Pre-Selma Larger Invertebrate Fossils From Well Core Samples in Western Alabama

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STUDIES OF PRE-SELMA CRETACEOUS CORE SAMPLES FROM THE OUTCROP AREA IN WESTERN ALABAMA

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ABSTRACT

This chapter records a dominantly molluscan shallow-water, near-shore marine fauna from the sands in the upper third of the Eutaw formation, in the Crawford hole, southern Perry County, Ala. The zone of *Ostrea cretacea* is interpreted as an oyster bank accumulation. In the lower two-thirds of the Eutaw formation the fauna is dominated by crustaceans and fish.

Cores from the Webb hole, northern Perry County, Ala., yielded a shallow-water marine molluscan assemblage from the Eoline member of the Coker formation. On the basis of the fauna, the Eoline member is correlated with the Woodbine formation of Texas, and affinities with the fauna of the Lewisville member of the Woodbine are noted.

INTRODUCTION

Upper Cretaceous invertebrate megafossils of a pre-Selma age were obtained from cores of two exploratory wells dealt with in this bulletin: the Webb hole and the Crawford hole. The Webb cores yielded a dominantly molluscan assemblage from the Eoline member of the Coker formation; the Crawford cores yielded a smaller but more varied fauna from both the Eutaw and McShan formations, including sponge, bryozoan, molluscan, crustacean, and echinodermal elements.

The cores were examined and cut by L. W. Stephenson and the author in Tuscaloosa, Ala., during a joint field trip in March 1955. The crustaceans obtained from the lower part of the Eutaw formation in the Crawford hole were identified by Henry J. Roberts of the U.S. National Museum. The fish remains from the same interval were identified by D. H. Dunkle, also of the U.S. National Museum.

Illustrations of the several fossil species have not been included, as better preserved material has been illustrated in several publications, especially in those by Stephenson cited in the text; additional references can be found by consulting the bibliographies provided in his papers.

DESCRIPTION OF CORE AND LIST OF FOSSILS FROM CRAWFORD HOLE

In the following descriptions of cores and the accompanying lists of fossils, the cited numbers of fossil collections are those assigned in the U.S. Geological Survey Mesozoic locality register. The depth intervals of the cores are those assigned by Monroe (1955). The colors of the sediments, as noted, are the visual estimates of the author.

SE¼NW¼ sec. 15, T. 18 N., R. 8 E.,
Perry County, Ala., altitude 184 feet

	Depth (feet)
Mooreville chalk, lower part:	
Upper part of core 2 (USGS 25522)	24. 3– 25. 8
A. Sandstone, light-gray, medium- to fine-grained, calcareous.	
Ostrea cretacea Morton	
Anomia preolmstedi Stephenson?	
Exogyra sp.	
Fish vertebrae	
B. Sand, greenish-gray, medium.	
Ostrea cretacea Morton	
Exogyra cf. *E. upatoiensis* Stephenson	
Pecten sp.	
Cardium sp.	
Fish vertebrae	
Upper part of core 3	25. 8– 26. 3
Sand, greenish-gray, medium to fine, some glauconite and phosphatic pellets. (Fossils present but not described specifically from this 0. 5-ft unit.)	
Eutaw formation:	
Core 3 (USGS 25523)	26. 3– 36. 1
Sand, greenish-gray, medium to fine, sparingly glauconitic, some zones a coquina of *Ostrea cretacea.*	
Clione sp. (boring sponge)	
Cyclostomatous Bryozoa	
Cheilostomatous Bryozoa	
Ostrea cretacea Morton	
Exogyra upatoiensis Stephenson	
Gryphaea wratheri Stephenson	
Plicatula sp.	
Anomia preolmstedi Stephenson	
Shark tooth	
Upper part of core 4 (USGS 25525 A)	36. 1– 51. 8
Sand, olive-gray, fine, sparingly glauconitic, micaceous, and fossiliferous; fossils preserved as thin films of altered shell material covering internal molds.	
Cardium (Trachycardium) ochilleanum Stephenson?	
sp.	
Cymbophora? sp.	

SE¼NW¼ sec. 15, T. 18 N., R. 8 E., Perry County, Ala., altitude 184 feet—Continued

	Depth (feet)
Eutaw formation—Continued	
Bottom part of core 4 (USGS 25525 B)	36. 1– 51. 8
Sand, grayish-green, medium-grained, glauconitic, sparingly micaceous.	
Ostrea sp. (immature)	
Cardium (*Trachycardium*) *ochilleanum* Stephenson?	
Upper part of core 5 (USGS 25526 A)	51. 8– 71. 9
Sand, same as preceding.	
Cardium (*Trachycardium*) *ochilleanum* Stephenson?	
Bottom part of core 5 (USGS 25526 B)	51. 8– 71. 9
Sand, same as preceding.	
Clione sp. (boring sponge)	
Ostrea battensis Stephenson	
sp.	
Cardium (*Trachycardium*) *ochilleanum* Stephenson?	
Shark tooth	
Upper part of core 6 (USGS 25527)	71. 9– 87. 2
Sand, olive-gray, fine, slightly argillaceous, sparingly glauconitic, micaceous.	
Nuculana? sp.	
Nemodon cf. *N. brevifrons* Conrad	
Ostrea battensis Stephenson?	
sp. (immature)	
Lucina sp.	
Linearia cf. *L. metastriata* Conrad	
Cymbophora sp.	
Shark teeth	
Middle of core 6 (USGS 25528)	71. 9– 87. 2
Sandstone, greenish-gray, medium-grained, glauconitic, sparingly micaceous.	
Clione sp. (boring sponge)	
Hardouinea cf. *H. bassleri* (Twitchell)	
Trigonarca sp.?	
Ostrea battensis Stephenson	
Cardium (*Trachycardium*) sp.	
Cyclorisma? sp.	
Cyprimeria? sp.	
Bottom part of core 6 (USGS 25529)	71. 9– 87. 2
Sand, olive-gray, medium, glauconitic, sparingly micaceous.	
Ostrea battensis Stephenson	
Exogyra upatoiensis Stephenson	
Upper part of core 8 (USGS 25530)	97. 5–108. 1
Sand, greenish-gray, fine to medium, argillaceous, glauconitic, micaceous.	
Macruran (indet.-fragments of carapace)	
Shark tooth, vertebra	

SE¼NW¼ sec. 15, T. 18 N., R. 8 E., Perry County, Ala., 184 feet—Continued

	Depth (feet)
Eutaw formation—Continued	
Bottom of core 9 (USGS 25531)	108. 1–118. 4
Clay, gray, silty, finely micaceous.	
? *Galathea* sp. (carapace and abdominal segments)	
Macruran (one abdominal segment)	
Middle part of core 10 (USGS 25532)	118. 4–129. 1
Sand, greenish-gray, coarse to medium, slightly micaceous, glauconitic, with scattered phosphatic pebbles.	
Shark tooth	
Upper part of core 11 (USGS 25533)	129. 1–139. 6
Sand, gray, fine, silty, and some silty clay.	
Hoploparia aff. *H. davisi* (Stenzel)	
?*Enoploclytia* sp. (anterior portion of carapace)	
Ctenoid fish scale	
McShan formation:	
Upper part of core 16 (USGS 25534)	183. 0–192. 6
Sand, greenish-gray, glauconitic.	
Cylcostomatous Bryozoan	
?*Meyeria* sp. (anterior portion of carapace, abdominal segments and limb fragments)	
Teleostean vertebra	
Scapanorhyncus subulatis (Agassiz)—Goblin shark	
Shark vertebra	
Core 17 (USGS 25535)	192. 6–228. 5
Sand, light-gray, medium to fine, highly silty, micaceous.	
Macruran abdominal segments	
Bottom part of core 18 (USGS 25536)	228. 5–239. 3
Sand, gray, medium, containing gray clay and tan silt pebbles.	
Fish vertebra	
Bottom part of core 19 (USGS 25537)	239. 3–282. 7
Clay, light-gray, silty, with thin interbedded layers of somewhat micaceous silt.	
Crustacean fragments	
Upper part of core 20 (USGS 25538)	282. 7–303. 3
Silt, gray, clayey, carbonaceous.	
cf. *Arca* sp.	
Lima? sp.	
Shark tooth	
Middle of core 21 (USGS 25539)	303. 3–316. 6
Sand, light olive-gray, medium-grained, glauconitic, with coarse clay and silty pebbles.	
Cyclostomatous Bryozoa	
Upper part of core 23 (USGS 25540)	368. 7–398. 5
Sand, greenish, coarse, sparingly micaceous, containing small sideritic pebbles.	
Fish vertebra and other bone fragments	

AGE AND CORRELATION OF EUTAW AND McSHAN FAUNA

Fossils recovered from the Crawford well at a depth of 13.5 to 26.3 feet include numerous indeterminable phosphatic internal molds and some fossil species of Eutaw age; these fossils seem to have been reworked from the underlying Eutaw to become part of the basal unit of the Mooreville chalk. From 26.3 feet downward, stratigraphically distinctive species such as *Ostrea cretacea* Morton, *Exogyra upatoiensis* Stephenson, and *Ostrea battensis* Stephenson are present in cores 3 to 6 at depths of 26.3 to 87.2 feet; these species are diagnostic of the fauna in the Tombigbee sand member, which comprises the upper part of the Eutaw formation in other parts of Alabama and Mississippi (Stephenson, 1936, 1956). Of the fossils listed under the core descriptions, *Ostrea cretacea* Morton is abundant in the 9.6 feet of core 3, a thickness very similar to the thickness of the *O. cretacea* zone where it crops out in western Alabama. Another significant species, represented by a specimen from the middle of core 6, is assigned to the echinoid genus *Hardouinea.* This specimen is too incomplete for positive specific identification; but the plate and pore arrangement is almost identical with that of *H. bassleri* (Twitchell), which is abundant in the Tombigbee sand member of central Alabama.

Other stratigraphically useful fossils in the cores include *Gryphaea wratheri* Stephenson and *Ostrea battensis* Stephenson, which are widespread in the Eutaw formation of Alabama. *Gryphaea wratheri* Stephenson is found also in the Tombigbee sand member of the Eutaw in Mississippi, and in the upper part of the Austin chalk of Texas (Stephenson, 1936, p. 3).

Below core 6 from 87.2–398.5 feet, which includes the lower part of the Eutaw formation and the entire McShan formation, the cores yielded few identifiable megainvertebrates. The fossils that are present are nondiagnostic and for the most part consist of crustaceans. Of these crustaceans, H. R. Roberts (written communication, Dec. 1959) states:

> Although several carapaces are present in the material examined, *Hoploparia* sp. aff. *H. davisi* (Stenzel) is the only form which is well enough preserved to be identified to species. In the case of the other carapaces . . ., unquestionable generic assignments cannot be made because the rostrom or other diagnostic structures are missing.
>
> None of the specimens—decapods or fishes—is of value in determining the precise age of the sediments enclosing them.

The few molluscan species represented in the cores from this part of the hole are likewise undiagnostic.

NOTES ON ECOLOGY

The fauna in the upper 87.2 feet of the Eutaw formation (cores 3–6), as represented in the Crawford hole, is composed of shallow-water forms. The coquina of *Ostrea cretacea* Morton in segments of core 3 (USGS 25523) closely resembles coquina zones in the outcrop area. For example, the *Ostrea cretacea* zone is continuous from the Tombigbee River of western Alabama to the Chattahoochee River at Broken Arrow Bend, 6 miles south of Columbus, Ga. At most places in this area the closely packed shells of *Ostrea cretacea* are almost the only fossils in sections of the Tombigbee sand member which are as much as 100 feet thick, such as in the vicinity of Uchee in the northwestern part of Russell County, Ala. This paucispecific zone of *Ostrea cretacea* probably represents a widespread oyster-bank accumulation, and substantiates Stenzel's (1954, p. 44) observations that most brackish-water oyster banks are paucispecific. These masses of oysters must truly represent optimum conditions of growth. Such conditions exist in waters which have a salinity about midway between fresh and salty (Ladd, 1957).

In the Crawford hole below the oyster coquina zones of core 3, and especially in cores 4, 5, and 6, the sands are coarser and the fauna is less dominated by the ostreid elements. Although other forms dominate at several levels, the fauna in the coarser sands likewise indicates shallow-water, near-shore environments but probably represents waters of higher, more normal salinity than the oyster zones.

Below 97.5 feet in the hole (71.2 feet from the top of the Eutaw), the faunal content changes markedly. Not only are fossils much rarer but the composition changes as crustacean and fish remains become the dominant elements. Clays and other fine sediments are more common than above 97.5 feet, but even the sandy parts that are lithologically similar to the sands of the upper cores are generally barren of fossils.

The decapod crustaceans, which unfortunately are the most common element, yield little information as to habitat or environment, as H. R. Roberts (written communication, Dec. 1959) states:

> All the decapods examined are vagrant bottom-dwelling marine forms. They are macrurans . . . no brachyurans are present. No ecological inferences can be drawn from the specimens at hand.

This section of the core appears analogous to the crossbedded to massive unfossiliferous sands in the Eutaw formation that Stephenson and Monroe (1940, p. 252) postulated as having formed in shallow water near shore. The fauna in the cores from this part of the Eutaw, however, provides no additional information on the environment of deposition of these sands.

DESCRIPTION OF CORE AND LIST OF FOSSILS FROM WEBB HOLE

NE¼NE¼ sec. 16, T. 21 N., R. 8 E., Perry County, Ala., altitude 210 feet

	Depth (feet)
Tuscaloosa group, Coker formation (Eoline member):	
Upper part of core 20 (USGS 25542B)	249. 8–261. 0
Clay, gray, silty, interlaminated with light-gray micaceous carbonaceous silt.	
Lingula cf. *L. subspatulata* Hall and Meek	
Tellina? sp.	
Anomia sp.	
Impressions of indeterminate pelecypods	
Upper middle part of core 20 (USGS 25542A)	249. 8–261. 0
Clay interlaminated with silt as above.	
Lingula cf. *L. subspatulata* Hall and Meek	
Lower third of core 25 (USGS 25543)	289. 2–299. 8
Sand, gray, fine, clayey, micaceous, carbonaceous, with gray clay pebbles.	
Ostrea sp. (small)	
Basal part of core 26 (USGS 25544)	299. 8–328. 8
Sandstone, light olive-gray, poorly sorted, sparingly glauconitic and micaceous, with silt and clay pebbles of various shades of gray and green.	
Nemodon sp.	
Brachidontes sp.	
Ostrea cf. *O. soleniscus* Meek	
Plicatula sp.	
Botula cf. *B. plumosa* Stephenson	
Several impressions of indeterminate pelecypods	

AGE AND CORRELATION OF THE EOLINE FAUNA

The invertebrate fossils recovered from the cores of the Eoline member of the Coker formation of Webb hole are not exceedingly diversified nor are they well preserved. Rather, their importance is chiefly their mere presence, as marine invertebrates are rare in sediments of the Tuscaloosa group. Stephenson (1952, p. 18) has noted four places in Alabama where a meager fauna has been found in the Tuscaloosa. Only one locality, discovered in 1945 by L. C. Conant, near Centreville in Bibb County, Ala. (fig. 1), has yielded actual shell material; at the other localities, only external impressions of fossils in clay can be seen.

The sandstone unit near the base of core 26 (depth 299.8–328.8 feet) can be correlated directly with the outcrop in Bibb County, Ala., both on the basis of the lithologic constituents and the contained fauna. The sandstone in core 26 is almost identical with the calcareous, clay- and silt-pebble-bearing sandstone of the Eoline member exposed in a 25-foot bluff on the east bank of the Cahaba River about 4 miles south of the courthouse in Centreville, Bibb County, Ala. (NW¼ sec. 14, T. 22 N., R. 9 E.). This locality (USGS 19577) has yielded:

Breviarca sp.
Ostrea cf. *O. soleniscus* Meek
Anomia ponticulana Stephenson
Brachidontes fulpensis Stephenson

The invertebrate fauna of the Eoline member of Alabama seems to have its closest affinities with the fauna described by Stephenson (1952) from the Woodbine formation of Texas. It is, however, less clear which of the four members of the Woodbine is the closest correlative of the Eoline member.

Of the species listed above from the Eoline member in the well cores and from the Centreville, Ala., outcrop, *Lingula subspatulata* Hall and Meek is a generalized form and rather poorly known, but, as reported in North America, it ranges throughout the Upper Cretaceous. Although it seems to have little stratigraphic value, it does occur in both the Lewisville and Templeton members of the Woodbine formation. Likewise, *Ostrea soleniscus* Meek, although restricted on the Gulf Coast to the Cenomanian (Stephenson, 1952, p. 74), ranges as high as the Coniacian in the Western Interior. The specimens from Alabama compared with *Ostrea soleniscus* Meek are all small for the species, but they do possess its characteristic beak curvature and probably represent a varietal form. *Botula plumosa* Stephenson, as far as known, is restricted to the Lewisville member of the Woodbine formation, but both the identification of the species in Alabama and its range in Texas are open to some doubt. The specimens of *Brachidontes* from the well cores are too incompletely preserved for specific identification. The more completely preserved specimens from the outcrop (USGS 19577), on the other hand, are assignable to *Brachidontes fulpensis* Stephenson, which occurs in the Dexter, Euless, and Lewisville members of the Woodbine formation of Texas. *Anomia ponticulana* Stephenson from the Eoline near Centreville, Ala., and possibly the *Anomia* sp. from core 20 in the Webb well range through the Woodbine formation in Texas. No species of *Nemodon* from the Woodbine are available for comparison with the specimens from core 26, but all other generically identified specimens listed from the Eoline have representative species in the Woodbine formation of Texas.

On the basis of the above range comparisons, a correlation of the Eoline member of the Coker formation with the Woodbine formation is rather definite, but there is no decisive evidence for correlation with a given member of the Woodbine formation. All the species common to Texas and Alabama are present in the Lewisville member but some may range either up into the Templeton member or may range downward as far as the Dexter member. The slim evidence thus afforded favors a correlation of the Eoline member with the Lewisville member of the Woodbine formation of Texas, but other lines of evidence are needed to substantiate such a correlation (see Applin, this bulletin).

NOTES ON ECOLOGY

The Eoline fauna, as represented in cores 20 and 26 from the Webb hole, suggests a shallow-water near-shore environment. Such an interpretation is decidedly applicable to core 20, which bears the brachiopod *Lingula*. Cooper (1957, p. 265) states that *Lingula* at present is "restricted to shallow water, usually shore zones subject to tidal action" and "has not been taken deeper than 23 fathoms." In the fossil record the common occurrence of *Lingula* in black shale and in sparse faunas has led many authors to assume that it was capable of withstanding stagnant or brackish water conditions. That such conditions are represented by core 20 cannot be ascertained, as the only accompanying forms are the pelecypods *Tellina* and *Anomia*. These forms generally inhabit water of normal salinity but are known from a variety of environments.

The remainder of the fauna of the Eoline member, as represented in core 26 and at the outcrop near Centreville, is not greatly diversified. From a negative standpoint this very lack of diversity in itself points to ecologic conditions that were other than optimum. The dominance of the ostreid and *Brachidontes* elements appears to reflect brackish water conditions such as those in many of the East Coast embayments today. *Anomia* could probably survive under these conditions, although it generally is more typical of normal marine environments. The boring sponge *Clione* today infests oyster shells in bay or estuarine brackish-water oyster banks. Only the shells identified with *Breviarca* and *Nemodon* appear at all out of place in such an environment but even these arcids are known from this type of an environment (Ladd and others, 1957).

The assemblage as a whole suggests shallow-water conditions, and all of the genera have numerous representatives in the near-shore shallow-water faunas of the present seas.

With the possible exception of the arcids, the fauna is composed almost entirely of epifaunal elements that lived on, rather than in, the sea bottom sediment. The arcids have a nesting habit but some forms do burrow. Such organisms as *Ostrea*, *Plicatula*, and *Anomia* attach themselves by cementing their valves to other shells or to any solid object on the bottom. *Brachidontes* attaches itself to plants or to solid objects on the bottom by means of its thread-like byssus. The available evidence does not furnish a definite solution concerning

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the lack of infaunal or burrowing forms. As the dominant lithologic constituent is a sand, however, a dearth of burrowing forms due to a fine mud bottom, as noted by MacGinitie and MacGinitie (1949), does not seem likely. Barrenness of many beach sands has been accounted for by Hedgpeth (1957, p. 603) and others as due to reworking by burrowing organisms, but this explanation does not account for the presence of the epifaunal elements in the Eoline member of the Coker formation.

Parts of core 26 are conglomeratic layers that contain silt and claystone pebbles associated with a moderate amount of broken shell material and comminuted plant material. These layers indicate current or wave activity sufficient for the transportation and rounding of coarse pebbles and the movement of shell fragments. Other layers in core 26, however, are relatively fine sand, and their included fossils may well have been buried in place.

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