

SOME NEW OR OTHERWISE INTERESTING MEMBERS
OF THE CALYPTRAEIDAE (MOLLUSCA: GASTROPODA)EMILY H. VOKES
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I. CALYPTRAEA (TROCHITA)

Although Gardner (1947) lists several species of Calyptraeidae from all three members of the Alum Bluff Group, some very interesting forms were not known to her. Present work has revealed three species of *Trochita* Schumacher, 1817 (type species: *Trochita spiralis* Schumacher = *Turbo trochiformis* Born), a group not found in the western Atlantic today. The Recent members occur primarily on the west coast of South America, with the species *Calyptraea (Trochita) trochiformis* (Born, 1778), and Mexico, with *C. (T.) spirata* (Forbes, 1852). The modern forms are rock-clingers, and Keen (1971, p. 456) notes that *C. spirata* "may be found clinging tenaciously to the most surf-beaten rocks on exposed coasts." Therefore, the presence of two species of *Trochita* in the Chipola Formation and a third in the Oak Grove Sand is of paleoecological value.

The two Chipola species were not known to Gardner but she did have the Oak Grove form, which she described as *Calyptraea crenata* (1947, p. 562, pl. 56, figs. 1, 2), not recognizing it as a *Trochita*. The holotype is refigured here (pl. 1, fig. 1) and it can be seen that, in spite of its small size (15 mm diameter), it is unquestionably a good *Trochita*. So far as is known the type lot of two specimens are the sole representatives of the species to be taken in the Alum Bluff Group. However, five examples of a closely related, if not identical, form have been collected in the early lower Miocene beds at Silverdale, North Carolina (TU 866). The largest of these is 13 mm in maximum diameter, so it would seem to be a relatively small species.

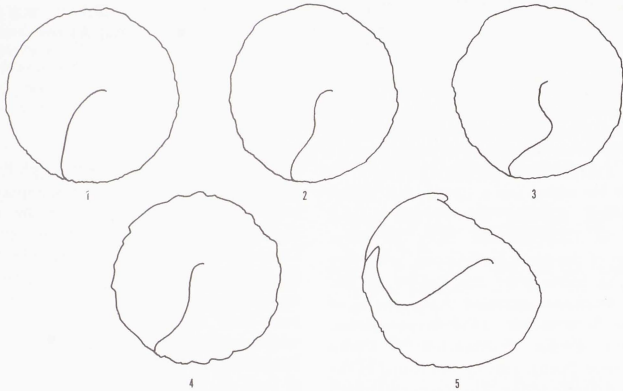
The two Chipola species are less rare, but nonetheless uncommon. The first is represented by five examples, the largest here figured (pl. 1, fig. 2). The second has a total of

25 specimens from six localities (pl. 1, figs. 3, 5). Not surprisingly the same two species also occur in the Miocene beds of the French Aquitaine Basin. Both forms are cited by Cossmann and Peyrot (1919, pp. 483, 485) as Aquitanian and Burdigalian, thus being exact correlatives of the Chipola forms. The members of *Trochita* are frequently widespread in their distribution; certainly the Eocene *C. (T.) aperta* (Solander, 1766) occurs in both the Old World and the New, and no special significance can be attached to this Miocene occurrence.

The more common of the two Chipola species of *Trochita* is *Calyptraea (Trochita) costaria* Grateloup, 1827. The rarer is *C. (T.) ornata* Basterot, 1825. The latter is marked by ornamentation consisting of small tubules and is probably the direct descendant of *C. aperta*, which also has tubules. The Eocene species is common throughout the London and Paris Basins and also in the Gosport Sand of Alabama. In addition it has been reported from the Vicksburg Oligocene.

From the literature alone it is impossible to know exactly whether a reported species is actually *C. aperta* or *C. ornata*. The chief distinguishing characteristic between the two species is in the nature of the basal septum, and unless this is shown, the specimen could be either. In the younger *C. ornata* the free edge of the septum is straight across; in the Eocene form it is somewhat curved, although not as much as in *C. costaria* (compare text figs. 1-4). Unfortunately these septa are very fragile and are frequently broken, so that of the entire lot of specimens from the Chipola not one *C. costaria* has an unbroken septum. However, the septa of *C. ornata* and *C. costaria* are well figured in Cossmann and Peyrot (1919, pl. 13, fig. 32, and pl. 14, fig. 3).

Calyptraea aperta (as "*C. trochiformis* Lamarck") was reported by Dall (1915, p. 103) from the early lower Miocene Tampa



Text figure 1, *Calyptraea (Trochita) ornata* Basterot. Text figure 2, *Calyptraea (Trochita) aperta* (Solander). Text figure 3, *Calyptraea (Trochita) costaria* Grateloup. Text figure 4, *Calyptraea (Trochita) trochiformis* (Born). Text figure 5, *Crepipatella dilatata* (Lamarck).

Formation. The material is too poor to determine the nature of the septum, but in the correlative Silverdale beds of North Carolina (TU 562) the species that occurs is definitely *C. aperta*. Probably the Tampa form is also.

A similar form has been reported from the middle Miocene of New Jersey and Maryland under the name *Infundibulum perarmatum* Conrad, 1841. There are no specimens in the Tulane collections and from the available illustrations it is impossible to be certain whether the species should be considered a synonym of *C. aperta* or of *C. ornata* but the specimen illustrated by Richards and Harbison (1942, pl. 18, fig. 23) from Millville, New Jersey, looks very much like the Chipola *C. ornata*.

Although the name *C. trochiformis* Lamarck, 1804, has been used extensively for the Eocene species it is a junior synonym of *C. aperta* (Solander). However, it is a source of some confusion in the literature as the Recent West Coast form is now known by the name *Trochita trochiformis* (Born).

The name *Turbo trochiformis* Born, 1778, has been the subject of some nomenclatural

controversy, and has been discussed by several authors (especially Palmer, 1963; Robertson, 1963). The original usage of the name is somewhat confused but the reference to a well executed figure in Knorr (1768, *Vergnugender Augen*, pt. 3, pl. 29, figs. 1, 2), plus the ruling by the International Commission on Zoological Nomenclature (Opinion 715, 1964) that the name *Trochus conchyliophorus* Born, 1780, refers to the carrier-shell *Xenophora*, thus leaving the name *trochiformis* nomenclatorially available for the *Trochita* from South America, has led to the acceptance by recent authors (e.g., Keen, 1971; Marincovich, 1973) of this name. Frequently in the pre-1964 literature this species is cited as *Trochus radians* Lamarck, 1816, which is a junior synonym.

The name *Patella trochiformis* Gmelin, 1791, is also involved. Several of the references cited by Gmelin apply to one or another species of *Trochita*. Gmelin does not refer to Born and there being no indication that he was using the name in the sense of Born, it is probably just a coincidence. But from his description of the shell as

longitudinally plicate, with the inner lip lateral, it would seem that a *Trochita* was what he was describing. However, his first reference is to a different form figured in Chemnitz (1788, *Conchyl.-Cab.*, v. 10, figs. 1626, 1627), which Rehder (1943, p. 43) as "first reviser" selected as the species to bear the name. This, as Rehder indicated, is now regarded as a member of *Bicatillus* (*Desmaulus*), a group more closely related to *Crucibulum*.

In addition to its occurrence on the west coast of South America, the species *C. trochiformis* is also found on the west coast of Africa, from the Cape Verde Islands to Benguela, Angola (Nicklès, 1950, p. 73). If one examines ocean currents one can see this is a plausible distribution. Given a long-lived larval stage, such as *Trochita* has, if a species were to move all the way to the southern tip of South America, the larvae would then get into the eastward-moving Cape Horn Current. From there they would move into the northward Benguela Current, and the next land-fall is southwest Africa. The two occurrences may represent remnants of a formerly continuous range, for the group is found today throughout the Magellanic area, but the species from Tierra del Fuego to Cabo San Antonio, northern Argentina, as well as the Falkland Islands, is slightly different from *C. trochiformis*. It has a more sinuated septum, much like that seen in the figure of *C. costaria* (text fig. 3), which well may be a secondary development in this geographically distinct area.

The western American species of *Trochita* probably all descended from a common ancestor, possibly the form figured by Woodring from the early Miocene La Boca Formation of western Panamá (1973, pl. 72, figs. 12, 16, 19). Closely related to this Panamic species is the Florida Pliocene *C. floridana* (Olsson and Petit, 1964, p. 563, pl. 81, figs. 2, 2a), which is common at some localities in the Brighton facies of the Pinecrest beds. Two other records in the western Atlantic for the latter are the Pliocene Matura Formation of Trinidad (Jung, 1969, pl. 47, figs. 12, 13, as *T. radians*) and the late Miocene beds of the Paraguaná Peninsula of Venezuela (Jung, 1965, pl. 66, figs. 1, 2, as *T.*

cf. radians). On the basis of over 400 specimens of *C. floridana* in the Tulane collections (373 from a single locality—TU 770) it can be seen that Jung's figured specimens fall well within the rather wide range of variability of this species. The form that occurs in the Gatun Formation of Panamá (Woodring, 1957, pl. 19, figs. 11–14) is the Mexican *C. spirata*, as noted subsequently by Woodring (1973, p. 474).

CALYPTRAEA (TROCHITA)

CRENATA Gardner

Plate 1, fig. 1

Calyptraea crenata GARDNER, 1947, U. S. Geol. Surv. Prof. Paper 142-H, p. 562, pl. 56, figs. 1, 2.

Figured specimen: USNM 136053 (holotype); maximum diameter 15.6 mm, height 7.0 mm; locality USGS 2646 (=TU 91).

CALYPTRAEA (TROCHITA)

ORNATA Basterot

Plate 1, fig. 2

Calyptraea ornata BASTEROT, 1825, Mém. Soc. Hist. Nat. Paris, v. 2, p. 72, pl. 4, fig. 2.

Figured specimen: USNM 647324; maximum diameter 25.0 mm, height 11.0 mm; locality TU 1051. Other occurrences: TU locality nos. 546, 830.

CALYPTRAEA (TROCHITA)

COSTARIA Grateloup

Plate 1, figs. 3, 4

Calyptraea costaria GRATELOUP, 1827, Soc. Linn. Bordeaux, Actes, v. 2, p. 82; 1847, Conch. Fossile Bassin Adour, Atlas, pl. 1, figs. 60–63.

Figured specimens: Fig. 3, USNM 647323; maximum diameter 27.0 mm, height 13.0 mm; locality TU 999. Fig. 4, USNM 647322; maximum diameter 24.0 mm, height 10.0 mm; locality TU 459. Other occurrences: TU locality nos. 547, 548, 825, 1048.

II. CREPIPATELLA

The second group of Calyptraeidae that is of unusual interest in the Chipola Formation is the otherwise eastern Pacific genus *Crepidatella* Lesson, 1830, a relative of *Crepidula*. So far as is known the Chipola species here described is the first to be recorded outside of that area. However, in Cossmann and Peyrot (1919, pl. 14, fig. 11) there is a specimen figured that is said to be *Crepidula (Janacus) gibbosa* DeFrance. This illustrated specimen bears little resemblance to the other two figures supposedly of the same species, and looks suspiciously like the modern "*Crepidula*" *dilatata* Lamarck, 1822, of Peru and Chile, type species of *Crepidatella*. Unfortunately, only the external view is given of this specimen, whereas the principal differentiating character between *Crepidula* and *Crepidatella* is the nature of the internal septum or deck. In *Crepidula* it is approximately straight across but in *Crepidatella* it is detached along one side (see text fig. 5). One could take a specimen of *Crepidatella* to be a rugose *Crepidula* with the septum apparently broken along one side.

Therefore, there may well be a species of *Crepidatella* in the Helvetian of Aquitaine, but if so it is more closely related to the modern *Crepidatella dilatata* than to the contemporaneous Chipola species. There are

several nominal species of *Crepidatella* in western South America, with "*Crepidula*" *dilatata* the first to be named. Broderip (1835, p. 202) named two additional forms from Peru as "*Crepidula*" *foliacea* and "*C.*" *strigata*, but large collections made at Antofagasta, Chile (TU R-226), indicate they are probably all the same species. However, Broderip described a third species, "*Crepidula*" *dorsata* (1834, p. 38) that is very different from *C. dilatata*. It is this latter to which the Chipola species is most nearly related.

There is another possible species of *Crepidatella* in the western Atlantic, *Calyptraea greensboroensis* Martin, based on one specimen from the middle Miocene Calvert Formation of Maryland (1904, pl. 59, fig. 3). The illustration shows a shell with a coiled marginal apex, an ornamentation pattern much like *Crepidatella dilatata*, and unfortunately a broken septum. It may be a specimen of the group named *Bostrycapulus* Olsson and Harbison, 1953 (type: *Patella aculeata* Gmelin, 1791) but the nature of the ornamentation is more like *Crepidatella*, as is the portion of the septum that remains. In addition, the shell has an almost circular outline, again more like *Crepidatella*. Although the Calvert is just slightly younger than the Chipola Formation, there is no possibility that the two occurrences are the same species for the Maryland form has a completely different type of ornamentation.

PLATE 1

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 Locality: USGC 2646 (= TU 91). Oak Grove Sand, (?) late lower Miocene.
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 USNM 647324; maximum diameter 25.0 mm, height 11.0 mm.
 Locality: TU 1051. Chipola Formation, late lower Miocene.
- 3, 4. *Calyptraea (Trochita) costaria* Grateloup (X 2) 165
 3. USNM 647323; maximum diameter 27.0 mm, height 13.0 mm.
 Locality: TU 999. Chipola Formation, late lower Miocene.
 4. USNM 647322; maximum diameter 24.0 mm, height 10.0 mm.
 Locality: TU 459. Chipola Formation, late lower Miocene.

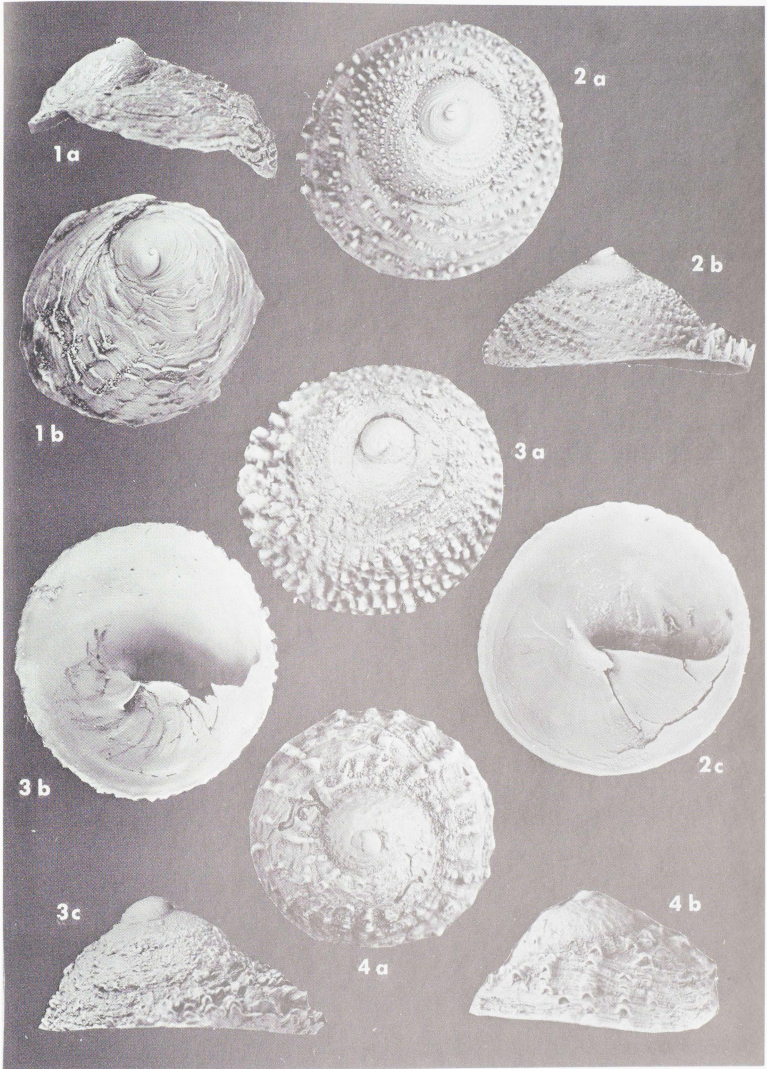


PLATE 1

Jung (1965, p. 500, pl. 66, figs. 7-9) has named a species from the Miocene of the Paraguana Peninsula, Venezuela, as "*Crepidula* ? (*Crepidatella* ?)" *insculpta* that appears to be a form of *Crucibulum* rather than *Crepidatella*. The internal septum is distinctly depressed into an apical hollow and this, combined with the total lack of external sculpture, suggests a species very near *Crucibulum* (*Dispotaea*) *constrictum* (Conrad, 1842).

The type lot of *Crepidatella apprimus* n. sp., consists of over 100 specimens, all but four from a single locality in the Chipola-TU 555. The environment of this particular area must have been somewhat unusual, for found here are several species, e.g., *Neritopsis vokesorum* Hoerle, which are confined essentially to this locality, with perhaps a few specimens also being taken at TU 547. The latter we know to have been a coral reef; whole coral heads abound at the site. Geographically TU 555 is about one-quarter mile away but its exact relationship to the reef is uncertain. There is some coral present, but only limited amounts compared with TU 547, and the fauna has many otherwise unknown species. The Trochacea are particularly well represented with numerous specimens of *Calliostoma* spp., *Tegula* cf. *T. fasciata* (Born), *Turbo* cf. *T. haraldi* Robertson, *Turbo* cf. *T. canaliculatus* (Hermann) to mention only a few. Calyptraeidae on the whole are

scarce, with the exception of large specimens of *Crucibulum chipolanum* Dall in fair numbers.

CREPIPATELLA APPRIMUS

E. H. Vokes, n. sp.

Plate 2, figs. 1, 2

Description: Shell flattened patelloid, very irregular in outline but generally about the same in maximum and minimum diameter. Protoconch small, of about one and one-half highly polished whorls, in almost the same plane as the remainder of the shell but placed nearer to one edge than to the center. A small smooth raised part encircling the polished portion of the protoconch, like a small cap, ending abruptly at a "drop-off" into the stronger external ornamentation, which consists of strong costae radiating out from the apex. Ornamentation extremely variable, the number of costae ranging from about 12 to 20, increasing with larger size by intercalation. The costae nodulated along their length at irregular intervals in accord with the concentric growth-lines that ring the apex; outer margin crenulated by the raised costae. Internal platform similar to that of *Crepidula* but more cup-like, and detached along one margin.

Dimensions of holotype: maximum diameter 14.4 mm, diameter at right angles to maximum, 12.5 mm, height 3.5 mm.

Holotype: USNM 647331.

Type locality: TU 555, east bank of Chipola River, about 1,000 feet above Four Mile Creek (SW ¼ Sec. 29, T1N, R9W), Calhoun County, Florida.

Occurrence: Chipola Formation, Florida; late lower Miocene.

PLATE 2

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6. (X 3) USNM 739424; maximum diameter 18.4 mm, height 10.0 mm. Locality: TUR-180, Masachapa, western Nicaragua. Recent.	

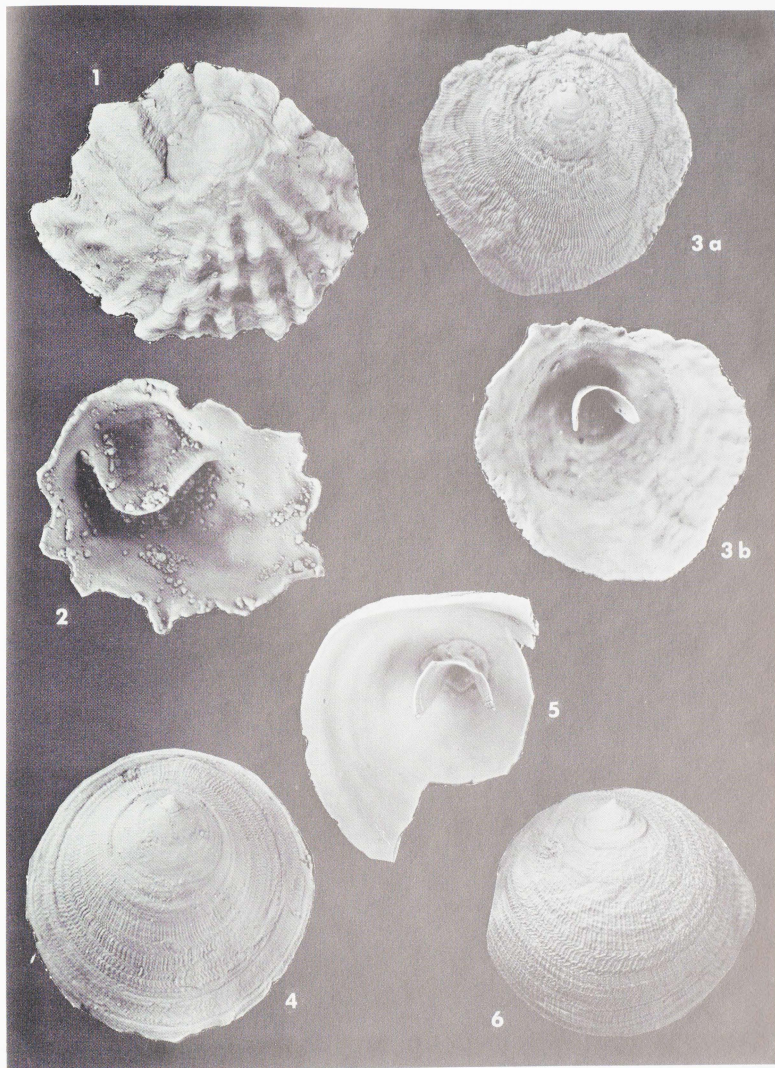


PLATE 2

Figured specimens: Fig. 1, USNM 647331 (holotype). Fig. 2, USNM 647332 (paratype); maximum diameter 7.0 mm, diameter at right angles to maximum, 6.5 mm, height 2.5 mm; locality TU 555. Other occurrences: TU locality nos. 459, 547.

Discussion: This new species is characterized by its small size, the holotype being the largest specimen seen, and by its very irregular ornamentation. *Crepipatella dilatata*, the type of the genus, has more numerous, finer radial costulae and its overall outline is more akin to *Crepidula*, being longer than wide. The nearest form is the Recent West Coast species *C. dorsata* (Broderip), which differs mainly in the shape of the septum. In *C. dorsata* the free edge is nearly stright but in *C. apprimus* it is deeply curved forward.

III. CHEILEA

The third genus-group of Calyptraeidae here reported for the first time in the Chipola Formation is *Cheilea* Modeer, 1793 (type species: *Patella equestris* Linné, s.d., Woodring, 1928, p. 374). Although primarily an Indo-Pacific genus, there are representatives in both the Caribbean and the eastern Pacific. The nomenclature of *Cheilea* has been complicated greatly by authors who seemingly did not recognize the variation within a species. Reeve (1858), who monographed the group (under the generic name *Calyptraea*), included 17 species from the Philippine Islands alone. Other authors have gone to the opposite extreme and placed almost all of the species in synonymy. The truth undoubtedly lies somewhere in between, but the author does not have the comparative material necessary for such a study. The name for the most common Caribbean form is usually cited as *C. equestris* (Linné), nominally an Indo-Pacific species. Whether this species has world-wide tropical distribution or whether the Caribbean form is different is not known. In any case, it seems certain that the eastern Pacific *C. cepacea* (Broderip, 1834) is the same as this Caribbean species; therefore should *C. equestris* prove unacceptable for the Caribbean form then *C. cepacea* is available. If geographic separation

is considered desirable then *C. stella* (Reeve, 1858), described from Belice (formerly British Honduras), could be recognized.

Cheilea equestris has previously been reported from the Pleistocene of Florida by Hoerle (1970, p. 62) and the Caloosahatchee Formation by Dall (1892, p. 348). Jung also reported it from the Pliocene Matura Formation of Trinidad (1969, p. 469), Woodring figured one of several specimens from the Bowden Formation of Jamaica (1928, p. 375, pl. 30, figs. 1, 2), and it occurs in the Pliocene Agueguexquite Formation of Mexico (TU 638). Perrilliat recently has figured a specimen from the middle Miocene of Santa Rosa, Veracruz, Mexico (1972, p. 59, pl. 26, figs. 1-4). The specimen here figured from the Chipola Formation is thus the oldest record of the species in the western Atlantic, for on the basis of one specimen there is no specific difference to be observed between the lower Miocene and the Recent forms. This is not unexpected, however, as *Cheilea boutillieri* (Cossmann, 1888) from the middle Eocene of the Paris Basin is so nearly the same it should probably also be considered the same species.

In addition to *Cheilea equestris*, there is a second species of this genus in the Chipola, which is the same as the modern Caribbean *C. uncinata* (Reeve, 1858). This species too has an Eocene ancestor, *C. bernayi* (Cossmann, 1885), from the upper Eocene of the Paris Basin. *C. uncinata* may be distinguished from *C. equestris* by its more regularly oval outline, its finer ornamentation, and its larger internal process. Clearly this is a very conservative group with the two lines of descent from the Eocene almost unchanged today. Although Keen (1971) lists no eastern Pacific equivalent of the *C. uncinata-bernayi* line, one specimen from Masachapa, western Nicaragua (TU R-180), in the Tulane Collections is apparently referable to *C. uncinata* (pl. 2, fig. 6).

Gardner had a single specimen of this shell from the Shoal River Formation at Shell Bluff, Shoal River, Florida. She named it as a new species, *Cheilea dryas* (1947, p. 570, pl. 57, figs. 20, 21), but there is no reason to separate it from the Recent *C. uncinata*.

CHEILEA EQUESTRIS (Linné)

Plate 2, fig. 3

Patella equestris LINNÉ, 1758, Syst. Nat., ed. 10, p. 780.

Figured specimen: USNM 647325; maximum diameter 12.8 mm, diameter at right angles to maximum, 12.7 mm, height 4.5 mm; locality TU 547.

CHEILEA UNCINATA (Reeve)

Plate 2, figs. 4–6

Calyptraea uncinata REEVE, 1858, Conchologia Iconica, v. 11, *Calyptraea*, pl. 5, fig. 17.

Cheilea dryas (Dall MS) GARDNER, 1947, U. S. Geol. Surv. Prof. Paper 142-H, p. 570, pl. 57, figs. 20, 21.

Figured specimens: Fig. 4, USNM 647326; maximum diameter 10.5 mm, diameter at right angles to maximum, 10.0 mm, height 4.3 mm; locality TU 459. Fig. 5, USNM 647327; maximum diameter 24.0 mm (incomplete), height 10.3 mm; locality TU 821. Fig. 6, USNM 739424; maximum diameter 18.4 mm, diameter at right angles to maximum, 16.7 mm, height 10.0; locality TU R-180. Other occurrences: TU locality nos. 546, 825, 1050.

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LOCALITY DATA

The following are Tulane University fossil locality numbers:

91. Oak Grove Sand, type locality, west bank of Yellow River, about 100 yards below bridge at Oak Grove (NE ¼ Sec. 20, T5N, R23W), Okaloosa Co., Florida.

459. Chipola Fm., east bank of Chipola River, steep bank about 1500 feet above the mouth of Taylor Lake Branch (NW ¼ Sec. 29, T1N, R9W), Calhoun Co., Florida.

546. Chipola Fm., Ten Mile Creek, about 1 3/4 miles west of Chipola River (NE ¼ Sec. 12, T1N, R10W), Calhoun Co., Florida (= USGS 2212, "one mile west of Bailey's Ferry").

547. Chipola Fm., west bank of Chipola River, about 2000 ft. above Four Mile Creek (SW ¼ Sec. 29, T1N, R9W), Calhoun Co., Florida.

548. Chipola Fm., west bank of Chipola River (NW ¼ Sec. 29, T1N, R9W), Calhoun Co., Florida.

555. Chipola Fm., east bank of Chipola River, about 1000 ft. above Four Mile Creek (SW ¼ Sec. 29, T1N, R9W), Calhoun Co., Florida.

562. "Silverdale beds," Onslow County marl pit, on south side of Webb Creek, near Silverdale, Onslow Co., North Carolina. (Note: in 1967 this locality was no longer collectable, pit is filled with water.)

770. Pinecrest beds and Caloosahatchee Fm. mixed, spoil banks west side of Kissimmee River, 1½ to 3½ miles north of Florida Highway 70 (Secs. 10, 14, 15, and 28, T37S, R33E), Highlands Co., Florida.

821. Chipola Fm., Farley Creek, 0.1 mile east of bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W), Calhoun Co., Florida.

825. Chipola Fm., Farley Creek, at abandoned mill about ¼ mile west of bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W), Calhoun Co., Florida.

830. Chipola Fm., Ten Mile Creek, at power line crossing about one mile west of Chipola River (SE ¼ Sec. 12, T1N, R10W), Calhoun Co., Florida.

866. "Silverdale beds." Marl pit on north side of Webb Creek and east side of unnumbered county highway, Silverdale, Onslow Co., North Carolina.

999. Chipola Fm., Farley Creek, about 900 feet west of bridge of Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W), Calhoun Co., Florida.

1048. Chipola Fm., Farley Creek, south bank, about 0.8 mile east of bridge on Florida Highway 275 (NE ¼ Sec. 21, T1N, R9W), Calhoun Co., Florida.

1050. Chipola Fm., west bank of Chipola River immediately below power line crossing, and directly across river from loc. 554 (SW ¼ Sec. 17, T1N, R9W), Calhoun Co., Florida.

1051. Chipola Fm., Ten Mile Creek, south bank, just downstream from large gully on property of Mr. A. Sexton (1967) (SE ¼ Sec. 12, T1N, R10W), Calhoun Co., Florida.

The following are Tulane University Recent locality numbers:

R-226. On rocks in front of Hotel Antofagasta, Antofagasta, Chile.

R-180. Beach collection, Masachapa, Nicaragua (Pacific Ocean).

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