

MOLLUSKS FROM THE TYPE LOCALITY OF THE CHOCTAWHATCHEE MARL.

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Dr. Wm. H. Dall¹ in 1892 referred the beds of true Miocene age in Florida to the Chesapeake group, and recognized two subdivisions which he designated the Jacksonville limestone in the eastern area and the "Ecphora bed" in the area west of the meridian of Tallahassee. The same author in 1903 wrote:

After the elimination of the Oligocene series from the so-called Miocene of Florida we have remaining practically only one series of beds which has been identified over a considerable area of northern Florida. The Miocene appears as a soft limestone rock in the vicinity of Jacksonville, and has been traced by material from artesian wells on the east side of the peninsula as far south as Lake Worth. The layers of fossiliferous marl in the vicinity of Chipola River, at Alum Bluff, and other localities in western Florida are usually less than 30 feet in thickness, but counting unfossiliferous clays, etc., it has been estimated that the rocks of this age in Florida may have attained to a thickness of some 500 feet or less.²

In 1910, Matson and Clapp³ gave a geographical formational name to the "Ecphora bed"⁴ and "aluminous clay"⁵ of Dall, and say:

In Florida the limestones, clays, and sandstones of the Miocene are lithologically so unlike the shell marls, that in the absence of satisfactory paleontologic evidence for their exact correlation, it seems best to describe them separately. The two divisions are therefore retained, but a new name is given to the marl. The "Ecphora bed" of Dall is here called the Choctawhatchee marl, from the river in western Florida where it is well exposed. At Dall's type locality the Jacksonville formation is known only from well records and excavations; hence the name is not entirely satisfactory. However, the United States Geological Survey has decided to retain "Jacksonville" as the name of the formation.

The Choctawhatchee marl takes its name from Choctawhatchee River, where it is well exposed in the vicinity of Redbay, a small

¹ Dall, Wm. H., and Harris, G. D., Neocene of North America, Bull. 84, U. S. Geol. Survey, 1892, pp. 123, 124.

² Trans. Wagner Free Inst. Sci., vol. 3, pt. 6, p. 1594.

³ Florida Geol. Survey, 2nd Ann. Rep., pp. 108, 114.

⁴ Bull. U. S. Geol. Survey, No. 84, 1892, p. 124.

⁵ Bull. Geol. Soc. America, vol. 5, 1894, pp. 168, 169.

settlement about 18 miles southeast of De Funiak Springs, Walton County, Florida. At Alum Bluff, Florida, this formation consists of a lower bed of dark gray to greenish fossiliferous sand above which is a steel gray unfossiliferous sandy clay to which Doctor Dall applied the name "Aluminous Clay," on account of the seepage from it of alum-bearing water.

The following is a list of species collected by George C. Matson on the John Anderson farm, 1 mile south of Redbay, Florida, identified by Dr. T. W. Vaughan¹ with his determination of the geologic horizon:

Turritella variabilis Conrad.

Dentalium attenuatum Say.

Arca staminea Say.

Pecten cf. *eboreus* Conrad.

Pecten madisonius Say.

Crassatellites melinus Conrad.

Chama arcinella Linnaeus. (Jackson bluff var.)

Cardium acutilaqueatum Conrad.

Venus rileyi Conrad.

Horizon—Miocene.—Jackson's bluff, Coe's Mill, upper bed at Alum Bluff.

During the autumn of 1914, Dr. C. Wythe Cooke and the writer visited Redbay, and obtained an additional collection of fossils near the place from which Mr. George Matson in 1908 obtained the collection identified by Doctor Vaughan. The exact location of Mr. Matson's collecting is on the Anderson farm, 1 mile south of Redbay, while the later collection was at a bluff beneath a spring, in E. Gomillion's field, about one-fourth mile east of Redbay. These two collections furnish the material for this paper.

According to Matson²

The Choctawatchee marl attains a thickness of over 50 feet in the vicinity of Redbay, Walton County, where it is exposed in some small ravines, and exceeds 30 feet on the banks of Mill Creek near Holland Post Office, Leon County. However, from observation elsewhere, it appears probable that the average thickness is not more than 25 to 30 feet. It rises to the surface in a belt 6 to 12 miles in width, extending from southern Walton County eastward to Leon County.

The following notes were taken in the vicinity of Redbay by Doctor Cooke:

The Choctawatchee marl is a bluish-gray argillaceous sand containing many fossils. Parts of it are micaceous. It outcrops in a bluff forming an escarpment which may easily be traced. The access to the outcrops is usually difficult, owing to the growth of dense tangled masses of vines and a covering of leaves and talus. An exposure of about 10 or 15 feet was found beneath a spring called "Dripping Spring," in E. Gomillion's field, about one-fourth of a mile east of Redbay. The material consists of blue argillaceous sand marl, replete with shells in the lower part but preserved only as casts in the laminated upper part. Above this bed is a yellow incoherent sand, which forms hill slopes. Springs issue from the top of the marl bed.

The character of the matrix in which the fossil collection one-fourth mile east of Redbay, Florida, was obtained, is as follows:

¹ Florida Geol. Survey, 2nd Ann. Rep., p. 117.

² Water Supply Paper 319, pp. 129-130.

Color, greenish-gray; size of grains varying from about 0.3 mm. to about 0.9 mm. in greatest diameter; feel, not harsh; effervescing rapidly in hydrochloric acid.

Under the microscope one sees:

(1) Small, angular, clear, sand grains, making up about seven-tenths of the mass. The size of the grains varies from about 0.2 mm. to about 0.4 mm. in greatest diameter, the average size of 10 grains taken at random being 0.297 mm.

(2) Small, mostly rounded, coal-black particles, the size of which varies from about 0.2 mm. to about 0.35 mm. greatest diameter, the average size of 10 particles taken at random being 0.2675 mm.

(3) Irregular, porous, very light gray particles, probably calcium carbonate, the size of which varies from about 0.3 mm. to about 0.9 mm., greatest diameter, the average size of 10 particles taken at random being 0.7965-mm.

(4) A few specimens of Foraminifera, broken spines of Echinoderms, and shell particles.

Observations under microscope after treatment of matrix with hydrochloric acid: Numbers 3 and 4 of the above disappeared, while 2 separated into fine particles. No. 2 was tested for phosphorus, but no convincing evidence of its presence was obtained. This material is probably of organic origin.

The following list gives the fauna from near Redbay, and the range of the species identified in other strata. A=upper bed at Alum Bluff; J=beds at Jackson Bluff; O=Oligocene; M=Miocene; P=Pliocene:

Fauna of Choctawhatchee marl near Redbay, Walton County, Florida.

Name.	A.	J.	O.	M.	P.
<i>Turritella variabilis</i> Conrad, variety (?)	*	*		*	
<i>Crucibulum auricula</i> Gmelin, variety (?)		*	?	*	*
<i>Dentalium attenuatum</i> Say	*	*		*	*
Shark's tooth					
<i>Leda choctawhatcheensis</i> , new species					
<i>Glycymeris</i> , species indeterminable					
<i>Arca</i> (<i>Scapharca</i>) <i>staminea</i> Say, <i>rubisiniana</i> , new subspecies.					
<i>Ostrea</i> (yo.)					
<i>Pecten gibbus</i> Linnaeus				*	*
<i>Pecten</i> , species indeterminable					
<i>Pecten madisonius</i> (?) Say			*	*	
<i>Crenella</i> , species (yo.)					
<i>Astarte</i> (yo.)					
<i>Astarte vaughani</i> , new species					
<i>Crassatellites melinus</i> Conrad	*			*	
<i>Venericardia</i> (yo.), species indeterminable					
<i>Chama arcinella</i> Linnaeus (Jackson Bluff variety)		*		*	*
<i>Phacoides crenulatus</i> Conrad	*	*		*	
<i>Phacoides choctawhatcheensis</i> , new species					
<i>Phacoides</i> , species indeterminable (specimen eroded)					

Fauna of Choctawhatchee marl near Redbay, Walton County, Florida—Continued.

Name.	A.	J.	O.	M.	P.
<i>Diplodonta</i> , 2 species, indeterminable.....					
<i>Diplodonta waltonensis</i> , new species.....					
<i>Diplodonta</i> (?), indeterminable.....					
<i>Sphaerella</i> (?), 2 species (fragments).....					
<i>Cardium acutilaqueatum</i> Conrad.....	*			*	
<i>Dosinia elegans</i> Conrad.....	*			*	*
<i>Macrocallista maculata</i> Linnaeus.....			*		*
<i>Venus rileyi</i> Conrad.....				*	*
<i>Semele</i> , species indeterminable.....					
<i>Corbula</i> , species (?), (1 specimen).....			?		
<i>Corbula</i> , species indeterminable.....					
<i>Panope goldfussi</i> Wagner.....	*			*	

The foregoing list contains one identified species which is represented in the Oligocene, five are exclusively Miocene, and none occur exclusively in beds younger than the Miocene.

Seven species are represented in the upper bed at Alum Bluff, Florida, and five at Jackson Bluff, southwest of Tallahassee, Florida.

The following observations are noted in regard to the seven species represented at Alum Bluff:

Turritella variabilis Conrad.—Not an Alum Bluff variety, but closer to the Jackson Bluff variety.

Dentalium attenuatum Say.—Specimen somewhat eroded; no variation can be detected.

Phacoides crenulatus Conrad.—Lacks the strong hinge of Alum Bluff var. *pemphigus* Dall, but possesses the fine concentric sculpture.

Cardium acutilaqueatum Conrad.—This is a poor specimen; no variation can be detected.

Panope goldfussi Wagner.—Close to, if not the same, variety found at Alum Bluff.

Crassatellites melinus Conrad.—Not the Alum Bluff variety.

Dosinia elegans Conrad.—This is a poor specimen; no variation can be detected.

Observations of other listed species are as follows:

Astarte vaughani, new species.—A closely allied form occurs in the De Funiak (Florida) *Cardium* zone, and also at Porter's Landing, Georgia.

Macrocallista maculata Linnaeus.—Has not been previously reported in the Miocene beds of the Gulf fauna.

Venus rileyi Conrad.—Variety occurs 3½ miles southwest of De Funiak Springs, Florida.

Corbula, species (?).—Is a near relative to an undescribed form at Flournoy's Mill near Argyle, Walton County, Florida.

Twenty genera of pelecypods and two of gastropods are listed from Redbay. On the other hand in the upper bed at Alum Bluff, there are 32 genera of gastropods and 27 of pelecypods listed by Doctor Dall.¹

On account of the small collections and the unidentifiable character of some specimens, it is not possible to determine the exact synchronism of the fauna with that of the upper bed at Alum Bluff, however, the species present indicate that the beds represent nearly the same if not precisely the same horizon.

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ARCA (SCAPHARCA) STAMINEA Say, new subspecies RUBISINIANA.

Plate 113, figs. 1, 3.

Shell of moderate size, rhombic and inflated; beak prominent, slightly prosogyrate, and situated near anterior third of length of the valve. There are 32 transverse nodulose radiating ribs, which are a little narrower over the middle of the disk than intervening spaces. Those on the posterior angle and anterior arch are a little wider. The two radials at the angle on the posterior side and one on the anterior are divided by an incised line basally for about half their length. The nodules are quite evenly spread over the disk, except on the posterior side, where they are replaced by nearly square crenulated ribs. In front, the disk is rounded; posteriorly, it is nearly vertically truncated, forming a somewhat extended edge. Anterior margin rounded; basal margin nearly straight; slightly oblique to hinge line and meeting the posterior margin in a short rounded line. Cardinal area triangular, flattened beneath the beak, and sulcated by four angled impressed lines. Hinge line, short, direct except at extremities, where it is slightly curved downward. There are 12 anterior and 26 posterior oblique mesially crowded teeth. The inner margin of the valve is fluted; the interior radically striated.

Type (Cat. No. 166911, U.S.N.M.).—This measures—length, 36 mm.; height, 31 mm.; diameter (double), 35 mm.

Type-locality.—Miocene of Florida, bluff on John Anderson's farm, 1 mile south of Redbay, Walton County, Florida. George C. Matson, collector.

Discussion.—Other poorly preserved specimens from same locality are larger, one measuring: length, 40 mm.; height, 40.5 mm.; diame-

¹Trans. Wagner Free Inst. Sci., vol. 3, pt. 6, pp. 1596-8.

ter, 45 mm. (double). Of these, one has 31 ribs and 5 have 30. Some of them show wider interspaces between radial ribs than type.

This subspecies differs from other forms of *A. staminea* Say, in having a straighter base line and more extended posterior edge. The ribs are squarer and show less tendency to be divided by longitudinal incised lines. The specimen¹ is the type of *A. staminata* Dall. Figure 13 is Miocene in age, and closer related to *A. staminea* than *A. staminata*. See also for comparison fig. 10 on plate 113.

LEDA CHOCTAWHATCHEËNSIS, new species.

Plate 113, figs. 2, 4.

Shell small, solid, subequilateral. The sculpture consists of 11 concentric, somewhat lamelliform ribs, which are finer and closer spaced near the beak and coarser, with wide interspaces, and very prominent over the middle of the disk. Anteriorly these lamellae become flattened and reflected beakward, but obsolete near a faintly indicated posterior ray. The large depressed escutcheon is set off by a nearly smooth carina, extends to the end of the rostrum, and is crossed by four low thread-like longitudinal lines. The narrow elongate lunule is set off by a broken ridge formed by the abruptly tapering of all of the concentric lamelliform ribs except three which continue as low, nearly longitudinal lines over the lunule. Anterior end rounded and much shorter than posterior; posterior end roundly pointed; base broadly rounded. There are 14 teeth on each side of the triangular-shaped chondrophore. The interior of valve has three concentric rounded folds corresponding to the depressions of the exterior sculpture.

Type (Cat. No. 166916 U.S.N.M.).—This measures—length, 5.4 mm.; height, 3.2 mm.; diameter (double), 3.2 mm.

This species is closely related to *Leda trochilia* Dall, but has coarser, wider spaced, and more prominent concentric ribs over the middle of the disk; a better defined lunule; absence of a depressed anterior ray; lack of sculpture on posterior ray; a nearly smooth escutcheon carina; and a more broadly rounded marginal base.

Type-locality.—Miocene of Florida, E. Gomillion's field, one-fourth mile east of Redbay, Walton County. C. Wythe Cooke, collector.

PHACOIDES (PLEUROLUCINA) CHOCTAWHATCHEËNSIS, new species.

Plate 113, figs. 5, 6.

Shell solid, suborbicular, slightly oblique, moderately convex, height and length nearly equal; anterior dorsal margin longer and sloping at a lower angle than the posterior dorsal margin; basal margin rounded and slightly undulated; beak small, prosogyrate and partly overhangs small depressed lunule; ligamental area depressed,

¹ Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, pl. 31, fig. 11.

quite deep, and long; anterior dorsal area slightly depressed and strongly separated from the rest of the surface by a wide shallow groove, which widens distally; posterior dorsal area arched, prominent, much larger than anterior, and resembles the first anterior radial rib. Surface with rather coarse raised concentric lamellae, which are slightly thickened over the radial ribs and dorsally reflected more near the margin and between the radial ribs. On the last half of the disk the lamellae are grouped into series and are separated by wide interspaces, between which are many fine rounded concentric threads. The radial sculpture consists of four diverging ribs, which are separated by moderately shallow distally widening interspaces. The median interspaces become nearly obsolete near the margin. The inner margin of the valve is crenate. The posterior lateral socket is about one-third the length of the valve from the cardinal teeth; the anterior socket is a little nearer; both are moderately deep and large. The two cardinal teeth are of nearly equal size, the posterior cardinal being a little eroded, and appears to be slightly bifid. The anterior socket is small and shallow.

Type (Cat. No. 166915 U.S.N.M.)—This measures—length, 10.3 mm.; height, 9.4 mm.; diameter (double), 7.4 mm. A broken and eroded specimen from the same locality is a little larger and more mature, but shows better the characteristic wide interspaced areas between the grouped concentric lamellae, which probably represent rapid-growth periods of the shell.

This species is related to the Oligocene *Phacoides* (*Pleurolucina*) *quadricostatus* Dall, and its closely allied form, the recent *Phacoides leucocyma* Dall, but differs from both in being larger and much longer and having a more prominent posterior area. It is less oblique and has a proportionately longer ligamental depression than *P. quadricostatus*. It is a little smaller than the Pliocene *Phacoides* (*Pleurolucina*) *amabilis* Dall, but appears to be less closely related to it than to either the Oligocene or recent species above cited.

This species records its subgenus "*Pleurolucina*" for the first time from the Miocene of Florida.

Type-locality.—Miocene of Florida, E. Gomillion's field, one-fourth mile east of Redbay, Walton County, Florida. C. Wythe Cooke, collector.

ASTARTE (ASHTAROTHA) VAUGHANI, new species.

Plate 113, figs. 8, 9.

Shell small, solid, subtriangular, nearly equilateral; beak moderately compressed and acute, inclined a little forward; anterior and posterior slopes nearly straight and of equal length; anterior and posterior basal margins rounded; basal margin broadly rounded; tip of beak smooth; beak sculptured with rounded concentric rib-

lets, which become higher and more broadly undulated to about the first third of the disk and then flatten out and become nearly obscure near the margin; whole surface with fine irregular growth lines, not sufficiently prominent to destroy the somewhat smooth appearance of the surface; posterior dorsal area depressed, nearly smooth and not sharply defined; lunule lanceolate, defined by a faint ridge, and is more distinct and depressed than posterior area. Anterior and posterior and basal inner margins crenulated with alternate ridges and pitted grooves. Anterior and posterior adductor scars prominent. Middle right cardinal tooth is large, slightly furrowed, elevated, and has crenulated inner sides. The anterior right cardinal is small, slightly elongate and lower than middle, but higher than posterior. Posterior terminal cardinal narrow and elongate. The lateral tooth and laminae not prominent and extend to about two-fifths length of valve.

Type (Cat. No. 166914 U.S.N.M.).—This measures—right valve, length, 9.5 mm.; height, 9.3 mm.; diameter (double), 5.2 mm.

This species is closely related to *Astarte* (*distans* var. ?) *floridana* Dall, but differs in the following respects: It is smaller; has less pointed and anteriorly inclined beaks; has shorter and more rounded posterior basal end; has more indistinct lunule and escutcheon areas; has shorter ligamental depression; and has more rounded undulations and smoother surface. The young forms of both *Astarte* (*distans* var. ?) *floridana* Dall and *Astarte distans* Conrad are much more depressed, thinner, more wrinkled, longer and more rostrate than the present species. In no specimen of these species examined was any of equal size found that possessed the crenulated inner margins which all unworn specimens of the new species show. *Astarte glenni* Dall lacks the undulated surface, has a more drawn out beak and a stronger hinge.

Type-locality.—Miocene of Florida, E. Gomillion's field, one-fourth mile east of Redbay, Walton County, Florida. C. Wythe Cooke, collector.

DIPLODONTA WALTONENSIS, new species.

Plate 113, fig. 7.

Shell medium size, ovate-trigonal, moderately convex, very thin, marked by many fine, closely spaced, inconspicuous, concentric rounded threads, which are nearly obscure on upper part of the disk, but visible near the margin. Anterior side shorter than the posterior, with the margin well rounded. Upper posterior part of disk rounded and somewhat truncated near the margin, the anterior side sloping more gradually. Beaks are low and small. Hinge plate narrow and channelled in front; cardinal teeth normal; the left anterior cardinal being short and distally sulcated, while the posterior is long.

Type (Cat. No. 166913 U.S.N.M.)—This measures—length of left valve, 16.5 mm.; height, 15 mm.

This shell recalls *Diplodonta radiata* Dall, from the Oligocene at Oak Grove, Florida, but differs from it as follows: The surface is smoother, the posterior side is more rounded, and the left posterior cardinal is proportionally longer.

The described specimen is somewhat eroded; the lower ventral margin is wanting, which prevents a more detailed description.

Type-locality.—Miocene of Florida, E. Gomillion's field, one-fourth mile east of Redbay, Walton County, Florida. C. Wythe Cooke, collector.

EXPLANATION OF PLATE 113.

FIG. 1. *Arca* (*Scapharca*) *staminea rubisiniana*, new subspecies; type; length, 36 mm. natural size; p. 603.

2. *Leda choctawhatcheënsis*, new species; type; length, 5.4 mm.; figure $\times 5$; p. 604.

3. Interior view of figure 1; p. 603.

4. Interior view of figure 2; p. 604.

5. *Phacoides* (*Pleurolocina*) *choctawhatcheënsis*, new species; type; length, 10.3 mm.; figure $\times 3$; p. 604.

6. Exterior view of figure 5; p. 604.

7. *Diplodonta waltonensis*, new species; type; length 16.5 mm.; figure $\times 1\frac{1}{2}$; p. 606.

8. *Astarte* (*Ashtarotha*) *vaughani*, new species; type; length, 9.5 mm.; figure $\times 3$; p. 605.

9. Interior view of figure 8; p. 605.

10. *Arca* (*Scapharca*) *staminea rubisiniana*, new subspecies; figured specimen; natural size.

11. *Chama arcinella* Linnaeus; Jackson Bluff variety; natural size.

12. Interior view of figure 11.

Figs. 11 and 12 serve to illustrate the variety which is not described in the text.



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