VIII

MESOZOIC FAUNA AND FLORA

By

JOSEPH KENT ROBERTS

THE MESOZOIC FAUNA AND FLORA OF KENTUCKY

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The Mesozoic era is represented by beds of Upper Cretaceous age, which rests unconformably upon limestones and cherts of Mississippian age. During Triassic, Jurassic, and Lower Cretaceous time land conditions prevailed, or if any sediments were accumulated, they were removed by contemporaneous erosion to such an extent that no record of them remains. Rocks of early and middle Mesozoic time are absent over the entire embayment region, and the Jurassic is not represented east of the Mississippi River by any sedimentary rocks known at the present time. The unconformity at the base of the Upper Cretaceous represents a vast thickness of rocks in the geologic record. This great break is not only marked by differences in the physical characteristics of the sediments below and above the unconformity, but also by the profound change in the floras and faunas.

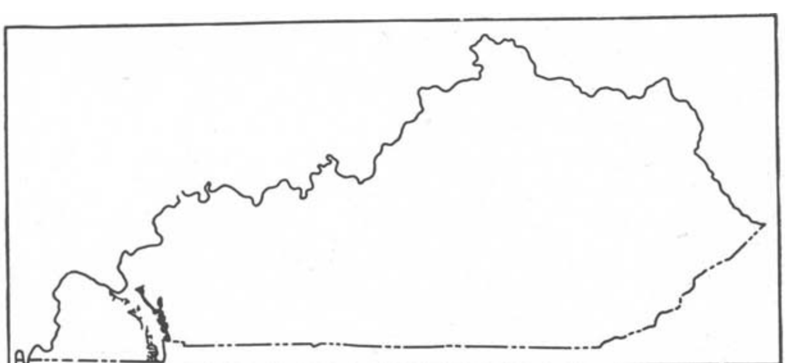


Fig. 31. Map of Kentucky showing outcrop of Cretaceous rocks. Scattered quartzite boulders of appalachian derivation also occur sparingly in Eastern Kentucky.

UPPER CRETACEOUS

Beds of Upper Cretaceous age extend across the State of Kentucky in a north-northwestern direction and the central portion or general axis of the beds lies about coincident with the Tennessee River. The belt extends from Tennessee and on the State line it is approximately 25 miles wide. It narrows towards the north to only a few miles where most of it is covered by Plio-Pleistocene and alluvial deposits, but reappears in southern Illinois in a few places, and shown in many instances by well logs. In many localities in Kentucky the Upper Cretaceous beds have been eroded, another factor in causing the belt not to be continuous across the State.

The beds occur over portions of Trigg, Lyon, and Livingston counties mainly between the Tennessee and Cumberland Rivers, but small areas east of the Cumberland River as well; also west of the Tennessee River in Calloway, Marshall, and McCracken counties. The deposits occurring between these two rivers and to the east of the Cumberland River are the oldest, and the beds become younger towards the west, as is the case with the Tertiary and younger sediments.

The Upper Cretaceous sediments consist of gravel, sand, greensand, and sandy, micaceous, and lignitic clays, high grade commercial clays, and some lignite. These sediments for the most part are little consolidated if any, and the only instances of any note are the beds in which iron oxides have been the agents of consolidation. They rarely show any appreciable dip, and when they do it is to the west in the southern portion of the region, and to the southwest towards the Ohio River. Faulting, while pronounced in the underlying limestones and cherts of the Paleozoic, is not observed in the unconsolidated beds of the Cretaceous. The formations of Upper Cretaceous recognized in western Kentucky are as follows: between the Tennessee boundary to which point both the Selma and Eutaw with very thin beds of Ripley near the Ohio River; east of the Cumberland River thin beds of the Tuscaloosa; west of the Tennessee and Eutaw with very thin beds of Ripley near the Ohio River; east of the Cumberland River thin beds of the Tuscaloosa; west of the Tennessee River the Tuscaloosa and Ripley with problematical Selma, which is mapped with Ripley. The entire Cretaceous west of the Tennessee is so thin and the beds so much alike that it is not possible to differentiate them and without faunas or floras one cannot differentiate them even at the Kentucky-Tennessee boundary to which point both the Selma and Eutaw have been mapped on the west side of the Tennessee River by Wade.

Upper Cretaceous Formations

FORMATION	CHARACTER OF SEDIMENTS	COUNTIES WHERE EXPOSED
Ripley	Sand, clay, and lignite	Livingston, McCracken, Marshall & Calloway
Unconformity		
Eutaw	Sand	Trigg, Calloway & Marshall
Tuscaloosa	Gravel with small masses of clay	Trigg, Livingston, Lyon & Marshall
Unconformity		

TUSCALOOSA FORMATION

The name, Tuscaloosa, was proposed in 1887 by Smith and Johnson[1] for the basal beds of the Upper Cretaceous in the vicinity of Tuscaloosa river (Black Warrior river), Alabama. The Tuscaloosa is best developed and exposed in Alabama where its maximum thickness is approximately one thousand feet according to Stephenson[2].

The Tuscaloosa extends in a lunate form from Alabama across Tennessee to Kentucky. In Kentucky this formation is found mainly in Trigg, Lyon, and Livingston counties and a very small area in Marshall County. The great bulk of Tuscaloosa lies between the Tennessee and Cumberland Rivers; a few detached areas on the eastern side of the latter river may have been continuous at one time but have been separated by erosion. On the average the Tuscaloosa belt is about four miles wide and forty miles long. The thickness ranges upwards to 170 feet, the average being much less.

The Tuscaloosa consists almost exclusively of gravel and this in an unconsolidated condition except in a very few cases. Sellier mapped Cretaceous gravel west of Golden Pond, Trigg County in 1915, shown on the current map of Kentucky (1929). In 1920 Bruce Wade[3] showed isolated deposits of

[1]Smith, E. A., and Johnson, L. C., Tertiary and Cretaceous strata of the Tuscaloosa, Tombigbee, and the Alabama rivers: U. S. Geol. Survey. Bull 43. pp. 95-116, 1887.

[2]Stephenson, L. W., The Mesozoic rocks: The Cretaceous system: Geology of Alabama, Alabama Geol. Survey, Special Rept. 14, pp. 231-250, 1926.

[3]Wade, Bruce, Recent Studies in the Upper Cretaceous of Tennessee: Tennessee Geol. Survey. Bull, 23, pp. 52-58, 1920.

Tuscaloosa gravel in Stewart County, Tennessee, extending to the Kentucky line, and mentioned the section west of Golden Pond, and at Canton, Trigg County.

The Tuscaloosa gravel consists of reworked Mississippian chert and limestone, and the chert, composes the great bulk of the gravels. These gravels are all well rounded, many of them roughly spherical, one of the distinctive marks from the Plio-Pleistocene gravels, the other being their white and light gray color in contrast to the reddish brown colors of the younger gravel. The gravels vary up to three inches on the average, though there are cobbles which reach as much as fifteen inches. The matrix is a fine clay with small chert gravels which become as small as coarse sand. This matrix is sometimes indurated by iron oxides but this is not nearly so common as in the case of the Plio-Pleistocene gravels. Locally a few lenses of light gray to white clay is contained in the gravel beds, such being the case in the gravel pits at Grand Rivers. For a fuller description of the Tuscaloosa beds, see the reports of the writer[4]. So far observed, the Tuscaloosa gravel yields no fossils, nor do the clay lenses show any. There are numerous reworked fossils in the gravels, and these consist of fragments of crinoid stems and plates, bryozoa, brachiopods, and other Mississippian forms from which the gravels are derived. Farther south in the embayment region, in Alabama, fossil floras are found, but in all such instances the formation carries beds of clay, much of which is lignitic with some sand. Some of the fossil localities are listed below, and certain diagnostic fossils listed in the plates from other localities, not that such represent the Tuscaloosa in Kentucky but the formation as a whole over the embayment region.

Extensive collections of plants have been made by Smith, Langdon, Ward, Berry, and others, and Ward named some thirty-five species. In 1919 Berry[5] described a number of Tuscaloosa plants and below are listed the localities with the number of species from each.

[4]Roberts, Joseph K., The Tuscaloosa formation of Kentucky: Am. Jour. Sci., vol. 14, pp. 465-472, 1 map, 1927.

Roberts, Joseph K., The Cretaceous deposits of Trigg, Lyon, and Livingston Counties, Kentucky: Kentucky Geol. Survey, vol. 31, pp. 281-326, 8 figs., 2 maps, 1929.

[5]Berry. E. W., Upper Cretaceous Floras in Tennessee, Mississippi, Alabama, and Georgia: U. S. Geol. Survey, Prof. Paper 112, 141 pp. 33 pls. 12 figs., 1919.

Tuscaloosa Plant Collecting Localities

LOCALITY	NUMBER OF SPECIES
Glen Allen, Alabama	39
Shirley's Mill, Alabama	98
Tuscaloosa, Alabama	11
Cottonwood, Alabama	48
Southwest of Northport, Alabama	5
Snow Place, Alabama	43
Robertson's Landing, Alabama	1
Sanders Ferry Bluff, Alabama	5
Whites Bluff, Alabama	6
Soap Hill, Alabama	1
Maplesville, Alabama	2
Jones Ferry, Alabama	1
Centerville, Alabama	1
Near Iuka, Mississippi	4

The plants described from the above localities are distributed over 87 genera and 150 species of which 44 genera are not represented in present day floras. Since the Tuscaloosa furnishes no fossil floras in Kentucky, only a few of the most widely distributed forms in Alabama will be given in the plates. This floral belt must have extended northward into and across Kentucky, but the gravels are not suited to the preservation of fossils.

EUTAW FORMATION

The name, Eutaw, was used by Hilgard for beds near Eutaw,[6] Alabama, which were first recognized and studied by Tuomey and described by him in his "First Biennial Report on the Geology of Alabama," published in 1850. Hilgard included what is now the Eutaw and Tuscaloosa under this term, and it remained for Eugene A. Smith and L. C. Johnson to recognize and make a separation in 1887.

There are two belts of the Eutaw in Kentucky; the best developed and easiest one to recognize occurs in Trigg County between the rivers, extending from Stewart County, Tennessee, and it terminates about the middle of Trigg County; the other occurs west of the Tennessee River in what is known as "The Jackson Purchase Region", and here it is difficult to differentiate it from the Ripley sands with which it is mapped. Neither of these occurrences are more than a mile wide. The sediments are poorly exposed compared to those of Tennessee and the states farther south. Very few exposures are found

[6]Hilgard, E. W., Report on the Geology and Agriculture of Mississippi: Jackson, Mississippi, pp. 60-95, 1860.

west of the Tennessee River, and Glenn reported some years ago in his studies of the underground water supply of western Kentucky that no sediments of Eutaw age occur in the wells at Paducah, and Hickman, Kentucky, and at Cairo, Illinois. In 1920 Wade[7] noted a small thickness of Eutaw in Henry County, Tennessee, and a fifteen foot exposure on the Tennessee river at Paducah, and his map accompanying the reports shows a narrow belt of Eutaw extending to the Kentucky line west of the Tennessee river.

The Kentucky deposits consist of brownish red sand, micaceous in most instances, and the textural range is from medium to coarse. The determination of the age of this sand was made by tracing it into Tennessee where the age relation was established by Wade, and he traced the beds into localities where they carry a marine fauna.

Wherever bedding is shown, the dip of the beds is to the west or southwest at low angles. The sands are not crossbedded east of the Tennessee River but more to the west. The sediments are unconsolidated for the most part except where iron oxides have cemented the grains into a fairly resistive rock. Wade recognized two members in the Eutaw in Tennessee, namely, the Tombigbee or basal member, and the Coffee sand or younger member; these are difficult to separate even in regions where well developed, and the Tombigbee appears to terminate south of the Kentucky line in Hardin County, Tennessee. It is possible that the Eutaw in Kentucky is an equivalent of the Coffee sand but without any clay lenses, and there are no fossils to indicate its stratigraphic position.

The absence of Eutaw fossils in Kentucky does not indicate that they were never present; they have probably been leached out by ground waters. The sand is composed of quartz largely with variable amounts of feldspars, muscovite and other minerals. Occasionally small grains of chert occur in the sand. The brownish red color is due to iron oxides, which forms an envelope around the grains and colors the matrix of clay.

In Tennessee 16 species of leaves, some poorly preserved wood, and a few specimens of fossil amber have been collected

[7]Wade. Bruce, Recent Studies in the Upper Cretaceous of Tennessee: Tennessee Geol. Survey, Bull., 23, p. 58, 1920.

from the Coffee sand and clay, and Eutaw fossils are fairly abundant in Alabama. No fossils have been reported from Kentucky, but some of the more representative ones are given in the plates. Some of the plant localities are given below with their number of species, as given by Berry[8].

Eutaw Plant Collecting Localities

Locality	*Number of Species*
McBride's Ford, Georgia	19
Broken Arrow Bend, Georgia	5
Chimney Bluff, Georgia	7
Havana, Alabama	l4
Coffee Bluff, Tennessee	16

The flora so far described from the embayment region comprises forty-three species, most of which are flowering plants. There are some marine invertebrate fossils along the Chattahoochie River in Alabama, and near Montgomery, Alabama. The fossils are not well preserved, and are only casts and molds.

RIPLEY FORMATION

In 1860 Hilgard used the term, Ripley,[9] for certain sandy marls and limestone near Ripley, Mississippi, and regarded it as an equivalent of the "Lower Cretaceaous" of Tuomey. In 1887 Smith and Johnson used the name, Ripley, for similar beds of the same horizon in Alabama, but Stephenson pointed out that the Ripley of northern Mississippi, and of east and central Alabama is represented in west Alabama and east Mississippi by chalk deposits, which are correlated according to our present knowledge with the Selma chalk.[10]

South of the state line, the Tennessee Ripley shows four members, namely, the Owl Creek, McNairy, ferruginous clay, and Coon Creek. The name, McNairy was introduced by Stephenson[11] from his studies in the Cretaceous of McNairy County, Tennessee. Towards the Kentucky line both the Owl Creek and the ferruginous clay members cannot be differentiated from the McNairy sand. In Calloway and Marshall counties there are certain sands, which may be the equivalent of the McNairy member, and these along with the clays, which are of Ripley age beyond a doubt are mapped as one unit.

[8]Berry, E. W., op. cit., pp. 44-48.
[9]Hilgard, E. W., op. cit. pp. 3, 62, 83-95.
[10]Stephenson, L. W., op. cit., pp. 240-241.
[11]Stephenson, L. W., Cretaceous Deposits of the Eastern Gulf Region: U. S. Geol Survey, Prof. Paper 81, pp. 17-18, 1914.

There is no way of differentiating these. It might be well to add here that the Selma cannot be differentiated in Calloway County, although Wade shows it to be a mile or so wide at the state line.

The Ripley has both sands and clays, and the sand predominates. The clay occurs as lenses in the sand. The sand is a brown, and sometimes it assumes a dark gray. It is crossbedded, and well bedded. Locally the sand may be indurated. The matrix is clay, and iron oxides act as the principal cementing agent. The texture of the sand varies from a relatively fine to a coarse, but no gravels occur.

There are several large clay lenses in the Ripley, which are used commercially in the vicinity of Briensburg, Marshall County. The clay is a dark variety, the coloring matter being organic materials. South of Benton, Marshall County, a few fossil leaf impressions occur, but they are not well preserved. Similar clays occur near Bruceton, Tennessee, which yield a number of fossil plants. This clay is well laminated, and contains quite a bit of marcasite and pyrite.

No Ripley faunas have been found in Kentucky, but they are fairly abundant in Alabama, Georgia, and Tennessee, and have been described by Berry[12]. The plants are distributed over 40 families, 71 genera, and 135 species. Of this total number 105 species are dicotyledons. The localities from which these collections have been made, the number of species from each are as follows:

Ripley Plant Collecting Localities

Locality	*Number of Species*
Near Eufala, Alabama	1
Cawikee Creek, Alabama	3
Near Beuna Vista, Georgia	6
Byron, Georgia	3
Perry Place, Tennessee	66
Cooper Pit, Bruceton, Tennessee	65
Near Beuna Vista, Tennessee	4
Near Mifflin, Tennessee	5
Northwest of Camden, Tennessee	2
Near Camden, Tennessee	1
Coon Creek, Tennessee	2
Near Selmer, Tennessee	13
Big Cut, Tennessee	3

[12]Berry, E. W, The Flora of the Ripley Formation. U. S. Geol. Survey, Prof. Paper, 136, 90 Pp. 23 pls. 6 figs., 1925.

Some of the faunas of the Ripley of Tennessee have been described in detail by Wade, and they have been collected chiefly from the Coon Creek and Owl Creek members; the Coon Creek faunas have been described and figured by Wade.[13] Most of the fauna consists of molluscan forms; there are 313 species exclusive of the bryozoa and crustacea. No fossil faunas were found near the Kentucky line by Wade, and no traces of any were found during the field work in Calloway, Marshall, and McCracken counties.

CONCLUSION

The Upper Cretaceous beds of western Kentucky represent an oscillation of the sea, trangressing from the south and southwest, reaching its maximum near the close of Eutaw time, and withdrawing by the close of Ripley time. The Tuscaloosa gravel deposits represent according to Berry[14] delta deposits, and this most likely is the case in Alabama where tree roots with entangled cobbles and rocks are found embedded in the gravels. This condition does not appear in Kentucky. The chert pebbles are more perfectly rounded than the terrace gravels of the Plio-Pleistocene, and they indicate a marine origin. Some of the Tuscaloosa might be augmented by delta agencies but it does not appear probable that all this deposit from the Tennessee line to the Ohio River could have been formed exclusively by delta action. Both the Eutaw and Ripley are of marine origin as is shown in the embayment region farther south. The sea did not begin its withdrawal until the close of the Midway Stage in Kentucky, when the last of the marine deposits were formed, namely, the Porters Creek clay and sand.

[13]Wade, Bruce. The Fauna of the Ripley formation on Coon Creek, Tennessee: U. S. Geo1. Survey. Prof. Paper 137, 192 pp., 72 pls., 2 figs., 1926.

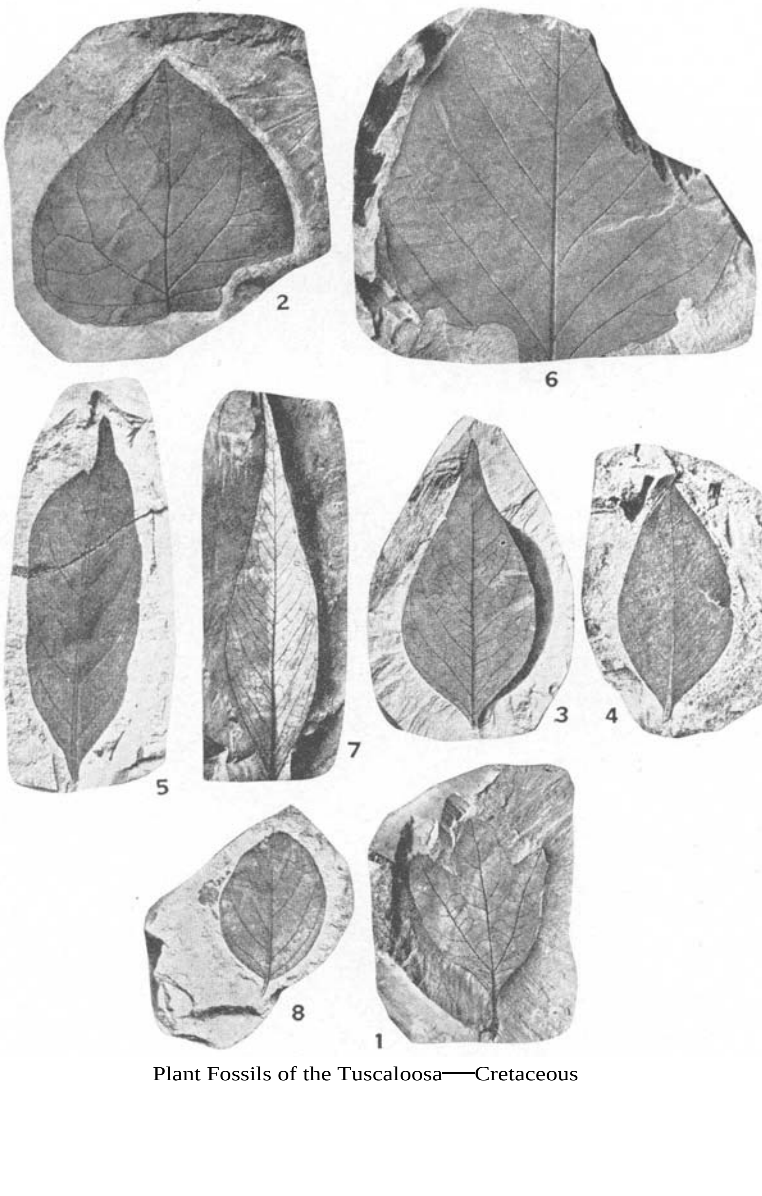
[14]Berry, E. W., The Delta Character of the Tuscaloosa Formation: Johns Hopkins Univ. Circ., n. s .. pp. 18-24 (216-222), 1917.

Explanation of Plate LXV

Tuscaloosa Floras

1. *Platanus shirleyensis* Berry: Tuscaloosa formation at Shirley's Mill, Fayette County, Alabama. U. S. Geol. Surv., Prof. Paper 112, Pl. XV, fig. l.
2. *Menispermites integrifolius* Berry. Tuscaloosa formation from Cottondale, Tuscaloosa County, Alabama. U. S. Geol. Surv., Prof. paper 112, Pl. XX, fig. l.
3. *Ficus inaequalis* Lesquereux. Tuscaloosa formation from Shirley's Mill, Fayette County, Alabama. U. S. Geol. Surv., Prof. Paper 112, Pl. XII, fig. l.
4. *Andromeda wardiana* Berry. Tuscaloosa formation from Shirley's Mill, Fayette County, Alabama. U. S. Geol. Surv., Prof. Paper 112, Pl. XXVII, fig. 6.
5. *Sapindus variabilis* Berry. Tuscaloosa formation from Shirley's Mill, Fayette County, Alabama. U. S. Geol. Surv., Prof. Paper 112, Pl. XXVII, fig. 3.
6. *Magnolia lacoeana* Lesquereux. Tuscaloosa formation from Shirley's Mill, Fayette County, Alabama. U. S. Geol. Surv., Prof. Paper 112, Pl. XVII, fig. 9.
7. *Ficus daphnogenoides* (Herr) Berry. Tuscaloosa formation from Shirley's Mill. Fayette County, Alabama. U. S. Geol. Surv., Prof. Paper 112, Pl. XIII, fig. 6.
8. *Diospyros rotundifolia* Lesquereux. Tuscaloosa formation from Cottondale, Tuscaloosa County, Alabama. U. S. Geol. Surv., Prof. Paper 112, Pl. XXX, fig. 5.

PLATE LXV



Plant Fossils of the Tuscaloosa—Cretaceous

Explanation of Plate LXVI

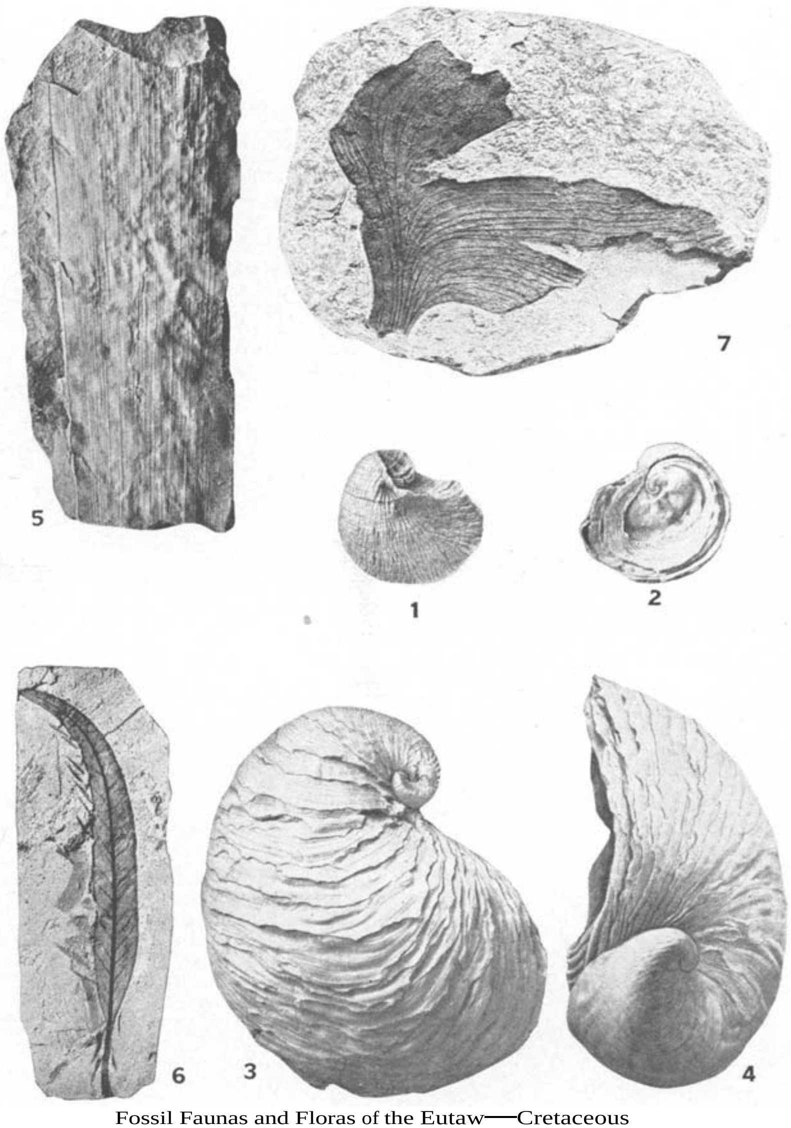
Eutaw Faunas

1. *Exogyra upatoiensis* Stephenson. Basal Eutaw beds, Broken Arrow Bend, Chattahoochie River, 10½ miles below Columbus Georgia. Left valve. U. S. Geol. Surv., Prof. Paper 81, Pl. XIII, fig. 1.
2. Same specimen as above (Fig. 1), showing right valve.
3. *Exogyra ponderosa* Roemer. Tombigbee sand member of the Eutaw formation, bluff on the Chattahootchie River at Bluff town, 31¼ miles below Columbus, Georgia. Shows the costae only on the apical region. U. S. Geol. Surv. Prof. Paper 81, Pl. XIII, fig. 6.
4. Same specimen as above (Fig. 3), showing a small attachment scar on the beak. U. S. Geol. Surv., Prof. Paper 81, Pl. XIII, fig, 7.

Eutaw Floras

5. *Doryanthites cretacea* Berry. Eutaw formation at Havana, Hale County, Alabama. U. S. Geol. Surv., Prof. Paper 112, Pl. XIII, fig. 1.
6. *Myrica havanensis* Berry. Eutaw formation at Havana, Hale County, Alabama. U. S. Geol. Surv., Prof. Paper 112, Pl. XXVIII, fig. 7.
7. *Phyllites asplenioides* Berry. Coffee sand member of the Eutaw formation at Coffee Bluff, Hardin, Hardin County, Tennessee. U. S. Geol. Surv., Prof. Paper 112. Pl. XXXIII, fig. 1.

PLATE LXVI



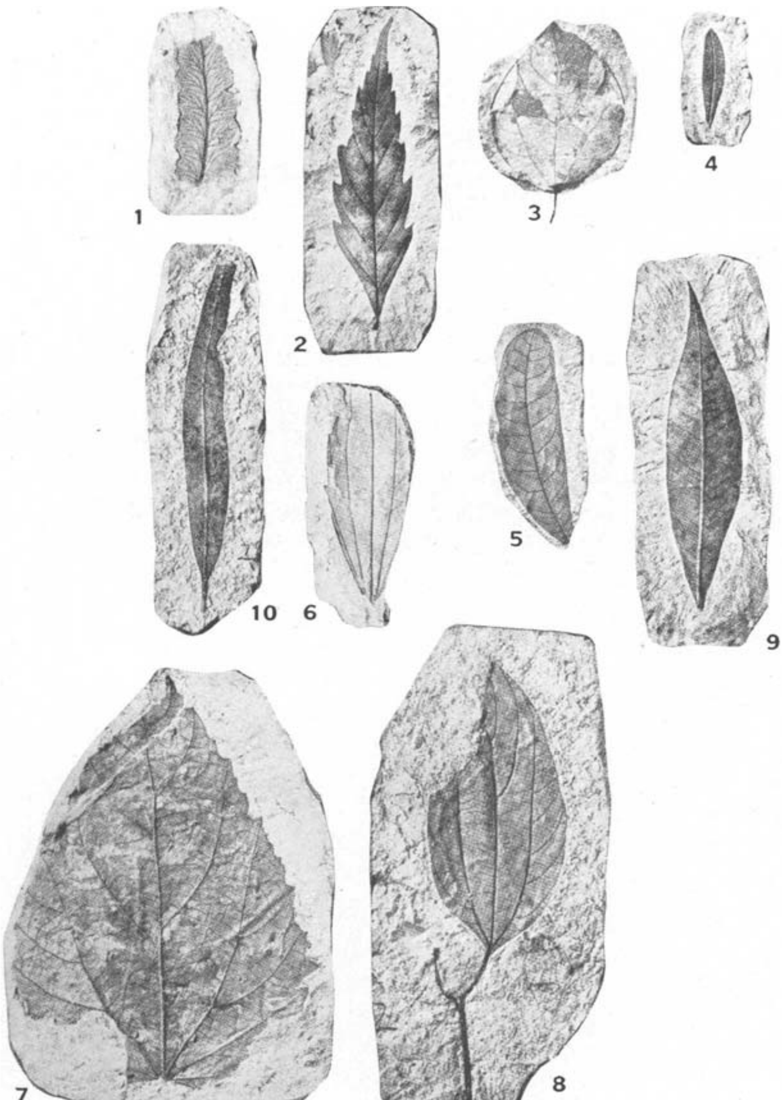
Fossil Faunas and Floras of the Eutaw—Cretaceous

Explanation of Plate **LXVII**

Ripley Floras

1. *Raphaelia neuropteroides* Debey & Ettingshausen. Ripley formation, Cooper Pit, Bruceton (Hollow Rock Junction), Tennessee. U. S. Geol. Surv., Prof. Paper 136, Pl. I, fig. 8.
2. *Myrica ornata* Berry. Ripley formation, Cooper Pit, Bruceton (Hollow Rock Junction), Tennessee. U. S. Geol. Surv., Prof. Paper 136, Pl. VI, fig. 5.
3. *Ficus celtifolius.* Berry. Ripley formation, Cooper Pit, Bruceton, Tennessee. U. S. Geol. Surv., Prof. Paper 136, Pl. X, fig. I.
4. *Mimosites cooperensis* Berry. Ripley formation, Cooper Pit, Bruceton, Tennessee. U. S. Geol. Surv., Prof. Paper, 136, Pl. X, fig. 7.
5. *Euphorbiophyllum tennesseensis* Berry. Ripley formation, Perry Place, Henry County, Tennessee. U. S. Geol. Surv., Prof. Paper 136, Pl. XII, fig. 4.
6. *Zizyphus ripleyensis* Berry. Ripley formation. Perry Place, Henry County, Tennessee. U. S. GeoI. Surv., Prof. Paper 136, Pl. XIII, fig. 9.
7. *Grewiopsis ripleyensis* Berry, Ripley formation, Cooper Pit, Bruceton, Tennessee. U. S. Geol. Surv., Prof. Paper 136, Pl. XV, fig. 2.
8. *Cinnamomum newberryi ellipticum* Berry. Ripley formation, Cooper Pit, Bruceton, Tennessee. U. S. Geol. Surv., Prof. Paper 136, Pl. XVI, fig. 7.
9. *Laurophyllum ripleyensis* Berry. Ripley formation, Perry Place, Henry County, Tennessee. U. S. Geol. Surv., Prof. Paper 136, Pl. XVIII, fig. 7.
10. *Myrtophyllum angustum* (Velenovsky) Berry. Ripley formation, Cooper Pit, Bruceton, Tennessee. U. S. Geol. Surv., Prof. Paper 136, Pl. XIX, fig. 1.

PLATE LXVII



Fossil Floras of the Ripley—Cretaceous

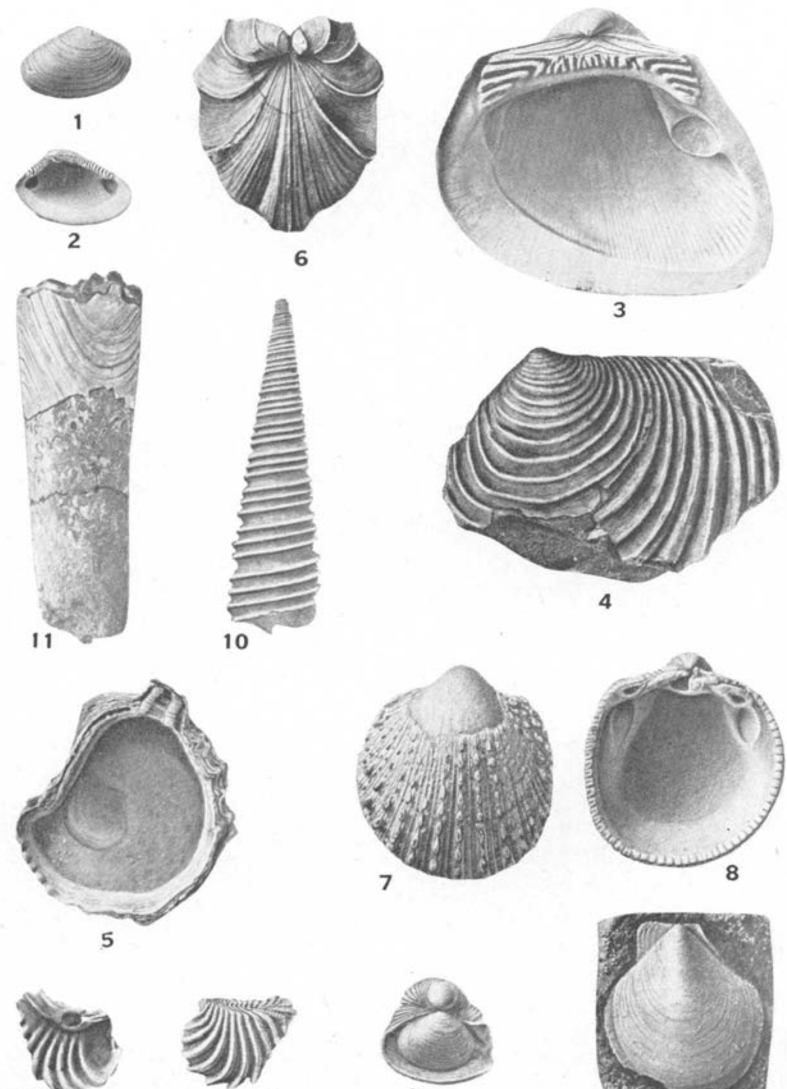
Explanation of Plate LXVIII

Ripley Faunas

1- 2.	*Nucula percrassa* Conrad (1, exterior view; 2, interior view). Coon Creek, Tennessee.
3.	*Cucullaena vulgaris* Morton. Coon Creek, Tennessee.
4.	*Inoceramus proximus* Tuomey. Coon Creek, Tennessee.
5.	*Ostrea plumosa* Morton. Coon Creek, Tennessee.
6.	*Veniella conradi* (Morton). Coon Creek, Tennessee.
7-8.	*Cardium kummeli* Weller. Coon Creek, Tennessee.
9.	*Corbula crassiplica* Gabb. Coon Creek, Tennessee.
10.	*Turritella trilira* Conrad. Coon Creek, Tennessee.
11.	*Bacu1ites ovatus* Say. Coon Creek, Tennessee.
12-13.	*Trigonia eufalensis* Gabb. Coon Creek, Tennessee.
14.	*Pecten simplicius* Conrad, Coon Creek, Tennessee.

All specimens are from the Coon Creek horizon of the Ripley formation, Tennessee, and are described and figured in U. S. Geol. Surv., Prof. Paper 137 by Wade. All figures are taken from this professional paper.

PLATE LXVIII



Fossil Faunas of the Ripley—Cretaceous