

STATE OF FLORIDA
DEPARTMENT OF CONSERVATION
GEORGE W. DAVIS, *Supervisor*

GEOLOGICAL BULLETIN No. 14

ADDITIONS TO THE MOLLUSCAN FAUNA OF THE
ALUM BLUFF GROUP OF FLORIDA

BY
JULIA GARDNER
United States Geological Survey

Tallahassee, Florida
1936

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LETTER OF TRANSMITTAL

*Honorable George W. Davis,
Supervisor of Conservation.*

DEAR MR. DAVIS:

The Florida Geological Survey has received from the United States Geological Survey the manuscript of a short paper entitled "Additions to the Molluscan Fauna of the Alum Bluff Group of Florida" by Dr. Julia Gardner. In 1926 the Federal Survey published as Professional Paper 142 a comprehensive treatment of the fauna of the Alum Bluff group of formations of Florida and the present short paper is a supplement, based largely on collections made subsequently. It will make therefore the treatment of the fauna of this interesting group more complete. This paper is a contribution from the Federal Survey, the only expense being that of publication. It is with deep appreciation that acknowledgment of this generous cooperation is made. I recommend that it be published as Geological Bulletin No. 14.

Very respectfully,

HERMAN GUNTER, *Assistant Supervisor,
State Board of Conservation,
Geological Department.*

Tallahassee, Florida,
December 3, 1935.

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ADDITIONS TO THE MOLLUSCAN FAUNA OF THE ALUM BLUFF GROUP OF FLORIDA¹

BY

JULIA GARDNER

INTRODUCTION

Although a comparatively short space of time has elapsed since the publication of the Molluscan Fauna² of the Alum Bluff group,³ subsequent collections, the most of which have been made by the Florida State Geological Survey, have yielded a number of mollusks of unusual interest. Many of the finest specimens are undescribed and others exhibit new characters of importance in the discussion of known species. The incompleteness of our published record so clearly indicated is in accord with estimates based on crude comparisons with the Recent faunas. A rough count of the existing fauna listed by Johnson⁴ includes between 400 and 450 pelecypods from the east coast of Florida. There is no apparent reason to assume that the warm water lower and middle Miocene faunas numbered appreciably fewer species than the Recent. The Chipola fauna, probably the warmest water and the most prolific, has yielded not quite 200 pelecypods, something less than half the postulated fauna at the time of deposition. Many of the missing have doubtless left no record, but it is probable that even in casual collections made for many years to come, undescribed species or interesting examples of already described forms will see the light.

¹Published by permission of the Director, U. S. Geological Survey, Washington, D. C.

²Only the report upon the bivalves has appeared. The first of the parts covering the gastropods is now in press. The rest will follow.

³Gardner, Julia, The molluscan fauna of the Alum Bluff group of Florida: U. S. Geol. Survey Prof. Paper 142, pp. 1-249; pls. 1-36, 1926-1928.

⁴Johnson, Charles W., List of marine Mollusca of the Atlantic Coast from Labrador to Texas: Boston Soc. Nat. Hist., Proc., vol. 40, no. 1, pp. 1-204, July, 1934.

The present appendix covers the most of the new bivalves that have appeared since the publication on the Alum Bluff fauna and a few gastropods common to the Shoal River, the uppermost of the formations of the Alum Bluff group, and the Choctawhatchee, which overlies the Alum Bluff. In working up the Choctawhatchee gastropods, Dr. W. C. Mansfield⁵ came upon a number of species common to the Choctawhatchee and the Shoal River. As the Alum Bluff gastropods had already been named, described and figured, Doctor Mansfield most courteously and most kindly has, in his published bulletins, made mention of these common forms by their generic determinations only. Some of the descriptions and figures of the Alum Bluff gastropods are already in the hands of the editor or the printer, but those forms still in my possession, which occur both in the Choctawhatchee and the Shoal River, have been included with the bivalves.

I am greatly indebted to Nelson W. Shupe of the U. S. Geological Survey, who has made the photographs, and to Miss Frances Wieser who has retouched them.

DISTRIBUTION OF THE FAUNA

The following list shows the localities cited by number in the text.

- 2238. Flournoy's mill race, 2 miles east of Argyle, and 5 miles east of DeFuniak Springs, near railroad, Walton County, Fla.
- 2646. Oak Grove, west bank of Yellow River, Okaloosa County, Fla.
- 3731. Near Mossyhead, sec. 6, T.3 N., R.21 W., Walton County, Fla.
- 3732. Dave Adams' Mill Creek, sec. 2, T. 3 N., R. 21 W., Walton County, Fla.
- 3733. Three-fourths mile west of Shell Bluff Landing, Shoal River, Walton County, Fla.
- 3742. Shell Bluff, Shoal River, Walton County, Fla.
- 3748. Summerville mill race, 1 mile east of Argyle, Walton County, Fla.
- 3856. 6 miles west-northwest of Mossyhead, Walton County, Fla.

⁵Mansfield, W. C., Miocene gastropods and scaphopods of the Choctawhatchee formation of Florida: Florida State Geol. Survey, Bull. No. 3, pp. 1-189; pls. 1-21, 1930. New Miocene gastropods and scaphopods from Alaquia Creek Valley, Florida: State of Florida Dept. Conservation, Geol. Bull. No. 12, pp. 1-64; pls. 1-5, 1935.

- 5079. One-half mile below Shell Bluff, Shoal River, Walton County, Fla.
- 5080. At head of first ravine below Shell Bluff, 200 yards north of Shoal River, Walton County, Fla.
- 5184. At head of first ravine below Shell Bluff, 200 yards north of Shoal River, Walton County, Fla.
- 5195. At head of first ravine below Shell Bluff, 200 yards north of Shoal River, Walton County, Fla.
- 5618. $3\frac{1}{2}$ miles southwest of De Funiak Springs, Walton County, Fla.
- 5632. Oak Grove, Yellow River, Okaloosa County, Fla.
- 5633. Below Oak Grove Bridge, Yellow River, Okaloosa County, Fla.
- 6800. Preston Sink, 3 miles north of Waldo, Alachua County, Fla.
- 7054. 400 feet below bridge, Oak Grove, Okaloosa County, Fla.
- 7261. Upper Alaqua Lethu(?) Bluff, near De Funiak Springs, Walton County, Fla.
- 7264. De Funiak *Cardium* Zone, Alaqua, Walton County, Fla.
- 9957. Gully south of the road and east of the bridge over White's Creek, on road from Eucheeanna to Knox Hill, 6.7 miles south of Argyle, 1.7 miles southeast of Eucheeanna, Walton County, Fla.
- 9958. Site of Flournoy's old mill, about $1\frac{1}{4}$ miles northeast of Argyle, Walton County, Fla.
- 9959. One-fourth mile west by north of Pleasant Ridge Church, 5.2 miles southwest of De Funiak Springs, SW. $\frac{1}{4}$, SE. $\frac{1}{4}$ sec. 6, T. 2 N., R. 19 W. (*Cardium* zone of Shoal River), Walton County, Fla.
- 9960. Folk's Creek, 6 miles south of Argyle and 1.7 miles from Eucheeanna, Walton County, Fla.
- 10603. Gully south of the road and east of the bridge over White's Creek, on road from Eucheeanna to Knox Hill, 6.7 miles south of Argyle, 1.7 miles southeast of Eucheeanna, Walton County, Fla.
- 10608. White's Creek, half a mile below bridge on Eucheeanna-Knox Hill road, Walton County, Fla.
- 11003. Six miles west of Greensboro, Gadsden County, Fla.

SYSTEMATIC DESCRIPTIONS

Anadara (strebla subsp.?) metastrebla Gardner, new species

Plate 1, Figures 1, 2

Shell rather small for the group and moderately heavy, transversely elongated, broadly inflated from the umbones to the ventral margin, the curvature of the anterior portion

of the shell higher than that of the posterior. Anterior lateral margin rounding very broadly and smoothly into the base. Posterior margin slightly constricted at the hinge line, broadly arcuate. No defined posterior area. Hinge line approximately parallel to the ventral margin and about three-fourths the width of the shell. Umbones broad and full, the tips compressed and feebly sulcate medially, bent forward and inward above the low cardinal area. Sculpture similar on the two valves. Radials 40 in the type, 37 to 41 in other specimens from the type locality, simple, moderately elevated, more narrow medially than toward the lateral margins. Incrementals cross-hatching the interradials and corrugating the radials, strongest toward the anterior margin, obsolete posteriorly. Cardinal area narrow, grooved in crude chevrons, the angle of the chevron slightly posterior to the tips of the umbones. Hinge narrow, very finely and closely serrate; 34 teeth in the anterior dental series of the type, 41 in the posterior; the line between the two series inconspicuous and in worn specimens, obliterated, but posterior both to the tips of the umbones and to the angle of the ligament grooves. Adductor scars large, distinct, set high up near the distal extremities of the hinge. Pallial line simple, not very close to the crenate ventral margin.

Dimensions of holotype, left valve: Height, 22.3 millimeters; width, 35.6 millimeters; thickness, 9.9 millimeters.

Type material: Holotype, a left valve, U. S. Nat. Mus. No. 372891.

Type locality: Collected by the State Geological Survey of Florida. In a gully on the east side of White's Creek, 200 feet south of the bridge on the road to Knox Hill, 6.7 miles by road south of Argyle and about 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of the Alum Bluff group.

Anadara metastrebla differs from the forms to which it holds a possible subspecific relationship in the lower umbones, and the less inflated and more regular outline. In *Anadara strebla*, the anterior portion of the shell is distinctly more inflated than the posterior and the ventral margin slightly constricted posteriorly giving to the shell a somewhat warped aspect. In *A. metastrebla*, the inflation is not so great and

more uniform and the ventral margin is approximately parallel to the hinge line. This possible subspecies does not seem to be in the line of evolution with any of the described species from the Choctawhatchee formation. *Anadara aresta* Dall, a possible descendant of *A. strebla* is farther removed from *metastrebla* than from *strebla*.

There are other species represented in the White's Creek fauna which have not been reported from the Shoal River formation, one of them suggesting *Anadara lienosa* (Say), which is first recorded from the Choctawhatchee. The material is, however, either imperfect or immature, and does not merit description.

Distribution: Shoal River formation, localities 10603^p,⁶ 10608^p, and the collections of the State Survey of Florida.

***Anadara gunteri* Gardner, new species**

Plate 1, Figures 3, 4

Shell of moderate dimensions, inflated, not very heavy, the left valve a little larger and more inflated than the right. Trigonal in the exterior view, the interior, excluding the cardinal area and the prominent umbones subrhomboidal. Umbones full, conspicuously elevated, incurved and prosogyrate, the apices falling within the anterior third. Anterior margin drawn in a little at the hinge, broadly and feebly rounded, merging smoothly into the base line which may be slightly compressed in front of the posterior rostrum. Rostrum obtuse but well defined from the umbones to the ventral margin. Posterior area obliquely flattened, the posterior margin intercepting the dorsal at an angle greater than 90 degrees. Valves differentially sculptured, the ribs upon the left running a little higher than those upon the right, more closely spaced, more elevated, and more nodose. Ribs of right valve running from 23 to 26, average 25, those of the type 25 in number, excluding the 8(or 9 in the type), upon the posterior slope; costals on anterior part of the shell corrugated by the incrementals and medially sulcate, the groove being deepest, the wrinkles heaviest, and the spacing widest along the curve from the anterior to the medial portion of

^ppr, Prolific; a, abundant; c, common; p, present; r, rare (not more than half a dozen individuals). Numbers indicate U. S. Geological Survey Stations.

the shell; depression in front of the posterior keel emphasized by the disappearance of ornamentation upon the costae and by their relatively wide spacing. Posterior ribs relatively narrow, rounded and feebly corrugated. Probably one more rib in the left valve than in the right, though there are no double valves in the collection; ribs of left valve corrugated or nodose and feebly sulcate upon the anteromedial arch, narrower and less closely spaced posteriorly than upon the medial portion of the shell. Inner margins fluted in harmony with the external ribbing. Cardinal area rather narrow, rudely kite-shaped in the double valves, scored with a few ligament grooves which are rudely parallel to the outer margins. Hinge narrow, broadly constricted medially, finely serrate; the teeth not far from 50 to the valve, striated upon their lateral surfaces, tending to become bent and irregular toward the distal extremities. Muscle impressions rather large, well defined, the posterior larger, less regular, and more remote from the hinge than the anterior. Pallial line running parallel and rather close to the outer margin.

Dimensions of cotypes: Right valve, height, 29.5 millimeters; width, 37.3 millimeters; thickness, 12.0 millimeters. Left valve of another individual, height, 26.0 millimeters; width, 30.0 millimeters; thickness, 13.0 millimeters.

Type material: Two cotypes, a right and a left valve not of the same individual, U. S. Nat. Mus. No. 372882.

Type locality: U. S. G. S. Sta. No. 10603, gully south of the road and east of the bridge over White's Creek, on road from Eucheeanna to Knox Hill, 6.7 miles south of Argyle, 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of the Alum Bluff group.

I have the pleasure of naming this species in honor of Herman Gunter, the State Geologist of Florida, to whose interest and intelligent cooperation we of the Government service have long been indebted.

Anadara gunteri is doubtless a member of the group of *staminata* of the Chipola fauna, *santarosana* of the Oak Grove and *waltonia* of the Shoal River. It is the least inflated of them all and the hinge area narrows with the less distant umbones. The shell is not so heavy as it is in other members of the Alum Bluff group and the muscle impres-

sions, particularly the posterior, are less conspicuous. The species is restricted in its known distribution to the exposures of the Shoal River beds along White's Creek in Walton County.

Distribution: Shoal River formation, localities 10603^c, 10608^c.

***Crenella armstrongi* Gardner, new species**

Plate 1, Figures 5, 6

Shell minute, roughly elliptical, inflated. Lining of shell chalky white against the gray subnacreous outer layer. Prodissoconch distinct porcellanous not greatly inflated smooth. Umbones inconspicuous, slightly anterior and feebly prosogyrate. Radials usually simple along the flanks of the shell, divaricate medially; the number at the periphery in the neighborhood of 70. Ligament opisthodontic, the area of attachment very narrow, extending from directly underneath the beaks more than two-thirds the length of the posterior dorsal margin. Provinculum of 4 to 6 subumbonal taxodont vertical teeth. Posterior dorsal margin very finely serrate along the inner surface, the teeth less narrow away from the beaks. Entire margin with the exception of the posterior dorsal which is simple along the edge, finely crenate in harmony with the radials; characters of interior obscure.

Dimensions of holotype, left valve: Height, 4.0 millimeters; width, 3.0 millimeters. Paratype, right valve: Height, 2.3 millimeters; width, 1.8 millimeters.

Type material: Holotype and paratype, U. S. Nat. Mus. No. 372864.

Type locality: U. S. G. S. Sta. No. 9960, Folk's Creek, sec. 21 or 22, T. 3 N., R. 18 W., 6 miles south of Argyle and 1.7 miles south of Eucheeanna, Walton County, Florida. Shoal River formation, Alum Bluff group.

The species is named in honor of Mr. J. M. Armstrong, who was my friendly guide while I was working in east-central Walton County. To him, to Mrs. Armstrong, and to their children I am very grateful for the pleasant memories of my field work in the area.

Crenella armstrongi is larger and less inflated than *Crenella minuscula* which Dall described from the Chipola

formation. In general characters both species are very close to the type of the genus, *Crenella decussata* (Montagu) recent in the North Atlantic.

Distribution: Shoal River formation, locality 9960^r.

***Lithophaga cookei* Gardner, new species**

Plate 8, Figures 5-7

Molds of double valves, slender, tapering, stream line cylinders. Beaks terminal, or nearly so, conforming to the curvature of the burrow. Ligament groove extending about half the length of the dorsal margin. Fragments of an exceedingly thin shell adhering to the mold. Calcareous coating a millimeter thick anteriorly, possibly not quite so thick or thicker posteriorly, apparently without structure, terminating posteriorly in a sort of stalk compressed parallel to the longer axis of the shell.

Dimensions of holotype, mold of double valves: Height, 8.8 millimeters; width, 23.2 millimeters; thickness, 8.3 millimeters.

Type material: Holotype (double valves) and paratype (individual encased in a calcareous coating), U. S. Nat. Mus. No. 372902.

Type locality: U. S. G. S. Sta. No. 6800, Preston Sink, 3 miles north of Waldo, Alachua County, Florida. Hawthorn formation? of the Alum Bluff group.

The species is named in honor of the collector, Dr. Wythe Cooke of the U. S. Geological Survey.

These slender coated flasks are not uncommon at the type locality and are well characterized by their slender stream line forms.

Distribution: Hawthorn formation, locality 6800^p.

Pecten (Pecten) species

The much worn left valve of a true *Pecten* more than 50.0 millimeters in height is included in the 10603 collection from White's Creek. It is interesting because of a suggested relationship to the species from Red Bay figured by Mansfield under *Pecten (Pecten) macdonaldi* Olsson.

***Chlamys (Lyropecten) nematopleura* Gardner, new species**

Plate 2, Figure 1; Plate 3, Figure 2

Shell large, not very heavy, sub-equivalve, sub-equilateral, showing a strong individual variation in relative dimen-

sions, not very much inflated; apical angle greater than 90° . Tips of the umbones flattened, sculptured with 15 simple smooth rounded ribs, with smooth simple intercostal areas. Costals becoming scabrous a millimeter more or less away from the umbones and intercalaries introduced, first a medial thread, then one on either side; number of costal threads increased to three; primary ribs broadening and flattening about 3 centimeters away from the tips of the umbones and indicated on the adult shell only by a feeble rippling. Costal and intercostal threads scabrous, continuing to increase by intercalation, the sculpture toward the ventral margins suggesting that of *P. clintonius* of the section *Placopecten* although the umbones of that species are unsculptured and primary ribbing is not developed at any stage in the growth of the shell. Submargins exceedingly narrow on the right valve, wider on the left. Auricles very large, the width of the dorsal margins appreciably more than half the maximum width of the valve. Byssal groove wide, sharply delimited, incrementally furrowed. Right anterior auricle coarsely threaded with about 6 lirae radiating fan-like from the tip of the umbone to the curved lateral margin; right posterior auricle large but not so wide as the anterior, deltoid, closely threaded with lirae similar to but finer than those upon the disk, the lateral margin almost vertical though slightly drawn in at the dorsal extremity. Left auricles imperfectly preserved but apparently similar to the right posterior auricle in size and sculpture. Ctenolium very coarse. Ligament grooves co-extensive with the dorsal margins of the auricles. Resilium deep, trigonal, the margins raised and thickened. Hinge area reinforced from the inner margin of the resilium to the outer dorsal extremities of the hinge but no defined crura observed. Adductor scars obscure. Interior retaining traces of the primary ribbing pattern which strengthen ventrally and crenate the inner margin, the lirae similar in character to those of *Amusium*.

Dimensions of holotype, right valve: Height, $100.0 \pm$ millimeters; width, $95.0 \pm$ millimeters; thickness, 11.5 millimeters.

Type material: Holotype, one right valve, U. S. Nat. Mus. No. 372895.

Type locality: U. S. G. S. Sta. No. 11003, 6 miles west of Greensboro, Gadsden County, Florida. Collected by the Florida Survey. Hawthorn formation of the Alum Bluff group.

Chlamys (*Lyropecten*) *nematopleura* is closely related to *Lyropecten sayanus* Dall from the Oak Grove. The Hawthorn species is apparently higher although the broken specimens, of which there are many, indicate that the holotype is an abnormally high individual. The most obvious distinction is the persistence of the primary ribs in the Oak Grove species. They broaden and weaken to be sure toward the ventral margin but this tendency is not manifested so early in the growth of the shell nor is it continued to such a degree as it is in the Gadsden County material. The species *C. nematopleura* is common at the type locality, the only locality in which it has been recognized, but the valves are broken though not greatly worn.

Distribution: Hawthorn formation, locality 11003c.

***Chlamys* (*Lyropecten*?) *nicholsi neotera* Gardner, new subspecies?**

Plate 2, Figures 2, 3

1926. *Chlamys* (*Plagioctenium*) *nicholsi* Gardner, U. S. Geol. Survey Prof. Paper 142-A, p. 48, pl. 12, figs. 5, 6 (ex parte).

The material on which this species was based was unfortunately juvenile. I did not recognize this at the time. The species was fairly common and well distributed through the Shoal River formation and there were no large shells associated with the small *nicholsi* in which I did not notice any signs of immaturity. In the later collections from White's Creek, particularly in those made by the Florida Survey, there are pectens bearing slight resemblance to those described and figured under *nicholsi* but which are apparently the adults of forms subspecifically related to that species. These larger shells are not typical of any described section of *Chlamys*. They are more inflated than those of typical *Chlamys*; the ribs do not increase by intercalation with the growth of the shell and are too narrow and high and sharply defined for typical *Aequipecten* although the species may possibly be referable to that section. The secondary threading developed upon the costal and intercostal areas in the adults throws the form out of *Plagioctenium* in which it was first

placed. The shell is relatively high and small for *Lyropecten* and much less coarse than typical shells of that section; the ribs are more numerous, and the ears too small, but the general character of the sculpture is typical for *Lyropecten* to which it is referred with grave doubts. The adult shell is herewith described.

Shell of moderate dimensions, relatively high, somewhat produced posteriorly, the left valve inflated, the right valve less strongly convex. Umbonal angle a little more than 90° . Anterior dorsal margins short, the posterior obliquely produced. Ventral arc including more than 180° . Radials 22 in number in the right valve, 21 in the left of another individual, narrow, high and spreading scarcely at all at the ventral margin. Intercostals U-shaped with straight sides and about the same width as the costals. Secondary threading developed near the close of the adolescent stage though there is a wide variation in the time of appearance of the secondaries but a marked uniformity in the character when once established. Secondaries 3 in number on each of the primaries, a medial secondary and occasionally secondaries on either side in each of the intercostal channels and feeble lirations upon the sides of the costals. Submargins smooth in the juvenile stages, lirate in the adult, the inner lirae increasing in prominence in the adolescent stages and developing into primary ribs, thereby increasing the number of the costals. Incremental grating fine and sharp, much more crowded in some individuals than in others. Auricles rather small. Byssal notch relatively deeper in the young than in the adults; threading upon the byssal ear rather coarse and irregular, imbricated by the incrementals. Lirae upon the posterior right auricle and the anterior and posterior left auricles less coarse and more numerous. Ctenolium distinct. Length of hinge line slightly less than half the maximum width of the shell. Ligament area very narrow, persisting almost to the distal extremities of the hinge. Ligament pit small, trigonal, subumbonal. Cardinal crura ill defined. Monomyarian, the single muscle adductor scar obscure. Inner surface and ventral margin fluted in harmony with the external ribbing.

Dimensions of cotypes: Right valve, height 59.0 millimeters; width, 56.5 millimeters; thickness, 12.0 millimeters.

Left valve of another individual, height 59.0 millimeters; width, 55.3 millimeters; thickness, 13.8 millimeters.

Type material: Two cotypes, a right and a left valve of two different individuals, U. S. Nat. Mus. No. 372893.

Type locality: U. S. G. S. Sta. No. 10603, gully south of the road and east of the bridge over White's Creek, on road from Eucheeanna to Knox Hill, 6.7 miles south of Argyle, 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of the Alum Bluff group.

The young of the subspecies are very difficult to separate from the peripheral forms of *nicholsi* sensu stricto. It is unfortunate that there is no adult material from Shell Bluff and the other Shoal River localities northwest of Mossyhead. These are slightly older than the White's Creek outcrops and there are probably time differences involved in the variations in the faunas.

Some of the differences implied in the descriptions and figures of *Chlamys nicholsi* and *neotera* are merely differences due to the age of the individual. The young are relatively broader than the adults, the ribs are more numerous by 1 or 2, and possibly more, in the adult than in the young; there is no indication of the adult secondary radial sculpture in the young on either the disk or the submargins and the adult auricles are relatively smaller and higher, and the byssal notch not so deep. There are certain differences, however, which can not be related to the age of the shell. The ribs of the White's Creek species are usually more numerous by 2 or more even in the young forms and they are consistently more angular. Specimens from the upper part of the Shoal River, $3\frac{1}{2}$ miles southwest of DeFuniak Springs measuring more than 30.0 millimeters in height show no trace of secondary ribbing on either the disk or the submargins. On the White's Creek individuals the liration usually makes its abrupt appearance at the close of a pronounced resting stage when the shell is between 20.0 and 30.0 millimeters in height. The relationship between the individuals from Shell Bluff with 17 smooth rounded ribs and that from White's Creek with 21 lirate squarish ribs is still somewhat obscure but it is certainly closer than one might infer from the figured material.

Distribution: Shoal River formation, localities 9957^c, 10603^a, 10608^p and in the collections made by the State Geological Survey of Florida.

***Chlamys (Nodipecten) pyx* Gardner, new species**

Plate 1, Figures 7-9

Shell of moderate dimensions, rather heavy, inequivalve, inequilateral, obliquely produced posteriorly but not to a marked degree. Right valve more inflated than the left and with a conspicuously different sculpture pattern. Apical angle close to 90°, the ventral margin approximating the quadrant of a circle. Tips of the umbones of both valves sculptured with 15 or 16 subequal and equispaced radials. Major ribs usually four in number in the right valve, the two lateral ribs less sharply defined than the two in the middle, each of them including 3 or 4 of the subequal umbonal ribs, which become more or less obscure and sometimes obsolete toward the margin. Interradials very deep U-shaped channels with vertical walls finely grated by the incrementals; a radial threading also developed toward the ventral margin both in the costal and the intercostal areas. Sculpture of the left valve the reverse of that of the right, the costals high and narrow, representing a single umbonal rib, the intercostals two or three times as wide and rather shallow, in which the intermediate umbonal ribs persist but with no uniformity in prominence; secondary threading developed upon the left valve similar to that upon the right. Intermittent knuckling best developed upon the left valve though there are no hollow bullae as in the typical *Nodipecten*. Submargins steep wide and smooth. Auricles small. Byssal groove not very wide, incrementally striated. Right anterior auricle threaded with 6 and an obscure seventh radial leaving a narrow, smooth wedge-shaped area along the dorsal margin; right posterior auricle with narrow sharper threads 10 in number on the type and a smooth marginal area. Left auricles sharply threaded, the number of radial threads increasing by intercalation to about 10 toward the lateral margin. Ctenolium rather coarse, distinct. Ligament grooves narrow, shallow and obscured by weathering. Resilial pit small, trigonal. Cardinal crura indicated but not developed with any degree of uniformity. Outline of muscle scars not traceable. In-

terior of shell rippled in harmony with the major external ribbing. Crenae of inner margins reflecting the umbonal ribbing.

Dimensions of cotypes: Right valve, height, 53.5 millimeters; width, 56.1 millimeters; thickness, 18.5 millimeters. Left valve of another individual, height, 46.4 millimeters; width, 47.0 millimeters; thickness, 12.5 millimeters.

Type material: Two cotypes, a right and a left valve not of the same individual, and one juvenile paratype, U. S. Nat. Mus. No. 372894.

Type locality: U. S. G. S. Sta. No. 10603, gully south of the road and east of the bridge over White's Creek, on road from Eucheeanna to Knox Hill, 6.7 miles south of Argyle, 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of the Alum Bluff group.

Chlamys (Nodipecten) pyx stands apart from any of the described Tertiary or Recent species in the dissimilarity of the sculpture upon the two valves and in the width and prominence of the few ribs upon the right valve. A single imperfect valve, probably a left, from the type locality, but from an earlier collection, is apparently *N. condylomatus* Dall, a Chipola species. Associated with it were juveniles which could not be determined until these later White's Creek collections had been made. *Nodipecten pyx*, the only other *Nodipecten* recognized in the Shoal River, is fairly common both in the collection No. 10603 and that made from the same locality by the State Geological Survey of Florida. The preservation is not very good, particularly of the adult right valves and much of the sculpture detail has been lost. The juveniles, on the other hand, are perfectly preserved.

The only possibility of confusion with any other described species is that of the left juveniles with those of *N. condylomatus*. The sculpture of the Chipola species is more uniform, and the secondaries are usually grooved medially.

Distribution: Shoal River formation, locality 10603.

Astarte (Ashtarotha) species

Plate 4, Figure 1

A worn right valve of *Astarte (Ashtarotha)* submitted by the Florida Geological Survey is our first record of this typically cold-water genus in the Chipola of Florida. The

species is probably undescribed but related to the Choctawhatchee forms rather than to those from the later Alum Bluff. The shell is compressed, ovate-trigonal and slightly warped posteriorly. The umbonal angle is not far from 60° ; the tips are bent inward and forward over the rather large lunule. The escutcheon is lanceolate. The sculpture is restricted to a few ripples upon the umbones and to faint incremental striae. The cardinal area is high and laterally compressed and bent forward with the inclination of the beaks. There are no laterals and the other characters of the interior are obscured by weathering.

Dimensions: Right valve, height, 14.6 millimeters; width, 16.2 millimeters; thickness, 4.0 millimeters.

Figured specimen: U. S. Nat. Mus. No. 372892.

Locality: One-fourth mile below Bailey's Ferry, Chipola River, Calhoun County, Florida. Chipola formation of the Alum Bluff group.

This single right valve is of uncommon interest since it is the first record of which I am aware of the *Ashtarotha* so abundant and diversified in the Chesapeake group and the Choctawhatchee. It is apparently more closely related to the type of the section than any forms recovered from the later Oak Grove or Shoal River.

***Astarte (Bythiamena) wagneri* Dall**

The recurrence in considerable abundance of the Oak Grove species *Astarte wagneri* in the late Shoal River faunas was not to be expected. The species is variable in the White's Creek fauna; in some individuals, the rippling is restricted to the umbonal region, in others it is strong and uniform over the entire disk and there is a complete series of intermediate forms. Possibly, there was a slight change in temperature conditions at the close of the Shoal River so that certain controlling ecological factors more closely approximated the Oak Grove conditions and permitted the return of the *Astarte*, a group commonly associated with the cooler waters. The same controls may possibly account for the *Crassatellites* (*Crassinella*) *tanicus* Dall of the White's Creek fauna which more closely resembles in its mutations those of the Oak Grove than those of the Shell Bluff faunas.

Distribution: Shoal River formation, localities 10603^c, 10608^c.

***Crassatellites (Scambula) densus* Dall**

Plate 3, Figure 1; Plate 4, Figures 2-5

The series of *Crassatellites (Scambula)* of which *densus* is a well represented member includes a number of sensitive types with a restricted stratigraphic range. There are certain differences which would be discernible in a composite of the White's Creek *densus* and that from Shell Bluff but it does not seem profitable to attempt to recognize them taxonomically. The average inflation is probably lower in the White's Creek forms and the tilt of the tips of the umbones not so marked. This is interesting because the White's Creek form is thus brought closer to *C. meridionalis* sensu lato, from the Choctawhatchee. There is a considerable variation, also, in the degree of warping of the ventral margin which in certain individuals is very broadly and evenly curved, in others, quite strongly constricted in front of the keel. The figures well illustrate the variation in the development of the concentric sculpture, which in some individuals is restricted to the anterior portion of the shell, in others is so strong and so regular that the surface resembles that of *Crassatellites gibbesii*, and in others is absent altogether excepting in the umbonal area.

This species is particularly abundant at White's Creek.

Distribution: Shoal River formation, localities 10603^c, 10608^c.

***Crassatellites (Crassinella) tanicus* Dall**

In the discussion of the *Crassinellas* in 1926⁷ certain individuals from an early collection (9957) were referred questionably to the Chipola species *triangulatus* Dall because of the strong development of the concentric sculpture. Similar individuals are not uncommon in the later collections from White's Creek but they probably represent a varietal form of *tanicus* rather than that of *triangulatus*. The *C. lunulatus* of the Choctawhatchee develops a sculpture reminiscent of *C. triangulatus* but stronger and more uniform over the en-

⁷Gardner, Julia, Molluscan fauna of the Alum Bluff group of Florida: U. S. Geol. Survey Prof. Paper 142-B, Pt. 2, pp. 86, 87, 1926.

tire disk, and like that of *triangulatus*, it is sharp and raspy rather than rippled as in *C. tanicus*. In the strongly sculptured variants of *C. tanicus* the ripples are persistent in some individuals to the ventral margin but they are very rarely pinched into sharp lamellae. There is no obvious reason to suppose that these more highly adorned White's Creek forms are genetically related to the succeeding *C. lunulatus*, rather than to *C. tanicus*, and there is little to be gained by according them recognition in the taxonomy. The sculptured variants are curiously enough less rare in the Oak Grove faunas than in those from the Shell Bluff horizon of the Shoal River.

Venericardia (Megacardita) hesperide Gardner, new species

Plate 5, Figures 16, 17

Shell large for the genus, heavy and coarsely sculptured, rudely quadrate in the interior view, obliquely elongated in the exterior. Dorsal and ventral margins subparallel, the anterior lateral margin rounding broadly into the base; posterior lateral margin imperfect but probably obscurely truncate. Posterior area indicated by a change in the contouring and sculpture. Umbones near the anterior extremity, full, prominent, involute and prosogyrate. Lunule small but deep and very distinct and defined by a sharply incised line. Ornamentation coarse. Ribs 20 in all, 12 in number from the foremost to that outlining the anterior margin of the keel, 2 less prominent upon the keel and 6 much smaller and lower ribs upon the slightly concave posterior area; anterior and medial ribs broadly arched, separated by deep-set grooves; incremental wrinkling very marked, especially toward the anterior and ventral margins. Ligament groove deep, extended, opisthodontic. Hinge worn; right medial cardinal heavy and obliquely elongated; posterior cardinal laminar and much produced; anterior cardinal either very small or atrophied. Left valve not known. Adductor muscle scars large, a smaller scar, probably the pedal, just within the anterior margin between the lunular groove and the anterior adductor scar. Pallial line simple, obscure. Inner margins coarsely crenate.

Dimensions of holotype, right valve: Height, 47.0 millimeters; width, $53.0 \pm$ millimeters; thickness, 19.7 millimeters.

Type material: Holotype, U. S. Nat. Mus. No. 372890.

Type locality: Collected by the State Geological Survey of Florida in a gully on the east side of White's Creek, 200 feet south of the bridge on the road to Knox Hill, 6.7 miles by road south of Argyle and about 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of the Alum Bluff group.

The type, a right valve, is unique, but it is of interest because it represents more closely than any other described specimen from the Miocene deposits of the Seaboard and the Gulf the *Megacardita* group of the European Miocene. In fact, it bears a strong superficial resemblance to the type of Sacco's subgenus, *Megacardita Jouanneti* (Basterot), so abundant in the South European deposits. According to Cossmann the "Couches a *Cardita Jouanneti*" "stigmatize" the middle Miocene as *Venericardia planicosta* "stigmatizes" the Eocene, and the presence of a species so closely allied in our own middle Miocene may be of some significance. The American species is not so thick-shelled as the most of the European specimens, the inflation is greater, the umbones are fuller, the ribs are higher and possibly fewer by one or two, and the margin of the lunule is more expanded. There are no related forms in the American faunas. *Venericardia hadra* of the Chipola and *V. himerta* of the Oak Grove are possibly in the ancestral line but they are much higher with more narrow ribs more distantly spaced. There are also marked differences in the dentition of the Shoal River form and those from the lower formations. Nothing of the kind has been reported from the Gatun or Santo Domingan faunas, so that for the present, this single right valve is the sole American representative of an exceedingly prolific and stratigraphically important south European group.

Distribution: Shoal River formation, White's Creek, 200 feet south of the bridge on the road to Knox Hill, 6.7 miles by road south of Argyle and about 1.7 miles southeast of Eucheeanna, Walton County, Florida.

***Venericardia* (*Pleuromeris*) *aposcitula* Gardner, new species**

Plate 5, Figures 1, 4

Shell small, trigonal-ovate, inflated, moderately heavy. Umbones medial or submedial. Anterior extremity broadly and evenly rounded; posterior dorsal margin obscurely trun-

cate, posterior lateral margin rounding smoothly into the up-curved base. Lunule and escutcheon smooth, inconspicuous but clearly defined, the escutcheon lanceolate and very narrow, the lunule cordate. Prodissoconch minute, unsculptured excepting for a few incremental striae. Conch adorned with narrow, noded, sharply elevated radials, 13 in number on the cotypes, radiating fanlike from the tips of the umbones and persisting to the ventral margin which they sharply crenulate. Incremental striations best defined toward the ventral margin, and at the intersections with the costals. Ligament external, opisthodetic. Dentition delicate for so sturdy a shell. Middle cardinal of right valve, heavy, broadly trigonal, the anterior and posterior cardinals short and laminar; left anterior cardinal fairly heavy, the posterior more produced and more slender. Muscle and pedal scars distinct and relatively large for so small a shell. Pallial line simple, relatively distant from the crenate ventral margin.

Dimensions of cotypes: Right valve, height and width, 3.0 millimeters; thickness, 1.5 millimeters. Left valve of another individual, height, 3.1 millimeters; width, 3.3 millimeters; thickness, 1.4 millimeters.

Type material: Two cotypes, the right and the left valves of 2 individuals, U. S. Nat. Mus. No. 372901.

Type locality: Collected by the State Geological Survey of Florida. Gully on east side of White's Creek, 200 feet south of the bridge on the road to Knox Hill, 6.7 miles south of Argyle and 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of the Alum Bluff group.

Venericardia aposcitula is best separated from the Oak Grove *V. scitula* by the relatively higher, sharper and more narrow ribs. The number is about the same in the two species, from 12 to 16 in *scitula*, from 13 to 15 in observed individuals of *aposcitula*. *V. aposcitula* is the more delicate shell and the umbonal angle is less acute than in the Oak Grove form. The Chipola species *V. tellia* is a heavier shell with heavier ribbing and dentition.

To *Venericardia aposcitula* are referred the "closely allied forms imperfectly preserved in the Shoal River forma-

tion'' cited under the discussion of *V. scitula* in 1926^s.

Distribution: Shoal River formation, localities 9958^r, 9959^r, 10603^p, 10608^p.

Phacoides (Parvilucina) diktyota Gardner, new species

Plate 5, Figures 2, 3

Shell small but heavy, globose, subequilateral. Umbones full even to the minute, submedial and proximate tips. Dorsal margins gently inclined, the lateral margins obscurely truncate vertically and rounding into the strongly curved base. A rather large posterior area indicated by an obtuse keel and the absence of radial sculpture. Lunule large, sunken, sharply defined by the depressed contour and by the abrupt cessation of the sculpture both radial and concentric. Escutcheon also smooth, narrow, lanceolate, slightly less produced than the lunule. Tips of the umbones evenly threaded with fine sharp concentric lirae. Radial sculpture introduced when the shell is between 2 and 3 millimeters high, developing into a fine even threading covering the disk from the posterior area to the anterior but evanescent toward the ventral margin; concentric lirae sharper than the radial and overriding them, continuous from the lunule to the escutcheon but less strong toward the lateral margins, and much crowded ventrally. Ligament groove short, deeply inset along the posterior dorsal margin. Dentition rather heavy for so small a shell. Anterior cardinal atrophied, the posterior, a short subumbonal hook. Laterals, both anterior and posterior exceptionally well developed. Characters of the interior obscure. Anterior muscle scar very short and broad for the group, the posterior smaller and more circular in outline. Pallial line distinct, simple, remote from the margin. Marginal crenations short but strong.

Dimensions of holotype, right valve: Height, 4.0 millimeters; width, 4.0 millimeters; thickness, 2.0 millimeters.

Type material: Holotype, a right valve, U. S. Nat. Mus. No. 372906.

Type locality: U. S. G. S. Sta. No. 10603, gully south of the road and east of the bridge over White's Creek, on road from Eucheeanna to Knox Hill, 6.7 miles south of Argyle, 1.7

^sGardner, Julia, The molluscan fauna of the Alum Bluff group of Florida: U. S. Geol. Survey Prof. Paper 142-B, Pt. II, Astartacea, Carditacea, Chamacea, p. 91, 1926.

miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of the Alum Bluff group.

The type is unique excepting for a single other badly eroded and questionable valve.

It has been named with some hesitation but it is exceptionally well characterized among the Parvilucinas by the globose form, well defined posterior area, sharply reticulate sculpture and strong dentition. The closest kinship is probably with the *P. multilineata* group.

Distribution: Shoal River formation, localities 10603^r, 10608^r.

Phacoides (Callucina) cala Gardner, new species

Plate 4, Figures 6-9

Shell of moderate dimensions, rather thin for the group, moderately inflated, transversely oval in outline. Umbones acute, proximate and prosogyrate at the tips, slightly posterior, not conspicuous. Shell constricted in front of the umbones; posterior dorsal margin feebly and obliquely arcuate; curvature of lateral and basal margins very low. Lunule small but deeply impressed, wider in the right valve than in the left. Escutcheon not defined. Prodissoconch smooth excepting for incremental striae, minute. Surface sculpture of broad squarish ripples, fairly uniform in arrangement on the umbones but becoming irregular and dying out away from the umbones, usually persisting, however, on the anterior portion of the shell; concentric sculpture of narrow, low, flat, not very uniform fillets, least feeble upon the interradial channels, and of incremental striae with occasional pronounced resting stages. Ligament inset in a deep groove extending more than half the length of the posterior dorsal margin. Anterior right cardinal merged with the lunular margin, the posterior cardinal short, strong and deeply grooved; left anterior and posterior cardinals short and sturdy; rudimentary lateral teeth indicated in the right valve, but no corresponding sockets developed in the left. Interior of the shell thickened slightly over the area of the adherent mantle. Anterior muscle scar narrow and much produced, the posterior smaller and less distinct. Pallial line simple, distinct. Interior faintly rayed, the margins feebly crenate.

Dimensions of cotypes: Right valve, height, 10.7 millimeters, width, 11.0 millimeters; thickness, 3.5 millimeters. Left valve of another individual, height, 10.2 millimeters; width, 10.7 millimeters; thickness, 3.5 millimeters.

Type material: Two cotypes, the right and left valves of different individuals, U. S. Nat. Mus. No. 372904.

Type locality: U. S. G. S. Sta. No. 10603, gully south of the road and east of the bridge over White's Creek, on road from Eucheeanna to Knox Hill, 6.7 miles south of Argye, 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation, Alum Bluff group.

A species closely related to *Phacoides* (*Callucina*) *cala* was indicated under *Codakia* (*Jagonia*) in the earlier collections covered by the 1926 report⁹ but there was no adequate type material available at the time. The right cardinal in *Callucina* is bifid; in *Codakia* (*Jagonia*), the analogous tooth is simple and the laterals much more strongly developed in both the right and the left valves than they are in *Callucina*. *Codakia crosa* Dall from the Chipola fauna is apparently a worn *Callucina* and is a smaller, heavier shell than *C. cala*, with a cruder ornamentation, both radial and concentric. The White's Creek species runs much the same wide range of variation in sculpture detail as that exhibited by the *Bellucina* section of *Phacoides*, and in external aspect the two groups may strongly resemble one another.

Distribution: Shoal River formation, localities 10603^p, 10608^p, collections of the State Geological Survey of Florida.

Diplodonta (Phlyctiderma) (glos subsp.?) lampra Gardner,
new species

Plate 5, Figures 5-7

Shell small, very thin, polished without and within, with subcircular margins and a moderately inflated disk. Umbones medial or slightly posterior, rather full, not conspicuous, with pointed orthogyrate proximate tips. Anterior portion of the shell broadly and evenly arcuate, the posterior flattening less gradually and the posterior dorsal margin obscurely truncate; ventral margin a smooth arc. Outer surface smooth excepting for incrementals least feeble anter-

⁹Gardner, Julia, The molluscan fauna of the Alum Bluff group of Florida: U. S. Geol. Survey Prof. Paper 142-C, p. 103, 1926.

iorly and a very obscure and microscopically fine roughening of the shell. Ligament deeply inset, marginal, opisthodetic. Dentition delicate; a short simple laminar anterior cardinal and a bifid posterior in the right valve and a bifid anterior and short laminar posterior in the left. Adductor scars and pallial line obscure. Inner surface faintly rayed. Inner margins smooth.

Dimensions of cotypes: Right valve, height, 8.4 millimeters; width, 8.5 millimeters; thickness, 2.2 millimeters. Left valve of another individual, height, 8.4 millimeters; width, 8.6 millimeters; thickness, 2.1 millimeters.

Type material: Two cotypes, the right and left valves of different individuals, U. S. Nat. Mus. No. 372903.

Type locality: U. S. G. S. Sta. No. 2646, Oak Grove, Yellow River, Okaloosa County, Florida. Oak Grove sand of the Alum Bluff group.

It is just possible that these forms may be the young of *Diplodonta glos* but though the outline is the same, none of the characteristic punctate sculpture of *D. glos* could be discerned. Furthermore, these shells do not have the aspect of immaturity although they are little more than half as large as *glos*. *Diplodonta glos* has been hitherto restricted in its known distribution to the Chipola while *lampra* is known only from the type locality at Oak Grove. The co-existent *D. nucleiformis* is very much more inflated and *D. radiata* is uncommonly well characterized by the lirate inner margins.

Distribution: Oak Grove sand, locality 2646^p.

***Transennella caryera* Gardner, new species**

Plate 5, Figures 8, 9

Shell small, not very heavy, moderately inflated, ovate-trigonal in outline. Umbones evenly rounded, subcentral, the tips bent inward and forward. Lunule relatively large, elongate-cordate, outlined by a shallow sulcus. Escutcheon not defined. Anterior end very slightly bowed in front of the lunule, rounding smoothly into the upcurved base. Posterior margin slightly hunched. Base line gently arcuate. Outer surface incrementally striate, the sculpture least feeble and irregular toward the distal and ventral margins. Ligament marginal, rather short, opisthodetic. Hinge relatively heavy, normal. Anterior and medial right cardinals laminar, their

inner faces flattened and proximate; the posterior right cardinal more produced and elevated. Anterior and posterior left cardinals simple and laminar, the medial left cardinal trigonal and feebly bifid. Anterior left lateral short but prominent, received in the short deep lateral socket on the lunular margin of the right valve. Adductor scars relatively large, the anterior distinct, the posterior polished but rather obscure. Pallial sinus short, broad, steeply ascending. Pallial line relatively distant from the margin. Tangential grooves few in number, running at a very low angle to the edge of the anterior and ventral margins.

Dimensions of holotype, right valve: Height, 4.6 millimeters; width, 5.2 millimeters; thickness, 1.7 millimeters.

Type material: Holotype, a right valve, U. S. Nat. Mus. No. 372912.

Type locality: U. S. G. S. Sta. No. 10603, Gully south of the road and east of the bridge over White's Creek, on road from Eucheeanna to Knox Hill, 6.7 miles south of Argyle, 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of the Alum Bluff group.

This is the first record of *Transennella* in the Shoal River formation.

The described species most closely related to *T. caryera* is *Transennella santarosana* Dall from the Oak Grove. The latter species is lower relatively, more regularly striate concentrically on the outer surface and with deeper tangential grooves along the inner edges of the anterior and ventral margins.

Distribution: Shoal River formation, localities 10603^p, 10608^r.

Callocardia (Agriopoma) calceola Gardner, new species

Plate 7, Figures 3, 4

Shell thin for the group, a deep, transversely elongated scoop, broadly rounded behind, narrow and snout-like in front. Umbones low but full, the tips bent forward and inward, falling near the beginning of the anterior third of the shell. Lunule long and rather wide, defined by an incised line. Escutcheon not delimited but suggested by the flattening of the shell and the evanescence of the sculpture. Outer

surface crowded with raised concentric threads not uniformly continuous from the anterior to the posterior margin but tending to bifurcate and reunite. Ligament deeply inset, produced for about half the length of the posterior dorsal margin. Hinge normal, that of the left valve only known. Hinge plate thin, sinuous; anterior and medial cardinals coalescent, obliquely divergent beneath the tips of the umbones; posterior cardinal laminar, produced; anterior lateral, a dentate process near the anterior extremity of the hinge-plate. Muscle scars large but inconspicuous, particularly the posterior. Pallial line distinct, rather close to the margin. Pallial sinus very broad and shallow, the axis directed toward the tips of the umbones. Inner margins simple.

Dimensions of holotype, left valve: Height, 41.0 millimeters; width, 54.0 millimeters; thickness, 16.0 millimeters.

Type material: Holotype, a left valve, U. S. Nat. Mus. No. 372888.

Type locality: U. S. G. S. Sta. No. 10603, gully south of the road and east of the bridge over White's Creek, on road from Eucheeanna to Knox Hill, 6.7 miles south of Argyle, 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of the Alum Bluff group.

The type is unique. It differs from all the other Alum Bluff Callocardias in the greater dimensions and relatively greater width but resembles in general outline and dimensions the type of the subgenus, *Callocardia* (*Agriopoma*) *texasiana* Dall, a Recent species in the western Gulf of Mexico. The Recent species, however, is broader and less produced anteriorly, the muscle scars are smaller and the pallial sinus is much deeper and acutely pointed.

Distribution: Shoal River formation, locality 10603'.

Pitar (Hysteroconcha [Lamelliconcha]) cypta Gardner, new species
Plate 5, Figures 10-13

Shell small, heavy, ovate-trigonal in outline, with high full umbones slightly posterior in position. Posterior dorsal margin obliquely arcuate, the lateral margin obtusely truncate parallel to the vertical axis. Anterior margin bowed slightly at the lunule, the lateral margin obliquely produced to meet the base line in a sharp curve. Ventral margin approximately horizontal. Lunule rather large, cordate, de-

finied by a feebly incised line and by the weakening but not the disappearance of the concentric sculpture. Escutcheon not differentiated. Entire outer surface heavily ribbed concentrically; ribs running about 3 to the millimeter in the umbonal region and about 2 toward the ventral margin; tabulated upon their outer surfaces, more or less undercut dorsally, most crowded anteriorly, continuous across the disk but not quite so wide posteriorly and standing out from the rest of the shell as in *Chione*. Ligament groove deep, inset, extending about half the length of the posterior dorsal margin. Dentition strong, concentrated, built up from a well developed hinge plate. The anterior right cardinal short and laminar, the medial short and trigonal, their inner faces flattened and proximate; posterior right cardinal laminar and produced. Left anterior cardinal very short and thin uniting dorsally with the trigonal medial cardinal; left posterior cardinal laminar and produced. A high lateral socket in the right valve to receive the short strong lateral of the left. Characters of the interior distinct if the shell is not too much weathered. Muscle scars relatively large. Pallial sinus broad, slightly ascending, acutely rounded at its extremity near an obscure medial thickening not sufficiently well defined to be called a rib, which extends from the umbonal region almost to the base. Pallial line distinct rather far removed from the simple but slightly thickened ventral margin.

Dimensions: Holotype, left valve, height, 12.3 millimeters; width, 13.2 millimeters; thickness, 5.2 millimeters. Paratype, right valve (individual not fully mature), height, 7.7 millimeters; width, 8.0 millimeters; thickness, 2.9 millimeters. Paratype, left valve of immature individual, height, 5.5 millimeters; width, 6.3 millimeters; thickness, 2.1 millimeters.

Type material: Holotype, U. S. Nat. Mus. No. 372866, and two paratypes, U. S. Nat. Mus. No. 372913.

Type locality: In a gully on the east side of White's Creek, 200 feet south of the bridge on the road to Knox Hill, 6.7 miles by road south of Argyle and about 1.7 miles southeast of Euchecanna, Walton County, Florida. Collection made by the State Geological Survey of Florida. Shoal River formation of the Alum Bluff group.

Pitar (*Lamelliconcha*) *cypta* is a species uncommonly well characterized by its rather crude blunt outline and the heavy tabulated ribbing. There is no described species with which it can be confused. The only other member of the group recorded from the Alum Bluff, Miss Maury's *Chipola* species, has a very different outline and a distinct ornamentation.

Distribution: Shoal River formation, localities 10603^r, 10608^r, State Geological Survey of Florida.

***Chione* (*Chione*) *oulotricha* Gardner, new species**

Plate 7, Figures 1, 2

Shell rather thin and delicate for the genus, transversely ovate-trigonal, smooth in outline and evenly rounded from the tips of the umbones to the ventral margin. Umbones small, not prominent, bent inward and forward. Anterior margin bowed in front of the lunule rounding smoothly into the ventral margin. Posterior extremity obtusely truncate, the posterior dorsal margin very slightly arched. Lunule small, relatively wide, delimited by a deep sulcus, evenly laminated, the lamellae in line with those which adorn the disk. Esecutive narrow, smooth in the umbonal region but, toward the ventral margin, with growth lines carried across it with increasing prominence. A rather well defined but not conspicuous posterior area marked by a change in the direction of the concentric lamellae and their lower elevation. Tips of the umbones sculptured with fine regularly spaced concentric threads which become rather abruptly more prominent and on the disk appear as prominent evenly spaced lamellae, evenly crinkled along the base of the outer surface but smoothly corded along the upper edge; microscopically fine wavy lines between the lamellae; lamellae persisting with uniform elevation across the disk the half of them disappearing a short distance in front of the lunular and anterior margins, the other half expanding and flaring outward; lamellae continuous in unlesened numbers across the posterior area but consistently lower and bending toward the umbones, the change in direction becoming increasingly prominent toward the umbones. Ligament external, the area of attachment narrow. Hinge plate delicate, sinuous. Three cardinal teeth in the right valve, the opposing faces of the

anterior and medial teeth rounded as if to receive the compressed but anteriorly flexed cardinal of the left valve; posterior cardinal obliquely produced to the margin of the hinge plate separated from the medial cardinal by a rather wide deltoid socket. Muscle scars rather large, not conspicuous. Pallial line and sinus easily traceable, the pallial line unusually distant from the margin. Pallial sinus short, broad, linguiform, the projected axis cutting the dorsal margin at the lunule. Inner margin very finely crenate from the tips of the umbones along the lunular margin and the anterior and ventral margins to the posterior margin which is smooth within.

Dimensions of the holotype, right valve: Height, 28.4 millimeters; width, 36.2 millimeters; thickness, 10.3 millimeters.

Type material: Holotype, a right valve, U. S. Nat. Mus. No. 372863.

Type locality: Ten Mile Creek, Chipola River, Calhoun County, Florida. Chipola formation of the Alum Bluff group.

Chione oulotricha may well be in the direct ancestral line to the late Miocene *Chione cribaria* Conrad, which it closely resembles in sculpture and dentition.

Distribution: Chipola formation, Ten Mile Creek, Calhoun county, Florida. Collected by the State Geological Survey of Florida.

***Chione (Lirophora) crossota* Gardner, new species**
Plate 7, Figure 8

Shell of moderate dimensions, not very heavy, transversely ovate-trigonal. Umbones bent inward and forward near the anterior third of the shell. Anterior lateral margin strongly bowed in front of the lunule, the posterior obliquely truncate, the ventral broadly curved. Lunule wider in the right valve than in the left, impressed, sharply delimited. Esutcheon lanceolate, defined by the contour of the shell and the abrupt disappearance of the concentric lamellae. Initial shell compressed, trigonal, sculptured only with a few (2 to 4) thin sharp lamellae and between them faint, very fine, concentric striae; heavy concentric ribbing abruptly initiated and, simultaneously, an irregular radial striation on the ventral surface of the ribs; number of closed ribs variable (4 in the type)

giving place to upstanding flanges frilled at the base, more or less recurved dorsally but thin-edged, persistent from directly behind the lunule to the posterior area where they abruptly narrow and instead of being thin, high and upstanding become rather narrow heavy lamellae directed outward at a low angle and, at the edge of the escutcheon abruptly disappear; faint concentric scratches in all the intercostal areas. Ligament attachment area narrow, slightly more produced than the posterior cardinal. Hinge normal for the genus and the sub-genus; right valve dentition including a thin anterior, a moderately heavy deltoid medial and an elongated posterior cardinal; left cardinals radiating fan-like beneath the tips of the umbones, the medial the heaviest, the posterior the most produced; right posterior dorsal margin grooved a little to receive the edge of the left valve. Adductor scars and pallial line distinct. Pallial sinus short, angular. Inner lunular, anterior and ventral margins finely crenate.

Dimensions of holotype, right valve; Height, 25.0 millimeters; width, 33.8 millimeters; thickness, 11.0 millimeters.

Type material: Holotype, a right valve, U. S. Nat. Mus. No. 372865.

Type locality: U. S. G. S. Sta. No. 10603, Gully south of the road and east of the bridge over White's Creek, on road from Eucheeanna to Knox Hill, 6.7 miles south of Argyle, 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of the Alum Bluff group.

Chione crossota is an end member of the group of *C. ceramota* and *C. ulocyma* Dall and the peripheral forms can not be separated with assurance. The type of *C. crossota* is, however, quite distinct from the type of *C. ceramota*. It is a smaller lighter shell, lower and relatively more transversely elongate with fewer, higher, free-edged ribs. Typical forms are not abundant but gradational individuals are very common. Additional subspecies might be made but there is little to be gained by increasing the names. The limitations of paleontology are realized in trying to interpret such a series. According to the latest concepts two closely related forms do not occupy exactly the same habitat but there are many different factors such as slight differences in the salinity or food supply or other animal life which would leave no

trace in the fossil fauna. In any case, there seem to be in the White's Creek fauna at least four species occurring in greater or less abundance and grading and intergrading; *Chione trimeris*, the largest and coarsest of them all with more or less fused ribs; *Chione funiakensis* also with fused ribs, a rather persistent radial sculpture, and a rather thin shell; *Chione ceramota*, short and high with numerous ribs not fused but bent back and almost or quite touching the shell at the dorsal edge of the rib; and *Chione crossota* with a few high free ribs and a relatively light transversely elongate shell.

Distribution: Shoal River formation, locality 10603^p.

***Chione (Lirophora) cymaina* Gardner, new species**

Plate 5, Figures 14, 15

Shell rather large for the group, massive, trigonal. Umbones small, high, flattened and pointed forward. Anterior margin strongly bowed in front of the lunule, rounding smoothly into the base. Posterior margin obliquely truncate from the beaks to the base. Lunule large, cordate, defined by a sulcus, scooped out, and the flattened area directly in front of the umbones obscurely defined, in effect a lunule within a lunule, the entire area corrugated by the strong growth lines. Escutcheon wide, sharply delimited, smoother than the lunule, the growth lines only faintly traceable upon it. Tips of umbones sculptured only with faint concentric lines and a few not very sharp nor prominent overlapping lamellae, the first heavy billowy concentric rib initiated when the shell is less than half a millimeter high. Adult sculpture of relatively few—about half a dozen—very prominent, crude and irregular ribs, scratched on the dorsal concave surface of the ribs with irregularly spaced concentric lines and, on the ventral surface, rather faintly and irregularly lineated radially. Ligament external, the area of attachment adequate. Dentition strong and normal. Anterior cardinal of right valve laminar and crowded by the lunular margin, not persisting to the margin of the hinge plate, the medial cardinal feebly bifid upon its dorsal surface, the posterior cardinal produced from the umbones to the wavy margin of the hinge plate. Cardinals of the left valve also three in number, more uniform in size than those of the right, the anterior thinner, however, than

those behind it and the posterior the most produced; a reinforcement at the base of the teeth near the umbones especially between the posterior and medial teeth. Interior slightly thickened over the area of the adherent mantle. Pallial scars distinct. Pallial line and sinus usually traceable, the sinus short and angular, the apex of the angle pointed forward and upward. Inner margins very finely crenate from the tips of the umbones around the lunule, the anterior and ventral margins to the edge of the escutcheon.

Dimensions of cotypes: Right valve, height, 32.3 millimeters; width, 39.1 millimeters; thickness, 12.8 millimeters. Left valve, height, 33.0 millimeters; width, 35.0 millimeters; thickness, 12.3 millimeters.

Type material: Two cotypes, a right and a left valve not of the same individual, U. S. Nat. Mus. No. 372862.

Type locality: Collected by the State Geological Survey of Florida. In a gully on the east side of White's Creek, 200 feet south of the bridge on the road to Knox Hill, 6.7 miles by road south of Argyle and about 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of the Alum Bluff group.

Chione (Lirophora) cymaina is well characterized. There is no other species in the Alum Bluff that has such heavy ribs and none in which the ribs approach so closely to the escutcheon. The species may be a progenitor of the later Miocene species, *Chione latilirata* Conrad, the type of the subgenus *Lirophora*.

Distribution: Shoal River formation, locality 9957^p and State Geological Survey of Florida.

Chione (Lirophora) species

A very large undescribed species of *Chione (Lirophora)* is indicated in the limestone at Lake Butler, Bradford County. The shell is not preserved but the molds are some of them more than 40 millimeters in height and more than 65 millimeters in width. The ribs are very heavy and, exclusive of those upon the umbones, are 4 to 6 in number. They do not coalesce but pinch out abruptly a little in front of the posterior keel as in *Chione glyptocyma* Dall and in most of the *Chione (Lirophora)* from the Shoal River. In *Chione sel-*

lardsi, however, and in *Chione cymaina*, the heavy ribs merely break down into the component lamellae. In general dimensions, this *Chione* far outstrips any of the described Alum Bluff species but the description must await better material.

***Petricola? senterfeiti* Gardner, new species**

Plate 6, Figures 1, 2

Shell moderately thin and convex, transversely ovate to subquadrate, gaping posteriorly; anterior end broadly rounded, the posterior warped and truncate, the ventral margin nearly horizontal, incurved. Umbones near the anterior third, not very prominent, incrementally sculptured, bearing on their prosogyrate tips the minute ovate trigonal prodissoconch. No lunule, esutcheon or posterior area differentiated. Sculpture reduced to incrementals with occasional resting stages and to a faint lateral threading or wrinkling perceptible in one shell near the posterior margin only, on the other near the anterior as well. Ligament external, opisthodontic, the groove deep and the nymph strong. Dentition reduced in the left valve to 2 divergent rudimentary teeth and between them and linked with the anterior, a third rudimentary tubercle, all of them mounted upon the reversed dorsal edge of the valve. Interior surface warped and irregular. Adductor scars fairly distinct, the subcircular to semi-elliptical posterior more so than the pyriform anterior. Pallial sinus very broad and deep, the ragged truncated lateral margin in line with the tips of the umbones, the ventral margin not confluent with the obscure and remote pallial line.

Dimensions of holotype, left valve: Height, 13.0 millimeters; width, 17.5 millimeters; thickness, 4.3 millimeters.

Type material: Holotype, a left valve, U. S. Nat. Mus. No. 372909; paratype, U. S. Nat. Mus. No. 372914.

Type locality: Senterfeit Branch, 4 miles southwest of Laurel Hill, Okaloosa County, Florida. Collected by the State Geological Survey of Florida. Oak Grove sand? of the Alum Bluff group.

The species is known only from the holotype and the paratype.

Both valves are to a certain extent warped by their situs.

Distribution: Oak Grove sand?, Senterfeit Branch, 4 miles southwest of Laurel Hill, Okaloosa County, Florida. Collected by the State Geological Survey of Florida.

Pleiorytis Conrad

Pleiorytis, Conrad, Acad. Nat. Sci. Philadelphia Proc. for 1862, p. 286, 1862.

“Equivalve, ovate or oval, with radiating striae, gaping posteriorly; hinge of right valve with two widely diverging teeth; left valve with one direct thick triangular, bifid tooth under the apex, and an oblique compressed tooth posteriorly; sinus of pallial impression extending beyond the middle of the valves; muscular impressions large. (Miocene.)” Conrad, 1862.

Monotype: *Pleiorytis ovata* Conrad (Day’s Point, James River, Virginia)=*Petricola centenaria* Conrad, 1833. (Pl. 6, figs. 3, 4.)

Conrad placed this genus under the family Petricolidae.

The group of *Pleiorytis centenaria* Conrad has a limited geographic and stratigraphic range and perhaps for that reason its dissimilarity to the type of *Asaphis*, (*Venus deflorata* Linnaeus from the Bahamas, pl. 6, figs. 6, 7) has apparently not been noticed. In *Asaphis*, as in many of the tellinids, the tips of the umbones are bent inward and very slightly backward and there is no trace of a lunular spur across the cardinals. In *Pleiorytis*, as in *Petricola* and other venerids, the umbones are decidedly prosogyrate and the lunular spur is more or less developed. In *Asaphis*, the bifid cardinal of the right valve is produced and oblique; in *Pleiorytis* it is short and nearly vertical. In *Asaphis* in the left valve the dorsal margin is tabulated in front of the bifid cardinal; in *Pleiorytis* there is a well developed laminar, left anterior cardinal.

The general relationships of *Pleiorytis* were properly indicated by Conrad, and though possibly it should be given only subgeneric rank under *Petricola*, the habits of the animal are not that of typical *Petricola*, the shell is not adjusted to a boring situs and the consequent differences may be recognized generically. The genus may then be described as follows:

Shell of moderate dimensions, rather thin, slightly gaping; transversely elongate, moderately inflated. Umbones anterior, not conspicuously prominent, the tips proximate and prosogyrate. Lunule and escutcheon not developed. Posterior area flattened but not rostrate. Ligament strong, external. A slender spur from the lunular region carried across the cardinals. Teeth short, built up from a narrow hinge plate; a laminar anterior and bifid medial cardinal in the right valve, the posterior cardinal almost or entirely obsolete; a laminar anterior, bifid medial and laminar posterior cardinal in the left valve. Laterals not developed. Adductor scars large, the pallial sinus broad and deep, not confluent ventrally with the pallial line. Inner edges of the valves simple.

The group is particularly characteristic of the middle and upper Miocene of the Eastern seaboard of the United States.

Petricola (*Rupellaria*) *harrisii* Dall has a hinge identical with that of *Pleiorytis centenaria* and may, as indicated by W. C. Mansfield,¹⁰ be nothing more than a much warped individual of that species. Warping is not common in the group but it is present to a very considerable degree in a few individuals. *Petricola* (*Petricolaria*) *calvertensis* Dall is similar in sculpture but is more cylindrical and though the hinge is rather badly broken it does not seem to have the hinge plate so well developed as that of *Pleiorytis*.

***Pleiorytis bowenae* Gardner, new species**

Plate 6, Figures 5, 8, 9

Shell rather small and thin for the group, transversely elliptical in outline, slightly gaping, moderately inflated. Umbones fairly high for the group, not very full, the tips proximate and prosogyrate, falling near the anterior third. Dorsal margins nearly horizontal; the anterior lateral margin broadly rounded to obscurely truncate, the posterior lateral margin more oblique than the anterior, the base line nearly horizontal medially, broadly upcurved in front. Posterior area flattened but with no defined rostrum. Lunule and escutcheon not developed. Entire outer surface finely threaded with wavy radials, irregular in prominence and arrangement, running about 6 to the millimeter toward the ventral margin

¹⁰Mansfield, W. C., Fla. State Geol. Survey Bull. 8, p. 149, 1932.

and double that number in the umbonal area. Ligament external, the groove deep and the nymph relatively wide. Dentition delicate, a slender spur from the lunular region carried across the cardinals. Hinge of right valve not well preserved. A laminar anterior cardinal indicated, a heavier medial cardinal and the margin of the ligament nymph pinched and elevated, possibly to function as a posterior cardinal. A slender laminar anterior cardinal in the left valve, a bifid medial cardinal, and a slender but elevated posterior cardinal. No trace of laterals in either valve. Interior retaining the scars rather clearly. Anterior adductor scar pyriform, the posterior semi-elliptical, both of them placed well up under the dorsal margins. Pallial sinus very deep; the dorsal margin nearly horizontal, its squarely truncate lateral extremity in line with the umbos, its ventral margin running backward at a very low angle to the obscure pallial line. Edges of valves thin, faintly rayed but not crenate.

Dimensions of cotypes: Right valve, height, 20.5 millimeters; width, 31.8 millimeters; thickness, 6.0 millimeters. Left valve, height, 20.4 millimeters; width, 31.6 millimeters; thickness, 6.3 millimeters.

Type material: Two cotypes, a right and a left valve not of the same individual, U. S. Nat. Mus. No. 372907.

Type locality: Shell Bluff, Shoal River, Walton County, Florida. Shoal River formation of the Alum Bluff group.

The species is named in honor of Miss Nell L. Bowen. Her cheerful interest and continuing patience have relieved the drudgery associated with the Alum Bluff manuscript since the beginning of the work.

Pleuropygia bowenae is closely related to *P. centenaria* Conrad of the Chesapeake fauna. It is not so large, it is thinner, and, as a rule, more elongated transversely, and the spur from the lunular region is less prominent than in the Chesapeake species. In all superspecific characters the two forms are identical.

Distribution: Shoal River formation, Shell Bluff on Shoal River, Walton County, Florida.

Semele species cf. *S. chipolana* Dall

Plate 7, Figures 5-7

The most of the material upon which *Semele chipolana*

was established is so fragmentary that it is difficult to properly evaluate the age and individual as contrasted with the specific variations. Among the collections made by the State Geological Survey of Florida is a young specimen (U. S. Nat. Mus. No. 372910) from the Chipola of Ten Mile Creek which though rather more compressed and more finely sculptured than the usual *S. chipolana* is probably the young of that species. It is considerably lower relatively than the type of *S. chipolana*, a difference due in part to age variation and probably in part to the greater relative height of the shells from Alum Bluff, the type locality, than of those from Bailey's Ferry and Ten Mile Creek. This young shell is figured in the hope that it may be of use in determining relationships which can not be clearly established from the available material.

Another left valve (U. S. Nat. Mus. No. 372911) of the same group or species was collected at Oak Grove. This shell is larger than No. 372910 but not fully mature. This is doubtless the same species as that to which reference was made in the Alum Bluff report of 1928¹¹. The material is still insufficient to determine the relationship between the Oak Grove and the Chipola species. There are certain differences in the character of the lunule and the escutcheon and the posterior area and in the spacing of the concentric lamellae. They may be specific but that still remains to be proven.

Donax species
Plate 8, Figure 1

A single broken right valve of a very large *Donax* 32 millimeters high and probably more than 55 millimeters wide was recovered from the Shoal River formation on White's Creek. There is nothing like it in the described Alum Bluff faunas. The umbones are at the apex of an angle of about 110° and behind them, the shell is acutely truncated much as it is in *Donax striatus* Linnaeus of the recent West Indian fauna. As in *Donax striatus*, also, the medial portion of the disk is somewhat flexuous, and the subsurficial radial sculpture strong and relatively coarse upon the disk, but finer and more crowded upon the posterior area. In external aspect these

¹¹Gardner, Julia, The molluscan fauna of the Alum Bluff group of Florida: U. S. Geol. Survey Prof. Paper 142-E, p. 204, 1928.

two species are very similar although the Miocene form is a little larger than any of the Recent representatives observed. In hinge characters, however, they differ widely. The Miocene specimen is very much worn but, certainly the anterior lateral which is well developed in the Recent species was not present in the Miocene. The other hinge elements of the Miocene valve are apparently normal for *Donax* sensu stricto. The ligament groove is short and deep. The cardinals were probably normal and there are remnants of a well defined lateral socket. The characters of the interior are obscure. The muscle scars seem rather small. The pallial sinus is rudely quadrate, almost horizontally directed, the ventral margin possibly coalescent, and the dorsal parallel to it and about the same distance from the ventral that the ventral is from the margin. The marginal crenation is not very strong though probably much of it has been lost by wearing.

This species of which we have no worthy type material, combines in a remarkable manner the external aspect of the *Donax* of the type commonly known as *Chion* with the hinge characters of the much smaller, more cylindrical *Paradonax*, the type of which was described from the lower and middle Miocene of southern France.

The specimen is No. 372889 of the U. S. National Museum, collected by the Florida Geological Survey from the Shoal River outcrop in a gully on the east side of White's Creek, 200 feet south of the bridge on the Knox Hill road, 6.7 miles by road south of Argyle and about 1.7 miles southeast of Eucheeanna, Walton County, Florida. This is the same locality as that indicated by Sta. No. 10603 of the U. S. Geological Survey.

***Mactra (Mactrotoma) profragilis* Gardner, new species**

Plate 8, Figures 13, 14

Shell rather small for the group, exceedingly thin and fragile, highly polished, ovate-trigonal in outline. Posterior area slightly depressed, sharply delimited by a difference in the concentric wrinkling and by the raised thread along the margin. Umbones smoothly contoured, the tips proximate and feebly prosogyrate. Lunule elongate-cordate, defined by a shallow depression; escutcheon narrow lanceolate. Surface

smooth excepting for an incremental wrinkling, most pronounced upon the posterior area, and short, fortuitous, oblique threadlets in front of the rostral extremity. Traces of color banding still preserved. Ligament marginal, the area of attachment short and slender, the resilium strong and attached to a fairly deep but not very wide chondrophore, apically roofed, the chondrophore and ligament area separated by a shelly plate. Anterior and posterior cardinal lamellae thin, sharp and prominent, the rather broad trigonal area between them for the reception of the V-shaped cardinal of the left valve; a deltoid accessory lamina developed slightly dorsal and anterior to the anterior cardinal lamina; dorsal and ventral clasping lamellae developed upon the walls of the anterior and posterior lateral grooves near the umbones, the dorsal lamellae springing from the walls at right angles, the anterior ventral lamella in line with the anterior cardinal and its accessory. Lateral grooves not entirely analogous to the lateral grooves of *Hemimactra* since the teeth of the opposing valve are short and contained only in the dorsal end while the ventral half is filled only with the soft parts. Adductor scars fairly large and rather high, the anterior very obscure. Pallial sinus broad and deep, the anterior extremity in line with the umbones, the ventral margin near but not confluent with the pallial line. Pallial line obscure. Interior of shell somewhat wrinkled and rayed, especially toward the ventral margin.

Dimensions of holotype, right valve: Height, 31.8 millimeters; width, $46.0 \pm$ millimeters; thickness, 8.0 millimeters.

Type material: Holotype, a right valve, U. S. Nat. Mus. No. 372908.

Type locality: Oak Grove, Yellow River, Okaloosa County, Florida. Oak Grove sand of Alum Bluff group.

Mactra profragilis differs from the late Tertiary and Recent *M. fragilis* in the higher, more inflated umbones, the more narrow chondrophore and the greater concentration of the hinge.

Distribution: Oak Grove sand, Oak Grove, on Yellow River, Okaloosa County, Florida. Collected by the State Geological Survey of Florida. Rare.

Sphenia senterfeiti* Gardner, new species*Plate 8, Figures 2-4**

Shell small, very thin and irregular in its transversely elliptical outline, concave, probably inequivalve. Beaks broad, flattened upon their summits, the tips acute, turned forward and proximate, placed well in advance of the medial line. Anterior extremity rounded with comparative regularity. Posterior extremity flaring for the extrusion of the long siphons. Ventral margin more or less bent inward. Outer surface wrinkled and cross wrinkled, the irregularity of the sculpture abruptly increasing when the shell is about half grown and taking on the irregularities of the situs. An acutely angular posterior keel developed upon the earlier portion of the shell, obsolete ventrally, the sculpture behind it a little sharper than upon the disk. Ligament internal; right chondrophore subumbonal; left chondrophore rather small, spreading and obliquely produced posteriorly, merging with the dorsal margin. Hinge edentulous excepting for the modification of the right anterior dorsal margin into a small trigonal subumbonal denticle. Interior more or less warped and rippled, the shell so thin that it reflects the irregularities of the outer surface. Scars not showing up well on so thin a lining. Anterior adductor obscure, linguiform, rather low; posterior adductor more distinct, larger, semi-elliptical, placed high up under the dorsal margin. Pallial sinus broad, and broadly rounded at its extremity near the median vertical. Pallial line obscure.

Dimensions of cotypes: Right valve, height, 3.3 millimeters; width, 6.0 millimeters. Left valve, height, 3.5 millimeters; width, 6.0 millimeters.

Type material: Two cotypes, a right and a left valve not of the same individual, U. S. Nat. Mus. No. 372905.

Type locality: U. S. G. S. Sta. No. 10659, Tanner's Mill (old Senterfeit mill), 4 miles southwest of Laurel Hill, Okaloosa County, Florida.

Sphenia senterfeiti is the first of the genus to be recorded from the Alum Bluff faunas. The later Tertiary *Sphenias* are all of them heavier shells, more or less attenuated posteriorly.

Distribution: Oak Grove sand, locality 10659^p.

Corbula (Caryocorbula) cala Gardner, new species**Plate 8, Figures 8-12**

Shell solid but well formed; inequivalve, the margin of the right valve folded over the left, the overlapping more pronounced posteriorly than anteriorly. Transversely trigonal ovate in outline, sharply rostrate behind. Umbones broad, moderately prominent, slightly anterior, the tips proximate, incurved and prosogyrate. Anterior end of shell symmetrically rounded. Posterior end produced along the rostrum and obtusely pointed. Base line gently upcurved laterally. Lunule and escutcheon indicated by the evanescence of the sculpture but not sharply defined. Sculpture concentric, incremental and irregular upon the umbonal area, becoming stronger toward the ventral margin and developing into clapboard-like ribs with a dorsal overlap; rostral sculpture relatively fine sharp and irregular; sculpture similar in character upon the two valves, possibly a little stronger upon the left. A very obscure radial warping of the shell barely perceptible but no radial sculpture. Ligament internal, mounted upon a cuneate chonodrophore projecting from the left posterior dorsal margin and received in a deep, subumbonal socket in the right valve. Right cardinal heavy, horizontally compressed, upturned at the tip, received in a correspondingly wide socket beneath the left umbo. A small tubercle at the margin of the chondrophore in the left valve and a corresponding depression in the right valve. Mantle cavity excavated, its margin warped and thickened. Adductor scars large and distinct, the anterior reniform and very close to the anterior extremity, the posterior broad, rounded ventrally, truncate dorsally, set close to the posterior lateral margin. Pallial line distinct, running closer to the margin posteriorly than anteriorly, slightly incurved between the posterior ventral extremity and the adductor scar. Gutter near the margin of the right valve indicating the line of closure of the left and running very close to the edge anteriorly, not so close posteriorly.

Dimensions of holotype, double valves: Height, 9.2 millimeters; width, 14.2 millimeters; thickness, 6.4 millimeters.

Type material: Holotype, double valves of a single individual, U. S. Nat. Mus. No. 372900.

Type locality: Collected by the State Geological Survey of Florida. Gully on the east side of White's Creek, 200 feet south of the bridge on the road to Knox Hill, 6.7 miles by road south of Argyle and about 1.7 miles southeast of Eucheeanna, Walton County, Florida. Shoal River formation of Alum Bluff group.

Corbula (*Caryocorbula*) *cala* is one of the group of Chipola species represented by *C. sphenia* and *sarda* Dall and *franci* Gardner. *Corbula sphenia* is larger and more strongly and regularly sculptured; *Corbula sarda* is more flexuous and attenuated behind and more regularly sculptured; and *Corbula franci* is smaller and not so finely sculptured.

The type is unique.

Distribution: Shoal River formation. Collection made by the State Geological Survey of Florida from the same locality as that represented by No. 10603.

***Architectonica quadriseriata waltonensis* Gardner, new subspecies**

Plate 9, Figure 1; Plate 10, Figure 4

Shell of normal size for the group and of normal proportions. Whorls very broadly and feebly inflated, 7 or 8 in number, including the small, loosely coiled protoconch of $1\frac{1}{2}$ volutions. External sculpture dominantly spiral, similar in general character and in the details of the number and arrangement of the spirals to *A. quadriseriata* s.s. but more subdued and less persistent; incrementals more shallow and more distant than in the Jamaican or even in the Oak Grove race, obliquely undercutting the low fillets so that they appear to be made up of a series of minute, overlapping tiles; sulci beginning to evanesce as early as the sixth whorl, where they appear for the most part as incised, linear grooves cutting obliquely across the spirals, replaced on the body whorl by microscopically fine striae; basal sculpture much reduced. Umbilical pit outlined by a wide and heavily corrugated spiral, which is separated by a profound sulcus from the somewhat rugose band outside of it. Periphery outlined by a heavy cord and just within it but separated from it by a very fine threadlet, another cord of almost equal size and also simple. Area between the umbilical and peripheral spirals about half the width of the entire base, feebly convex

and smooth in the adult excepting for 2 or 3 faint spiral striations and incremental scratches which radiate from the umbilical keel. Sutures so deeply channeled that the profile of the spire is interrupted and the whorls assume a gibbosity greater than that which they really possess. Characters of aperture normal for the species. Umbilical funnel a trifle narrower and less open than that of *A. quadriseriata* s.s.

Dimensions of holotype: A slightly imperfect specimen, height, 14.0 millimeters; maximum diameter, 26.0 millimeters.

Type material: Holotype, U. S. Nat. Mus. No. 351515.

Type locality: U. S. G. S. Sta. No. 3742, Shell Bluff, Shoal River, Walton County, Florida.

The subspecies differs from the Bowden form only in the somewhat less flattened whorls, the less ornate and less persistent sculpture, the channeled suture, the slightly smaller umbilicus, and in the development of only one instead of two spiral bands encircling the heavily corrugated umbilical spiral. The Oak Grove race is intermediate in the character of its sculpture between the Bowden and the Shoal River races. In the profile of the spire and the consequent outline of the umbilicus it resembles the former. *Architectonica belastriata* var. *vicksburgensis* (Dall) is probably more closely allied with the *granulata* group than it is with the *belastriata*. It differs from the Shoal River race in the somewhat more elevated and more rounded outline, rather finer sculpture upon the sides of the spire, and the more ornate base and most obviously in the exposure of the peripheral spiral as a fine piping directly behind the suture line. The species is the most common representative of the genus within the Shoal River beds.

Distribution: Shoal River formation, localities 3742^a, 3856^a, 2238^r, 5618^r.

***Architectonica alvear* Gardner, new species**

Plate 9, Figure 2; Plate 10, Figures 5-6

Shell of moderate size for the genus, somewhat rounded, suggesting in outline a very low beehive. Whorls about $7\frac{1}{2}$ in number, including the small, loosely coiled protoconch of approximately $1\frac{1}{2}$ volutions, the initial half turn, however, largely immersed. Whorls of conch flattened between the channeled sutures, the body whorl somewhat tumid, sharply

angulated at the periphery, and flattened upon the base. Sculpture very simple for the genus; earliest spiral initiated as in others of the *granulata* group directly behind the suture on the first turn of the conch, growing increasingly prominent and more sharply granulose until the ultima, where it tends to flatten out and become more simple; a second spiral introduced soon after the first directly in front of the suture but this is quickly reduced to a series of fine incremental puckerings; wide, flattened interspiral area smooth excepting for oblique incremental rugae which are most pronounced upon the spire and correspond in number to the posterior puckers and the granules of the anterior spiral. Periphery outlined by a very heavy, rounded, feebly corrugated cord which appears to be wider on the basal surface than upon the apical, and a second strongly rounded and well elevated cord developed upon the base just within the peripheral spiral and separated from it by only a deep linear sulcus. Umbilical carina sharp, outlined by a wide denticulate spiral; outer margin separated from the flattened, more or less rugose spiral which surrounds it by a narrow but deep channel; area between the umbilical and peripheral spirals flattened, smooth excepting for radial growth striae and a vague spiral sulcus a little less than half-way from the periphery to the umbilicus. Umbilical pit rather large, open to the apex, the wall displaying the umbilical keel of the successive whorls. Shell broken at the mouth and characters of aperture not well known.

Dimensions of imperfect holotype: Height, 17.0 millimeters; maximum diameter, 25.0 millimeters.

Type material: Holotype, U. S. Nat. Mus. No. 350446.

Type locality: U. S. G. S. Sta. 5633, Oak Grove, Yellow River, Okaloosa County, Florida. Oak Grove sand of Alum Bluff group.

Architectonica alvear is allied to *A. amphiterma* Dall from the Miocene of Maryland. It is relatively higher, however, with a more prominent and, on the spire, more sharply annulate anterior spiral. The young are discoidal in outline.

Architectonica quadriseriata waltonensis is lower than *A. alvear* and the whorls are more flattened and more deeply channeled at the sutures. Intermediate spiral fillets are pres-

ent in *waltonensis* which on the later whorls are as strong as the anterior and posterior spirals.

The species is restricted in its distribution to the Oak Grove sand.

Distribution: Oak Grove sand, localities 2646^c, 5632^r, 5633^r, 7054^r.

***Architectonica (Psilaxis) verecunda* Gardner, new species**

Plate 10, Figures 1-3

Shell small, a much depressed cone, acutely angulated at the periphery, flattened upon the basal surface, and broadly rounded in the apical region. Nucleus porcellaneous, large, ill-shaped, broadly inflated, completing a little more than a single revolution, strongly differentiated from the conch both by the abrupt change in the texture of the shell and by the initiation of the conchal sculpture. Whorls of conch 3 in number in the unique type, which is probably not fully mature; earliest whorl obscurely rounded, the two later volutions flattened laterally. Sculpture very simple; two narrow ornate bands of equal width marked off by incised lines, the one placed directly in front of the suture and the other directly behind it; a second anterior, non-crenate, and slightly narrower band delimited by a more feebly incised line, set about one-third the distance from the anterior to the posterior suture. Suture line deeply impressed but very narrow. Periphery of body wound with a very strong cord with a second cord equally strong revolving on the base directly in front of it and separated from it by only a linear interspace. Area between the umbilicus and periphery broadly rounded, devoid of spiral sculpture excepting for a feeble thread, delimited by incised lines revolving about one-third the distance from the periphery to the umbilical keel and marking the outer limit of the radial sulci of the umbilical area; keel sharply crenulated, set off by a deeply impressed channel. Incremental sculpture manifested in the puckerings of the base, the crenate bands upon the spire, and the very faint striae on the smooth medial portion of the whorl. Aperture rudely quadrate, sharply angulated at the peripheral and umbilical keels and at the union of the parietal wall with the labrum and the pillar. Outer lip very thin and sharp. Body wall thinly glazed. Umbilicus small, its diameter less than

one-third that of the entire base, persistent to the apex, revealing within, the umbilical keels of the earlier volutions.

Dimensions of holotype: Height, 4.0 millimeters; maximum diameter, 6.5 millimeters.

Holotype: U. S. Nat. Mus. No. 352117.

Type locality: U. S. G. S. Sta. 5618, $3\frac{1}{2}$ miles southwest of De Funiak Springs, Walton County, Florida.

Architectonica verecunda is interesting as the first record in the Floridian Miocene of the section *Psilaxis* Woodring (Miocene mollusks from Bowden, Jamaica: Carnegie Inst. Washington Pub. No. 385, p. 355, from the Bowden of the West Indies. Type, *Architectonica krebsii* Mörch. Recent in the West Indies and Florida). The section is characterized by the very large nuclear whorl and a sculpture of spiral cords girdling the periphery and the umbilicus. All of the observed species are small. Recent representatives have been recorded from the western Atlantic and the western Pacific. The Shoal River shell differs from the two described Bowden species in slight details of the spiral sculpture and in the stronger incremental striae which have sufficient depth and regularity to bead the spirals upon the dorsal surface.

Distribution: Shoal River formation, locality 5618^r.

***Melanella* (*Melanella*) *makista* Gardner, new species**

Plate 10, Figures 7-9

Shell imperforate, straight, moderately slender and rather large for the group. Porcellaneous, highly polished, devoid of sculpture. Whorls narrow, appressed, slowly and regularly increasing in diameter, flattened laterally, slightly undercut anteriorly, probably exceeding 20 in number in the perfect adult. Body whorl about one-third as high as the entire shell, broadly rounded at the periphery. Extreme tip not preserved and characters of protoconch not known. Faint brownish flammules which may be the remnants of a colour pattern occasionally visible on the conch. Suture strong. Aperture obliquely lobate, acutely angulated posteriorly. Outer lip expanded and slightly pouting, not thickened, rounding smoothly into the labium which is thickened and closely appressed against the body wall. Umbilicus entirely closed but faintly indicated by a very narrow, depressed and

arcuate area along the margin of the sharply raised and thickened basal portion of the inner lip.

Dimensions of holotype: Height, $23.0 \pm$ millimeters; greatest diameter, 6.4 millimeters; height of aperture, 5.0 millimeters.

Type material: Holotype and 1 juvenile paratype, U. S. Nat. Mus. No. 483782. A figured individual probably referable to the same species.

Type locality: U. S. G. S. Sta. No. 3856, 6 miles west-northwest of Mossyhead, Shoal River, Walton County, Florida. Shoal River formation of the Alum Bluff group.

Melanella makista resembles *Melanella magnoliana* Gardner and Aldrich from the higher Miocene of Florida and the Carolinas in the many slowly enlarging whorls separated by conspicuous suture lines. The Alum Bluff species is the more slender, and the body whorl relatively shorter and more abruptly constricted.

Distribution: Shoal River formation, locality 3856^p.

Typhis pterinus Gardner, new species

Plate 10, Figure 10

Shell polished, of moderate dimensions for the genus, rather thin and quite slender excepting for the flange-like varices; spire scalariform; body including the varices cuneate; maximum diameter falling a little in front of the median horizontal. Whorls of conch probably 6 in number in the adult, very closely appressed, the posterior margin creeping up a little upon the preceding whorl, acutely angulated at the periphery. Shoulder slightly concave, more or less corrugated by the intervarical tubes; sides of whorls flattened, slightly inclined toward the axis; body somewhat rounded medially, gently concave anteriorly. Sutures linear, inconspicuous, zigzagging around the varices. Protoconch known only from the final whorl but apparently small, smooth, and very highly polished. Opening of conch indicated by a change in the texture of the shell and by the initiation of the axial sculpture in the form of obtuse tubercles. Primary varices 4 in number, the terminal varix a rather broad, laminar flange, the other 3 body varices compressed, acutely angulated ridges, terminating at the shoulder in compressed, posteriorly direct-

ed tubes; short circular tubes also developed in the intervarical areas directed at right angles to the axis of the shell, perforate at their outer extremities but only the last tube in direct communication with the body cavity. Spiral sculpture restricted to very fine, feeble, rather distant, and more or less irregular lirations, often obsolete altogether upon the spire, strengthening toward the aperture and usually 3 to 5 in number upon the terminal wing, absent upon the anterior canal. Incrementals macroscopic, retractive and somewhat arcuate upon the shoulder, flexuous upon the anterior canal and relatively prominent upon the apertural surface of the terminal varix, where they are quite strongly crenulated and are puckered into the fine, sharp spiral lirae. Apertural opening rather small, oval in outline, widening a little posteriorly, the margin elevated slightly above the body surface; peristome continuous, smoothly rounded; inner surface very smoothly glazed; area between the labral varix and that directly behind it filled with a rather thin, trigonal plate. Anterior canal short, compressed, feebly inclined toward the right, the former canals, one to each varix, superimposed but diverging very slightly at their anterior extremities.

Dimensions of holotype: Height, $20.0 \pm$ millimeters; maximum diameter including varices, 13.0 millimeters; diameter at right angles to maximum diameter, 8.0 millimeters.

Type material: Holotype, U. S. Nat. Mus. 371860.

Type locality: U. S. G. S. Sta. No. 3742, Shell Bluff, Shoal River, Walton County, Florida. Shoal River formation of Alum Bluff group.

Typhis pterinus is certainly very closely allied to *Typhis alatus* subsp. *obesus* Gabb, but the spire is more elevated in proportion to the body, and the spiral sculpture is sharper and more regular than in either the Bowden or the Chipola individuals referred to *obesus* or in *Typhis harrisi* Olsson and the subspecies *waltonensis* Mansfield. The slender spire and the sharper spirals suggest *alatus* s.s., but if Sowerby's figure is correct the aperture in the Santo Dominican species is less ovate than in that from Shoal River.

Distribution: Shoal River formation, localities 3742^p, 3856^p, 5184^r.

Alectrion waltonensis Gardner, new species**Plate 9, Figures 3, 4**

Shell of moderate dimensions, ovate-conic in outline. Whorls of spire trapezoidal, very narrowly tabulated posteriorly, the later whorls increasing a little more rapidly in diameter than the earlier; volutions between $9\frac{1}{2}$ and 10 in all, $3\frac{1}{2}$ of this number being included in the smooth, naticoid protoconch. Initial turn minute, flattened posteriorly, almost entirely submerged in the succeeding whorl; remaining whorls broadly convex, flattening somewhat toward the close of the protoconch, increasing regularly and rather rapidly in height. Dividing line between conch and protoconch indicated by a slight change in the texture of the shell and by the abrupt initiation of the axial sculpture. Conchal sculpture cancellate, the spirals appearing later than the axials and dominated by them. Axials very narrow, sharply pinched, vertical or nearly so, 10 to 20 in number upon the first whorl of the conch, increasing to 23 upon the body of the type, persisting from suture to suture and well down to the base of the body, subnodose posteriorly upon the later whorls; intercostal areas, concave, a little wider than the costals. Presutural spiral initiated near the beginning of the second turn of the conch; other spirals not developed until the third or fourth whorl, appearing on the later whorls of the spire as low, broad, flattened bands separated from one another by linear sulci, the posterior of the three a little more prominent than the two in front of it and a little wider than that directly in front of the suture, from which it is separated by a channel of approximately its own width; presutural spiral strongly nodulated at the intersection with the axials; spirals upon the body of the type 9 in all, including the rather heavily nodulated posterior spiral, the less strongly nodose spiral in front of it, 4 equal and regularly spaced fillets upon the medial portion of the whorl, and 3 narrower, more distant and quite sharply nodulated basal spirals; posterior margin of basal sulcus defined by a narrow, corrugated thread. Basal sulcus narrow but sharply concave. Fasciole coarsely but not strongly lirate. Suture lines deeply impressed, crenulated by the costate of the preceding whorl. Aperture obliquely lenticular, acutely angulated and sulcated posteriorly. Outer

lip thickened a little behind the margin, sharp-edged, denticulate within, the denticles elongated normal to the margin, alternating in size posteriorly, most prominent medially, persistent to the mouth of the canal. Inner margin of aperture strongly concave, the labium thickened, reverted, and spread in a broad arc over the parietal wall and pillar; denticles irregularly developed, that directly in front of the posterior commissure and the three or four upon the pillar heavier than the intermediate denticles; edge of pillar elevated into a sharp fold terminating at the mouth of the aperture in a rather prominent denticle. Anterior canal very short and sharply recurved. Fasciole rather wide, cuneate, its flexuous extremity forming one arm of the broad, obliquely U-shaped terminal notch, the base and outer arm of the U being formed by the raised posterior margin of the basal sulcus.

Dimensions of holotype: Height, 12.7 millimeters; maximum diameter, 7.5 millimeters.

Type material: Holotype and juvenile paratype, U. S. Nat. Mus. No. 371811.

Type locality: U. S. G. S. Sta. No. 3742, Shell Bluff, on Shoal River, Walton County, Florida. Shoal River formation of the Alum Bluff group.

Alectrion waltonensis, like most of the members of the genus, offers a wide range of variation in the details of the sculpture, especially of the spirals. The outline varies at the type locality from rather squat, ovate-conic to elevated-conic. It runs through much the same range of variation as *A. harrisi* Maury, the analogous form in the Chipola fauna, though the latter runs about a third smaller and is frequently more slender than any specimens of *waltonensis*. *Alectrion dalli* Maury from the Oak Grove fauna is also smaller and more coarsely and rudely sculptured. *A. berthae* Maury is taller relatively, and the posterior tabulation of the whorls is more pronounced. The number of the whorls both in the conch and protoconch of the four species in question is very close, although it runs a little higher in the conch of *waltonensis* and a little lower in the conch and protoconch of *harrisi*. The axials of *waltonensis* range from 18 to 25 upon the body and upon the first whorl of the conch there may be as many as 20. The axials are constantly narrower

and sharper, however, than in any of the analogous forms and, as a rule, more strongly nodose posteriorly. The axials upon the later whorls of the spire are less numerous than in *berthae* Maury but more numerous than in either *dalli* or *harrisi*. The spiral sculpture and the resulting cancellation is much more marked in *waltonensis* at least upon the body. There is not a very wide range in the number of spirals in *waltonensis*, though the variation is quite marked in their relative width and in the degree of elevation. In some individuals the interspirals are linear and not very deeply impressed; in others they are almost or quite as wide as the spirals and very squarely and deeply channeled. The second spiral in front of the posterior suture may be almost as prominent and almost as strongly nodose as the presutural spiral, or it may be similar in character to those in front of it.

The subspecies *deleta* has been isolated because of the late and feeble development of the spiral sculpture, the subdued axials, and the relatively slender, scalariform outline.

Alectrion waltonensis is more abundant at the single horizon at which it occurs than any of its congeners or analogues at other horizons in the Alum Bluff group.

Distribution: Shoal River formation, localities 3742^a, 3856^r, 5184^r, 3731^r, 3732^r, 3733^r, 5195^r, 5080^r, 3748^p, 2238^r, 5618^p.

***Alectrion waltonensis deleta* Gardner, new subspecies**

Plate 9, Figure 5

Shell of moderate dimensions, ovate-conic in outline, acutely tapering; aperture less than half as long as the entire shell. Whorls of conch 6 in number, trapezoidal, narrowly tabulated posteriorly, the body whorl broadly rounded at the base and abruptly constricted into the well defined basal sulcus. Suture lines inconspicuous, finely crenulated by the costals of the preceding whorl. Protoconch small, smooth, probably polished in fresh specimens, three-whorled; initial turn minute, immersed at the tip; succeeding volutions broadly rounded, increasing regularly both in diameter and altitude. Dividing line between conch and protoconch indicated by a slight change in the texture of the shell and by the abrupt appearance of the axial sculpture. Axials narrow, acutely

rounded, abruptly elevated, approximately vertical, dissected by the posterior sulcus so that the extremities of the ribs form a circle of obtuse tubercles in front of the suture; axials 10 to 15 in number on the earliest whorls, increasing to 23 upon the body, uniform in elevation from the sulcus to the anterior suture and well down to the base of the body, subequal and equispaced, separated by broadly concave intercostals, slightly wider than the costals. Spiral sculpture incised rather than elevated, feeble excepting for the posterior sulcus which partially dissects the ribs; 3 low spiral fillets developed in the type between the posterior sulcus and the anterior suture; grooves equal and equispaced, restricted entirely to the intercostal areas, least feeble upon the body. Base of body girded with 4 low fillets which become increasingly narrow and decreasingly low anteriorly. Basal sulcus threaded with a single sharp lira. Anterior fasciole irregularly lirated, margined posteriorly with a sharply elevated ridge. Aperture narrow, obliquely lenticular, acutely angulated and sulcated posteriorly, narrowly constricted anteriorly. Outer lip flaring in front, abruptly contracted at the mouth of the canal, broadly varicose behind the thin, sharp margin; inner surface of labrum threaded with 6 or 7 lirae, the posterior corresponding in position to the posterior sulcus, the anterior indicating the entrance to the canal; medial lira the shortest and the most elevated, those behind it less prominent and more distant than those in front. Inner margin of aperture strongly concave, heavily reinforced, the wash spread in a broad, sharply defined arc from the posterior commissure to the anterior canal; a series of irregular, elongated denticles developed just within the margin, the posterior the most prominent and placed directly across from the posterior liration on the inner margin of the labrum; edge of pillar acute and proximate to the anterior liration on the inner margin of the labrum. Anterior canal short, recurved; terminal notch narrow and very oblique, its inner arm formed by the sinuous lateral margin of the anterior fasciole, its outer by the produced keel which outlines the posterior margin of the fasciole.

Dimensions of holotype: Height, 11.4 millimeters; length of aperture, 5.8 millimeters; maximum diameter, 6.5 millimeters.

Type material: Holotype, U. S. Nat. Mus. No. 371812.

Type locality: U. S. G. S. Sta. No. 5079, one-half mile below Shell Bluff, Shoal River, Walton County, Florida. Shoal River formation of the Alum Bluff group.

The subspecies is apparently a local variation of *A. waltonensis* s.s., from which it differs in the somewhat more slender and scalariform outline and in the more subdued sculpture, both axial and spiral. The axials run the same in number but are not so sharply pinched as a rule as in *waltonensis* s.s. The spiral sculpture on the early whorls is restricted to the posterior sulcus, and even on the later whorls is very feeble excepting for the basal spirals and seemingly impressed rather than elevated. Aside from the age variations, the subspecies is quite constant at the single locality at which it is represented, although the number of incised lines between the posterior sulcus and the base of the whorl may be increased to 4 or even 5.

Distribution: Shoal River formation, locality 5079^a.

***Alectrion dystakta* Gardner, new species**

Plate 9, Figures 6-8

Shell rather small, thin, elongate-conic in outline. Basal sulcus ill-defined. Aperture in mature individuals less than half as high as the entire shell. Whorls of spire trapezoidal or feebly convex, the body broadly rounded. Number of whorls running up to 8 in the largest individuals, more frequently 7 or 6½. Protoconch of moderate dimensions, smooth, polished, naticoid, performing 3½ volutions; initial turn minute, somewhat inflated but almost entirely immersed in the succeeding whorl; remaining nuclear turns increasing in height and diameter with a moderate degree of rapidity. Line of demarcation between the conch and protoconch rather obscure, indicated by the gradual introduction of the axial sculpture. Axials very narrow both at the summit and the base, obtuse, feebly arcuate, uniform in prominence between the sutures, more or less obsolete upon the base of the body, varying widely in number,—from 15 to 25 or 26 upon the penultima, irregular in size and spacing upon the body; interaxial areas shallow, frequently wider than the axials. Spiral sculpture feeble and irregular; grooves usually 6 or 7 in number upon the penultima, the posterior sulcus deeply

incised and in some individuals dissecting the ribs, the medial spirals very feeble but becoming increasingly less so toward the anterior suture; anterior spiral groove often almost as deeply impressed as the posterior. Base of the body sculptured with low, flattened bands 8 or 9 in number, as a rule, which become increasingly narrower and more sharply elevated anteriorly. Fasciole threaded with about half a dozen lirae equal in size and linearly spaced. Suture line distinct, finely crenulated by the costae of the preceding volution. Aperture obliquely lenticular in outline, obtusely angulated posteriorly. Outer lip almost vertical medially, often feebly emarginate at the base, possibly for the extension of the eye-stalks, thin-edged but broadly varicated externally a little behind the margin, thickened and rather finely lirate internally. Inner wall of aperture quite strongly concave, washed with rather a heavy glaze, the margin of which extends in a broad arc from the commissure to the base of the pillar; an amorphous denticle or two sometimes developed upon the pillar and more rarely upon the parietal wall; edge of pillar acute, slightly elevated. Anterior canal incipient. Terminal notch very broad, not very deep, somewhat obliquely directed.

Dimensions of holotype: Height, 7.5 millimeters; length of aperture, 3.5 millimeters; maximum diameter, 3.8 millimeters. Paratype (an immature individual): Height, 5.3 millimeters; length of aperture, 2.7 millimeters; maximum diameter, 3.0 millimeters.

Type material: Holotype and 2 paratypes, U. S. Nat. Mus. No. 371815.

Type locality: U. S. G. S. Sta. No. 5618, $3\frac{1}{2}$ miles southwest of De Funiak Springs, Walton County, Florida. Shoal River formation of Alum Bluff group.

A. dystakta is rather closely related to *A. waltonensis*. The latter, however, is much larger and decidedly stouter than *dystakta*; the conch performs, as a rule, 2 or $2\frac{1}{2}$ more volutions, the axials are more or less Λ -shaped instead of being obtuse upon their summits, and are very narrow at the base, the spirals are fewer and more uniform, and the denticulation both upon the outer and inner wall of the aperture is much more developed.

A. dystakta offers a bewilderingly wide range of variation in relative proportions, the number of axials, and in the character and relative prominence of the spirals. The small thin shell and the numerous, arcuate, more or less irregular axials are usually sufficient to isolate the species. The spirals are also numerous, usually 6 at least upon the penultima, and, as a rule, they appear as unequally impressed, sublinear sulci. They may, however, be approximately equal and the spiral sculpture as a whole may appear to be elevated rather than depressed. The terminal varix is conspicuously broad, and there are not uncommonly remnants of former varices to be seen upon the shell.

Alectrion dystakta is apparently restricted in its distribution to the environs of the type locality.

Distribution: Shoal River formation, localities 5618^c, 7261^r, 7264^p.

Alectrion grapta Gardner, new species
Plate 9, Figure 9

Shell rather small, slender, elongate-conic in outline. Whorls probably 5 in number in an adult conch but only a little more than 4 in the type. Protoconch not very large, obtuse, smooth, and highly polished; initial turn minute, broadly inflated, almost entirely submerged in the succeeding whorl; remaining $2\frac{1}{2}$ volutions increasing in height and diameter with a moderate degree of rapidity. Dividing line between the conch and protoconch rather obscure, indicated by the gradual initiation of the axial sculpture; spiral sculpture not developed until the last half of the first post-nuclear turn. Axials very narrow, acute, persisting from suture to suture and well down to the base of the body, approximately uniform in prominence throughout their extent though tending to be slightly nodose posteriorly; from 14 to 16 in number upon the later whorls of the spire and half as many again upon the earlier. Spiral sculpture, taking the form of more or less deeply incised linear grooves, very feeble upon the earliest turns; posterior sulcus broader and deeper than those in front of it, outlining a presutural fillet which is, in some individuals, strong enough to feebly nodulate the costals which it overrides; sulci between the posterior groove and the anterior suture 4 in number in the type, frequently 5,

equal and equispaced, obsolete upon the summits of the costals; anterior and medial portion of the body sculptured like the later whorls of the spire; base of the body channeled with 5 increasingly wider and deeper grooves, the intervening areas becoming increasingly narrower and more elevated anteriorly; basal sulcus ill-defined. Fasciole coarsely threaded with 4 irregular lirae. Sutures distinct, impressed, crenulated in harmony with the costals of the preceding turn. Aperture rather narrow, obliquely lenticular, acutely angulated at the posterior commissure, broadest in front of the median horizontal. Labrum asymmetrically arcuate, abruptly constricted at the base, thickened externally a little behind the margin, reinforced within by rather prominent lirae (5 in number in the type), most prominent just before they abruptly evanesce a short distance within the margin. Inner wall of aperture smoothly but quite strongly concave; a heavy wash of callus spread in a broad, sharply defined arc from the posterior commissure to the anterior extremity of the pillar; a single rather prominent tooth developed upon the parietal wall directly in front of the commissure; other less elevated denticles usually present upon the pillar wash of the adult and on the anterior portion of the body wall; edge of pillar acutely elevated; anterior canal moderately broad, very short, and sharply recurved; terminal notch broad, moderately deep, obliquely directed.

Dimensions of holotype: Height, 6.0 millimeters; length of aperture, 2.5 millimeters; maximum diameter, 2.6 millimeters.

Type material: Holotype, U. S. Nat. Mus. No. 371829.

Type locality: U. S. G. S. Sta. No. 3742, Shoal Bluff, Shoal River, Walton County, Florida. Shoal River formation of the Alum Bluff group.

Alectrion grapta is characterized by the rather slender, elevated spire and the incised spiral sculpture.

Distribution: Shoal River formation, localities 3742ⁿ, 3748^r, 5618^p.

PLATES 1 - 10

PLATE 1

Figures 1-2. *Anadara (strebla* subsp.?) *metastrebla* Gardner, new species. (p. 9).

1. Exterior of holotype (left valve): Height, 22.3 millimeters; width, 35.6 millimeters.
2. Interior of holotype.

Figures 3-4. *Anadara gunteri* Gardner, new species (p. 11).

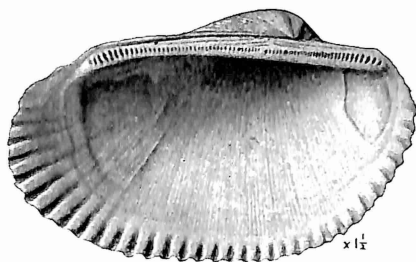
3. Exterior of cotype (right valve): Height, 29.5 millimeters; width, 37.3 millimeters.
4. Exterior of cotype (left valve): Height, 26.0 millimeters; width, 30.0 millimeters.

Figures 5-6. *Crenella armstrongi* Gardner, new species (p. 13).

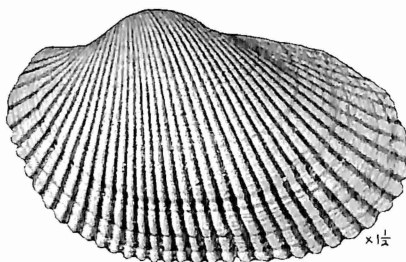
5. Exterior of holotype, left valve: Height, 4.0 millimeters; width, 3.0 millimeters.
6. Interior of paratype, right valve: Height, 2.3 millimeters; width, 1.8 millimeters.

Figures 7-9. *Chlamys (Nodipecten) pyx* Gardner new species (p. 19).

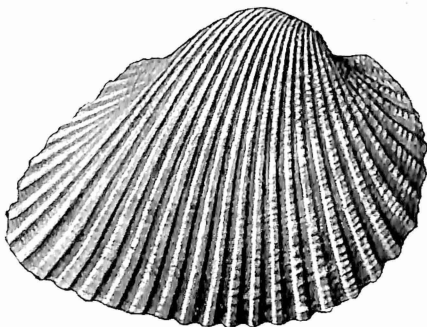
7. Exterior of paratype (juvenile left valve): Height, 26.5 millimeters; width, 25.5 millimeters.
8. Exterior of cotype (left valve): Height, 46.4 millimeters; width, 47.0 millimeters.
9. Exterior of cotype (right valve): Height, 53.5 millimeters; width, 56.1 millimeters.



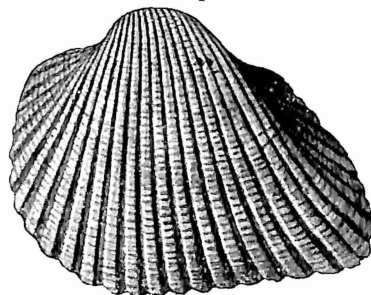
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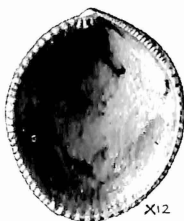
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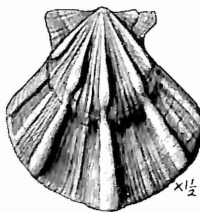
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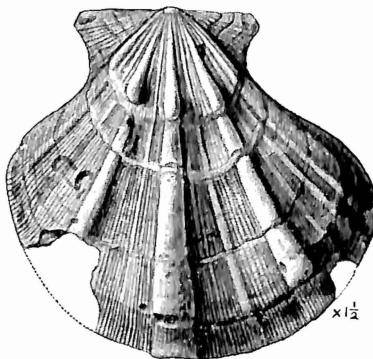
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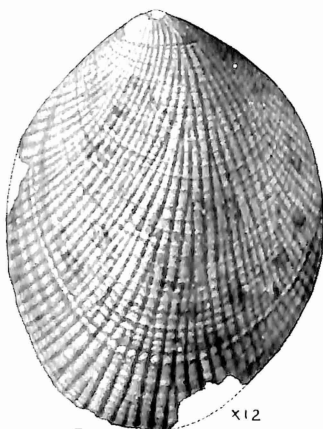
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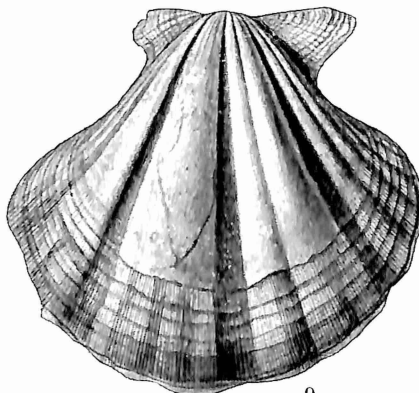
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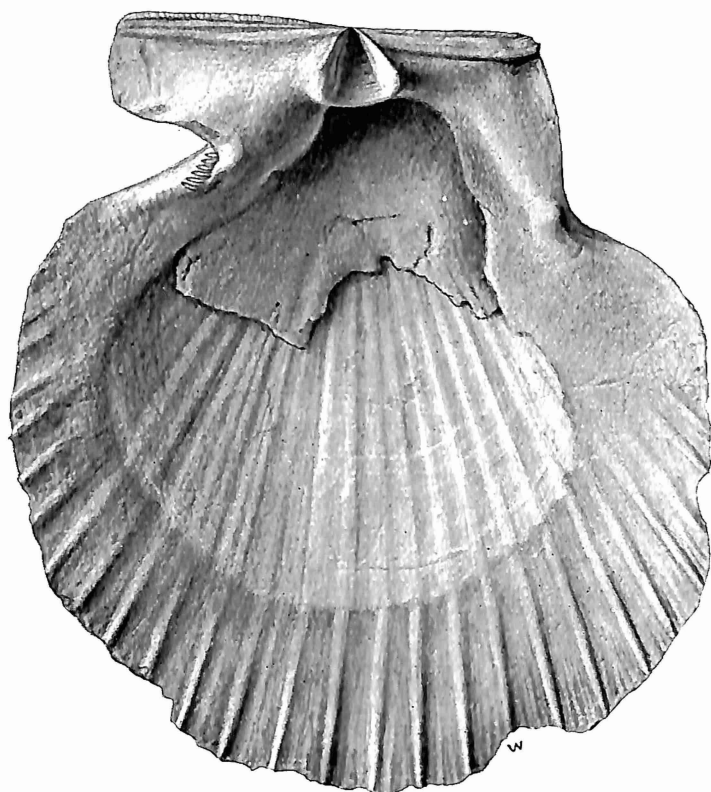
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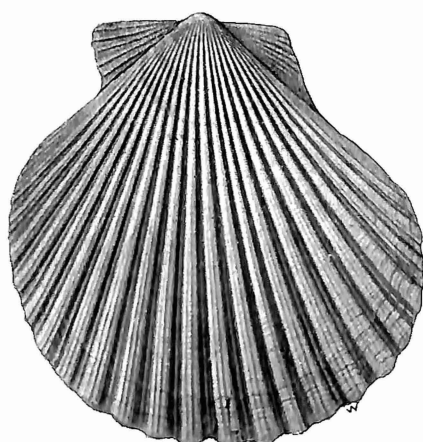
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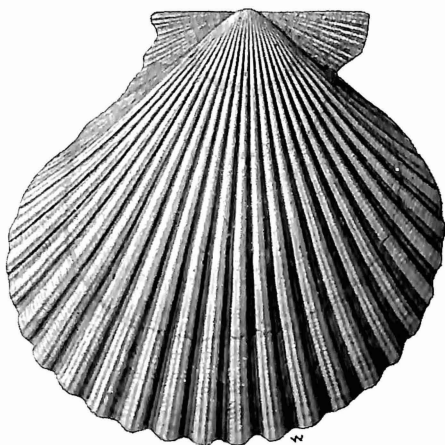
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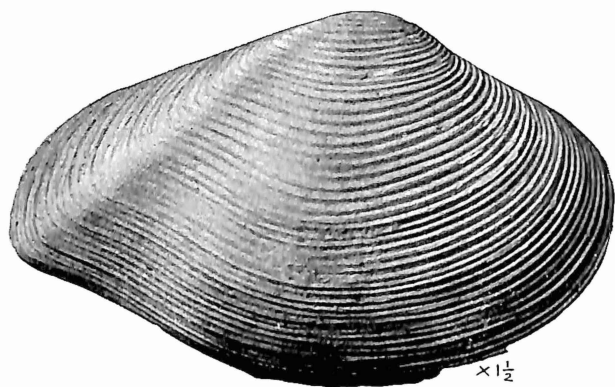
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PLATE 2

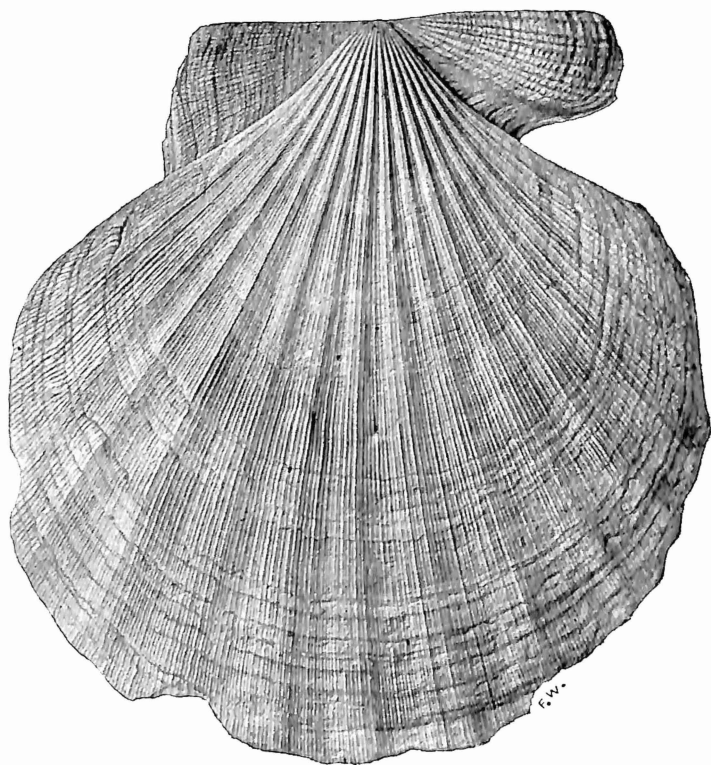
- Figure 1. *Chlamys (Lyropecten) nematopleura* Gardner, new species (p. 14).
Interior of holotype (right valve): Height, $100.0 \pm$ millimeters; width, $95.0 \pm$ millimeters.
- Figures 2-3. *Chlamys (Lyropecten?) nicholsi neotera* Gardner, new subspecies? (p. 16).
2. Exterior of cotype (right valve): Height, 59.0 millimeters; width, 56.5 millimeters.
 3. Exterior of cotype (left valve): Height, 59.0 millimeters; width, 55.3 millimeters.

PLATE 3

- Figure 1. *Crassatellites (Scambula) densus* Dall (p. 22).
Exterior of right valve: Height, 33.5 millimeters,
width, 53.5 millimeters.
- Figure 2. *Chlamys (Lyropecten) nematopleura* Gardner, new
species (p. 14).
Exterior of holotype (right valve): Height, 100.0±
millimeters; width, 95.0± millimeters.



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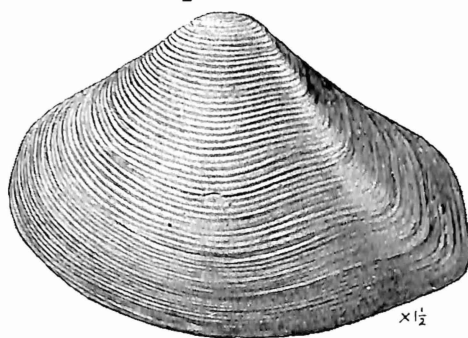


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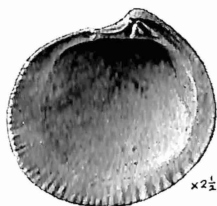
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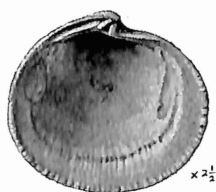
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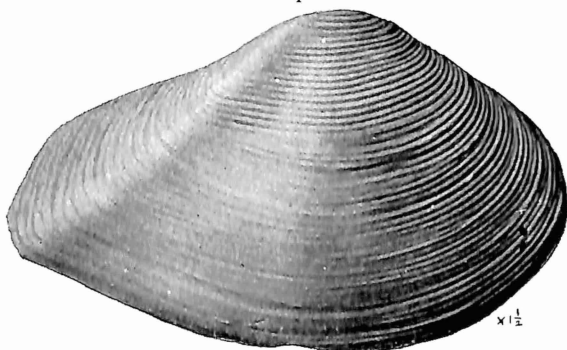
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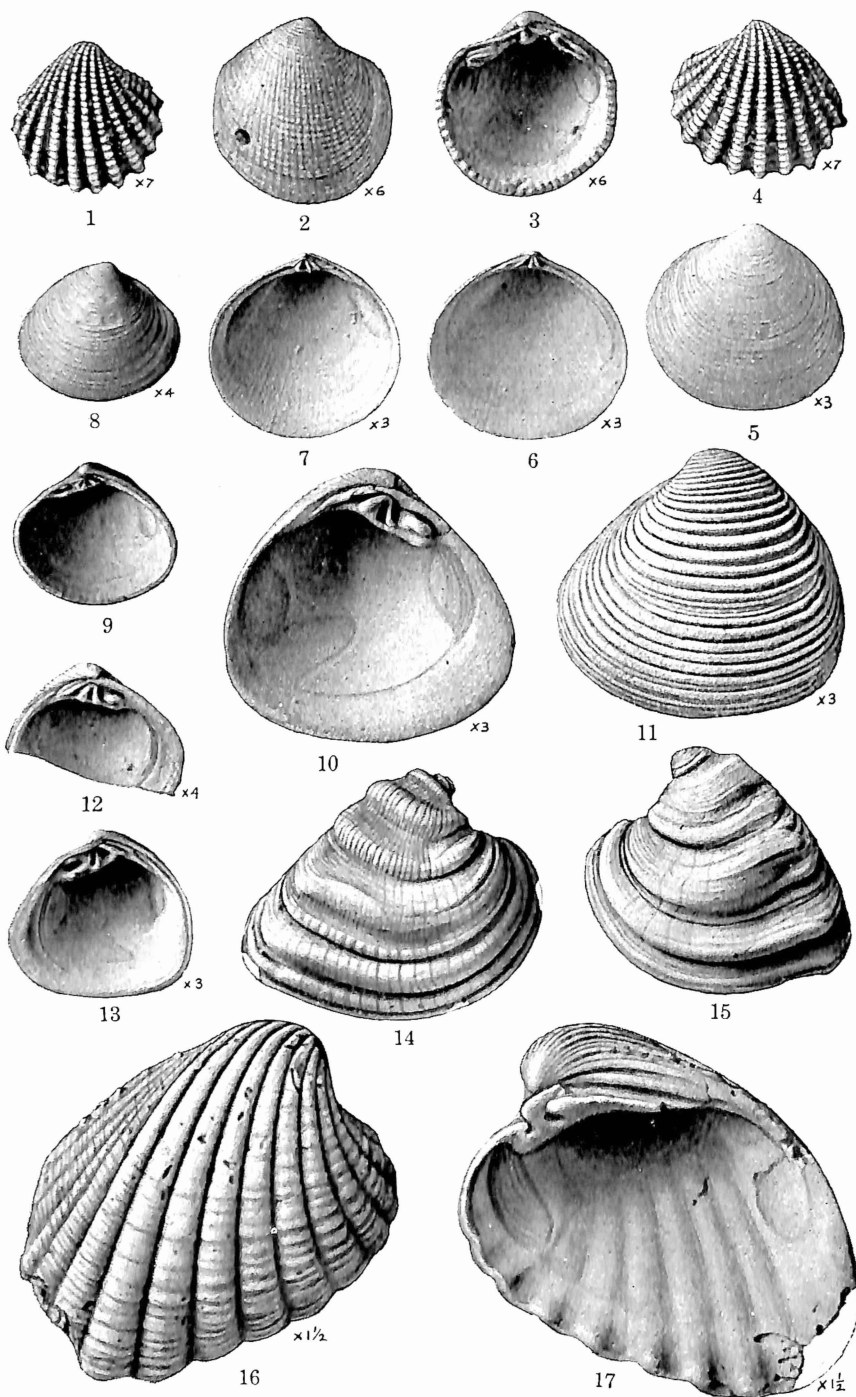
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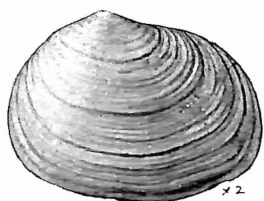
PLATE 4

- Figure 1. *Astarte (Ashtarotha)* species (p. 20).
Exterior of right valve: Height, 14.6 millimeters;
width, 16.2 millimeters.
- Figures 2-5. *Crassatellites (Scambula) densus* Dall (p. 22).
2. Exterior of left valve: Height, 26.0 millimeters; width, 37.5 millimeters.
 3. Exterior of left valve: Height, 29.5 millimeters; width, 42.0 millimeters.
 4. Exterior of right valve: Height, 28.0 millimeters; width, 42.5 millimeters.
 5. Exterior of right valve: Height, 30.0 millimeters; width, 49.0 millimeters.
- Figures 6-9. *Phacoides (Callucina) cala* Gardner, new species (p. 27).
6. Exterior of cotype (right valve): Height, 10.7 millimeters; width, 11.0 millimeters.
 7. Interior of cotype (right valve).
 8. Interior of cotype (left valve): Height, 10.2 millimeters; width, 10.7 millimeters.
 9. Exterior of cotype (left valve).

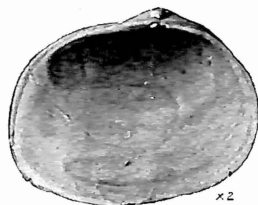
PLATE 5

- Figure 1. *Venericardia (Pleuromeris) aposcitula* Gardner, new species (p. 24).
Exterior of cotype (right valve): Height, 3.0 millimeters; width, 3.0 millimeters.
- Figures 2-3. *Phacoides (Parvilucina) diktyota* Gardner, new species (p. 26).
2. Exterior of holotype (right valve): Height, 4.0 millimeters; width, 4.0 millimeters.
3. Interior of holotype.
- Figure 4. *Venericardia (Pleuromeris) aposcitula* Gardner, new species (p. 24).
Exterior of cotype (left valve): Height, 3.1 millimeters; width, 3.3 millimeters.
- Figures 5-7. *Diplodonta (Phlyctiderma) (glos subsp. ?) lampra* Gardner, new species (p. 28).
5. Exterior of cotype (left valve): Height, 8.4 millimeters; width, 8.6 millimeters.
6. Interior of cotype (left valve).
7. Interior of cotype (right valve): Height, 8.4 millimeters; width, 8.5 millimeters.
- Figures 8-9. *Transennella caryera* Gardner, new species (p. 29).
8. Exterior of holotype (right valve): Height, 4.6 millimeters; width, 5.2 millimeters.
9. Interior of holotype.
- Figures 10-13. *Pitar (Hysteroconcha [Lamelliconcha]) cypta* Gardner, new species (p. 31).
10. Interior of holotype (left valve): Height, 12.3 millimeters; width, 13.2 millimeters.
11. Exterior of holotype.
12. Hinge of immature paratype (left valve): Height, 5.5 millimeters; width, 6.3 millimeters.
13. Interior of immature paratype (right valve): Height, 7.7 millimeters; width, 8.0 millimeters.
- Figures 14-15. *Chione (Liophora) cymaina* Gardner, new species (p. 36).
14. Exterior of cotype (right valve): Height, 32.3 millimeters; width, 39.1 millimeters.
15. Exterior of cotype (left valve): Height, 33.0 millimeters; width, 35.0 millimeters.
- Figures 16-17. *Venericardia (Megacardita) hesperide* Gardner, new species (p. 23).
16. Exterior of holotype (right valve): Height, 47.0 millimeters; width, 53.0 $\pm$ millimeters.
17. Interior of holotype.

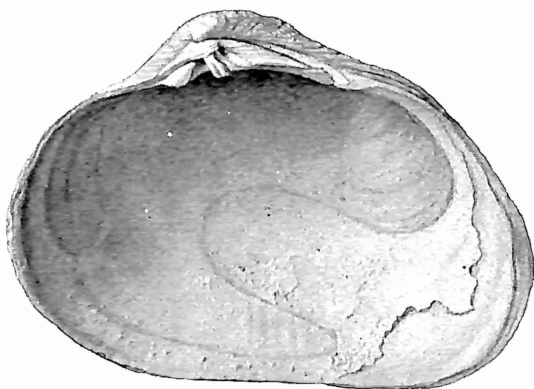




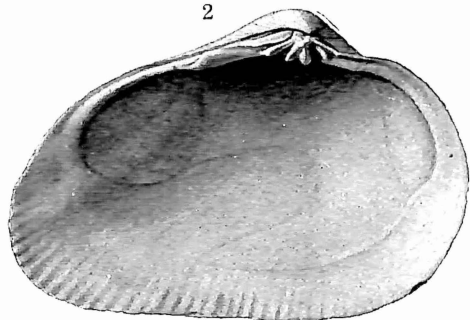
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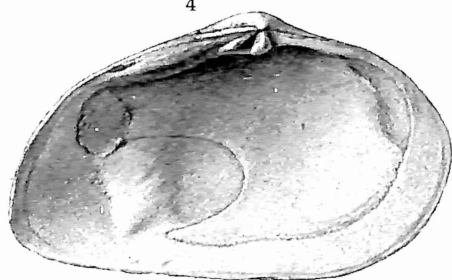
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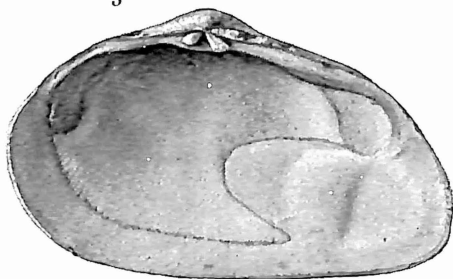
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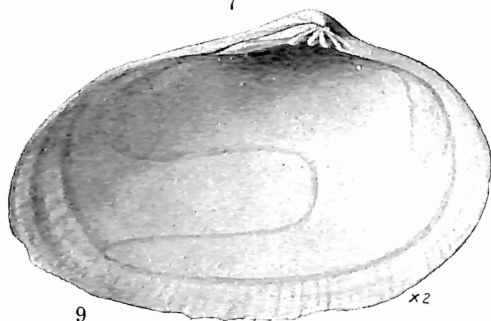
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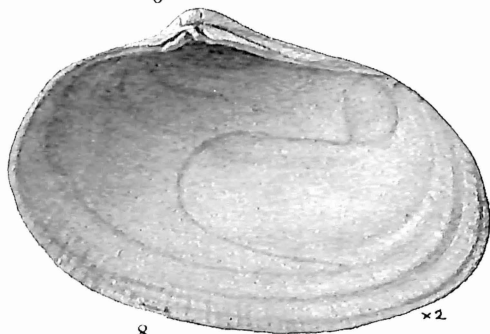
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PLATE 6

- Figures 1-2. *Petricola? senterfeiti* Gardner, new species (p. 38).
1. Exterior of holotype (left valve): Height, 13.0 millimeters; width, 17.5 millimeters.
 2. Interior of holotype (left valve).
- Figures 3-4. *Pleiorytis centenaria* Conrad (p. 39).
3. Interior of right valve from U. S. G. S. Sta. 10535, near the James River about half way between Indian Point and Coggins Point, Prince George County, Virginia; Yorktown formation: Height, 50.0 millimeters; width, 70.0 millimeters.
 4. Interior of left valve from U. S. G. S. Sta. 10204, Tormentor Creek, 2 miles north of Smithfield, Isle of Wight County, Virginia; Yorktown formation: Height, 41.0 millimeters; width, 62.0 millimeters.
- Figure 5. *Pleiorytis bowenae* Gardner, new species (p. 40).
- Exterior of cotype (right valve): Height, 20.5 millimeters; width, 31.8 millimeters.
- Figures 6-7. *Asaphis deflorata* (Linnaeus); genotype of *Asaphis* Modeer, U. S. Nat. Mus. No. 73118, from Abaco, the Bahama Islands (p. 39).
6. Interior of right valve; Height, 36.0 millimeters; width, 60.0 millimeters.
 7. Interior of left valve of the same individual.
- Figures 8-9. *Pleiorytis bowenae* Gardner, new species (p. 40).
8. Interior of cotype (right valve); Height, 20.5 millimeters; width, 31.8 millimeters.
 9. Interior of cotype (left valve): Height, 20.4 millimeters; width, 31.6 millimeters.

PLATE 7

Figures 1-2. *Chione* (*Chione*) *oulotricha* Gardner, new species (p. 33).

1. Exterior of holotype (right valve): Height, 28.4 millimeters; width, 36.2 millimeters.
2. Interior of holotype.

Figures 3-4. *Callocardia* (*Agriopoma*) *calceola* Gardner, new species (p. 30).

3. Exterior of holotype (left valve): Height, 41.0 millimeters; width, 54.0 millimeters.
4. Interior of holotype.

Figures 5-7. *Semele* species cf. *S. chipolana* Dall (p. 41).

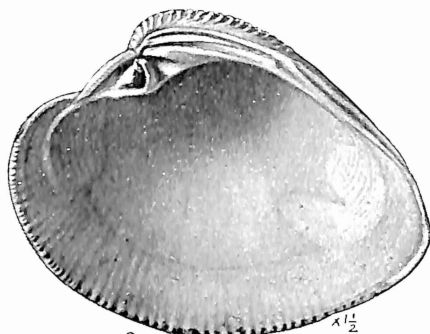
5. Exterior of left valve, U. S. Nat. Mus. No. 372911: Height, 22.5 millimeters; width, $30.0 \pm$ millimeters.
6. Exterior of left valve, U. S. Nat. Mus. No. 372910: Height, 12.0 millimeters; width, 16.8 millimeters.
7. Interior of U. S. Nat. Mus. No. 372910.

Figure 8. *Chione* (*Lirophora*) *crossota* Gardner, new species (p. 34).

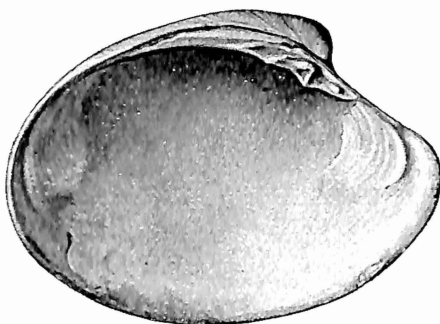
Exterior of holotype (right valve): Height, 25.0 millimeters; width, 33.8 millimeters.



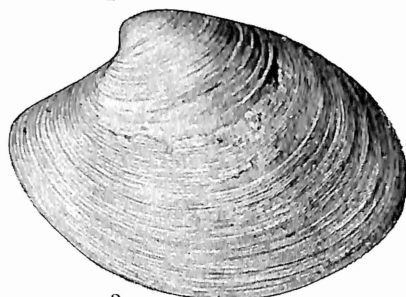
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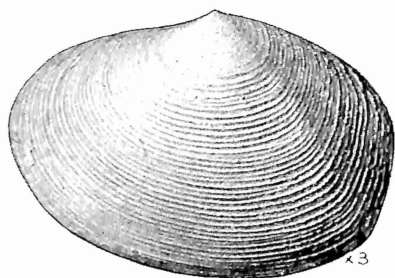
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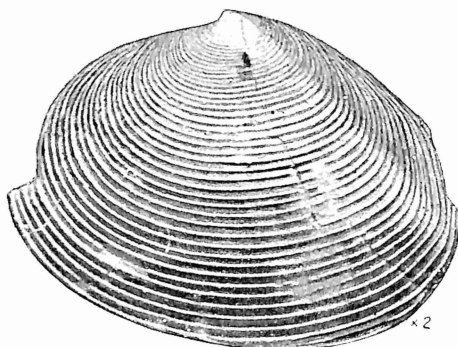
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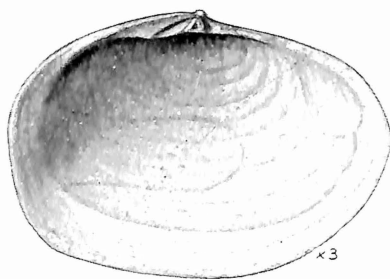
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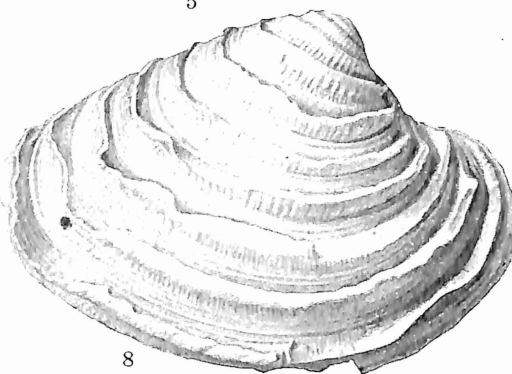
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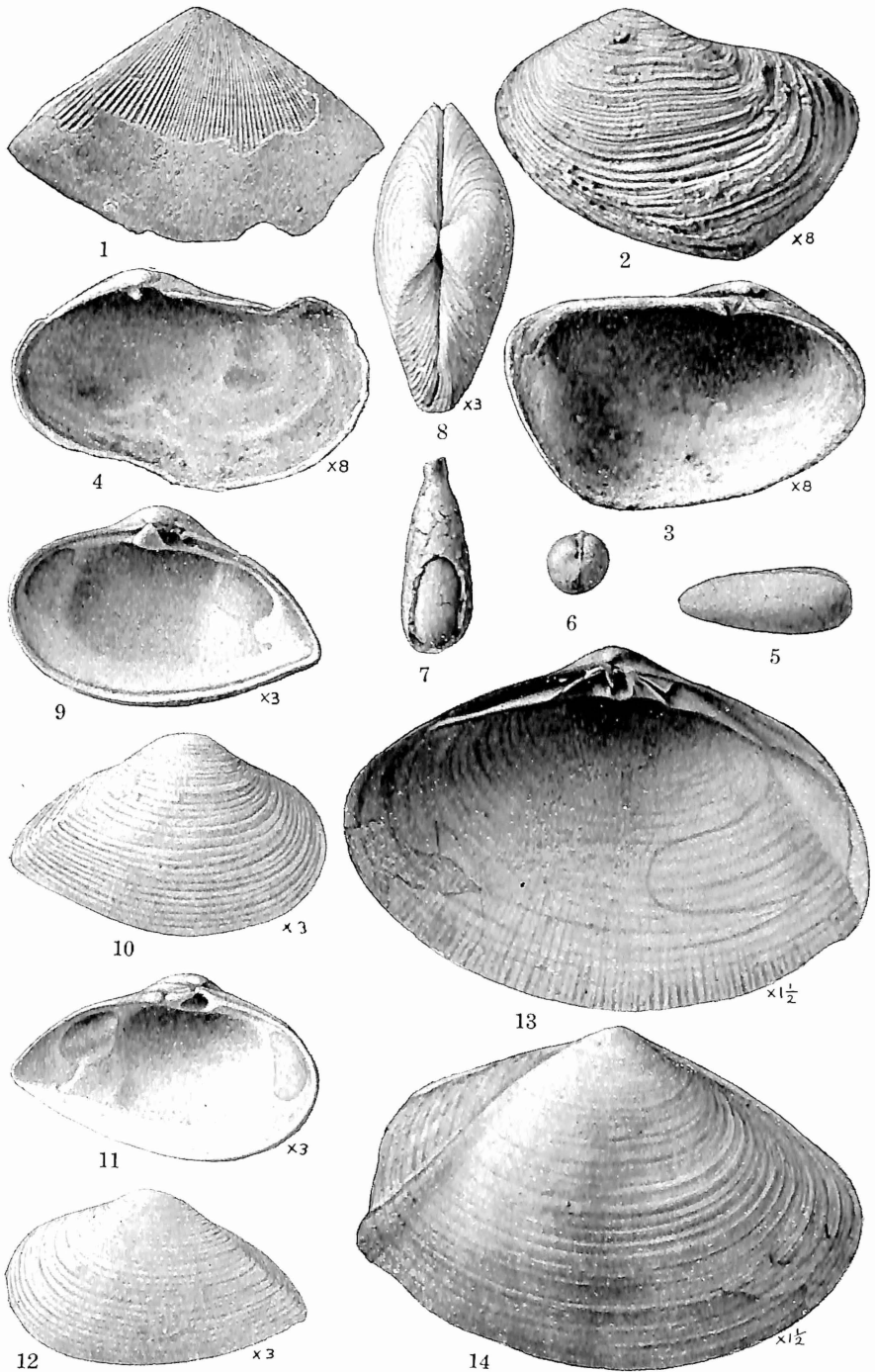
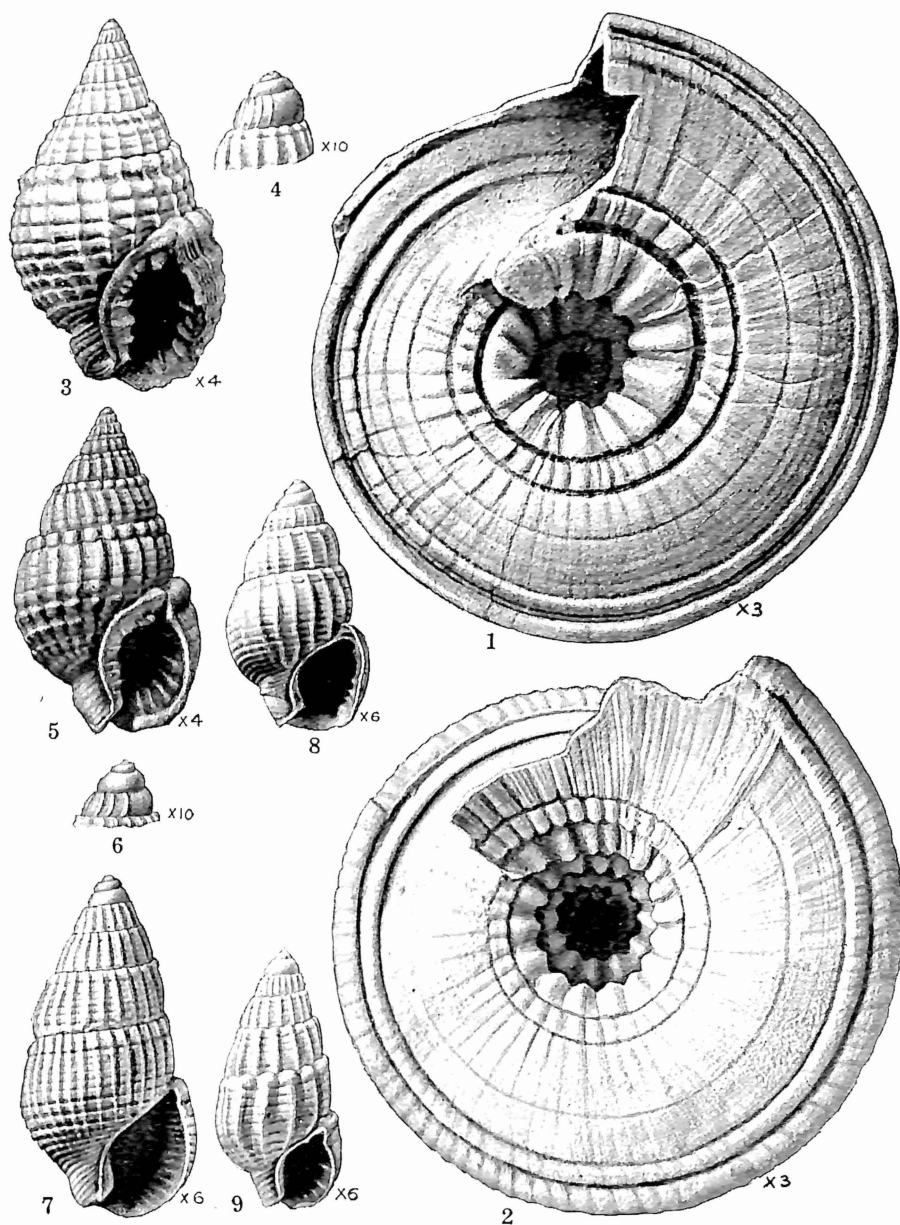


PLATE 8

- Figure 1. *Donax* species (p. 42).
Exterior of right valve, U. S. Nat. Mus. No. 372889:
Height, $32.0 \pm$ millimeters; width, $55.0 \pm$ millimeters.
- Figures 2-4. *Sphenia senterfeiti* Gardner, new species (p. 45).
2. Exterior of cotype (left valve): Height, 3.5 millimeters; width, 6.0 millimeters.
3. Interior of cotype (left valve).
4. Interior of cotype (right valve): Height, 3.3 millimeters; width, 6.0 millimeters.
- Figures 5-7. *Lithophaga cookei* Gardner, new species (p. 14).
5. Lateral profile of holotype (mold of double valves): Height, 8.8 millimeters; width, 23.2 millimeters.
6. Holotype viewed from the front.
7. Profile of paratype (individual encased in a calcareous covering): Length of imperfect tube, 26 millimeters.
- Figures 8-12. *Corbula (Caryocorbula) cala* Gardner, new species (p. 46).
8. Dorsal view of holotype (double valves of a single individual): Height, 9.2 millimeters; width, 14.2 millimeters; thickness, 6.4 millimeters.
9. Interior of right valve of holotype.
10. Exterior of right valve of holotype.
11. Interior of left valve of holotype.
12. Exterior of left valve of holotype.
- Figures 13-14. *Mactra (Mactrotoma) profragilis* Gardner, new species (p. 43).
13. Interior of holotype (right valve): Height, 31.8 millimeters; width, $46.0 \pm$ millimeters.
14. Exterior of holotype.

PLATE 9

- Figure 1. *Architectonica quadriseriata waltonensis* Gardner, new subspecies (p. 47).
Basal view of holotype: Height, 14.0 millimeters; maximum diameter, 26.0 millimeters.
- Figure 2. *Architectonica alvear* Gardner, new species (p. 48).
Basal view of holotype: Height, 17.0 millimeters; maximum diameter, 25.0 millimeters.
- Figures 3-4. *Alectrion waltonensis* Gardner, new species (p. 54).
3. Apertural view of holotype: Height, 12.7 millimeters; maximum diameter, 7.5 millimeters.
4. Tip of juvenile paratype, x10.
- Figure 5. *Alectrion waltonensis deleta* Gardner, new subspecies (p. 56).
Apertural view of holotype: Height, 11.4 millimeters; maximum diameter, 6.5 millimeters.
- Figures 6-8. *Alectrion dystakta* Gardner, new species (p. 58).
6. Tip of juvenile paratype, x10.
7. Apertural view of holotype: Height, 7.5 millimeters; maximum diameter, 3.8 millimeters.
8. Apertural view of adolescent paratype: Height, 5.3 millimeters; maximum diameter, 2.7 millimeters.
- Figure 9. *Alectrion grapta* Gardner, new species (p. 60).
Apertural view of holotype: Height, 6.0 millimeters; maximum diameter, 2.6 millimeters.



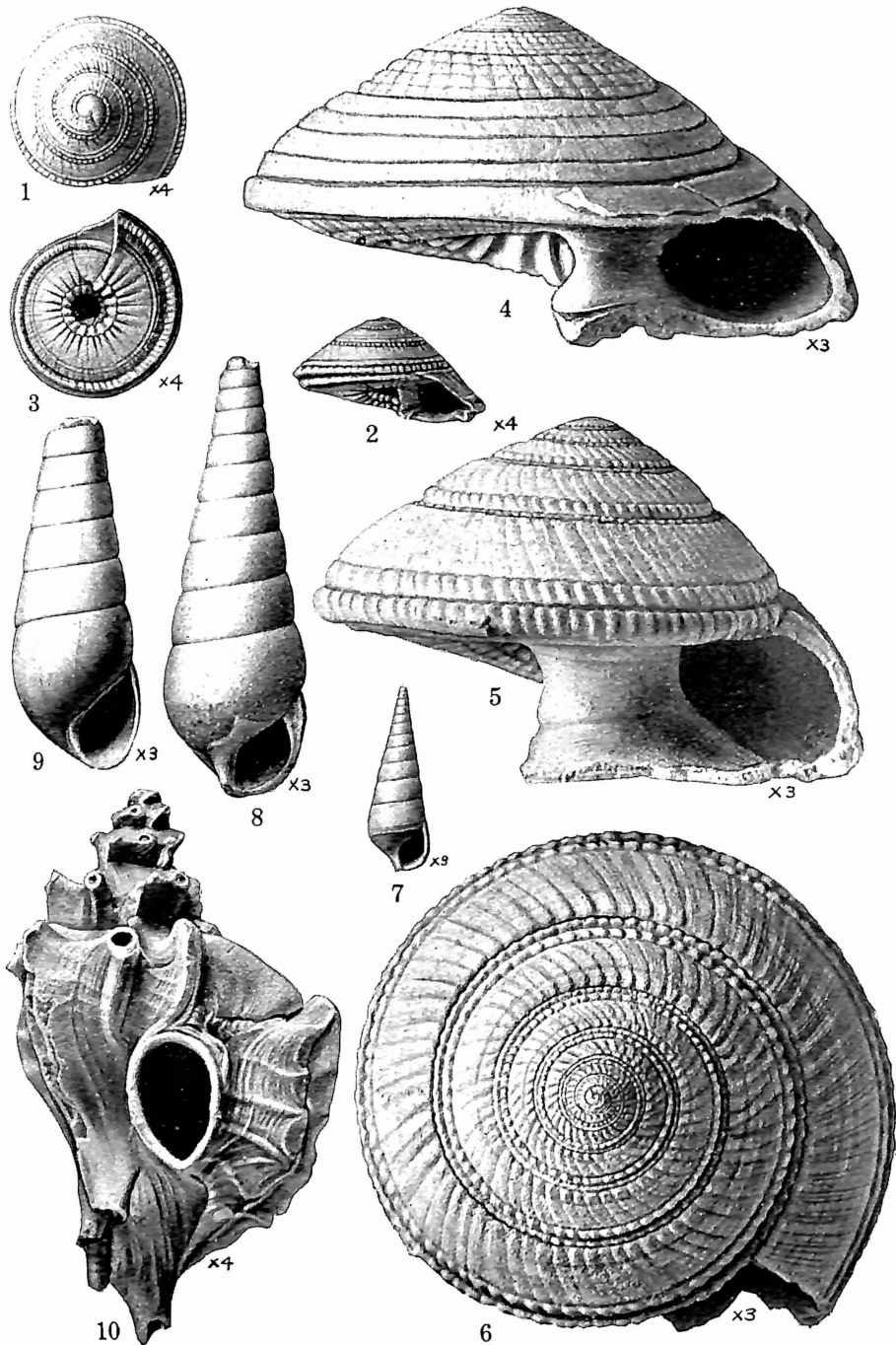


PLATE 10

- Figures 1-3. *Architectonica (Psilaxis) verecunda* Gardner, new species (p. 50).
1. Apical view of holotype: Height, 4.0 millimeters; maximum diameter, 6.5 millimeters.
 2. Apertural view of holotype.
 3. Basal view of holotype.
- Figure 4. *Architectonica quadriseriata waltonensis* Gardner, new subspecies (p. 47).
Apertural view of holotype: Height, 14.0 millimeters; maximum diameter, 26.0 millimeters.
- Figures 5-6. *Architectonica alvear* Gardner, new species (p. 48).
5. Apertural view of holotype: Height, 16.0 millimeters; maximum diameter, 25.0 millimeters.
 6. Apical view of holotype.
- Figures 7-9. *Melanella (Melanella) makista* Gardner, new species (p. 51).
7. Apertural view of juvenile paratype: Height, 7.8 millimeters; maximum diameter, 2.7 millimeters.
 8. Apertural view of holotype: Height, $23.0 \pm$ millimeters; maximum diameter, 6.4 millimeters.
 9. Specimen figured to show an unusually well rounded body whorl: Height, $20.0 \pm$ millimeters; maximum diameter, 6.0 millimeters.
- Figure 10. *Typhis pterinus* Gardner, new species (p. 52).
Apertural view of holotype: Height, $20.0 \pm$ millimeters; maximum diameter including varices, 13.0 millimeters.

