CORRELATION OF THE EOCENE FORMATIONS IN MISSISSIPPI AND ALABAMA

By Wythe Cooke

INTRODUCTION

During Eocene time the site of the boundary between the States of Mississippi and Alabama fell within the transition zone between the Mississippi embayment and the open Gulf of Mexico. That different types of deposition proceeded simultaneously within these two regions may be inferred from the different facies which deposits of the same age exhibit on opposite sides of the State line. In general, much clay and carbonaceous material were laid down in Mississippi, while shell marl, laminated sand, and limestone were being formed in Alabama. The purpose of this paper is to point out the equivalences of formations of different facies in the two States. The correlation adopted is shown in the following table, all the formation names in which have been previously used, except Kosciusko sandstone, a new name proposed for a member of the Lisbon formation.

Correlation of Eocene formations in Mississippi and Alabama

	Mississippi			Alabama	
	Jackson formation	Yazoo clay member		Jackson formation	Ocala limestone east of Tombigbee River
		Moodys marl member			
Claiborne group	Yegua formation			Gosport sand	
	Lisbon formation	Kosciusko sandstone member		Lisbon formation	
		Winona sand member			
	Tallahatta formation				
Wilcox group	Grenada formation		Overlapped area	Hatchetigbee formation	
	Absent			Bashi formation	
	Holly Springs sand			Tuscahoma formation	
	Overlapped near Tennessee boundary	Ackerman formation	Overlapped area	Nanafalia formation	
Midway group	Porters Creek clay	Tippah sandstone member	Unexplored area	Naheola formation	
				Sucarnochee clay	Overlapped area
	Clayton formation				

The Eocene of the Gulf region is commonly divided into four parts—the Midway, Wilcox, and Claiborne groups and the Jackson formation. The types of the Midway, Wilcox, and Claiborne groups are based on the superb sections of Eocene strata exposed along Alabama and Tombigbee rivers. These sections, as interpreted by Prof. Eugene A. Smith and his associates, have long been the standard for comparison with sections in other parts of the Gulf Coastal Plain. The type of the youngest division of the Eocene, the Jackson formation, is in Mississippi.

MIDWAY GROUP

The Midway group is divisible into three formations—the Clayton formation (at the base), the Porters Creek or Sucarnochee clay, and the Naheola formation. These three seem to constitute a conformable series but at places may be separated from one another by local unconformities. The group is set off from the underlying Cretaceous rocks by a profound unconformity and from the overlying Wilcox group by a less conspicuous break.

The Clayton is thickest in the neighborhood of Chattahoochee River, the eastern boundary of Alabama, and thins toward the west. In western Alabama and in Mississippi it is reduced to a thin bed of limestone, and over a considerable area in both States it is completely overlapped by the Porters Creek or Sucarnochee clay. The Porters Creek, on the other hand, is thickest in Tennessee or Mississippi and pinches out entirely or is completely overlapped about midway across Alabama. It is probable that the two formations are partly contemporaneous, but the base of the Clayton is doubtless older than any part of the Porters Creek. The Naheola formation, consisting prevailingly of highly micaceous yellow to red sand, extends across Alabama into Mississippi at least as far north as De Kalb. The Tippah sandstone member, at the top of the Porters Creek clay in northern Mississippi, is probably of the same age as the Naheola formation, and it is not unlikely that the two could be united on the map by more detailed field work. It is perhaps significant that deposits of bauxite occur in clays tentatively correlated with the Naheola formation in Henry County, Ala., and also above the characteristic Porters Creek clay and beneath lignitiferous beds of the Ackerman formation (Wilcox group) at several places in Mississippi.

WILCOX GROUP

The formations of the Wilcox group in Mississippi differ much more markedly from those of the typical Wilcox of Alabama than the Midway formations in Mississippi differ from the Midway of Alabama. The State line lies not far from a natural boundary or transition zone which separates areas differing in type of deposists. It has been necessary to assign different names on opposite sides of the State line to several divisions of the Wilcox group.

The classic work of E. A. Smith and others, culminating in 1894 in their report on the geology of the Alabama Coastal Plain,[1] separated the Wilcox group of Alabama into four formations—the Nanafalia (lowest), Tuscahoma, Bashi, and Hatchetigbee. The first separation of the Wilcox group of Mississippi into formations was made in 1913, by E. N. Lowe,[2] who named the Ackerman (lowest), Holly Springs, and Grenada formations. Two years later [3] he added the "Woods Bluff formation," an alternate name for the Bashi formation, basing his recognition upon fossils identified by me. Berry [4] in 1917 pointed out the presence of the Hatchetigbee formation near Meridian.

The Nanafalia formation, which forms the base of the Wilcox group in Alabama, extends from Chattahoochee River at Fort Gaines, Ga., as far west as the junction of Yantley and Tickabum creeks in Choctaw County but has not been recognized in Mississippi. It contains a considerable proportion of hard rock resembling the buhrstone of the Tallahatta formation (of the Claiborne), which distinguishes it from the other parts of the Wilcox group, and it is further distinguished by carrying a great profusion of *Ostrea thirsae*.

In Mississippi the position at the base of the Wilcox group is occupied by the Ackerman formation, which is most extensively developed in the middle part of its belt of outcrop and pinches out near the Tennessee line on the north and near the Alabama line on the east. It consists of gray, rather massive clays, some of which are lignitic, and contains a peculiar flora. No marine fossils have been found in it. The Ackerman formation is tentatively correlated with the Nanafalia formation on the basis of its apparent stratigraphic position, but it may be equivalent to the lower part of the Tuscahoma formation of Alabama.

The Tuscahoma formation extends entirely across Alabama and abuts against the Holly Springs sand at the Mississippi line. Its most characteristic lithologic facies are very fine laminated gray sand and clay and yellow sand containing angular tilted blocks of laminated clay. Both of these facies are found also in the Holly Springs sand in eastern Mississippi. It is obvious that the Holly Springs is equivalent to at least part of the Tuscahoma, but whether or not both formations occupy the same stratigraphic interval would be difficult to prove. No marine fossils have been found in the Holly Springs to compare with a rather characteristic fauna in the type

[1] E. A. Smith, Johnson, L. C., and Langdon, D. W., jr., Report on the geology of the Coastal Plain of Alabama, Alabama Geol. Survey, 1894.

[2] Preliminary report on iron ores of Mississippi: Mississippi Geol. Survey Bull. 10, pp. 23–25, 1913.

[3] Mississippi Geol. Survey Bull. 12, p. 71, 1915.

[4] Berry, E. W., Geologic history indicated by the fossiliferous deposits of the Wilcox group (Eocene) at Meridian, Miss.: U. S. Geol. Survey Prof. Paper 108, p. 62, 1917.

area of the Tuscahoma, and too few plant remains are known from the Tuscahoma to furnish an adequate basis for comparison with the large flora of the Holly Springs.

The Bashi formation crops out along a narrow band extending nearly across Alabama but apparently is covered by an overlap of Hatchetigbee clays in western Choctaw County, near the Mississippi line. In Mississippi it has been recognized at only two localities near Meridian, but shells reported by Hilgard [5] from sec. 33, southwest of Marion and 2 or 3 miles north of Meridian, although referred by him to the Claiborne, probably came from the Bashi formation. The characteristic feature of the Bashi is a marl bed which has become locally indurated into gray pillow-like nodules of speckled marlstone or impure limestone. The marl at most places contains a large and varied fauna of mollusks.

Overlying the Bashi formation at Meridian and apparently overlapping for several miles beyond the Bashi is the Hatchetigbee formation, which is made up of brown or chocolate-colored, more or less carbonaceous clay and gray sand. In Mississippi the Hatchetigbee appears to be restricted to Lauderdale County, of which it covers somewhat more than 300 square miles, and the northeast corner of Clarke County. In Alabama its belt of outcrop extends across the State but is interrupted by overlaps of younger formations at the eastern extremity. Fossil leaves taken from Hatchetigbee clay at Meridian correlate the formation closely with the Grenada of northwestern Mississippi.[6] The Grenada formation, which is very similar in appearance to the Hatchetigbee, has been mapped from the vicinity of Duck Hill, Montgomery County, Miss., northward to the Tennessee line and is known to extend for a considerable distance into Tennessee.

CLAIBORNE GROUP

The Claiborne group is divided into three formations—the Tallahatta (lowest), Lisbon, and Yegua formations in Mississippi and the Tallahatta and Lisbon formations and Gosport sand in Alabama.

The Tallahatta formation extends from Grenada County, Miss., where it emerges from beneath the loess, eastward across Mississippi and Alabama and is still recognizable across Chattahoochee River at Fort Gaines, Ga. The formation nearly everywhere is easily identifiable by its characteristic lithology, consisting chiefly of brittle claystone or diatomaceous earth and hard sandstone with angular lumps of claystone, but in eastern Alabama these rocks are not conspicuous and most of the formation is composed of loose sand. Crider [7] and Lowe [8] included in the Tallahatta certain beds of quartzitic to granular sandstone which are most extensively developed in Attala and adjoining counties of Mississippi but are here regarded as a local facies of the Lisbon formation. Lowe divided the Tallahatta formation into two parts—a lower, called the Winona sand, and an upper, called the "Basic claystone." He regarded the sandstone of Attala County as equivalent to the "Basic claystone," which is typical Tallahatta formation, but the buhrstone of the Tallahatta can be traced beneath the typical Winona, which underlies the sandstone. The Winona is here treated as the basal member of the Lisbon formation.

In Alabama the Lisbon formation consists of two parts to which individual names have not been applied. The lower part consists chiefly of fine yellow or reddish sand and pale-green flaky clay. The upper part is made up of calcareous clay, impure limestone, or shell marl.

Lowe [9] has divided the Lisbon of Mississippi into four members— the "Enterprise green marl" (lowest), "Decatur sand," "Wautubbee marls," and "Cockfield beds." The last is usually regarded as synonymous with the Yegua formation of Texas and Louisiana and is treated as an independent formation overlying the Lisbon. The names "Enterprise" and "Decatur" have been dropped because they had already been used for a shale and a limestone in Kansas and Tennessee.

The "Enterprise marl," named from a village in Clarke County, contains a great deal of glauconite, which, on weathering, gives rise to highly ferruginous red beds. These red beds are perhaps the most conspicuous member of the Lisbon formation and can easily be traced northwestward along a belt adjacent to the outcrop of the Tallahatta formation. They appear to merge into the typical Winona sand. As the name "Enterprise" is preoccupied, the Winona sand is here redefined so as to include the typical Winona sand of Montgomery County and the typical "Enterprise marl" of Clarke County but to exclude the sands at the base of the Tallahatta formation in Lauderdale County which were erroneously correlated with the Winona by Lowe.

Above the Winona red beds lie sand beds called the "Decatur sand" by Lowe. The ledges of hard sandstone in Attala County referred to in the discussion of the Tallahatta formation appear to represent an indurated facies of these sands. The name Kosciusko sandstone member is here proposed as a designation for the ledges of saccharoidal to quartzitic

[5] Hilgard, E. W., Geology and agriculture of the State of Mississippi, p. 124, 1860.

[6] Berry, E. W., Geologic history indicated by the fossiliferous deposits of the Wilcox group (Eocene) at Meridian, Miss.: U. S. Geol. Survey Prof. Paper 108, pp. 61–72, 1917. This correlation was suggested by Lowe in Mississippi Geol. Survey Bull. 12, p. 72, 1915.

[7] Crider, A. F., Geology and mineral resources of Mississippi: U. S. Geol. Survey Bull. 283, pp. 29–32, 1906.

[8] Lowe, E. N., Mississippi, its geology, geography, soil, and mineral resources: Mississippi Geol. Survey Bull. 12, pp. 72–76, 1915; Bull. 14, pp. 73–76, 1919.

[9] Lowe, E. N., Mississippi Geol. Survey Bull. 12, pp. 76–78, 1915; Bull. 14, pp. 77–79, 1919.

sandstone exposed in the vicinity of Kosciusko, the county seat of Attala County, Miss., and for the unconsolidated sands of the same age in Mississippi. The name "Decatur sand," being preoccupied, will be dropped.

The "Wautubbee marls," which lie at the top of the Lisbon formation in Mississippi, carry the characteristic Lisbon fauna and may be regarded as the equivalent of the upper or typical part of the Lisbon of Alabama, which they closely resemble. For this reason it seems better to regard them not as a member of the formation but as the undivided part of the formation, and the local name is not needed.

The famous sand bed at Claiborne, Ala., which has yielded so many beautiful shells, is now called the Gosport sand. It is the topmost formation of the Claiborne group. It is nowhere very thick and, except for its shells, is not very significant. It contains a few lenses of leaf-bearing clay which suggest correlation with the Yegua formation. The Gosport lies conformably on the Lisbon formation and is overlain by the *Scutella*-bearing bed at the base of the Ocala limestone.

A series of beds of carbonaceous sand and clay, the extension of the Yegua formation of Texas, crosses Louisiana and Mississippi, rapidly thins toward the east, and probably merges with the Gosport sand in Alabama. The correlation of the Yegua with the Gosport is based primarily upon the stratigraphic position of both between the Lisbon and the Jackson, for the paleontologic evidence is inadequate. Of the 14 species of plants recorded from the Gosport sand only 7 are included in the list of 66 from the Yegua.[10]

DEPOSITS OF JACKSON AGE

Deposits of Jackson age form the upper division of the Eocene. They lie conformably above the Claiborne group and below the Vicksburg group (Oligocene). Two formations, the typical Jackson formation and the Ocala limestone, are recognized in this division of the Eocene in Mississippi and Alabama, and they are regarded as contemporaneous.[11] Many fossils are common to the two formations, but each has some peculiar species. The formations differ in lithology.

The Jackson formation in Mississippi consists of two members—the Moodys marl at the base and the Yazoo clay at the top. The Moodys marl contains the celebrated shell bed from which many beautifully preserved fossils have been taken but is not otherwise notable. The Yazoo clay is much thicker and more extensive and is the horizon of *Basilosaurus cetoides*, the "zeuglodon." The Jackson formation extends from the bluffs bordering the Yazoo Delta eastward across Mississippi and into Alabama as far as Tombigbee River, where it merges into the Ocala limestone.

The Ocala limestone extends eastward from Tombigbee River across Alabama and is widely distributed in Florida and southwestern Georgia.

[10] Berry, E. W., The middle and upper Eocene floras of southeastern North America: U. S. Geol. Survey Prof. Paper 92, p. 31, 1924.

[11] Cooke, C. W., Correlation of the deposits of Jackson and Vicksburg ages in Mississippi and Alabama: Washington Acad. Sci. Jour., vol. 8, pp. 186–198, 1918.