

NOTES ON THE FAUNA OF THE CHIPOLA FORMATION - XIV
 ON THE OCCURRENCE OF *BURSA* (MOLLUSCA:GASTROPODA),
 WITH COMMENTS ON THE GENUS

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The gastropod genus *Bursa* Röding, 1798 (type species: *Murex bufonius* Gmelin) has a long history in the New World, with two forms being known from the Eocene Talara Formation and Oligocene Chira Formation of Peru (Olsson, 1930, pp. 62, 63). By Miocene time the group had spread into the Caribbean and from then on flourished, with numerous species known from both the fossil and Recent faunas. Hitherto there have been no fossil representatives of *Bursa* reported from the southern United States, but in this paper two species are recorded for the first time. A single specimen of a species originally described from the middle Miocene of Santo Domingo, *B. amphitrites* Maury, has been collected from the type area of the middle Miocene Shoal River Formation of northwestern Florida (see fig. 1). This form is widespread in the Caribbean Miocene; as was noted by Woodring (1959, p. 207) it is common in the Gatun Formation of Panamá (in the Tulane collections there are over 80 specimens from TU 757 and 958), and also occurs in the Punta Gavilán Formation of Venezuela, originally described as *B. albofasciata boussingaulti* Rutsch.

In the lower Miocene fauna of the Chipola Formation there have been found rare specimens of another species of *Bursa*, which thus becomes the oldest reported from the southern United States. Readers of previous papers in this series will not be greatly surprised to learn that it is identifiable as one named from the Aquitaine Basin of France by Cossmann and Peyrot (1923). This form was first figured by Grateloup in the Atlas to the *Conchyliologie Fossile du Bassin de l'Adour* as "*Ranella scrobiculata* Kiener," alias *Murex scrobilator* Linné, a Recent Mediterranean species, with which it does have some affinities. However, the

differences are such that it was given a new name, *Apollon pelouatensis*, by Cossmann and Peyrot.

This Chipola and Aquitaine species is clearly akin to the *B. caelata* (Broderip) group. In this assemblage we would include in addition to the Recent East Pacific *B. caelata*: *B. calcipicta* Dall, also from the Recent East Pacific; *B. mexicana* Perrilliat Montoya, from the Pliocene Agueguexquite Formation of Mexico*, which is exceedingly close to *B. calcipicta* (the holotype of the latter is figured in Keen, 1971, fig. 965); *B. amphitrites* Maury; *B. thomae* (d'Orbigny) from the Recent Caribbean; and *B. corrugata* (Perry), named without locality but which may be the correct name for the Caribbean "analog" of *B. caelata*. There are others such as *B. ponderosa* (Reeve), which may be a synonym of *B. caelata*, and *B. pustulosa* (Reeve), a heavily noded form from the mid-Atlantic Ascencion Island, that belong here also. In all of this "*caelata*" group the ornamentation is much alike, and closely resembles that of *B. pelouatensis*; however, all differ in a single striking way from the older Chipola-Aquitaine species in that the varices of the latter are not aligned up the spire, whereas in all of the "*caelata*" group they are aligned in two rows on either side of the spire.

The systematics of the Bursidae have been particularly complicated by the fact that there is a degree of similarity between certain of the Cymatiidae and certain of the Bursidae. The similarity is much more apparent than real, and consists primarily of the corrugated nature of the aperture, both on the inner and outer lips, and the presence of varices. Typical bursids have two varices

*This same species occurs in the Pleistocene Moín Formation, Puerto Limon, Costa Rica (TU 954).

arranged on either side of the shell, forming two neat rows up the spire. Typical cymatiids, on the other hand, have two varices per whorl, but they are off-set and consequently do not form a line up the spire. Unfortunately there are exceptions to both of these rules, for there are the members of the genus *Apollon* Montfort (type: *Murex gyrinus* Linné), a cymatiid in which the varices are arranged in perfect symmetry on opposite sides of the spire; and there are the members of the bursid subgenus *Tutufa* Jousseume in which the varices are off-set. The primary distinguishing character between the Bursidae and the Cymatiidae, therefore, is the anal gutter that *always* occurs in the Bursidae and never in the Cymatiidae.

The problem of the "frog shells" vs. the "tritons" was covered by Dall (1904) in a review of the two groups and in general his observations agree with those of the writer. However there are certain differences in nomenclature for the accepted groups, the one of primary concern here being his usage of the name *Bufonaria* in place of *Tutufa*. Dall considered the type of *Bufonaria* Schumacher to be *Murex scrobilator* Linné (as *scrobilator*, a change in spelling by Linné in the 12th Edition); however, the type had been previously designated as *Ranella spinosa* Lamarck, making *Bufonaria* a synonym of *Gyrinium* Link. *Murex scrobilator* was Schumacher's second species, under the name *Bufonaria pesleonis*, and was subsequently named type of *Bufonariella* Thiele, 1929. *Bufonariella scrobilator* is undoubtedly congeneric with the type of *Tutufa* Jousseume, 1881, and as Jousseume's name is almost 50 years older, there is no problem here.

The type of *Tutufa* was originally designated as *Tutufa lampas* (L.), but the identity of that species is clouded in the usual Linnaean fashion. In fact, two distinct families were involved in the confusion of "*Murex lampas* Linné" and "*Triton lampas* Lamarck," ostensibly the same form. Dodge (1957, pp. 103-105), in his review of the Linnaean species, identified true *Murex lampas* Linné as the cymatiid *Triton*

nodiferum Lamarck, and the "*Murex lampas*" of authors, i.e., *Triton lampas* Lamarck, as the bursid species for which the name *Murex rubeta* Linné would seem to be the best choice. This group was the subject of a study by E. A. Smith (1914) and, as first revisor, he restricted *rubeta* (i.e., "*lampas*") to the form well-figured in Chemnitz, v. 4, figs. 1236, 1237. Thus the type of *Tutufa* Jousseume is correctly denominated as *Tutufa lampas* Jousseume, = *Murex lampas* of authors not Linné, = *Murex rubeta* Linné.

The type of *Bursa* s.s., *B. bufonia* (Gmelin), is a peculiar species with extreme development of the anal gutters, almost to the point of being tubes, although never completely closed. The varices are diametrically opposed and aligned up the spire. In *Tutufa* the gutters are less well developed and the most noticeable difference is the non-aligned varices. Following Thiele (1929-1931), Wenz (1941, pp. 1072-1073) placed *Tutufa* and *Lampas* Schumacher (non *Lampas* Montfort, 1808, a foraminifera) in the synonymy of *Bursa* s.s. and recognized *Bufonariella* as the valid subgenus for the bursids with non-aligned varices.

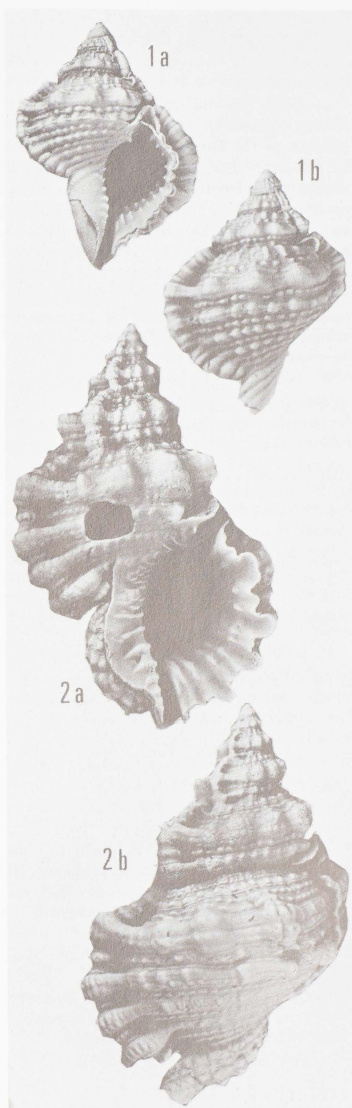
Woodring (1959, p. 207) has suggested that the subgeneric name *Colibrellina* Fischer, 1884 (type: *Ranella candidata* Lamarck = *Murex conditus* Gmelin), is best for the *B. caelata* group. However, the writer questions that assignment. The type of this subgenus is an extremely elongated shell, with fine granular ornamentation and does not seem especially closely related to the members of the "*caelata*" group.

The nature of the shell ornamentation in the *B. caelata* group is so similar to that of *Tutufa rubeta* (Linné), plus the fact that the last varix does often show a tendency to appear in front of the equivalent varix on the penultimate whorl, that one wonders if *Tutufa* is not a better assignment for the *B. caelata* lineage in spite of the somewhat aligned varices. If this suggestion is not acceptable, then the alternative is another subgenus that has been largely overlooked (it is not in Wenz, for example) and that is *Dulcerana* Iredale, 1931 (type: *Ranella granifera* Lamarck).

In the Recent fauna of the Caribbean there is a common species, *B. cubaniana* (d'Orbigny) (also known as *granularis* Röding, but that name should be restricted to the Indo-Pacific form), that is definitely referable to *Dulcerana*. It has the varices perfectly aligned up the spire, and the ornamentation is chiefly spiral rows of small granules. This species shows considerable variation in the nature of these spiral granules. In the Tulane collections there are some 100 specimens from the Panamá region (TU R-93, R-94, R-109, R-197) and among these there are examples that perfectly match d'Orbigny's original illustration, being covered with tiny bead-like spiral ribs; other examples are so coarsely ornamented that they approximate the sculpture of the *caelata* group but the over-all shell shape is still that of *B. cubaniana*.

Certainly there is no question of the placement of *B. pelouatensis*, the varices are completely non-aligned and the form is very close to the Recent *Tutufa rubeta*. In fact, if there were any purpose to be served by it one could insist that the Miocene form was well within the range of variation of the modern species. This is one of the biggest problems in all bursid taxonomy. There is a marked similarity in the spiral ornamentation among many of the species, which indicates that they all are descendants of a common ancestor. The ornamentation of the Peruvian Eocene and Oligocene forms differs but little from the Miocene *B. amphitrites* or the Recent *B. thomae*. The non-aligned varices of *B. pelouatensis* and *B. (Tutufa) lampas* seem to be clearly a random occurrence that appears from time to time in the group and probably has little if any taxonomic significance above the species level.

Text figure 1. *Bursa amphitrites* Maury, USNM 647109; height 22.2 mm, diameter 16.6 mm; locality TU 69A, Shoal River Formation, Florida; middle Miocene (X 2).
Text figure 2. *Bursa pelouatensis* (Cossmann and Peyrot), USNM 647108; height 48.3 mm, diameter 30.8 mm; locality TU 547, Chipola Formation, Florida; lower Miocene (X 1½).



It seems probable that the tubes of *Bursa s.s.* are also a random happening, which has occurred more than once. The ornamentation of *B. bufonia* is not closely allied to that of the "caelata" group, suggesting a far distant separation of that line. However, another of the Dominican species described by Maury (1917, p. 272, pl. 43, fig. 8) should be referred to *Bursa s.s.* as it has pronounced anal tubes. As its name *B. bufoniopsis* implies, it is much like *B. bufonia* but it has the "caelata" type of ornamentation and would seem to represent an independent development of the tubular structure. This conjecture is further advanced by a specimen from the upper Miocene of Trinidad, cited by Jung (1969, p. 486) as *B. aff. thomae* (d'Orbigny). This specimen has the ornamentation of the Recent *B. thomae*, but still has the anal tubes of *B. bufoniopsis* and presumably represents an intermediate stage. Morrison (1949, p. 11) placed *B. thomae* in *Bursa s.s.*, but the writer is of the opinion that as the species in question has no anal tubes it is better placed in the "caelata" group. There are no Recent species in either the western Atlantic or eastern Pacific that should be assigned to *Bursa s.s.*

In addition to the members of the true genus *Bursa*, in the Caribbean there are also representatives of the genus *Marsupina* Dall. The oldest known species was described from the Oligocene or early Miocene of Peru by Olsson (1932) and a third Dominican burssid was cited by Maury (1917, p. 272, pl. 43, figs. 6, 7) as "*B. crassa* Dillwyn" (= *spadecia* Montfort = "*Murex*" *bufo* Bruguière, 1792), which is the Recent type of the genus. Maury's species is probably *M. proavus* (Pilsbry, 1922), but it is clearly of the *Marsupina bufo* lineage. This group is also widespread in the Miocene to Recent faunas, having been reported from the Miocene of Santo Domingo (Gabb, Maury, Pilsbry), Costa Rica (Olsson), Trinidad (Maury, Jung), and the (?) Pliocene of Jamaica (Guppy, Pilsbry, Woodring).

BURSA (TUTUFA) PELOUATENSIS
(Cossmann and Peyrot)

Text Figure 1

- Ranella scrobiculata* "Kiener." GRATELOUP, 1847, Atlas, Conch. Foss. Bassin Adour, Ranelles, pl. 1 [pl. 29], fig. 10. [Not *Murex scrobiculator* Linné, 1767, = *M. scrobilator* Linné, 1758.]
- NOT *Apollon subgranifer* d'Orbigny. COSSMANN, 1903, Essais Paléoconch. Comp., v. 5, p. 116, pl. 4, fig. 10. [Included by Cossmann and Peyrot, 1923, in the synonymy of *A. pelouatensis*; however, the specimen figured in 1903 is *A. inaequicrenatus* Cossmann and Peyrot, described at the same time also from Peloua.]
- Apollon pelouatensis* COSSMANN and PEYROT, 1923, Conch. Néogén. Aquitaine, in Soc. Linn. Bordeaux, Actes, v. 75, p. 309, pl. 15, figs. 38, 39; pl. 17, figs. 1, 2.

Figured specimen: USNM 647108; height 48.3 mm, diameter 30.8 mm; locality TU 547. Other occurrences in the Chipola Formation: TU locality nos. 546, 787, 830, 951, 1098 (all fragments except figured specimen and another small example also from TU 547).

BURSA (? TUTUFA) AMPHITRITES

Maury

Text figure 2

- Bursa amphitrites* MAURY, 1917, Bulls. Amer. Paleontology, v. 5, no. 29, p. 273 (109), pl. 43 (17), fig. 9. [Gurabo Formation, Dominican Republic; middle Miocene.]
- Bursa amphitrites* Maury. PILSBRY, 1922, Acad. Nat. Sci. Phila., Proc., v. 73, p. 360.
- Bursa (Marsupina) albofasciata boussingaulti* RUTSCH, 1934, Schweizer Palaeont. Gesell., Abh., v. 54, p. 58, pl. 3, figs. 3, 4. [Punta Gavilán Formation, Venezuela; Mio-Pliocene.]
- Bursa (Colubrellina) caelata amphitrites* Maury. WOODRING, 1959, U.S. Geol. Surv. Prof. Paper 306-B, p. 207, pl. 28, figs. 1, 2, 7, 8. [Gatun Formation, Panama; middle Miocene.]
- [?] *Bursa (Colubrellina) caelata amphitrites* Maury. JUNG, 1965, Bulls. Amer. Paleontology, v. 49, no. 223, p. 513, pl. 68, figs. 12, 13; pl. 69, fig. 2. [Cantaure Formation, Venezuela; middle Miocene.]

Bursa (Marsupina) albofasciata boussaaultingi Rutsch. JUNG, 1965, *Bulls. Amer. Paleontology*, v. 49, no. 223, pl. 69, fig. 1. [Paratype from Punta Gavilan.]

Figured specimen: USNM 647108; height 22.2 mm, diameter 16.6 mm; locality TU 69A, Shoal River Formation, middle Miocene.

LOCALITY DATA

The following are Tulane University fossil locality numbers:

- 69A. Shoal River Fm., first ravine upstream from Shell Bluff, Shoal River (NW ¼ Sec. 4, T3N, R21W), about ¾ miles north of Mossyhead, Walton Co., Florida.
546. Chipola Fm., Ten Mile Creek, about 1 ¾ miles west of Chipola River (NE ¼ Sec. 12, T1N, R10W), Calhoun Co., Florida.
547. Chipola Fm., west bank of Chipola River, about 2000 ft. above Four Mile Creek (SW ¼ Sec. 29, T1N, R9W), Calhoun Co., Florida.
757. Gatun Fm., roadcut on south side Boyd-Roosevelt Highway at junction of road to Refineria Panama, S.A., just east of Cativa, Prov. of Colon, Panama.
787. Ten Mile Creek about 1½ miles west of Chipola River (SE ¼ Sec. 12, T1N, R10W), 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.
951. Chipola Fm., Ten Mile Creek, about 1¼ miles west of Chipola River (SE ¼ Sec. 12, T1N, R10W), Calhoun Co., Florida.
954. Moín Fm., hill cut immediately behind Standard Fruit Co. box factory, just west of cemetery at Pueblo Nuevo, about 2 km west of Puerto Limon, Costa Rica.
958. Gatun Fm., hillslope on east side of road from Boyd-Roosevelt Highway to Refineria Panama, S.A., about ¼ km north of junction, just east of Cativa, Prov. of Colon, Panama.
1098. Chipola Fm., Ten Mile Creek, about 100 yards downstream from TU 830 (SE ¼ Sec. 12, T1N, R10W), Calhoun Co., Florida.

The following are Tulane University Recent locality numbers. All are located on the Caribbean side of Panamá.

- R-93. Holandes Cay, east of Cape San Blas, Panamá.
- R-94. Duarte Cays, north island, north of Porto

Bello, Panamá.

- R-190. Fill for Refineria Panama, S.A., Bahia las Minas, Isla Payardi, Panamá (Radiocarbon dated at 7000 YBP).
- R-197. Devil's Beach, west of Porto Bello, Panamá.

LITERATURE CITED

- COSSMANN, A. E. M., and A. PEYROT, 1923, *Conchologie néogénique de l'Aquitaine: Soc. Linn. Bordeaux, Actes*, v. 75, p. 191-318, pls. 12-18.
- DALL, W. H., 1904, An historical and systematic review of the Frog-Shells and Tritons: *Smithsonian Misc. Coll.*, v. 47, no. 1467, p. 114-144.
- DODGE, HENRY, 1957, A historical review of the mollusks of Linnaeus—Part 5. The genus *Murex* of the Class Gastropoda: *Amer. Mus. Nat. Hist., Bull.*, v. 113, Art. 2, p. 73-224.
- JUNG, PETER, 1969, Miocene and Pliocene mollusks from Trinidad: *Bulls. Amer. Paleontology*, v. 55, no. 247, p. 289-657, pls. 13-60, text figs. 1-4.
- KEEN, A. M., 1971, Sea shells of tropical West America; Second Edition. Stanford Univ. Press, Stanford, California. 1074 p., 22 colored plates, numerous text figs.
- MAURY, C. J., 1917, Santo Domingo type sections and fossils, pt. 1—Mollusca: *Bulls. Amer. Paleontology*, v. 5, no. 29, p. 165-415, pls. 27-65, map.
- MORRISON, J. P. E., 1949, Notes on the Florida species of *Bursa*: *Amer. Malac. Union, News Bull. and Ann. Rept.*, 1949, p. 10-13.
- OLSSON, A. A., 1930, Contributions to the Tertiary Paleontology of northern Peru—Part 3, Eocene Mollusca: *Bulls. Amer. Paleontology*, v. 17, no. 62, p. 1-96, pls. 1-12.
- OLSSON, A. A., 1932, *ibid.*, Part 5, The Peruvian Miocene: *Bulls. Amer. Paleontology*, v. 19, no. 68, p. 1-272, pls. 1-24.
- SMITH, E. A., 1914, Note on *Bursa (Tutufa) rubeta* (Bolten) = *Triton lampas* (Lamarck et auct.): *Jour. of Conchol.*, v. 14, p. 226-231.
- THIELE, JOHANNES, 1929-1931, *Handbuch der systematischen Weichtierkunde*. Jena, v. 1, p. vi + 1-778, 783 text figs. [Issued in parts—p. 1-376 in 1929, *vide* Wenz, 1944—Bibliography.]
- WENZ, WILHELM, 1941, *Handbuch der Paläozoologie*, v. 6, Part 1—Gastropoda, *lief.* 5, p. 959-1200, figs. 2788-3416.
- WOODRING, W. P., 1959, Geology and Paleontology of Canal Zone and adjoining parts of Panama; Description of Tertiary mollusks (Gastropoda: Vermetidae to Thaididae: U.S. Geol. Surv. Prof. Paper 306-B, p. 147-239, pls. 24-38.