiensis,* and *Pecten poulsoni,* from Bayou Funne Louis.

HOPKINS, Dr. F. V. First annual report of the geological survey of Louisiana.

In La. State Univ. report for 1869, 1870.

A good many names of species of fossils of undoubted Jackson age are given. The Zeuglodon is mentioned from Grand View (on the Ouachita River), Montgomery (on the Red River), and at a point where the Harrisonburg and Columbia roads cross the Catahoula and Caldwell parish line. On page 47 a list of fossils from Montgomery is given. On page 51 some Vicksburg species are listed.

———. Second annual report of the geological survey of Louisiana.

In La. State Univ. report for 1870, 1871.

On page 11 is found a "List of fossils found in Jackson strata of Louisiana (determined by Prof. E. W. Hilgard, of Mississippi University)." On page 17 is found a list of "Fossils of the Vicksburg group in Louisiana (determined by Dr. E. W. Hilgard)." In neither of these lists are localities for the species given.

JOHNSON, LAWRENCE C. Report on the iron regions of northern Louisiana and eastern Texas.

50th Congress, 1st session, House of Representatives, Ex. Doc. No. 195, p. 20., 1888.

Notes the occurrence in Louisiana of fossils comparable to those of the Middle and Lower Claiborne of Alabama.

LERCH, OTTO. A preliminary report upon the hills of Louisiana, Part I, north of the Vicksburg, Shreveport and Pacific Railroad.

Bull. of La. State Exper. Stations, 1892.

On page 28 gives a list of a few species from near Mount Lebanon, and refers them to the Claiborne.

The same, Part II, south of the Vicksburg, Shreveport and Pacific Railroad, 1893.

On page 89 he mentions finding Zeuglodon near Tullos Station, in Catahoula Parish.

MORTON, Dr. S. G. Synopsis of the organic remains of the Cretaceous group of the United States.

Philadelphia, 1834.

On page 24, Morton erroneously speaks of Cretaceous ("ferruginous sands") strata between Alexandria and Natchitoches, and relates that Judge Bry "has also noticed near the township of Washita, on the Washita River, where it is recognized as Belemnites, Ammonites, and Gryphæa."

OWEN, Prof. RICHARD. Observations on the teeth of the Zeuglodon, Basilosaurus of Dr. Harlan.

Proc. Geol. Soc. Lond., Vol. III, 1839, pp. 24 et seq.

Discusses the systematic position of Zeuglodon.

———. Observations on the Basilosaurus of Dr. Harlan (Zeuglodon cetoides, Owen).

Read January 9, 1839.

Trans. Geol. Soc. Lond., Vol. VI, pp. 69–79, 1842.

———. Observations on certain fossil bones from the collection of the Academy of Natural Sciences of Philadelphia.

Jour. Acad. Nat. Sci., Phila., Vol. I (2d series), p. 18 et seq, 1847.

VAUGHAN, T. WAYLAND. Notes on a collection of mollusks from northwestern Louisiana and Harrison County, Texas.

Am. Naturalist, November, 1893.

On page 946 mentions *Ostrea sellæformis* from the northern part of Natchitoches Parish,[1] and refers the strata there exposed to the Claiborne group.

———. Stratigraphy of northwestern Louisiana.

Am. Geologist, Vol. XV, pp. 205–229, April, 1895.

In this paper several lists of species of fossils from Louisiana are published.

LOCALITIES FROM WHICH FOSSILS ARE LISTED IN THIS PAPER.

After each of the Lower Claiborne species a list of the localities at which it is found is given, but the descriptions of the localities are abbreviated. Therefore the exact geographic position of each locality is given here.

The numbers are the station numbers in the record book of the United States National Museum.

LOWER CLAIBORNE LOCALITIES.

BOSSIER PARISH.

2041. Near Redland, SW. ¼ of SW. ¼ of sec. 20, T. 23, R. 12 W.

2042. L. P. Saunders's place on sec. 18, T. 22, R. 12 W.; L. C. Johnson collector.

2416. Near Redland, SE. ¼ sec. 19, T. 23, R. 12 W.; G. D. Harris collector.

WEBSTER PARISH.

2001. On Mount Lebanon road 2 miles east-southeast of Minden, SE. ¼ of SE. ¼ of sec. 26, T. 19, R. 9 W.; L. C. Johnson collector.
NE. ¼ sec. 7, T. 17 N., R. 9 W.; Otto Lerch collector.

[1] Exact locality sec. 32, T. 14, R. 7 W., in Bienville Parish, almost at the Natchitoches line.

CLAIBORNE PARISH.

Near Homer; exact locality not given; Otto Lerch collector.
2040. NE. ¼ of sec. 10, T. 19, R. 6 W.
2043. Near Pittmans Mill, sec. 16, T. 19, R. 7 W.
2038. Pittmans Mill, SW. ¼ of SE. ¼ sec. 19, T. 19, R. 7 W.; L. C. Johnson collector.

LINCOLN PARISH.

2008. Exact locality (?) L. C. Johnson collector.

BIENVILLE PARISH.

The largest single collection was that made by myself during a residence of several years at Mount Lebanon. There are several wells in the vicinity of the town, in the dumps from which I obtained many fossils. One known as Tooke's well is situated in the eastern outskirts of the town; another, known as Roland's well, is 1 mile north, on the road to Gibbsland. Casts of fossils are found in the brownish ferruginous sandstone which abounds in that neighborhood. The best collecting ground is on Hammetts Branch, SW. ¼ sec. 30, T. 18 N., R. 6 W., about 2 miles northeast of Mount Lebanon. The fauna found in these localities is identical. At first I kept all of the specimens carefully separated under their respective locality labels, but later I placed nearly all of them under the general label Mount Lebanon. All of the species from the vicinity of Mount Lebanon, except two or three, were collected at Hammetts Branch.

I also made a collection on sec. 32, T. 14, R. 7 W., in the southern part of the parish.

Mr. L. C. Johnson collected from the following localities:
2033. Holstun's well, 5 miles southeast of Gibbsland.
2034. Holstun's place, sec. 17, T. 18, R. 5 W.
2035. Hammetts Branch, sec. 30, T. 18, R. 6 W.
2036. Well, sec. 6, T. 16, R. 5 W.
2037. Well at Rayburn's place, sec. 29, T. 17, R. 5 W.
2045. Well No. 1, sec. 17, T. 18, R. 6 W.
2046. Well No. 2, sec. 17, T. 18, R. 6 W.
2047. Well No. 3, sec. 16, T. 17,[1] R. 6 W.

NATCHITOCHES PARISH.

2006. Natchitoches; L. C. Johnson, collector.
Natchitoches; strata 1 and 2.[2]
One-half mile northwest of Provencal, on Texas and Pacific Railway.
Victoria; T. W. Vaughan collector.
I collected a good many poor fossils, mostly casts in argillaceous limestone, in the vicinity of Provencal, that are not listed.
Two miles east of Provencal, sec. 26, T. 8 N., R. 8 W.; Lerch and Vaughan collectors.

WINN PARISH.

Couley, sec. 10, T. 10, R. 5 W.
Ten miles northwest of Winnfield; Lerch and Vaughan, collectors.
St. Maurice, at the mouth of Sabine Bayou; T. W. Vaughan, collector.
2005. St. Maurice; Dr. D. S. Waddell, collector.

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[1] This probably should be T. 18.
[2] Am. Geol., Vol. XV, Pl. IX, fig. 5, p. 229, April, 1895.

JACKSON PARISH.

Ten miles east of Liberty Hill, on road to Vernon.
Fourteen miles east of Liberty Hill, on same road; Lerch and Vaughan, collectors.

GRANT PARISH.

Georgetown; Lerch and Vaughan, collectors.

JACKSON LOCALITIES.

GRANT PARISH.

2003. Montgomery; L. C. Johnson, collector.
Montgomery; T. W. Vaughan, collector.

CATAHOULA PARISH.

Tullos-Zeuglodon bones; Lerch and Vaughan, collectors.
Two miles north of Rosefield; presented to the Louisiana Geological Survey.

DESCRIPTIONS OF NEW SPECIES.

PLEUROTOMA LERCHI, sp. nov.

Pl. II, fig. 1.

Form and size indicated by figure. Whorls, 9; 1 and 2 smooth, 3 and 4 costate; remaining whorls devoid of costæ or longitudinal folds. Suture in a depression bordered above and below by a prominent elevated revolving line. The whorls of the spire are concave; the concavity is bordered above and below by a strong revolving line; the upper of these lines is just below the suture, while the lower is just above it. In the medial portion of this depressed region is a beaded revolving line, and sometimes several faint plain revolving lines. The beaded line corresponds in position to the retral sinus. On the body whorl the lower of the above-described prominent revolving lines forms a slight carina. Immediately below this carina is a space, in which is a very fine line, bordered below by a rather prominent line. The position of the suture corresponds to this prominent line. Anterior to this line are fine but distinct revolving striæ, usually alternating in size. Lines of growth indistinct.

Localities.—Hammetts Branch, near Mount Lebanon (type, Vaughan); St. Maurice (Vaughan).

Geological horizon.—Lower Claiborne.

Type in United States National Museum.

PLEUROTOMA SANCTI-MAURITII, sp. nov.

Pl. II, fig. 2.

Form and size indicated by figure. Whorls, 11; 1–3 smooth; 4 minutely costate; 5–9 have about 17 rather faint longitudinal folds below the sinus; 10–11, devoid of longitudinal folds, may be subcarinate. Coarse spiral lines may be distinguished on all of the whorls

except the embryonic. Lines finer in region of sinus. Below humeral angle revolving striæ alternating in prominence and grouped in systems of five, two coarser on the outside, between which is a median finer one; between the median and each outer stria is another still finer. Lines of growth distinct. Sinus moderately deep, situated in the space between humeral angle and suture. Region of sinus slightly concave.

Locality.—St. Maurice (Vaughan, types); 10 miles northwest of Winnfield (Lerch and Vaughan).

Geological occurrence.—Lower Claiborne.

Types in United States National Museum.

PLEUROTOMA LUDOVICIANA, sp. nov.

Pl. II, fig. 3.

Size and form indicated by figure. Unfortunately the apex of the specimen is broken off. The figure shows the number of whorls in type. Whorls slightly concave between suture and the shoulder. Suture margined above by a row of nodules, which projects outward beyond the suture. Surface marked by minute revolving striæ. Retral sinus situated on the humeral angle, and corresponds in position to the nodules that margin the suture superiorly.

Locality.—Hammetts Branch, near Mount Lebanon (Vaughan).

Geological horizon.—Lower Claiborne.

Type in United States National Museum.

PLEUROTOMA SHALERI, sp. nov.

Pl. II, fig. 4.

Size and form indicated by figure. Whorls, 6+. The embryonic whorls are broken off the type. On each of the post-embryonic whorls above the body whorl there are seven gentle longitudinal folds, which decrease in prominence with the increasing age of the shell. On the body whorl the folds have vanished. Suture appressed. Surface coarsely striate spirally. Below the suture is a space, on the body whorl 1 mm. wide, in which there is a single elevated revolving line. Between this space to the suture below there are five coarse striæ; just above the uppermost of these there is a smaller stria. The lowest of the above mentioned striæ borders the suture superiorly. On the back of the rostrum the striæ are finer, crowded, and wavy. Lines of growth rather distinct. Retral sinus situated medially in the whorls of the spire.

This species apparently is most nearly related to *Pleurotoma vaughani* Harris, but is smaller and more robust, and the longitudinal folds are obsolete in the body whorl.

Locality.—Ten miles west of Liberty Hill, on the road to Vernon (Lerch and Vaughan).

Geological horizon.—Lower Claiborne.

Type in the collection of the Louisiana geological survey.

PLEUROTOMA STANTONI, sp. nov.

Pl. II, fig. 5.

Form and size indicated by figures. Whorls, 9½; 1 and 2 smooth (embryonic), 3–9½ costate. On whorl 3 there are nine costæ; the body whorl has eleven. The last two whorls are distinctly carinated. The area between the carina and the suture is concave, and in it the longitudinal folds are almost obsolete. Surface ornamented with minute crowded spiral striæ, which below the carina are wavy and frequently not continuous. Canal slightly curved.

This species is closely related to *Pleurotoma huppertzi* var. *penrosei* Harris, but it is smaller, the last two whorls are more strongly carinated, the costæ are more numerous, the length of the aperture relative to the spire shorter, and the canal is curved.

Locality.—St. Maurice (Vaughan).

Geological horizon.—Lower Claiborne.

Type in the United States National Museum.

BORSONIA LUDOVICIANA, sp. nov.

Pl. II, figs. 6, 6a.

For size and form consult figures. The specimen represented in fig. 6, Pl. II, has 11 whorls; 1 and 2 are smooth; the remaining are crossed by longitudinal folds which are most prominent submedially and tend to vanish in the sutural region. Suture margined inferiorly by a strong elevated revolving line; surface ornamented by prominent spiral lines, which alternate in size on the older whorl (9–11). Whorl 3 has about nine small costæ; whorl 4, eight costæ; 7–11 have six each. Fig. 6a, Pl. II, represents the last whorl of an older specimen, showing that this whorl becomes carinate. In the region of the retral sinus the revolving lines are not so prominent. The columella possesses two strong folds, the upper being the most prominent. On the old specimen, only the last whorl of which is drawn, there is a rudimentary third fold.

This species is closely related to *B. biconica*, Whitfield. It is larger and the spiral sculpture much coarser.

Locality.—Montgomery (Vaughan).

Geological horizon.—Jackson.

Type in United States National Museum.

VASUM HUMEROSUM.

Pl. II, figs. 7, 8.

Size and form indicated by figures. The specimen upon which this species is founded is not very good. Whorls shouldered, about six, each having eight sharp, short, thick, pointed humeral spines; surface

marked by distinct coarse elevated revolving lines; there are several between the shoulder and suture, one on the shoulder and five below it. About two-thirds the distance from the shoulder to the anterior extremity there is a spiral row of spines; one spine for each humeral spine. Anterior to these spines there is a prominent subspinous revolving elevation. Shell umbilicated. On the columella there are three revolving folds, the uppermost the most prominent.

Locality.—Montgomery (Vaughan).

Geological horizon.—Jackson.

Type in United States National Museum.

FUSUS MONTGOMERIENSIS, sp. nov.

Pl. III, fig. 2.

For size and form see figure. Whorls, 10; 1–3 smooth; 4 costate, with obscure revolving lines; 4–7 costate, 13 costæ, four prominent revolving lines, one on the median portion of the whorls, two between this median line and the suture (above), and one below it. The median line and the one below it are about equal in prominence. On 7, finer intermediate lines between the coarser. On whorls 8, 9, and 10 the line on the median portion becomes more prominent, forming a carina. The other revolving lines coarse, alternate in size. Outer lip striate within; columella covered with a deposit of callus, which has striations corresponding to the more prominent revolving striæ of the part of the shell over which it is laid down. There are a few granulations (five can be seen in the type specimen) on the columella callus at the posterior end of the canal.

Locality.—Montgomery (Vaughan).

Geological horizon.—Jackson.

Type in United States National Museum.

CONOMITRA POLITA, sp. nov.

Pl. III, fig. 1.

Form and size indicated by figure. Whorls, 6; surface smooth, polished, without longitudinal folds or costæ. Suture slightly impressed; a short distance anterior to it (on body whorl about .5 mm.) is an impressed revolving line. Between this line and the suture below are a few very faint impressed revolving lines. On the body whorl anterior to the line upon which the suture will be located are about 17 distinct impressed revolving lines. Lines of growth indistinct. Inner lip incurved from the posterior termination of the aperture. Columella straight, with four folds; the anterior is much smaller than the others, which are of about the same size.

This species differs from *C. fusoides*, Lea, to which it is closely related, by the incurving of the inner lip and the entire absence of longitudinal

folds (costæ). The inner lip and columella of *C. fusoides* is straight, and although there are smooth varieties of the species, obscure longitudinal folds are nearly always present.

Locality.—Georgetown (Lerch and Vaughan).

Geological horizon.—Lower Claiborne.

Types in collection of the Louisiana geological survey.

PHOS JOHNSONI, sp. nov.

Pl. III, fig. 3.

Form and size indicated by the figure. The embryonic whorls are so worn that they can not be described. Whorls, about 8; excepting the embryonic, they are regularly and rather coarsely cancellate. On the short beak the revolving lines are alternated in size.

Locality.—Montgomery, La. (Vaughan).

Geological horizon.—Jackson.

Type in United States National Museum.

NISO, sp.

Pl. III, figs. 7, 7a.

The specimens figured are much larger than *N. umbilicata*, Lea, and probably should be considered another species, but as I have no perfect specimens, no name is proposed for it.

Locality.—St. Maurice (Vaughan).

Geological horizon.—Lower Claiborne.

Specimens figured in United States National Museum.

MESALIA PLEBOIDES, sp. nov.

Pl. III, figs. 4, 5, 6.

Size and form indicated by figures. Whorls convex, with a deeply impressed suture, 1–5 smooth. Surface of remaining whorls covered with many revolving, rather coarse, striæ, finer ones often being between the coarser. On the median portion of the fifth to the ninth whorls two of the revolving lines are stronger than the others, giving these whorls a subcarinate appearance. The lower of these striæ may be decidedly more prominent, thus producing a rather decided carination.

This species bears considerable resemblance to the Miocene *Turritella plebeia*, but is smaller, and has not such coarse striæ. The older whorls of the Miocene species in the old forms show indications of loose coiling. I have not seen such in *T. pleboides*.

Localities.—Hammetts Branch, near Mount Lebanon (types Vaughan) wells, sec. 17, T. 18, R. 6 W.; Holstun's place, sec. 17, T. 18, R. 6 W.; and Holstun's well; all in Bienville Parish (L. C. Johnson).

Geological horizon.—Lower Claiborne.

Types in United States National Museum.

ARCA RHOMBOIDELLA, Lea, var.

Pl. III, fig. 8.

At Couley and St. Maurice a peculiar robust variety of this species is found, which I thought worth figuring. This varietal form is shorter and its base more arcuate than is typical for the species.

Geological horizon.—Lower Claiborne.

Figured specimen in collection of the Louisiana Geological Survey.

CARDIUM HARRISI, sp. nov.

Pl. IV, figs. 1, 2.

Shell large, ventricose umbones very prominent, incurved, situated about halfway between the anterior and posterior terminations of the shell. Anterior portion somewhat rostrate; anterior margin gradually rounded. Base gently curved. The posterior margin almost straight, rounding to meet the basal margin. Nineteen broad ribs anterior to the umbonal slope. Posterior to the umbonal slope the ribs do not show on the cast. Length, 74 mm.; height (from basal margin to the highest point of umbonal prominence), 70 mm.; diameter, 56 mm.

The figure and description are made from an excellent internal cast.

Localities.—Mount Lebanon (Lerch), from near Homer, exact locality not known (Lerch); L. P. Saunders's place, sec. 18, T. 22, R. 12 W. (L. C. Johnson); near Redland, SE. ¼ sec. 19, T. 23, R. 12 W. (G. D. Harris); also found at Walnut Bluff, Ouachita County, Ark.[1]

Geological horizon.—Lower Claiborne.

Type in collection of the Louisiana geological survey.

LIST OF FOSSILS.

LOWER CLAIBORNE SPECIES.

VERTEBRATA.

SHARK'S TEETH.

Galeocerdo sp.

Hammetts Branch, near Mount Lebanon (V.).[2]

Lamna sp.

St. Maurice and stratum 2, Natchitoches (V.).

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[1] *Cardium* sp., G. D. Harris, "Tertiary geology of southern Arkansas," Annual Report Arkansas Geological Survey for 1892, Vol. II, p. 142, published 1894. Professor Harris informs me in a private letter that the specimen listed by him as *Cardium* sp. is my *C. harrisi*. He states also that the ribs have broad spines about one-half inch apart on them.

[2] In giving the names of the collectors of the species after the localities the following abbreviations are used: L. C. J.=L. C. Johnson; V.=T. W. Vaughan; L. C. J. and V.=L. C. Johnson and T. W. Vaughan (independently); L. and V.=Dr. Otto Lerch and T. W. Vaughan (jointly).

INVERTEBRATA.

MOLLUSCA.

GASTEROPODA.

Bullinella galba Con.

Hammetts Branch (V.).
Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
Ten miles northwest of Winnfield (L. and V.).

Ringicula biplicata Lea.

Hammetts Branch (V.).
St. Maurice (V.).
Ten miles east of Liberty Hill, on road to Vernon (L. and V.).

Terebra houstonia Harris.

Mount Lebanon (V.).
St. Maurice (V.).
Pittmans Mill (L. C. J.).
Near Pittmans Mill, sec. 16, T. 19, R. 7 W., Claiborne Parish (L. C. J.).
Two miles east by southeast of Minden (L. C. J.).

Terebra texagyra Harris.

Near Mount Lebanon (V.).
St. Maurice (V.).
Rayburn's well (L. C. J.).

Conus sauridens Con.

Mount Lebanon (V.).
St. Maurice (Waddell and V.).
Well at Moreland's place, sec. 16, T. 17, R. 6 W. (L. C. J.).

Pleurotoma texana Gabb.

Mount Lebanon (V.).
St. Maurice (V.).
Rayburn's well (L. C. J.).

Pleurotoma shaleri sp. nov.

Ten miles east of Liberty Hill, on road to Vernon (L. and V.).

Pleurotoma sancti-mauritii sp. nov.

St. Maurice (.V).
Ten miles northwest of Winnfield (L. and V.).

Pleurotoma moorei Gabb.

St. Maurice (V.).
Holstun's place (Miss Dora Holstun).

Pleurotoma gabbii Conrad.

NE. ¼ sec. 7, T. 17 N., R. 9 W., Webster Parish (Lerch).

Pleurotoma retifera Gabb.

Hammetts Branch (V.).
St. Maurice (V.).
Rayburn's well (L. C. J.).

Pleurotoma lerchi sp. nov.

Hammetts Branch (V.).
St. Maurice (V.).

Pleurotoma nodocarinata Gabb.

Hammetts Branch (V.).
St. Maurice (V.).
Pittmans Mill (L. C. J.).
Two miles east by southeast of Minden (L. C. J.).
Rayburn's well (L. C. J.).
Ten miles east of Liberty Hill, on road to Vernon (L. and V.).
Two miles east of Provencal (L. and V.)

Pleurotoma childreni Lea.

Rayburn's well (L. C. J.).
St. Maurice (V.).
Two miles east of Provencal (L. and V.).

Pleurotoma childreni var. *bitota* Harris.

St. Maurice (V.).
Ten miles east of Liberty Hill, on road to Vernon (L. & V.).

Pleurotoma near *childreni* Lea.

Mount Lebanon (V.).

Pleurotoma ludoviciana sp. nov.

Hammetts Branch (V.).

Pleurotoma terebriformis Mr.

Hammetts Branch (V.).
St. Maurice (V.).

Pleurotoma texacona Harris.

Rayburn's well (L. C. J.).

Pleurotoma kellogi Gabb.

Hammetts Branch (V.).
Rayburn's well (L. C. J.).

Pleurotoma cf. *P. huppertzi* Harris's var. *penrosei* Harris.

The sculpture of the Hammetts Branch specimens is not so coarse as that represented in the figure given by Harris; otherwise I could discover no difference.
Hammett's Branch (V.).
Rayburn's well (L. C. J.).

Pleurotoma insignifica Heilprin.

Rayburn's well (L. C. J.).
Two miles east of Provencal (L. and V.).

Pleurotoma stantoni sp. nov.

St. Maurice (V.).

Borsonia biconica Whitfield.

Hammetts Branch (L. C. J. and V.).
Rayburn's well (L. C. J.).
St. Maurice (V.).
Two miles east of Provencal (L. and V.).

Concellaria bastropensis Harris.

Mount Lebanon (V.).

Olivella sp.

A small species, apparently undescribed.
Near Mount Lebanon (V.).
St. Maurice (V.).
Pittmans Mill (L. C. J.).
Holstun's well (L. C. J.).
Ten miles east of Liberty Hill, on road to Vernon (L. and V.).

Ancilla staminea Conrad.

Hammetts Branch (V.).
St. Maurice (V.).
Sec. 17, T. 18, R. 6 W., Bienville Parish (L. C. J.).
Holstun's well (L. C. J.).
Holstun's place, sec. 17, T. 18, R. 5 W. (L. C. J.).
Rayburn's well (L. C. J.).

Ancilla ancillops Heilprin.

NE. ¼ sec. 7, T. 17, R. 9 W., Webster Parish (Lerch).

Monoptygma crassiplica Con.

Mount Lebanon (V.).
Sec. 17, T. 18, R. 6 W., Bienville Parish (L. C. J.).
Rayburn's well (L. C. J.).

Marginella larvata Con.

Hammetts Branch (V.).
Holstuns well (L. C. J.).
Ten miles east of Liberty Hill, on road to Vernon (L. and V.).

Marginella constrictoides Mr. and Ald.

Hammetts Branch (V.).
Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).

Volutilithes petrosus Con.

Hammetts Branch (L. C. J. and V.).
Wells on sec. 17, T. 18, R. 6 W., Bienville Parish (L. C. J.).
Holstun's well (L. C. J.).
Ten miles east of Liberty Hill (L. and V.).
Fourteen miles east of Liberty Hill (L. and V.).
Ten miles northwest of Winnfield (L. and V.).
Georgetown (L. and V.).
St. Maurice (V.).

Volutilithes sayanus Conrad, var. ?

Humeral spines larger than usual in the species; possesses the usual coarse, revolving striæ; may be only a variety of *V. petrosus*.
St. Maurice (V.).

Voluta? sp.

Dall, Trans. Wagner Inst., Vol. III, p. 77, pl. 6, fig. 5a, Aug., 1890.
This species has not been named.
Pittmans Mill (L. C. J.).

Levifusus trabeatoides Harris.

Rayburn's well (L. C. J.).

Caricella demissa Con. var. *texana* Gabb.

Hammetts Branch (V.).
Holstun's well (L. C. J.).

Conomitra polita sp. nov.

Georgetown (L. and V.).

Conomitra texana Harris.

St. Maurice (Waddell).

Fusus mortoni Lea var. *carexus* Harris.

Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
St. Maurice (V.).

Fusus mortoni Lea var. *mortoniopsis* Gabb.

Pittmans Mill (L. C. J.).
Well on sec. 17, T. 18, R. 6 W., Bienville Parish (L. C. J.).
Near Pittmans Mill, sec. 16, T. 19, R. 7 W. (L. C. J.)
Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
Hammetts Branch (L. C. J. and V.)
St. Maurice (Waddell and V.).
Ten miles east of Liberty Hill on road to Vernon (L. and V.).
? Ten miles northwest of Winnfield (L. and V.). This is undoubtedly *F. mortoni*, but as it is only an imperfect cast, probably it was not justifiable in me to refer it to the var. *mortoniopsis* in my "Stratigraphy of Northwestern Louisiana."[1]

Pappilina dumosa Con. var. *trapaquara* Harris.

Hammetts Branch (V.).
NE. ¼ sec. 7, T. 17 N., R. 9 W., Webster Parish (Lerch).

Lapparia dumosa Con.

St. Maurice (V.).

Fusus bastropensis Harris.

Hammetts Branch (V.).
Pittmans Mill (L. C. J.).
Holstuns well (L. C. J.).
St. Maurice (Waddell and V.).

Pyrula (*Fusoficula*) *texana* Harris.

Hammetts Branch (L. C. J. and V.).
Well on sec. 17, T. 18, R. 6 W. (L. C. J.).
Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
NE. ¼ sec. 7, T. 17, R. 9 W., Webster Parish (Lerch).

Ficus sp.

A poor specimen, closely related to *F. mississippiensis*, Con., but sculpture not quite so coarse, and spire somewhat more elevated.

Locality.—St. Maurice (V.).

Clavilithes humerosus Con. var. *texanus* Harris.

Pittmans Mill (L. C. J.).
Holstun's well (L. C. J.).
Hammetts Branch (L. C. J. and V.)
St. Maurice (Waddell and V.).
Fourteen miles east of Liberty Hill, on road to Vernon (L. and V.).

[1] Am. Geol., Vol. XV, p. 217, April, 1895.

Clavilithes penrosei Hpn.

St. Maurice (V.).

Latirus moorei Gabb.

Pittmans Mill (L. C. J.).
Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
Hammetts Branch (L. C. J. and V.).
St. Maurice (Waddell and V.).
Georgetown (L. and V.).

Pseudoliva vetusta Conrad.

Two miles east-southeast of Minden (L. C. J.).
Pittmans Mill (L. C. J.).
Near Pittmans Mill, sec. 16, T. 19, R. 7 W. (L. C. J.).
Well on sec. 17, T. 18, R. 6 W., Bienville Parish (L. C. J.).
Moreland's well, sec. 16, T. 17, R. 6 W., Bienville Parish (L. C. J.).
Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
Well on sec. 6, T. 16, R. 5 W. (L. C. J.).
Hammetts Branch (L. C. J. and V.).
St. Maurice (Waddell and V.).
Ten miles east of Liberty Hill, on road to Vernon (L. and V.).
Fourteen miles east of Liberty Hill, on road to Vernon (L. and V.).
Ten miles northwest of Winnfield (L. and V.).

Cornulina armigera Con.

Two miles east-southeast of Minden (L. C. J.).
Hammetts Branch (V.).

Phos texanus Gabb.

Mount Lebanon (V.).
Rayburn's well (L. C. J.).
Ten miles east of Liberty Hill, on road to Vernon (L. and V.).
Two miles east of Provencal (L. and V.).

Phos scalatus Heilprin.

NE. ¼ sec. 7, T. 17 N., R. 9 W., Webster Parish (Lerch).

Murex (Odontopolys) compsorhytis Gabb.

Hammetts Branch (V.).

Murex vanuxemi Conrad.

St. Maurice (Waddell).

Murex engonatus Con.

Roland's well, Mount Lebanon (Lerch).

Murex cf. *fusates* Harris.

Longitudinal folds acute, but devoid of spines or angular projections.
Holstun's well (L. C. J.).

Distorsio septemdentata Gabb.

Pittmans Mill (L. C. J.).
Near Pittmans Mill, sec. 16, T. 19, R. 7 W. (L. C. J.).
Hammetts Branch (L. C. J. and V.).
Sec. 17, T. 18, R. 6 W., Bienville Parish (L. C. J.
Sec. 17, T. 17, R. 6 W., Bienville Parish (L. C. J.)

Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
St. Maurice (Waddell and V.).
Ten miles east of Liberty Hill, on road to Vernon (L. and V.).
? Ten miles northwest of Winnfield (L. and V.).

Cassidaria planotecta Mr. and Ald.

Rayburn's well (L. C. J.).
St. Maurice (Waddell and V.).
Ten miles northwest of Winnfield (L. and V.).

Phalium globosum Dall.

Pittmans Mill, Rayburn's well (L. C J.).
Mount Lebanon (V.).
NE. ¼ sec. 7, T. 17, R. 9 W. Webster Parish (Lerch).
Ten miles east of Liberty Hill, on road to Vernon (L. and V.).

Cypræa kennedyi Harris.

Hammetts Branch (V.)

Calyptraphorus velatus Con.

Pittmans Mill (L. C. J.).
Near Pittmans Mill, sec. 16, T. 19, R. 7 W. (L. C. J.).
Two miles east-southeast of Minden (L. C. J.).
Well on sec. 17, T. 18, R. 6 W., Bienville Parish (L. C. J.).
Holstuns well (L. C. J.).
Rayburn's well (L. C. J.).
Well on sec. 6, T. 16, R. 5 W., Bienville Parish (L. C. J.).
Hammetts Branch (L. C. J. and V.).

Rimella texana Harris.

Rimella laqueata Vaughan (non-Con.), Am. Geol., Vol. XV, p. 213, April, 1895, belongs to this species.
Hammetts Branch (V.).
St. Maurice (V.).
Ten miles northwest of Winnfield (L. and V.).

Turritella nasuta Gabb.

Pittmans Mill, 2 miles east-southeast of Minden (L. C. J.).
Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
Hammetts Branch (L. C. J. and V.).

Turritella dutexata Harris.

Pittmans Mill (L. C. J.).
Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
Hammetts Branch (V.).
St. Maurice (Waddell).
Ten miles northwest of Winnfield (L. and V.).

Turritella carinata Lea var.

St. Maurice (Waddell and V.).

Turritella apita de Greg.

Ten miles northwest of Winnfield (L. and V.).

Mesalia claibornensis Harris.

Turritella vetusta Vaughan (non-Con.), Am. Geol., Vol. XV, p. 213, April, 1895.
Hammetts Branch (V.).
Holstun's and Rayburn's wells (L. C. J.).

Mesalia pleboides sp. nov.

Hammetts Branch (L. C. J. and V.).
Well on sec. 17, T. 18, R. 6 W., Bienville Parish (L. C. J.)
Holstun's, sec. 17, T. 18, R. 5 W. (L. C. J.).
Holstun's well (L. C. J.).

Tuba antiquata Con.

Rayburn's well (L. C. J.).

Solarium elaboratum Con.

Mount Lebanon (V.)

Solarium scrobiculatum Con.

Hammetts Branch (V.).
St. Maurice (V.).

Solarium alveatum Con.

Mount Lebanon (V.)

Solarium cœlatura Con.?

Moreland's, sec. 16, T. 17, R. 6 W., Bienville Parish (L. C. J.).

Solariella stalagmia Con. var. *modesta* Mr. and Ald.

Pittmans Mill (L. C. J.).

Crepidula lirata Con.

Hammetts Branch (L. C. J. and V.).
Sec. 17, T. 18, R. 6 W., Bienville Parish (L. C. J.).

Calyptræa trochiformis Lam.

Ten miles northwest of Winnfield (L. and V.).

Natica semilunata Lea.

Pittmans Mill (L. C. J.).
Mount Lebanon (V.).
St. Maurice (V.).

Neverita limula Con.

Specimens of the same species as mine in the collection of the United States National Museum and Philadelphia Academy of Natural Sciences are so labeled, and some specimens were thus named for me by Prof. G. D. Harris. Conrad's description is poor and he published no figure.
Pittmans Mill (L. C. J.).
Sec. 17, T. 18, R. 5 W., Bienville Parish (L. C. J.).
Hammetts Branch (V.).

Neverita arata Gabb.

Pittmans Mill.
Near Pittmans Mill, sec. 16, T. 19, R. 7 W. (L. C. J.).
St. Maurice (Waddell and V.)
Ten miles east of Liberty Hill, on road to Vernon (L. and V.).

Liotia granulata Lea.

Mount Lebanon (V.).

Actæon punctatus Lea.

St. Maurice (V.).
Hammetts Branch (V.).

Actæon lineatus Lea.

St. Maurice (V.).

Niso sp.

St. Maurice (V.).

SCAPHOPODA.

Dentalium minutistriatum Gabb.

Pittmans Mill (L. C. J.).
Two miles east-southeast of Minden (L. C. J.).
Hammetts Branch (V.).
St. Maurice (V.).
Ten miles east of Liberty Hill, road to Vernon.
Two miles east of Provencal.
Ten miles northwest of Winnfield (L. and V.).

Cadulus juvenis Mr.

A small species, apparently *juvenis*. Specimens not perfect.
St. Maurice (V.).

Cadulus subcoarctatus Gabb.

Specimens not well preserved. Apparently belong to this species.
St. Maurice (V.).

PELECYPODA.

Ostrea divaricata Lea.

Two miles east-southeast of Minden (L. C. J.).
Sec. 17, T. 18, R. 6 W., Bienville Parish (L. C. J.).
Hammetts Branch (V.).
Ten miles northwest of Winnfield (L. and V.).

Ostrea alabamiensis Lea.

Ten miles northwest of Winnfield (L. and V.).

Ostrea sellæformis Con.

Sec. 32, T. 14, R. 7 W., Bienville Parish (L. and V. independently).
Upper stratum at Natchitoches (V.).
One-half mile northwest of Provencal (V.).
Victoria (V.).

Anomia ephippoides Gabb.

Pittmans Mill (L. C. J.). Two miles east-southeast of Minden (L. C. J.). Holstun's well (L. C. J.). Moreland's place, sec. 16, T. 17, R. 6 W., Bienville Parish (L. C. J.).
Hammetts Branch (V.). Mount Lebanon in general (V.). Sec. 32, T. 14 N., R. 7 W., Bienville Parish (V.). Victoria (V.). One-half mile northwest of Provencal (V.). Stratum 1 at Natchitoches (V.).

Pecten deshayesii Lea.

St. Maurice (Waddell and V.).

Pecten claibornensis Con.

Hammetts Branch (V.).
St. Maurice (V.).
Ten miles northwest of Winnfield (L. and V.).

Plicatula filamentosa Con. var.

The specimens which are referred to this species have not as many or as minute radiating lines as those from Claiborne, Ala.
St. Maurice (V.).
Two miles east of Provencal and Couley (L. and V.).

Plicatula planata Mr. and Ald.

St. Maurice (Waddell).

Arca rhomboidella Lea.

Two miles east-southeast of Minden (L. C. J.).
Hammetts Branch (V.).
Rayburn's well (L. C. J.).

Arca rhomboidella Lea var.

St. Maurice (Waddell and V.).
Couley (L. and V.).

Trigonarca decisa Con.

Hammetts Branch (V.).

Limopsis aviculoides Con.

Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
Mount Lebanon (V.).
St. Maurice (Waddell and V.).
Two miles east of Provencal (L. and V.).
Couley (L. and V.).
Ten miles northwest of Winnfield (L. and V.).

Pectunculus stamineus Con.

Hammetts Branch (V.).

Pectunculus declivis Con.

Holstun's well (L. C. J.).
Rayburn's wells (L. C. J.).
Hammetts Branch (V.).

Nucula magnifica Con.

Pittmans Mill (L. C. J.).
Two miles east-southeast of Minden (L. C. J.).
Holstun's well (L. C. J.).
Sec. 17, T. 18, R. 6 W. (L. C. J.).
Sec. 17, T. 17, R. 6 W. (L. C. J.).
Hammetts Branch (V.).

Leda semen Lea.

Hammetts Branch (V.).

Verticordia eocensis Langdon.

St. Maurice (V.).

Periploma collardi Harris.

St. Maurice (Waddell and V.).

Venericardia planicosta Lam.

Pittmans Mill (L. C. J.).
Near Pittmans Mill, on sec. 16, T. 19, R. 7 W. (L. C. J.).
Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
Hammetts Branch and the vicinity of Mount Lebanon in general (V.).
St. Maurice (V.).
Ten miles east of Liberty Hill, on road to Vernon (L. and V.).
Georgetown (L. and V.).

As casts in ferruginous sandstone L. C. Johnson found it on NE. ¼ of sec. 10, T. 19, R. 6 W., Claiborne Parish, and collected a splendid suite from Lincoln Parish. Mr. Johnson also collected it in Harrison County, Tex., as casts in the same material. I have found similar casts in the vicinity of Mount Lebanon, a few miles south of Arcadia on the road to Liberty Hill, and 6 miles south of Gibbsland on the railroad from that place to Bienville.

Venericardia rotunda Lea.

Hammetts Branch (V.).

Venericardia alticostata Con. var.

Locality.—St. Maurice (Waddell and V.).
Stratum 2, Natchitoches (V.).
One-half mile northwest of Provencal (V.).

Venericardia sp. near *sillimani* Lea.

Hammetts Branch (V.).

Meretrix poulsoni Con.

Hammetts Branch (V.).

Crassatella protexta Con.

Pittmans Mill (L. C. J.).
Hammetts Branch (V.).

Crassatella texana Heilprin.

St. Maurice (Waddell).

Crassatella sp. cf. *texana* Heilprin.

Resembles *C. texana*, but is too elongate for that species and is not sufficiently elongate for *C. protexta*.

Crassatella texalta Har.?

Dr. Lerch and I found at 10 miles northwest of Winnfield an internal cast of a *Crassatella* which apparently belongs to this species.

Corbula texana Gabb.

Hammetts Branch (V.).

Corbula alabamiensis Lea, small var.

Holstun's well (L. C. J.), Rayburn's well (L. C. J.).
Hammetts Branch (V.).
Ten miles east of Liberty Hill, or road to Vernon (L. and V.).

Corbula oniscus Con.

These specimens probably belong to var. *fossata* of Meyer and Aldrich. They consist of external casts.
Ten miles northwest of Winnfield (L. and V.).

Corbula oniscus Con. var. *fossata* Mr. and Ald.

Hammetts Branch (V.).

Corbula aldrichi Mr. var. *smithvillensis* Harris.

NE. ¼ sec. 7, T. 17 N., R. 9 W. (Lerch).
Stratum 2, Natchitoches (V.).

Corbula sp.

A small species, subtrapezoid in form, valves not ventricose, marked by rather coarse concentric rugæ.
Hammetts Branch (V.).

Mactra sp.

A small, delicate, very fragile species, resembling *M. parilis* somewhat, but certainly distinct.
Hammetts Branch (V.).

Pholadomya claibornensis Ald.

St. Maurice (Waddell and V.).
Two miles east of Provencal as a cast in limonitic iron ore (V.).

Pteropsis conradi Dana.

L. P. Saunders's place, sec. 18, T. 22, R. 12 W. (L. C. J.).
Hammetts Branch and Mount Lebanon in general (V.).
This species is frequently found in northern Louisiana as casts in ferruginous sandstone.

Protocardia gambrina Gabb.

Hammetts Branch (V.).
Ten miles northwest of Winnfield (L. and V.).
I collected an internal cast of what is probably this species at St. Maurice.

Cardium harrisi sp nov.

Mount Lebanon (Lerch).
Near Homer, exact locality not known (Lerch).
L. P. Saunders's place, sec. 18, T. 22, R. 12 W. (L. C. J.).
Near Redland, SE. ¼ sec. 19, T. 23, R. 12 W. (G. D. Harris).

Sphærella (?) *anteproducta* Harris.

Mount Lebanon (V.).
St. Maurice (Waddell and V.).
Fourteen miles east of Liberty Hill, on road to Vernon.

Astarte tellinoides Con.

Hammetts Branch (V.).

ANTHOZOA.

Flabellum cuneiforme Lons. var. *pachyphyllum* Gabb and Horn.

Pittmans Mill (L. C. J.).
Two miles east-southeast of Minden (L. C. J.).
Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
Moreland's place, sec. 16, T. 17, R. 6 W. (L. C. J.).
Sec. 17, T. 18, R. 6 W. (L. C. J.).
Hammetts Branch and Mount Lebanon in general (V.)

Turbinolia phraretra Lea.

Holstun's well (L. C. J.).
Rayburn's well (L. C. J.).
Hammett's Branch (V.).

Discotrochus orbignianus Edwards and Haime.

Pittmans Mill (L. C. J.).
Holstun's well (L. C. J.).

Endopachys maclurii Lea.

Holstun's well (L. C. J.).
Sec. 17, T. 18, R. 6 W., Bienville Parish (L. C. J.).
Hammetts Branch (L. C. J. and V.).
St. Maurice (V.).
Mount Lebanon (in the town) (V.).
Stratum 2, Natchitoches (V.),

New species of corals belonging to the following genera have been discovered in the Lower Claiborne of Louisiana:

Flabellum 1 n. sp. and 1 n. var. of *F. cuneiforme* Lons.
Turbinolia 1 n. sp.
Paracyathus 2 n. sp.
Stylophora 1 n. sp.
Amphihelia 1 n. sp.
Dendrophyllia 2 n. sp.

Making a total of twelve species of corals plus one variety.

In stratum 2 at Natchitoches indeterminable fragments of a *Balanophyllia* and a *Eupsammia* were found.

JACKSON SPECIES.

Creole Bluff is the only place from which a large collection of Jackson fossils was made. Mr. L. C. Johnson made the first collection. I made the second. I collected all of the species listed except *Cassidaria petersoni* and the Zeuglodon bones which were presented to the United States Geological Survey.

VERTEBRATA.

Basilosaurus macrospondylus Harlan (*Zeuglodon cetoides* Owen).

INVERTEBRATA.

CRUSTACEA.

Numerous detached crab claws.

ECHINODERMATA.

Scutella sp. fragments abundant.

MOLLUSCA.

GASTEROPODA.

Bullinella jacksonensis Mr.
Scaphander grandis Ald. Very large specimens.
Terebra cf. *polygyra* Con. A small, slender species, consisting of about 12 whorls, marked longitudinally by numerous small costæ; an impressed revolving line slightly anterior to the suture. Canal curved. The sculpture is too fine for *T. tantula*. It is close to *T. polygyra* Con. and *T. texagyra* Harris. The form and longitudinal sculpture are about the same as those of the former species, but the line below the suture is not so much impressed and is nearer the suture. It differs from *T. texagyra* by having finer costæ, and the line below the suture is not as much impressed. I have only one specimen, and that does not fit any species precisely; apparently it is nearest *T. polygyra*.
Conus tortilis Con.
Conorbis alatoides Ald.
Pleurotoma rotædens Con.
americana Ald.
(*Ancistrosyrinx*) *columbaria* Ald.
Mangilia meridionalis Mr.? Probably this species. Without seeing the type I can not make a positive identification.

Borsonia ludoviciana sp. nov.
Eucheilodon creno-carinata Hpn.
Cancellaria, 2 sp. = *C. plicata*, Lea ? and *C. mississippiensis* Con. ?
Margininella semen Lea.
Volutilithes petrosus Con.
Caricella subangulata Con.
Vasum humerosum sp. nov.
Mitra millingtoni Con.
Fusus pearlensis Ald.
Fusus montgomeriensis sp. nov.
Papillina dumosa Con.
Lapparia dumosa Con. (= *pactilis* Con.).
Clavilithes humerosus Con.
Mazzalina inaurata Con.
Latirus jacksonensis Ald.
Ficus mississippiensis Con.
Pseudoliva vetusta Con.
Phos cf. *hilli* Harris. This species is slightly larger than *P. hilli*; its longitudinal folds are more prominent and less numerous (from 6 to 8 on the body whole, while in *P. hilli* there are about 10); spiral sculpture not so pronounced. Every one of these characters is subject to variation, so the species may be, and probably is only a variety of *P. hilli*.
Phos johnsoni sp. nov.
Cassidaria petersoni Con.
Calyptraphorus velatus Con.
Aporrhais (*Platyoptera*) *extenta* Con. Represented by a fragment only.
Turritella arenicola Con.
alveata Con.
clevelandia Harris.
Solarium alveatum Con.
claboratum Con. var. *acutum* Con.
sp. near *elaboratum*, but has two elevated revolving lines within the umbilicus, and constitutes at least a distinct variety.
sp. nov.? A small species grouping with *elaboratum*. The specimens are not very good.
bellastriatum Con.
triliratum Con.
Serpulorbis granifera Say.
Xenophora humilis Con. (= *Xenophora reclusa* Vaughan, not Conrad, in Am. Geol., Vol. XV, p. 223, April, 1895).
Calyptræa trochiformis Lam.
Amalthea americana Con.
pygmæa Lea.
Natica permunda Con.
Lunatia eminula Con.
vicksburgensis Con.
Actæon punctatus Lea.
Umbrella planulata Con.

SCAPHOPODA.

Dentalium thalloides Con.
danæ Mr.
Cadulus jacksonensis Mr.

PELECYPODA.

Ostrea trigonalis Con.
Pecten nuperus Con.
calvatus Morton.

Avicula sp. Represented by fragments, probably *A. claibornensis* Con.
Pinna sp. Represented by fragments, probably *P. argentea* Con.
Navicula cuculloides Con.
Limopsis radiatus Mr.
Pectunculus filosus Con.
Nucula meridionalis Mr.
magnifica Con. A small variety or young specimens.
Leda multilineata Con.
Venericardia planicosta Lam.
jacksonensis Con.
parva Lea. var. The specimens have only 17 ribs, a smaller number than is typical for the species. They are identical with a specimen in the United States National Museum from Cornish Ferry, Saline River, Arkansas, and labeled by Prof. G. D. Harris *V. parva* Lea.
Meretrix mississippiensis Con.
sobrina Con.
mortoni Con.
Alveinus minutus Con.
Crassatella flexura Con.
Corbula bicarinata Con.
alabamiensis Lea. Small var.
Cardium nicoletti Con.
Astarte parilis Con.
Lucina smithi Mr. ?
choctavensis Mr.
Tellina cf. *vicksburgensis* Con.
Teredo mississippiensis Con.

ANTHOZOA.

Flabellum cuneiforme Lons. var. *wailesii* Con.
Turbinolia pharetra Lea var.
Trochocyathus lunulitiformis Con.
Balanophyllia irrorata Con.
Endopachys maclurii Lea var. *triangulare* Con.

Besides these corals there are new species belonging to the following genera:
1 n. gen., including 1 n. sp. belonging to the Turbinolidæ and related to Platytrochus in the character of the columella.
Caryophyllia 1 n. sp.
Parasmilia 1 n. sp.
Astrangia 1 n. sp.

PROTOZOA.

Orbitoides mantelli Morton.

From a locality about 2 miles north of Rosefield, near the Catahoula-Caldwell parish line, the Louisiana geological survey has a small collection of Jackson fossils. The fossils were embedded in an indurated shell agglomerate. By breaking them out a sufficient number was identified to determine the horizon. The following is a list of the species:

Scaphander primus Aldrich ?
Volutilithes petrosus Con.
Fusus sp.
Mazzalina inaurata Con.
Lunatia eminula Con.
Cadulus sp.
Arca sp.
Nucula sp.
Meretrix sobrina Con.
Corbula bicarinata Con.
Cardium nicolletti Con.
Cardium sp.
Flabellum cuneiforme Lonsdale.
F. cuneiforme var. *wailesii* Con.
Parasmilia Jackson species.

The following are the localities in Louisiana from which Zeuglodon bones have been reported:

1. Tullos, Catahoula Parish, from a cutting on the railroad between Alexandria and Monroe (Lerch and Vaughan).
2. Montgomery, Grant Parish (Hopkins).
3. Grand View, on the Ouachita River (Hopkins).
4. Where the Harrisburg and Columbia road crosses the Catahoula-Caldwell parish line (Hopkins).

VICKSBURG SPECIES.

I have seen Vicksburg fossils from only one locality in Louisiana, viz, about 3 miles south of Rosefield, in Catahoula Parish (Lerch and Vaughan collectors). The species collected are:

Dentalium mississippiensis Con.
Ostrea vicksburgensis Con.
Pecten poulsoni Morton.
Arca mississippiensis Con.
Byssoarca lima Con.
Pectunculus arctatus Con.
Crassatella mississippiensis Con.
Meretrix sobrina Con.
Balanophyllia caulifera Con.
Orbitoides mantelli Morton.

PLATES.

PLATE I.

EXPLANATION OF PLATE I.[1]

FIG. 1. Section at Slaughter Pen Bluff, at the head of Cross Lake, one-half mile above Shreveport. (Reduced from figure in L. C. Johnson's Iron Regions of Louisiana and Texas, p. 18.) This section probably is Lignitic.

FIG. 2. Section of Lower Claiborne on Hammetts Branch, SW. ¼ sec. 30, T. 18 N., R. 6 W., 2 miles northeast of Mount Lebanon. No. 1 grades into 2, and 5 is derived from 6 by oxidation.

FIG. 3. Section of Lower Claiborne in the first railroad cutting west of Arcadia. Length of cutting, 1,040 feet; depth, 15 feet.

1. Red clay with some sand passing into
2. Gray laminated clay ("Arcadia clays") passing into
3. Black, thinly laminated clay.

FIG. 4. Section of Lower Claiborne 6¼ miles south of Gibbsland, on the Louisiana and Northwestern Railway. Length of cutting, 510 feet; depth, 16½ feet.

1. Red clay, with some sand in the upper portion, passing into
2. Gray laminated clay ("Arcadia clays") passing into
3. Black, thinly laminated clay.

FIG. 5. Section of Lower Claiborne one-half mile north of Natchitoches, on Old River. No. 1 is a yellow calcareous marl with calcareous nodules, forming a prairie soil. *Ostrea sellæformis* and an *Orbitulina*-like foraminifer are very abundant in many places on the surface. Below the surface a few feet sometimes fossils are numerous; sometimes only calcareous nodules are present.

Below the lignite seam (3) the laminated sands and clays sometimes show cross bedding.

FIG. 6. Section of bluff on Saline Bayou one-half mile above St. Maurice, showing fossiliferous Lower Claiborne (4), overlaid by the Cocksfield Ferry beds (2). I do not know whether 3 should be referred to the same category as 4 or classed with 2. The whole section, excepting 1, is one conformable series. No. 1 is gravel, probably of Columbia age.

FIG 7. Section at Cocksfield Ferry, showing the Cocksfield Ferry beds, lower part of section unexposed. No. 1 is gravel, probably of Columbia age.

FIG. 8. Section near the upper end of the bluff at Montgomery showing the Jackson 2, 3, and 4 overlying the Cocksfield Ferry beds 6 and 7.

FIG. 9. Section one-half mile west of Provencal, on the Texas and Pacific Railway, showing what is probably the basal contact of the Sparta sands. Cutting 240 feet long, 8 feet deep.

1. Yellowish sand with some clays, resting uncomformably on
2. Stratified red clay with white clay partings, mantled by soil 2′, probably Eocene.
3. Hematitic iron ore developed along the contact of 1 and 2.

Sections drawn by D. W. Cronin.

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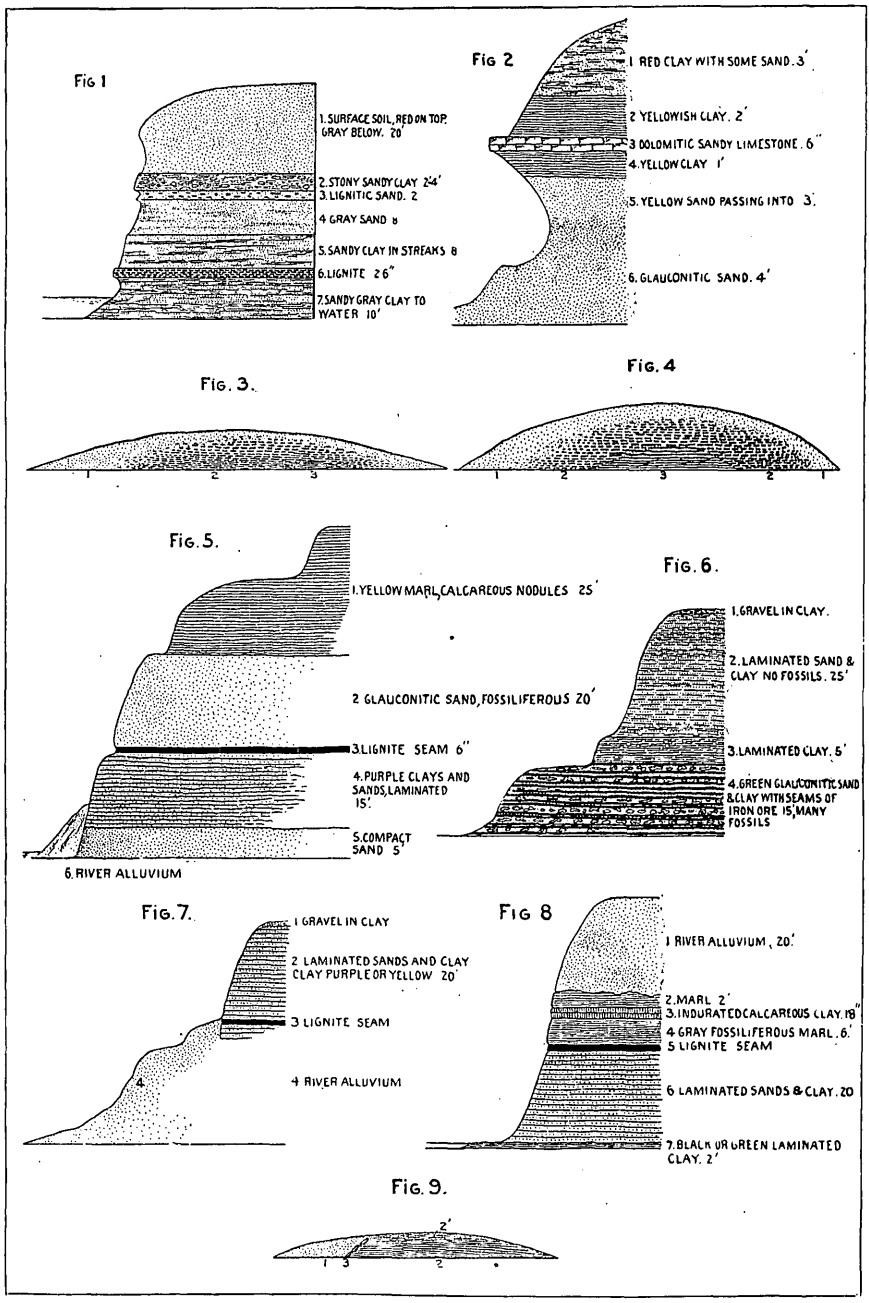
[1] This plate is the same as pl. ix in vol. xv of the American Geologist, 1895.



GEOLOGIC SECTIONS SHOWING THE CHARACTER OF THE EOCENE BEDS OF LOUISIANA.

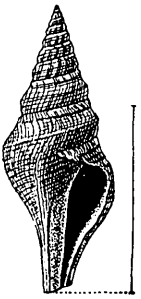
PLATE II.

EXPLANATION OF PLATE II.

FIG. 1. *Pleurotoma lerchi* sp. nov. (p. 32).
FIG. 2. *Pleurotoma sancti-mauritii* sp. nov. (p. 32).
FIG. 3. *Pleurotoma ludoviciana* sp. nov. (p. 33).
FIG. 4. *Pleurotoma shaleri* sp. nov. (p. 34).
FIG. 5. *Pleurotoma stantoni* sp. nov. (p. 34).
FIG. 6. *Borsonia ludoviciana* sp. nov. A specimen not fully grown, but perfect (p. 34).
FIG. 6a. *Borsonia ludoviciana.* The last whorl of an older specimen, showing the carination of the whorl (p. 34).
FIG. 7. *Vasum humerosum* sp. nov. Aperture view natural size (p. 34).
FIG. 8. *Vasum humerosum.* Dorsal view natural size (p. 34).

Figs. 1, 3, and 4 were drawn by J. Henry Blake; figs 2, 6, 6a, 7, and 8 by J. L. Ridgway; fig. 5 by H. Chadwick Hunter.

1



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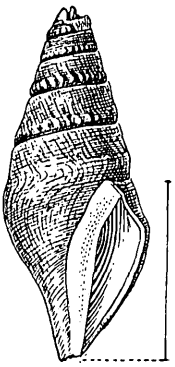

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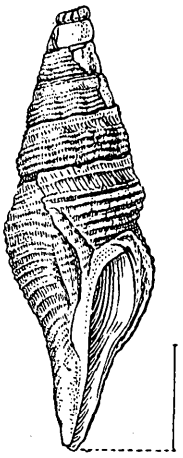

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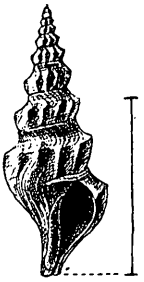

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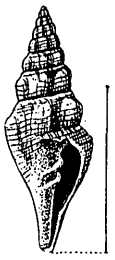

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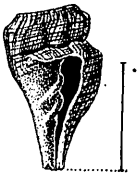

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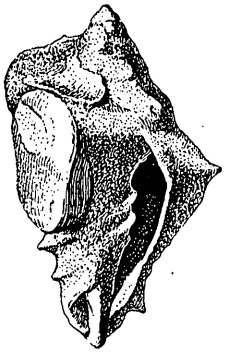

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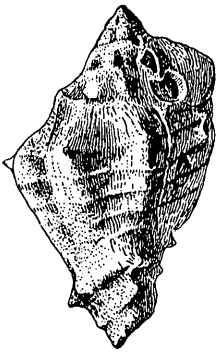


8

EOCENE FOSSILS OF LOUISIANA.

PLATE III.

EXPLANATION OF PLATE III.

FIG. 1. *Conomitra polita* sp. nov. (p. 35).

FIG. 2. *Fusus montgomeriensis* sp. nov. (p. 35).

FIG. 3. *Phos johnsoni* sp. nov. (p. 36).

FIG. 4. *Mesalia pleboides* sp. nov. A young specimen showing the apical whorls enlarged about 8 times (p. 36).

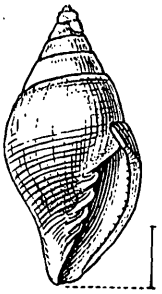
FIG. 5. *Mesalia pleboides.* An ordinary specimen. The apical whorls are broken off the specimen figured, but were drawn in from another specimen (p. 36).

FIG. 6. *Mesalia pleboides.* A part of the last whorl of the specimen represented in fig. 5, much enlarged to show sculpture of the surface (p. 36).

FIGS. 7 and 7a. *Niso* sp. Natural size (p. 36).

FIG. 8. *Arca rhomboidella* Lea var. (p. 37).

Figs. 1, 4, 5, and 6 were drawn by J. Henry Blake; figs. 2, 3, 7, and 7a by J. L. Ridgway.



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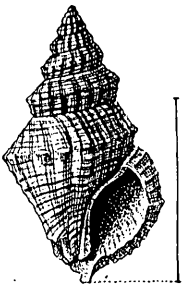

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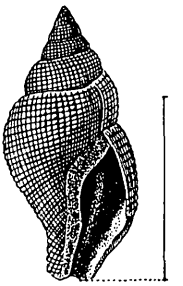

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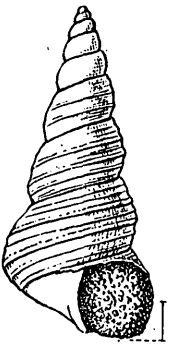

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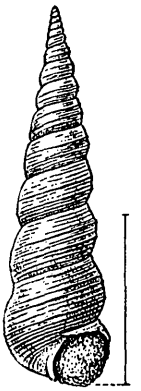

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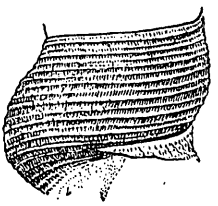

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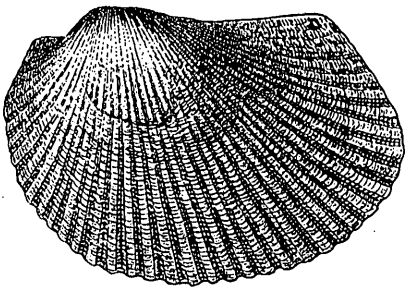


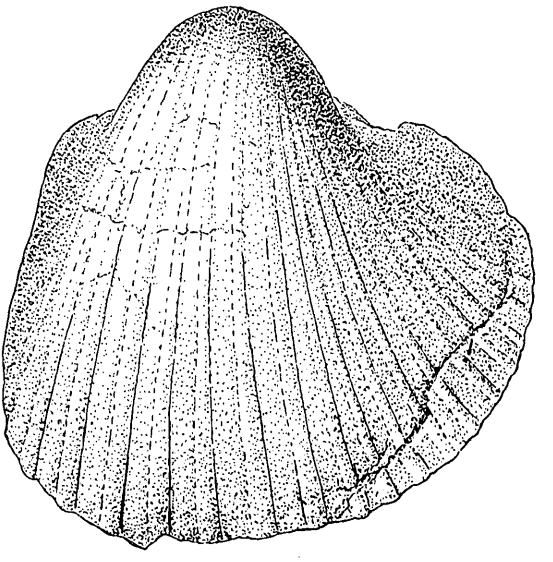
8

EOCENE FOSSILS OF LOUISIANA.

PLATE IV.

EXPLANATION OF PLATE IV.

FIGS. 1 and 2. *Cardium harrisi* sp. nov. Natural size (p. 37) Drawn by J. Henry Blake.



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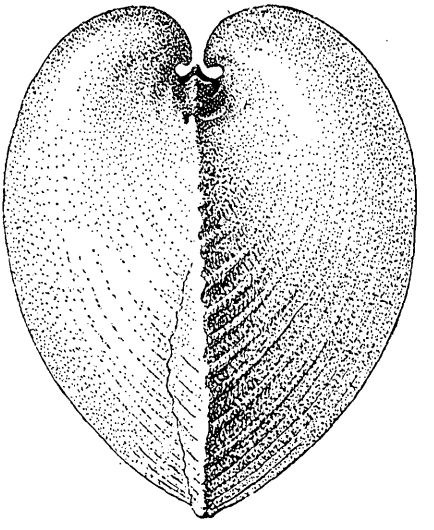

2

EOCENE FOSSILS OF LOUISIANA.

INDEX.

[Descriptions of species appear on pages indicated by italic figures.]