TULANE STUDIES IN GEOLOGY AND PALEONTOLOGY

Volume 12, Number 3 September 15, 1976

CENOZOIC MURICIDAE OF THE WESTERN ATLANTIC REGION PART VII – *CALOTROPHON* AND *ATTILIOSA*

EMILY H. VOKES
TULANE UNIVERSITY

CONTENTS

ILLUSTRATIONS

I. ABSTRACT

The two small genus-groups of *Calotrophon* Hertlein and Strong and *Attiliosa* Emerson are shown to be recently derived lines, presumed to come from a *Poirieria (Panamurex)* ancestor sometime during the Miocene. As emerging groups both demonstrate an amount of specific variability unusual in the Muricinae. There are only six species in *Calotrophon:* one from the eastern Pacific (the type) and five western Atlantic, of which two are described herein. These are *C. ascensus,* n. sp., from the Pleistocene of Costa Rica, and *C. andrewsi,* n. sp., from the Recent fauna of Yucatán and south Florida. There are but five species of *Attiliosa,* three western Atlantic and two eastern Pacific. All of the western Atlantic species are treated systematically.

II. INTRODUCTION

The two genus-groups treated in this paper are considered together because they are believed to be descendants of a common ancestor (see text fig. 1). In an earlier work (Vokes, 1971, p. 7) the writer suggested that *Attiliosa* was a subgenus of *Calotrophon* but more detailed investigation has indicated that they are parallel lineages and not especially closely related. Both have a fairly heavy intritacalx, or chalky outer layer, although not as heavy as that seen in

EDITORIAL COMMITTEE FOR THIS PAPER:
ROBERT C. BULLOCK, University of Rhode Island, Kingston, Rhode Island
WILLIAM K. EMERSON, American Museum of Natural History, New York, New York
GEORGE E. RADWIN, Natural History Museum, San Diego, California

members of the genera *Aspella* and *Dermomurex*, treated previously (Vokes, 1975). Both are but vaguely muricine in appearance with the varices and spines, so characteristic of the group as a whole, reduced as to be frequently completely lacking. This is, in fact, the "tag-end" of the subfamily and one might say that the species included are most unlikely murices. In neither group is there a great number of species, and in *Attiliosa* we have yet to find any great number of individuals. One final trait they share is the fact that morphologically the species of both groups are inordinately variable, unlike most murices, which are normally very stable. This may be a reflection of the fact that they are youthful, emerging genera and are still in a plastic stage.

Both groups are found in the western Atlantic and the eastern Pacific only, the types of both genera being Recent Pacific species. Both groups have only recently been recognized as valid generic units and the species of both have multiple names* and a chequered history of generic assignment.

The geologic history of each is very brief. *Attiliosa* first occurs in the (?) upper Miocene of Santo Domingo; *Calotrophon* is first seen in the lower Pliocene of south Florida. At their initial appearance both are represented by a Recent species and the changes since that time have been limited. It would seem that we are witnessing the appearance of two new lineages in the subfamily.

If one goes back into the Oligocene and lower Miocene of the southeastern United States, we see that there is a well defined line of murices, starting with *Poirieria (Panamurex) macneili* Vokes, in the Vicksburg fauna. This species gave rise to a similar form, *P. heilprini* (Cossmann), in the lowermost Miocene (Tampa Limestone, Aquitanian). In turn, we see in the Burdigalian Chipola Formation four species that all seem to be immediately derived from this ancestral line. The relationship of the various species was discussed by the writer in a previous paper (Vokes, 1970) and all were figured there. Of the four Chipola species the least typical is *P. mauryae* Vokes, the smallest of the group.

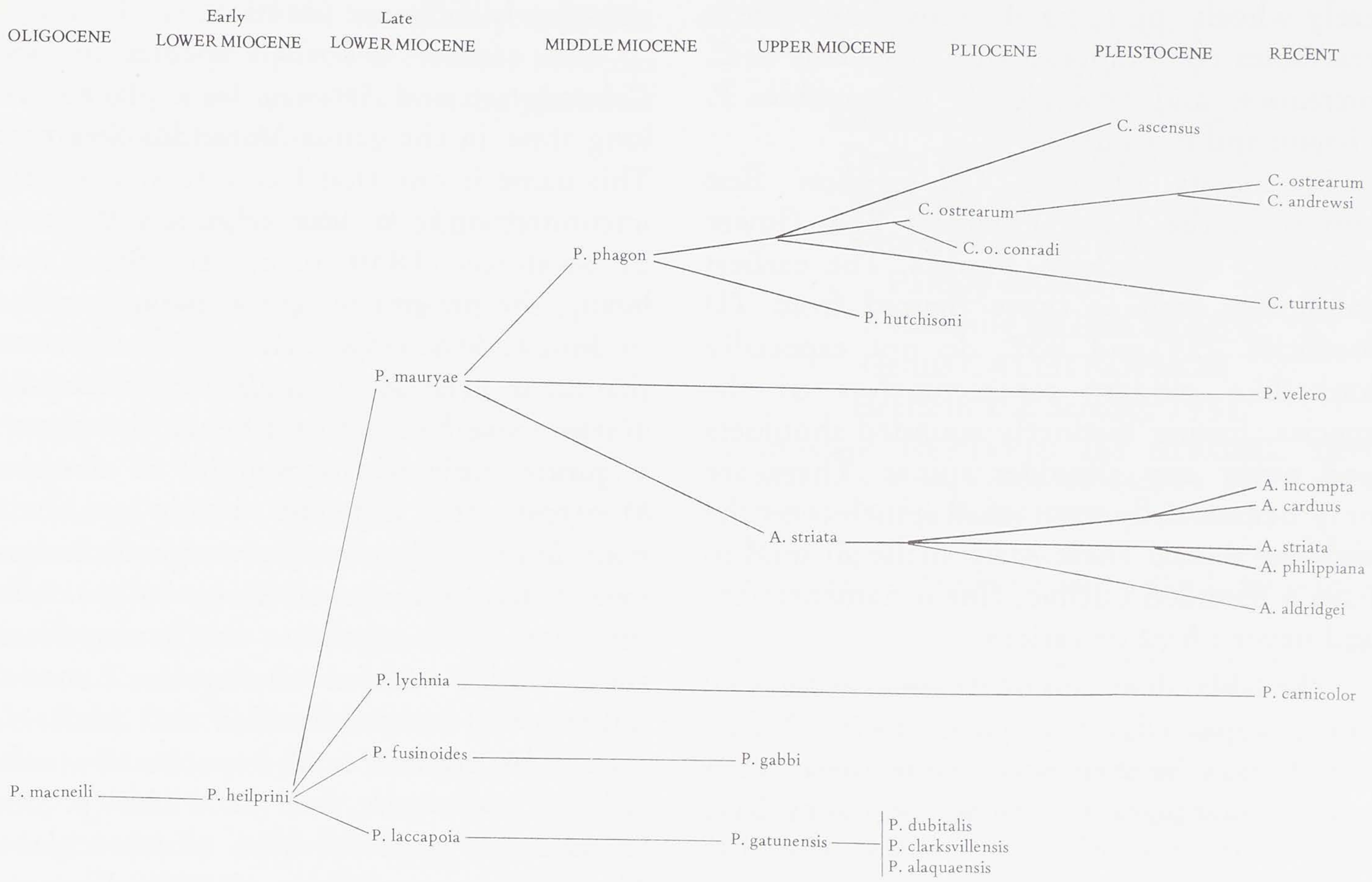
Dr. George Radwin (personal communication) has suggested that perhaps *P. mauryae* should not be included in *Panamurex*, but rather in *Calotrophon*. It is true that the type species, *P. gatunensis* (Brown and Pilsbry), is at one extreme of the group, *P. mauryae* at the other. The completely typical *Panamurex* is characterized by having a strong labral tooth, but no spines encircling the siphonal canal. In addition to the type, there are several other fossil species with these characteristics, but the line is now extinct. The remainder of the species placed in *Panamurex* by the writer (Vokes, 1970) differ from the typical form in having small spines encircling the siphonal canal but lacking the labral tooth. It is this group for which Rehder (1946, p. 142) originally proposed the name *Dallimurex*. In seeking a modern representative for the type species, he chose *Poiriera (Paziella) nuttingi* (Dall), which lacks the strong spiral ornamentation and the labial denticles of the *Panamurex* group, and so the subgenus remained nameless until Woodring (1959) proposed *Panamurex*.

The absence or presence of the spines circling the canal does not seem to be of more than specific value in the genus *Poiriera* as a whole. In *Poirieria* s.s. (type species, *Murex zelandicus* Quoy and Gaimard) they are missing; in the subgenus *Paziella* (type species, *Murex pazi* Crosse) they occur in some species and are lacking in others, but there seems little reason to erect yet a third subgenus for those that do not, although such a name is available if deemed necessary – *Bathymurex* Clench and Pérez Farfante, 1945 (type species, *Murex atlantis* Clench and Pérez Farfante).

All of the species referred to the subgenus *Panamurex* are characterized by a general lack of spiral and axial ornamentation except for the major cords and the varices. The surface of the shell between the major spirals is notably smooth. There are no scabrous axial growth lines and secondary spiral cords are greatly reduced. These

---

*As further evidenced in the note by R. C. Bullock, which follows in this volume.



Text figure 1. Inferred relationship between *Poirieria (Panamurex), Calotrophon,* and *Attiliosa.*

species are all marked by having usually four strong denticles at the anterior end of the columella wall. This combination of strong primary spiral cords, with smooth interspaces, and labial denticles also appears in the *Attiliosa* line. In fact, the Dominican holotype of *A. striata* (Gabb) is so much like *P. mauryae* (compare pl. 1, fig. 1, and text figure 2), if it were not for the subsequent specimens one would probably include *A. striata* in *Panamurex*. It is less ornamented even than *P. mauryae* and the denticles are greatly reduced, usually appearing only in fully mature individuals.

Panamurex mauryae also seems to be the link to another lineage that diverged in the form of *P. phagon* (Gardner) (pl. 1, fig. 5), a species that occurs in the Oak Grove and Shoal River formations of Florida. This species is elaborately sculptured with both axials and secondary spirals. It lived in a shallow sandy environment, and how much the differences seen are due to ecology and how much to genetics is not known. It would appear, however, that *P. phagon* is a logical candidate for the immediate ancestor of the *Calotrophon* line.

The decision to place *P. phagon* with the ancestral *Panamurex* group rather than the derivative *Calotrophon* group is based upon several considerations, as the species has certain features of both. It has the sculpture and lack of spines of *Calotrophon,* but it also has varices and the labial denticles of *Panamurex.* When one compares the early whorls of *P. phagon* (pl. 1, fig. 5a) and *C. ostrearum* (Conrad) (pl. 1, figs. 6, 9c) the differences are striking. The resemblance of the adults may well be parallelism rather than close relationship. The oldest examples of *C. ostrearum* (pls. 1, 2) from the lower Pinecrest Beds actually bear very little resemblance to *P. phagon,* it is the modern forms that suggest *P. phagon* perhaps should be placed in *Calotrophon.*

The *P. phagon* line did not change into *Calotrophon*, this much is certain. In the Melajo Clay of Trinidad (either late Miocene or early Pliocene) there is another small species much like *P. phagon,* which has been named *"Calotrophon* (?)" *hutchisoni* by Jung (1969, p. 494). *"C." hutchisoni* (see pl. 1, figs. 3, 4) was referred by the present writer to *Panamurex* because of the similarities to *P. phagon.* Again, examination of the early whorls (pl. 1, fig. 4) shows how little it resembles contemporaneous specimens of *C. ostrearum* and how closely it resembles *P. phagon* and *P. mauryae.*

Specimens of true *Calotrophon* first appear in the lower Pinecrest Beds (lower Pliocene) of southern Florida. The earliest examples, such as those figured from TU localities 729 and 932, do not especially look like modern representatives of the species, having distinctly rounded shoulders and never any shoulder spines. There are only occasionally even small spinelets on the siphonal canal. These early shells all tend to have a rounded outline, fine ornamentation, and never a hint of varices.

The labial denticles of *Panamurex* have all but disappeared; a few specimens (pl. 2, figs. 3 & 4) may be seen with two or three much reduced denticles but most specimens have only a single tooth at the entrance to the siphonal canal. After these oldest occurrences no specimens, of all the hundreds examined, ever have more than the single tooth on the inner lip.

The morphological function, if any, of these labial denticles cannot be ascertained. It is not a reflection of underlying spines as it might seem to be at first glance. The members of *Panamurex,* such as *P. laccapoia* and *P. gatunensis,* that have no spines on the siphonal canal still have very strong labial denticles. They do not seem to be related to the spiral cords either, because it is possible to break away the columellar callus and see that the columellar wall has been polished smooth and then the callus is laid down on top of it. The denticles have no particular orientation in regard to the previously existing spiral cords. This same type of denticle occurs among various families of Gastropoda and is usually of at least subgeneric importance. In the Muricinae such denticles are found in *Panamurex* and *Attiliosa,* although they are reduced in the latter. In the Muricopsinae they occur in the type genus, *Muricopsis,* and in *Risomurex.* But they are also present in the Cymatiidae, Bursidae, and numerous other totally unrelated families. They may represent an approximation on the part of the animal to the columellar folds of the Volutacea, or they may serve a completely different function.

The earliest described species of both *Calotrophon* and *Attiliosa* were placed for a long time in the genus *Muricidea* Swainson. This name is one that has a history of being misunderstood. It was originally proposed by Swainson (1840, p. 65) for those shells having the progressive growth stages marked by longitudinal ridges. He specifically stated that "the type of *Muricidea* is the harp-like *Murex magellanicus*" and hence the name is a junior objective synonym of *Trophon* Montfort, the type of which is also *M. magellanicus* Gmelin (by original designation, = *Buccinum geversianum* Pallas). In his list of species assigned to this genus, Swainson included *"Murex" hexagonus* Lamarck. Subsequent authors decided that *Muricidea* should be applied to the species now referred to *Muricopsis,* and in 1880 (p. 335) Jousseaume cited the type of *Muricidea* as *Murex hexagonus.* In 1882 Bucquoy, Dautzenberg, and Dollfus (p. 19) proposed *Muricopsis* for that group, with *Murex blainvillei* Payraudeau as type; however, the usage of the name *Muricidea* persisted in the literature for some years thereafter as a sort of "waste-basket" for muricine species that could not be placed into any other genus-group.

There have been excellent recent papers on both genera being considered here: *Attiliosa* by Emerson (1968) and *Calotrophon* by McLean and Emerson (1970). Therefore, there is no necessity to repeat what has been said there. The observation may be made, however, that the radulae of the two genera *(Attiliosa:* Emerson, 1968, figs. 2, 3; *Calotrophon:* McLean and Emerson, 1970, figs. 8, 9) are noticeably different. This is a strong corroboration of the geological history, which suggests that the two groups are not as closely related as formerly thought by the writer (Vokes, 1971, p. 7). *Attiliosa* has what might be called a "normal" muricine radula, no different from the *Pterynotus-Poirieria* group from whence it is assumed to be derived. *Calotrophon* is marked by having extremely long cusps on the rachidian tooth but the overall pattern is still muricine rather than trophonine. Both groups also have a normal muricine operculum with an apical nucleus. In spite of the marginally muricine appearance of the shell, therefore, it seems obvious that both genera are to be placed in the subfamily Muricinae.

III. ACKNOWLEDGMENTS

For a small group of species, this paper involved an unusual amount of borrowing of specimens. *Attiliosa*, especially, is poorly represented in collections, and almost every specimen in this part of the study was provided by outside sources. The writer is particularly grateful to a group of Florida collectors who provided most of the figured specimens. These include: Mr. and Mrs. Robert C. Hoerle and Mrs. Virginia Lee, West Palm Beach; Mrs. Margaret C. Kennedy, Delray Beach; and Mrs. Barbara A. Steger, Tampa. Mrs. Ruth Fair, Honolulu, Hawaii, also generously contributed a paratype to the collection. In addition, a number of institutions provided comparative material and thanks are expressed to: Earl A. Shapiro, Academy of Natural Sciences, Philadelphia; Barry Roth, California Academy of Sciences; Kenneth J. Boss, Museum of Comparative Zoology, Harvard University; Joseph Rosewater and Thomas R. Waller, U.S. National Museum. Special gratitude is reserved for William K. Emerson, American Museum of Natural History; George E. Radwin and Anthony D'Attilio, San Diego Natural History Museum; Robert C. Bullock, University of Rhode Island; and William G. Lyons, Florida Dept. of Natural Resources, Marine Research Laboratory, St. Petersburg, Florida; all of whom provided not only specimens but a great deal of valuable information.

Many of the specimens utilized in this study were collected with the financial support of National Science Foundation Grant Number G.B. 6048; this assistance is gratefully acknowledged. In addition, specimens loaned by the Florida Department of Natural Resources were collected during the University of Miami *Gerda* cruise G-7124, under a grant to Dr. D. R. Moore.

IV. SYSTEMATIC DESCRIPTIONS

Phylum MOLLUSCA
Class GASTROPODA
Subclass PROSOBRANCHIA
Order NEOGASTROPODA
Suborder STENOGLOSSA
Superfamily MURICACEA
Family MURICIDAE
Subfamily MURICINAE
Genus CALOTROPHON
Hertlein and Strong, 1951

Calotrophon HERTLEIN and STRONG, 1951, Mollusks West Coast of Mexico and Central Amer., pt. 10, *in* Zoologica, v. 36, p. 87.

Type species: *Calotrophon bristolae* Hertlein and Strong [= *Tritonalia turrita* Dall], by original designation.

Pseudosalpinx OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 8, p. 254.

Type species: *Urosalpinx floridana* Conrad [= *Murex ostrearum* Conrad], by original designation.

Hertleinella BERRY, 1958, Leaflets in Malac., v. 1, no. 16, p. 95.

Type species: *Hertleinella leucostephes* Berry [= *Tritonalia turrita* Dall], by original designation.

CALOTROPHON OSTREARUM (Conrad)

Plate 1, figs. 6-9; Plate 2, figs. 1-6;
Plate 3, figs. 1-9; Plate 4, figs. 1-11;
Plate 5, figs. 1-11

Murex ostrearum CONRAD, 1846, Acad. Nat. Sci. Phila., Proc., v. 3, p. 25 [Feb., 1846, *fide* Sherborn]; 1846, Amer. Jour. Sci., (N.S.) v. 2, p. 397.

Urosalpinx floridana CONRAD, 1869, Amer. Jour. Conch., v. 5, p. 106, pl. 12, fig. 4.

Murex ostrearum Conrad. TRYON, 1880, Man. Conch., v. 2, p. 135.

Urosalpinx floridana Conrad. TRYON, 1880, Man. Conch., v. 2, p. 153, pl. 39, fig. 486 (after Conrad, 1869).

Muricidea floridana (Conrad). DALL, 1884, U.S. Natl. Mus., Proc., v. 6, p. 326; 1889, Harvard Mus. Comp. Zool., Bull., v. 18, p. 212 (with *Murex ostrearum* in queried synonymy); 1889, U.S. Natl. Mus., Bull. 37, p. 120; 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 189; 1892, *ibid*, v. 3, pt. 2, p. 212.

Muricidea floridana var. *attenuata* DALL, 1890, Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 149.

Urosalpinx floridana Conrad. BAKER, 1891, Acad. Nat. Sci. Phila., Proc. for 1891 [v. 43], p. 51.

Muricidea ostrearum (Conrad). DALL, 1902, U.S. Natl. Mus., Proc., v. 24, p. 505, pl. 30, fig. 2 (with *U. floridana* in synonymy).

Muricidea ostrearum (Conrad). MAURY, 1922, Bulls. Amer. Paleontology, v. 9, no. 38, p. 98.

Muricidea floridana (Conrad). WEISBORD, 1926, Nautilus, v. 39, p. 86.

Muricidea floridana (Conrad). MANSFIELD, 1930, Fla. Geol. Surv., Bull. 3, p. 86.

Muricidea ostrearum (Conrad). JOHNSON, 1934, Boston Soc. Nat. Hist., Proc., v. 40, p. 116.

Muricidea ostrearum (Conrad). JAUME, 1946, Soc. Malac. Habana, Revista, v. 4, p. 106.

Muricopsis floridana (Conrad). GARDNER, 1948, U.S. Geol. Surv. Prof. Paper 199B, p. 225.

Muricidea ostrearum (Conrad). M. SMITH, 1953, Illus. Cat. Recent Species Rock Shells, p. 11, pl. 14, fig. 1.

Cantharus (Pseudosalpinx) floridana (Conrad). OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 8, p. 254, pl. 37, figs. 2, 2a (syntypes of *U. floridana*).

Cantharus (Pseudosalpinx) perplexus OLSSON and HARBISON, 1953, Acad. Nat. Sci. Phila., Mon. 8, p. 255, pl. 37, figs. 1, 1a.

Muricopsis ostrearum (Conrad). ABBOTT, 1954, Amer. Seashells, p. 211, fig. 47G (after Dall, 1902).

Muricopsis ostrearum (Conrad). PERRY and SCHWENGEL, 1955, Marine Shells Western Coast Florida, p. 155, pl. 31, fig. 218.

Muricopsis ostrearum (Conrad). RADWIN and WELLS, 1968, Bull. Mar. Sci., v. 18, p. 77, figs. 6 (radula), 20-G (shell).

Urosalpinx floridana (Conrad). JUNG, 1969, Bulls. Amer. Paleontology, v. 55, no. 247, p. 294.

Pseudosalpinx ostrearum (Conrad). S. E. HOERLE, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 2, p. 63.

Calotrophon ostrearum (Conrad). MCLEAN and EMERSON, 1970, Veliger, v. 13, p. 60, plate figs. 11-14 [fig. 11, lectotype-*Urosalpinx floridana;* fig. 12, holotype-*Cantharus perplexus*]; text figs. 15, 16 [fig. 15, radula; fig. 16, operculum].

[Calotrophon] ostrearum (Conrad). E. H. VOKES, 1971, Bulls. Amer. Paleontology, v. 61, no. 268, p. 77 (with *U. floridana* in synonymy).

Muricopsis ostrearum (Conrad). MORRIS, 1973, Field Guide to Shells . . . Third Edition (W. J. Clench, Ed.), p. 193, pl. 52, fig. 20.

Calotrophon ostrearum (Conrad). ABBOTT, 1974, Amer. Seashells, 2nd Ed., p. 188, fig. 1965 (after Dall, 1902).

Diagnosis: "Fusiform, with revolving ribs alternated in size; and with longitudinal wrinkles; spire elevated, scalariform; base umbilicated; within livid." (Conrad, 1846-*Murex ostrearum*).

"Fusiform, longitudinal ribs distant, prominent, thick, rounded; spire prominent, scalariform; whorls 6, penultimate whorl with 3 prominent revolving lines; last volution profoundly ribbed and having 10 conspicuous prominent revolving lines; caudal ridge prominent, curved; beak recurved, longitudinal prominent wrinkled lines are conspicuous over the whole surface; aperture and columella purple; labrum with 7 lines within." (Conrad, 1869-*Urosalpinx floridana*).

Dimensions of lectotype: height 29.2 mm (Olsson and Harbison, 1953, pl. 37, expl.).

Lectotype *(U. floridana):* ANSP 36551 (designated, McLean and Emerson, 1970, p. 60).

Type locality: Tampa Bay, Florida (original designation for both *ostrearum* and *floridana).*

Occurrence: Duplin Formation, (?) middle Pliocene; North Carolina. Waccamaw Formation, upper Pliocene; North and South Carolina. Pinecrest Beds, lower and middle Pliocene; Caloosahatchee Formation, upper Pliocene; Bermont Formation, lower Pleistocene; Anastasia and Ft. Thompson formations, upper Pleistocene; Florida. Recent, Florida and Yucatán, only.

Figured specimens: Plate 1, fig. 6, USNM 711115; height 10.6 mm, diameter 5.2 mm; locality, St. Joseph's Sound, Florida, Recent. Plate 1, fig. 7, USNM 240642; height 27.8 mm, diameter 15.2 mm; fig. 8, USNM 240643; height 26.8 mm, diameter 13.0 mm; locality TU 729. Plate 1, fig. 9, USNM 240644; height 27.9 mm, diameter 14.4 mm; Plate 2, fig. 1, USNM 240645; height 32.7 mm, diameter 17.4 mm; locality TU 932. Plate 2, fig. 2, USNM 240646; height 29.6 mm, diameter 14.7 mm; fig. 3, USNM 240647; height 27.2 mm, diameter 13.7 mm; fig. 4, USNM 240648; height 22.3 mm, diameter 10.2 mm; fig. 5, USNM 240649; height 27.2 mm, diameter 13.7 mm; fig. 6, USNM 240650; height 24.1 mm, diameter 11.9 mm, locality TU 730. Plate 3, fig. 1, USNM 240654; height 26.2 mm, diameter 12.5 mm; fig. 2, USNM 240655; height 24.4 mm, diameter 12.8 mm; fig. 3, USNM 240656; height 20.2 mm, diameter 11.7 mm; locality TU 1000. Plate 3, fig. 4, USNM 240657; height 24.7 mm, diameter 14.0 mm; fig. 5, USNM 240658; height 24.9 mm, diameter 13.2 mm; fig. 6, USNM 240659; height 27.4 mm, diameter 13.2 mm; fig. 7, USNM 240660; height 24.6 mm, diameter 12.0 mm; locality TU 519. Plate 3, fig. 8, USNM 240661; height 31.5 mm, diameter 15.0 mm; locality TU 539B. Plate 3, fig. 9, USNM 647695; height 20.0 mm, diameter 10.7 mm; locality USGS 24123, 1½ miles NE of Fairmont, Robeson Co., North Carolina. Plate 4, fig. 1, USNM 240662; height 21.5 mm, diameter 10.4 mm; fig. 2, USNM 240663; height 21.4 mm, diameter 10.8 mm; locality TU 726. Plate 4, fig. 3, USNM 240664; height 20.6 mm, diameter 10.4 mm; fig. 4, USNM 240665; height 22.3 mm, diameter 11.1 mm; locality TU 767. Plate 4, fig. 5, USNM 240666; height 24.0 mm, diameter 12.0 mm; fig. 6, USNM 240667; height 25.3 mm, diameter 13.0 mm, locality TU 727. Plate 4, fig. 7, USNM 240668; height 25.3 mm, diameter 12.0 mm; fig. 9, USNM 240670; height 35.3 mm, diameter 17.0 mm; fig. 10, USNM 240671; height 21.5 mm, diameter 11.5 mm; locality TU 978. Plate 4, fig. 8, USNM 240669; height 28.3 mm, diameter 14.8 mm; locality TU 759. Plate 4, fig. 11, USNM 240672; height 17.3 mm, diameter 9.4 mm; locality TU 201. Plate 5, fig. 1, USNM 240673; height 24.6 mm, diameter 11.7 mm; fig. 2, USNM 240674; height 22.0 mm, diameter 11.2 mm; locality TU 580. Plate 5, fig. 3, USNM 240675; height 24.1 mm, diameter 12.5 mm; locality TU 777. Plate 5, fig. 4, USNM 240676; height 20.0 mm, diameter 10.7 mm; fig. 5, USNM 240677; height 19.0 mm, diameter 10.1 mm; locality TU 529A. Plate 5, fig. 6, USNM 240678; height 25.7 mm, diameter 13.7 mm; locality TU 977. Plate 5, fig. 7, AMNH 100637A; height 27.9 mm, diameter 14.4 mm; locality, off Egmont Key, Tampa Bay, Florida, 25 fms. Plate 5, fig. 8, USNM 711108; height 22.4 mm, diameter 11.6 mm; locality TU R-9. Plate 5, fig. 9, USNM 711109; height 25.3 mm, diameter 12.8 mm; fig. 10, USNM 711110; height 24.4 mm, diameter 12.3

mm; locality TU R-220. Plate 5, fig. 11, FSBC I 11240; height 23.2 mm, diameter 14.0 mm; locality, off Ft. Myers, Florida, 20 fms.

Other occurrences: TU locality nos. 79, 200, 202, 203, 283, 520, 522, 523, 525, 527, 529B, 532, 536, 539A, 540, 579, 582, 583, 725, 728, 729, 731, 733, 736, 740, 745, 746, 747, 750, 752, 754, 755, 768, 769, 770, 788, 790, 792, 793, 796, 797, 803, 808, 815, 816, 870, 933, 936, 973, 981, 982, 985, 987, 988, 989, 990, 1044, 1177. Recent occurrences: TU locality nos. R-17, R-20, R-44, R-46, R-105, R-164, R-304, R-306, R-350, R-351, R-352, R-353, R-354.

Discussion: As the lengthy occurrence list indicates, *C. ostrearum* is one of the more ubiquitous species in the Plio-Pleistocene beds of southern Florida. However, other than in Florida, the species is extremely rare in the fossil record. Dall (1892, p. 212) listed the species (as *Muricidea floridana* – USNM 112324) occurring at Todd's Ferry, on the Waccamaw River, near Conway, South Carolina, and in the Tulane Collections there are three examples from the Waccamaw Formation at Old Dock, North Carolina (TU 870). In the USNM collections there is a single example from the Duplin Formation of North Carolina (figured here, pl. 3, fig. 9), but otherwise the species is unknown outside of the southern Florida area. The form that occurs in the Jackson Bluff Formation (TU 60) in northern Florida is a distinct subspecies, *C. ostrearum conradi* (Mansfield).

In the Recent fauna it is slightly more widespread, reaching as far as the Yucatán Peninsula. Baker (1891, p. 51) and Weisbord (1926, p. 86) reported it from Progreso and Campeche, respectively. Jaume (1946, p. 106), in a report on the mollusks of Yucatán, noted that the species did not occur at Cabo Catoche and merely repeated Weisbord's locality. However, in the Tulane Collections there is a single example from Cabo Catoche (TU R-304) and, in addition, we have collected specimens from a number of other Mexican stations (see list above) ranging from near Champoton, Campeche, to Isla Mujeres, Quintana Roo.

Ecologically, there seems to be a direct relationship between the shallow-water occurrences of *C. ostrearum* and mangrove swamps. All of the specimens that the writer has collected personally have been in the vicinity of mangroves or the adjacent lagoons, such as Tarpon Bay on Sanibel Island, Florida (TU R-220). All of the Yucatán specimens collected alive, without exception, were found at low tide crawling on the shell-rubble exposed among the mangrove roots. Certainly, the type locality, Tampa Bay, has large areas of mangroves along the south side. The paleoecologic implication of this association can be seen when one notes that during the Pliocene *C. ostrearum* ranged much farther north than it does today, with specimens reported from North and South Carolina. It is assumed, therefore, that mangrove swamps also extended into these areas.

Today, on the Atlantic coast of Florida the species has been reported by Maury (1922, p. 98) to range as far north as St. Augustine. This marks the northern limit of the black mangrove *(Avicennia germinans);* the red *(Rhizophora mangle)* and white *(Laguncularia racemosa)* mangroves not ranging past approximately Daytona Beach (Carlton, 1974, p. 289, fig. 5). On the Gulf side of Florida *C. ostrearum* gets as far north as Apalachee Bay (Radwin and Wells, 1968, p. 73). There is a single deep-water specimen from the sub-Recent "mudlump" fauna (TU 977) off the mouth of the Mississippi River (where, incidentally, the black mangrove does grow). However, in general, the present range of the species is the east and west coasts of Florida, the Yucatán Peninsula, and apparently nowhere else.

The generic placement of *"Murex" ostrearum* has been a problem to workers as is shown by the complicated synonymy above. Conrad first assigned the form to *"Murex"* and then later, not realizing the variability of the species, redescribed it as *"Urosalpinx."* There is a certain superficial resemblance to the members of *Urosalpinx,* although it is obvious from Conrad's description that he realized it was more elaborately ornamented than *Urosalpinx* is normally, hence his emphasis on the "prominent" axial ribs and spiral cords, especially those on the siphonal canal. Subsequently, Dall (1884, p. 326) observed that the "operculum is muricoid and it is not a *Urosalpinx* [which has a purpuroid operculum]," assigning the species to the genus *Muricidea.*

Olsson and Harbison, recognizing that the group to which *"Murex" ostrearum* belongs was in need of a name, proposed the subgenus *Pseudosalpinx* in 1953 (p. 254), with the type species as *"Urosalpinx floridana."* However, what they had not realized, and what would not be recognized for another 20 years, was that the Atlantic species was congeneric with a west Mexican species named as the type of a new genus by Hertlein and Strong in 1951 (p. 87). This Mexican species was named *Calotrophon bristolae,* and it was not until 1970 that McLean and Emerson recognized the generic affinities of the two disjunct occurrences and, at the same time, noted an older name for *C. bristolae* was *"Tritonalia" turrita* Dall, 1919.

Although all of the specimens figured herein, ranging in age from early Pliocene through the Recent, are referred to the same species there are some obvious changes in the morphology of the shell through time. However, the Recent examples exhibit so much infraspecific variation there are specimens seen that match the oldest fossils, and so the differences may be due to varying environmental parameters rather than significant changes in the genetic composition. But considering the number of specimens and the number of localities representing different ages, this is not at all certain. For this reason it was decided to figure as many variations as possible and to recognize but one, highly variable, species.

In general, the oldest examples (those from TU 730 and 932) tend to have a more rounded outline, finer ornamentation, only the smallest of spinelets on the siphonal canal, and absolutely no spines on the shoulders. Also, there is no suggestion of varices and the angle at the shoulder is inconspicuous in the aperture. Some specimens (pl. 2, figs. 3 & 4) have two small denticles at the base of the columella but no later examples have more than a single tooth on the inner lip. These oldest specimens are relatively large, one (pl. 2, fig. 1) is 31 mm in height.

By the middle Pliocene "Brighton facies" (TU localities 520, 729, 770, 797, 1000, etc.) the shoulder has become more angulate, as can be seen especially in the aperture. There are still no varices, but the aperture tends to flare at the outer edge, which gives rise to the axial nodes on the whorls. These swollen areas, usually eight or nine per whorl, are the equivalent of varices, as can be seen from the small spines on the siphonal canal. However, there are still no shoulder spines on any specimens. The same is true for the Caloosahatchee examples. It is not until the early Pleistocene Bermont Formation (TU localities 201, 727, 759, etc.) that small open spinelets appear on the shoulders of the whorls.

From the earliest examples the degree of inflation of the body whorl, and the consequent elongation of the shell, is extremely variable (compare pl. 2, figs. 1 and 4, from the same locality). Dall (1890, p. 149) named a variety, *attenuata,* that he stated "shows a considerably more slender shell than the average of this species," giving the dimensions of 29 mm height and 13 mm diameter. The specimen in pl. 3, fig. 8, is a close match for these dimensions and clearly it is well within the range of this variable species. Specimens at the opposite end of the range of variation have been given the name *"Cantharus perplexus"* by Olsson and Harbison (1953, p. 255). As noted by McLean and Emerson (1970, p. 58) that species is based upon robust specimens of *C. ostrearum.* The specimen here figured in pl. 1, fig. 7, is virtually identical to Olsson and Harbison's paratype (1953, pl. 37, fig. 1a).

The nature of the spiral ribbing is equally variable but on the whole the oldest examples tend to have more numerous and less distinct cords. There is also a tendency to have spiral ribs on the subsutural region. Younger specimens have fewer, more pronounced spiral cords, and frequently have the subsutural area almost smooth. (Compare pl. 1, fig. 9c and pl. 4, fig. 11.) As a result of the decrease in number of spiral cords, the younger specimens have correspondingly fewer lirations on the inside of the outer lip. In the early examples there are usually seven or eight lirations, in the younger ones six or seven. These lirations mark the area *between* the external spiral cords and are one of the few really constant morphological features of the shell. The columellar lip is always smooth, standing slightly erect, glazed, and with a single small denticle that is opposite the anteriormost labral liration, the pair forming a constriction at the entrance into the siphonal canal. The canal is almost straight with the previous terminations forming a marked anterior fasciole that also varies in width.

In the Recent fauna specimens of *C. ostrearum* from deeper water (20 to 25 fathoms) exhibit rather elaborate sculpture. They have short spines at the shoulder, scabrous axial growth lines and small spinelets on the siphonal canal. Three such examples are shown here (pl. 5, figs. 6, 7 & 11), and another is given by McLean and Emerson (1970, plate-fig. 14). The lack of these sculptural features among the fossil specimens suggests that all of the fossils probably lived in water of less than 20 fathoms, which in view of the geology of south Florida is not unexpected.

The type of the genus *Calotrophon, C. turritus* (Dall) from the eastern Pacific, has a very restricted range along the southern end of Baja California, and, is the only species known to occur outside of the western Atlantic. It is markedly different from *C. ostrearum,* being much larger (attaining a maximum height of over 40 mm) and possessing dark color bands on the spiral cords. Nevertheless, there seems no doubt that the two species with such disjunct occurrences are congeneric, the only mystery is the route of travel. Except for the atypical *C. ascensus* from the Pleistocene of Costa Rica, there are no fossil occurrences of *Calotrophon* outside of the Florida area. Somewhere between the middle Miocene and the middle Pliocene this line had to have made its way through the southern Caribbean and up the Pacific coast, leaving no trace of its passage yet known.

CALOTROPHON OSTREARUM CONRADI (Mansfield)

Plate 2, figs. 7-9

Muricidea floridana libertiensis MANSFIELD, 1930, Florida Geol. Surv., Bull. 3, p. 86, pl. 11, fig. 8.

Muricidea floridana conradi MANSFIELD, 1930, Florida Geol. Surv., Bull. 3, p. 87, pl. 12, fig. 3.

Diagnosis: "Shell of moderate size, solid, stronger axially sculptured than spirally, and consists of 5 whorls, tip decollate. Whorls enlarging rather uniformly, constricted below the suture on the later whorls and at the base of the body whorl. Suture more appressed on the earlier than later whorls. Axial sculpture of (9 on the body whorl) prominent rounded ribs separated by rounded-bottomed interspaces equal in width to ribs. Spiral sculpture of rather strong, weakly crenulated, rounded primary lines which are usually intercalated with slightly weaker secondaries. Outer lip, within, strongly marked with 9 entering lirations. Pillar large, end provided with a large perforation." (Mansfield, 1930 – *M. conradi*)

Dimensions of holotype: height 30 mm, diameter 16 mm.

Holotype *(M. conradi):* USNM 370203.

Type locality: Harvey's Creek, Leon County, Florida.

Occurrence: Jackson Bluff Formation, middle Pliocene, Florida.

Figured specimens: Fig. 7, USNM 240651; height 24.4 mm, diameter 13.9 mm; fig. 8, USNM 240652; height 23.4 mm, diameter 11.8 mm; fig. 9, USNM 240653; height 18.0 mm, diameter 10.0 mm; locality TU 60. Other occurrences: TU locality no. 72.

Discussion: Mansfield, in his study of the mollusks of the Choctawhatchee Formation (now Group) of northwestern Florida (1930), described two subspecies of *"Muricidea floridana."* The first, *M. libertiensis,* he stated, "differs from *Muricidea floridana* (Conrad) in having a wider and flatter subsutural area, a less steeply inclined posterior slope, and wider and stronger axials" (1930, p. 87). The second, *M. conradi,* was said to differ from *"M. floridana"* in "having less angulated whorls and a much more constricted pillar at the junction of the body whorl" *(ibid.). M. conradi* supposedly differed from *M. libertiensis* in having a more slender shell and in lacking the secondary spiral sculpture.

Although Mansfield was correct in considering the specimens in the Choctawhatchee as being different from those in the more southern portions of Florida, his lack of specimens did not allow him to recognize the inherent variability of this entire group. In the Tulane Collections there are 42 specimens from Jackson Bluff, and it can be seen that both of his subspecies are the same. The specimens are just a variable as *C. ostrearum* s.s.; however, they are consistently different from that form in having a marked constriction at the base of the body whorl. Some have secondary spirals and some do not.

In view of the geographical separation, as well as this consistently different appearance, the writer feels justified in accepting *C. conradi* as a valid subspecies of *C. ostrearum.* Although *C. libertiensis* has page priority, none of the type lot is complete, and so as first reviser the name *C. conradi* is here selected for the subspecies.

In the Choctawhatchee beds this subspecies occurs with *Peristernia filicata* (Conrad), with which it may be confused at first glance. But *P. filicata* has a strong columellar plait at the base of the pillar and it never forms more than a weak columellar lip, which is completely appressed at the posterior end. The siphonal canal of *P. filicata* is shorter and curved.

CALOTROPHON ASCENSUS
E. H. Vokes, n. sp.
Plate 6, figs. 1, 2

Diagnosis: Shell small, with a protoconch of one and one-half bulbous whorls; five teleoconch whorls in the type material (possibly six in adult specimens). Early ornamentation consisting of ten or eleven small loop-like spines on the first two post-nuclear whorls, decreasing to seven or eight on later whorls. Spiral ornamentation not visible except on body whorl, where three major cords encircle the central portion of the whorl, with two minor cords between the anteriormost major cord and the constriction into the siphonal canal. Only a single poorly developed cord on the siphonal canal. Spiral cords made scabrous by small axial growth lines, and also where the spirals cross the varices, especially on the apertural side of each varix. Suture impressed, subsutural area almost perpendicular to the suture giving a stepped appearance to the spire, which is greatly extended relative to the entire shell. Spire about one-half the total length of the shell. Aperture oval, outer edge crenulated by the three strong spiral cords; inner side of outer lip bearing five or six lirations. Inner lip smooth, polished, appressed against the columellar wall. Siphonal canal short, recurved at the distal end, forming a small fasciole. Shell probably covered in life by a heavy intritacalx, only fragments preserved on fossil specimens.

Dimensions of holotype: height 14.7 mm, diameter 8.7 mm.

Holotype: USNM 240679.

Type locality: TU 954, 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.

Occurrence: Moín Formation, early Pleistocene, Costa Rica.

Figured specimens: Fig. 1, USNM 240679 (holotype). Fig. 2, USNM 240680 (paratype); height 12.7 mm, diameter 8.0 mm; locality TU 954.

Discussion: In the early Pleistocene beds of the Moín Formation of Costa Rica two small specimens were found, which clearly represent a very different line of *Calotrophon.* Although there seems little doubt that they belong in this genus, they have little resemblance to any of the other known members. The species is small; although the two specimens are probably not adult, as they would be expected ultimately to have six whorls. Even so, they would still be little more than 18 mm in total height. (Compare pl. 6, figs. 1 and 6, both specimens with same number of whorls and same magnification.) The relative spire height is much greater than the *C. ostrearum* line, giving the shell a different outline, with the mid-point of the axis being posterior to the edge of the aperture, whereas in the *C. ostrearum* group it falls well within the aperture. The number of spiral cords is reduced to just three major cords with all others being markedly reduced.

This species has not been noted in the Recent fauna; however, the fauna of the Moín Formation is considered to be relatively deep water and it is anticipated that specimens of *C. ascensus* will soon be recognized as deep dredging continues in the Caribbean.*

CALOTROPHON ANDREWSI
E. H. Vokes, n. sp.
Plate 6, figs. 3-6

Diagnosis: Shell with protoconch of one and one-half bulbous whorls, and six teleoconch whorls in the adult. Early ornamentation invariably worn, but apparently consisting of nine pointed axial nodes; no spiral ornamentation preserved. Axial ornamentation throughout the development of the shell of nine varices, more or less distinct, best evidenced by the spinose processes where the spiral

---

*From past experience it is probable that once it has been described it will be recognized in collections. Many of the small species in the Caribbean have been overlooked and only after they have attention called to them are they recognized. A good case in point for this is *Poirieria (Pazinotus) bowdenensis* Vokes, originally based upon a single specimen from the Pleistocene of Jamaica (Vokes, 1970, p. 27). Since then numerous Recent specimens have appeared, which previously had been mis-identified as *"Eupleura" stimpsonii* Dall, another *Pazinotus.* The small shell is apparently not rare at depths of about 100 fathoms.

ornamentation crosses. Spiral ornamentation on body whorl of three to five heavy cords, with a varying number of intercalary threads. No spirals on the subsutural slope. The strength of the cords varying greatly, but usually three more pronounced than the others. Where the cord at the shoulder crosses the varices, long open spines developed; these sometimes curving forward but more usually broken back to simple loops. In addition to the long shoulder spines, smaller spinelets occasionally formed where the other cords cross the varices. On the siphonal canal two additional spiral cords, which always bear spinelets. Aperture triangular, opening into the shoulder spine. Inside the outer lip six to eight lirations, which generally correspond to the intervals between the spiral cords. Inner lip smooth, slightly erect from the columellar wall. Canal moderate in length, straight, anal fasciole of variable width, usually moderately broad in older specimens, lacking in younger ones. Entire shell covered by a heavy, white, massive intritacalx, which masks the overall ornamentation of fine scabrous axial growth lines. Aperture a deep apricot in fresh examples, but quickly fading to pale yellow.

Dimensions of holotype: height 20.0 mm, diameter 11.4 mm.

Holotype: USNM 711111.

Type locality: TU R-44, Isla Mujeres, Quintana Roo, Mexico. Open ocean side (beach collected).

Occurrence: Recent only, southwest Florida to northeast Yucatán.

Figured specimens: Fig. 3, USNM 711111 (holotype). Fig. 4, USNM 711112 (paratype A); height 19.0 mm, diameter 11.4 mm; locality, 80 miles west of Marco, Florida, 28 fms. Fig. 5, USNM 711113 (paratype B); height 17.6 mm, diameter 12.0 mm; locality TU R-44. Fig. 6, AMNH 183197 (paratype C); height 16.0 mm, diameter 10.0 mm; locality, west of Shark River, Florida, 4 fms. Other occurrences: TU locality nos. R-46, R-164; St. John's Pass, Florida, 26 fms. (Steger Coll.); off Egmont Key, Florida, 77 fms. (AMNH 182710).

Discussion: After having documented the extreme variability of *C. ostrearum,* one is hesitant to name a new species of *Calotrophon* that has the same geographical range. It may be that *C. andrewsi* is an ecotype of *C. ostrearum* but the specimens seem sufficiently and consistently different to warrant specific recognition. As noted, the ranges overlap with *C. andrewsi* being confined to the limy banks off southwest Florida and northeast Yucatán. One unfigured paratype (ANSP 303232) in the collections of the Academy of Natural Sciences, Philadelphia, was collected alive in two fathoms depth on sand and grass, off the northwest corner of Isla Mujeres (= TU R-271). We have not taken any specimens at this locality but at nearby TU localities R-44 and R-46, it occurs together with *C. ostrearum* in beach collections.

The differences between *C. ostrearum* and *C. andrewsi* include the much heavier intritacalx, the stronger but less numerous spiral cords, the longer spines and the lack of a labial denticle in *C. andrewsi.* Even the most elaborate deep-water specimens of *C. ostrearum* do not approach the spinosity of *C. andrewsi.* The new species is also smaller, the largest specimen seen is the holotype, which measures only 20 mm, compared with an average of 30 mm for the normal adult of *C. ostrearum.*

C. andrewsi is named in honor of the late Dr. E. Wyllys Andrews of Merida, Yucatán, who, although not a professional malacologist, was perhaps the leading authority on the shells of the Yucatán Peninsula. Unfortunately his untimely death prevented completion of his study of the distribution of species around the peninsula, a task which the author and especially her husband have most willingly inherited.

Genus ATTILIOSA Emerson, 1968

Attiliosa EMERSON, 1968, Veliger, v. 10, no. 4, p. 380.

Type species: *Coralliophila incompta* Berry, by original designation [= *Peristernia nodulosa* A. Adams; see R. C. Bullock, following this paper].

ATTILIOSA STRIATA (Gabb)

Plate 7, figs. 1-9; Plate 8, figs. 1-8
Text figure 2

Muricidea striata GABB, 1873, Amer. Phil. Soc., Trans., (N.S.) v. 15, p. 203.

Muricidea philippiana DALL, 1889, Harvard Mus. Comp. Zool., Bull., v. 18, p. 213 (in part, Key West specimen only); 1889, U.S. Natl. Mus., Bull. 37, p. 120 (Key West specimen only cited).

Muricidea striata Gabb. PILSBRY, 1917, Acad. Nat. Sci. Phila., Proc., v. 73, p. 354, pl. 28, fig. 7 (holotype).

Muricidea philippiana Dall. M. SMITH, 1953, Illus. Cat. Recent Species Rock Shells, p. 12 (in part).

Coralliophila philippiana (Dall). M. SMITH, 1953, Illus. Cat. Recent Species Rock Shells, p. 33, pl. 20, fig. 20 (Dall's Key West specimen).

Attiliosa philippiana (Dall). S. E. HOERLE, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 2, p. 63 (not of Dall).

Diagnosis: "Spire elevated about equal to the aperture; whorls eight, including the nucleus; angulated. Body whorl sloping nearly straight above, convex below, the angle constricted in advance.

Surface ornamented by seven large ribs on the widest part of the whorls, which become obsolete above and below. Crossing these below the angle are half a dozen linear ribs with broad smooth interspaces. These latter ribs are well developed where they cross the others, but are much smaller in the concave spaces. Mouth subovate, constricted in advance. Incrustation of the inner lip heavy, smooth, and with a projecting free edge; outer lip faintly striate internally. Canal twisted, with a broad imperforate umbilicus." (Gabb, 1873)

Dimensions of holotype: height 12.3 mm, diameter 7.0 mm.

Holotype: ANSP 3249.

Type locality: Santo Domingo, exact locality unknown.

Occurrence: Unknown formation (?) Miocene, Santo Domingo. Agueguexquite Formation, middle Pliocene; Veracruz, Mexico. Pinecrest Beds, middle Pliocene; Caloosahatchee Formation, late Pliocene; Bermont Formation, early Pleistocene; southern Florida. Recent, southern Florida.

Figured specimens: Plate 7, fig. 1, ANSP 3249 (holotype). Fig. 2, USNM 240681; height 23.7 mm, diameter 13.5 mm; locality TU 727. Fig. 3, USNM 240682; height 26.4 mm, diameter 15.7 mm; locality TU 726. Fig. 4, USNM 240683; height 31.9 mm, diameter 18.0 mm; locality TU 991. Fig. 5, USNM 240684; height 16.4 mm, diameter 9.4 mm; locality TU 638. Fig. 6, USNM 240685; height 30.7 mm, diameter 17.3 mm; locality TU 759. Fig. 7, USNM 240686; height 18.9 mm, diameter 11.0 mm; fig. 8, USNM 240687; height 26.0 mm, diameter 17.1 mm; fig. 9, USNM 240688; height 26.3 mm, diameter 15.4 mm; locality TU 201. Plate 8, fig. 1, AMNH 183200; height 14.6 mm, diameter 9.0 mm; fig. 2, AMNH 183200; height 20.0 mm, diameter 12.5 mm; fig. 3, AMNH 183200; height 17.4 mm, diameter 11.0 mm; locality, off Palm Beach County, Florida, 17 fms. Plate 8, fig. 4, FSBC I 11238; height 20.0 mm, diameter 12.5 mm; locality, "Hourglass" Station C, off Tampa Bay, Florida, 20 fms. Fig. 5, AMNH 182709; height 23.6 mm, diameter 12.5 mm; locality, off Sanibel Island, Florida, 30 fms. Fig. 6, AMNH 183199; height 24.8 mm, diameter 13.2 mm; locality, off Briar Reef, Florida. Fig. 7, MCZ 258185; height 17.6 mm, diameter 10.0 mm; locality, Windy Key, Florida. Fig. 8, USNM 34642 ("cotype" of *Muricidea philippiana* Dall); height 17.0 mm, diameter 9.6 mm; locality, Key West, Florida. Other occurrences: TU locality nos. 933, 1177; Recent from Dry Tortugas, Florida, and southwest of Egmont Key, Florida, 25 fms.

Discussion: In beds of an unknown age from an unknown locality, somewhere in

---

PLATE 1

Figures Page

1,2. *Poirieria (Panamurex) mauryae* Vokes 103
    1. (X 3) USNM 646430 (holotype); height 16.6 mm, diameter 9.0 mm.
    Locality: TU 458. Chipola Fm., late lower Miocene.
    2. (X 10) USNM 240641; height 12.5 mm, diameter 7.4 mm (protoconch only figured).
    Locality: TU 546. Chipola Fm., late lower Miocene.
3,4. *Poirieria (Panamurex) hutchisoni* (Jung) 103
    3. (X 3) USNM 645495 (paratype); height 15.6 mm, diameter 9.0 mm.
    Locality: USGS 18399, Malajo River, Trinidad. Melajo Clay, (?) late Miocene.
    4. (X 10) USNM 645494 (holotype); height 16.6 mm, diameter 9.4 mm
    (protoconch only figured).
    Locality: USGS 21178, Melajo River, Trinidad. Melajo Clay, (?) late Miocene.
5. *Poirieria (Panamurex) phagon* (Gardner) 103
    USNM 646431; height 20.0 mm, diameter 11.5 mm.
    Locality: TU 91. Oak Grove Sand, (?) late lower Miocene.
    (Fig. 5a, X 10; fig. 5b, X 3)
6-9. *Calotrophon ostrearum* (Conrad) 105
    6. (X 10) USNM 711115; height 10.6 mm, diameter 5.2 mm (protoconch only figured).
    Locality: St. Joseph's Sound, Florida. Recent.
    7. (X 2) USNM 240642; height 27.8 mm, diameter 15.2 mm.
    Locality: TU 729. Lower Pinecrest Beds, lower Pliocene.
    8. (X 2) USNM 240643; height 26.8 mm, diameter 13.0 mm.
    Locality: TU 729. Lower Pinecrest Beds, lower Pliocene.
    9. USNM 240644; height 27.9 mm, diameter 14.4 mm.
    Locality: TU 932. Lower Pinecrest Beds, lower Pliocene.
    (Figs. 9a, 9b, X 2; fig. 9c, X10)

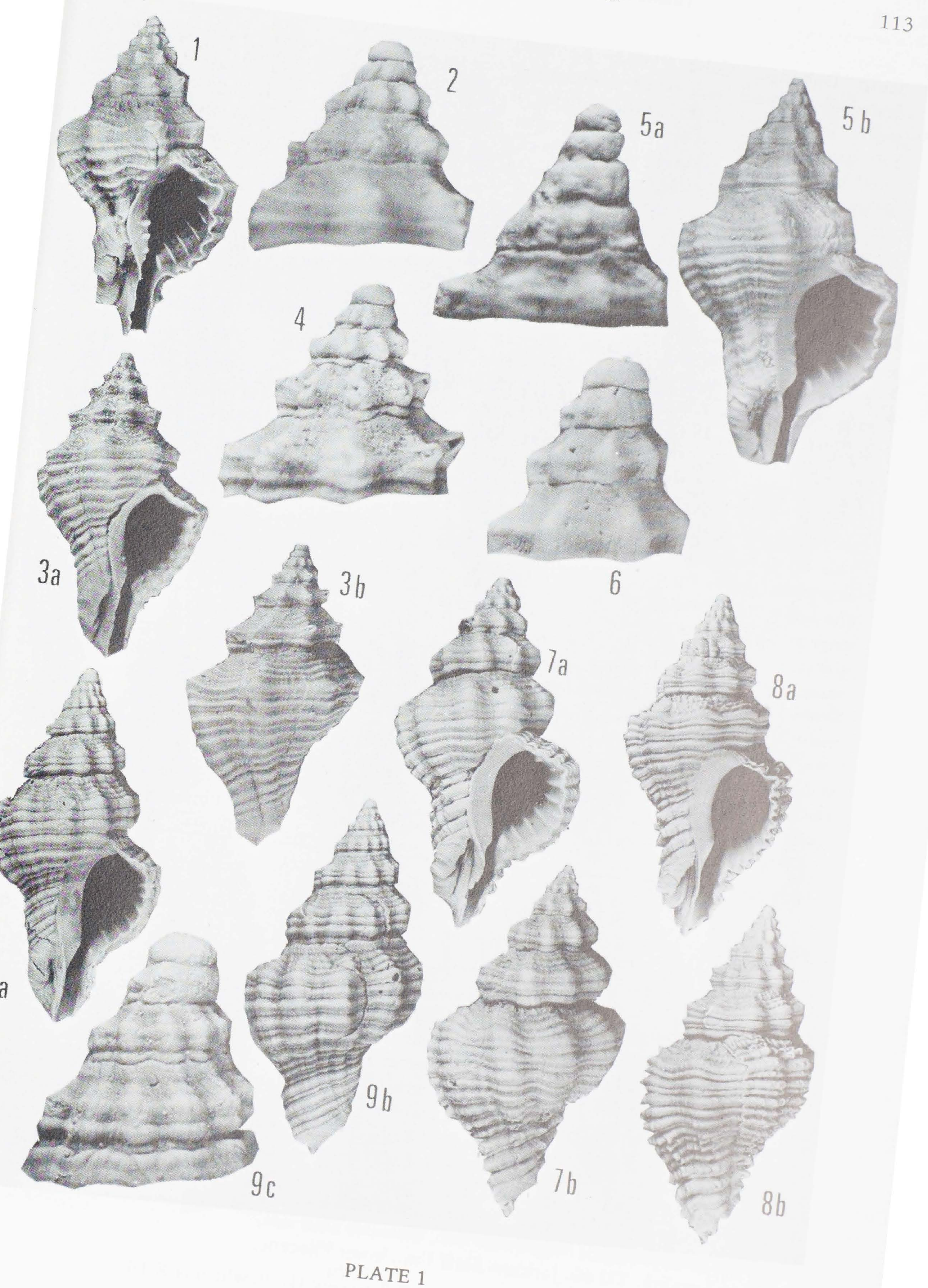


PLATE 1

Santo Domingo, Gabb (1873, p. 203) described a small species as *"Muricidea" striata*. It is unfortunate that the pedigree of this species is so poor as it is the (presumably) oldest known example of a species still living today in the area off southern Florida. No subsequent examples were located in the Dominican Republic by the Maury Expedition of 1916 (Maury, 1917), and so the holotype remains the sole evidence for the early history of the genus *Attiliosa*. The next documented appearance is three worn examples from the middle Pliocene Agueguexquite Formation of southern Veracruz, Mexico (see Akers and Koeppel, 1973, p. 83; also Akers, 1972, p. 28).

The holotype is relatively small, although it is an adult with six post-nuclear whorls, but otherwise it differs little from the Mexican specimens (see pl. 7, figs. 1 and 5). This resemblance is greater than appears at first glance as the tip of the siphonal canal of the holotype is broken and gives the appearance of being shorter than it actually was (see text fig. 2). Other than the smaller size there seems to be no difference between this Dominican fossil and the Recent specimen included by Dall in his *"Muricidea" philippiana* (see pl. 8, fig. 8). When one considers the amazing degree of variability seen in just the specimens figured here, wherein virtually no two are alike, it seems only reasonable to include this small form within the species, and it thus gives the entire subsequent line a name.

Text figure 2. *Attiliosa striata* (Gabb). ANSP 3249 (holotype); height 12.3 mm, diameter 7.0 mm; locality, Santo Domingo. (X 4)

There is a curious lack of specimens of this species in the Pinecrest Beds of south

---

PLATE 2

Figures		Page
1-6. *Calotrophon ostrearum* (Conrad)		105
	1. USNM 240645; height 32.7 mm, diameter 17.4 mm. Locality: TU 932. Lower Pinecrest Beds, lower Pliocene.	
	2. USNM 240646; height 29.6 mm, diameter 14.7 mm.	
	3. USNM 240647; height 27.2 mm, diameter 13.7 mm.	
	4. USNM 240648; height 22.3 mm, diameter 10.2 mm.	
	5. USNM 240649; height 27.2 mm, diameter 13.7 mm.	
	6. USNM 240650; height 24.1 mm, diameter 11.9 mm. Locality: TU 730. Lower Pinecrest Beds, lower Pliocene.	
7-9. *Calotrophon ostrearum conradi* (Mansfield)		109
	7. USNM 240651; height 24.4 mm, diameter 13.9 mm.	
	8. USNM 240652; height 23.4 mm, diameter 11.8 mm.	
	9. USNM 240653; height 18.0 mm, diameter 10.0 mm. Locality: TU 60. Jackson Bluff Fm., lower Pliocene.	

(All figures magnified X 2, except fig. 9, which is X 10)

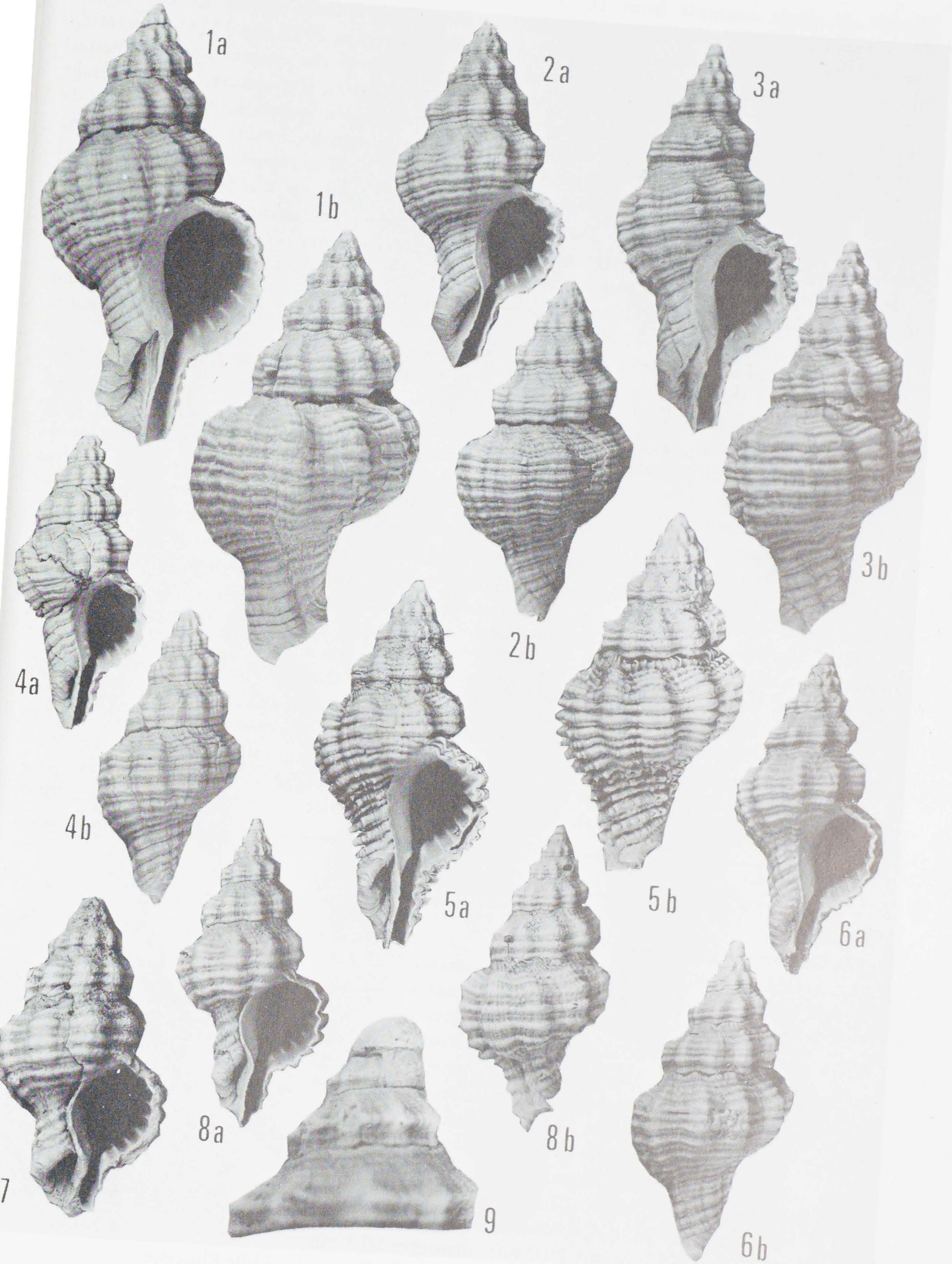


PLATE 2

Florida (a single example from TU 933). Some ecologic change must have occurred at the end of the middle Pliocene so that a more tropical fauna moved into the Florida area. There are several species that do not occur in the Pinecrest but do occur in the Caloosahatchee. In fact, this is the only way one may separate the two "formations" (really time-faunal units). Evidently *A. striata* is one of these, along with *Turbinella scolymoides* Dall and *Liochlamys bulbosa* (Heilprin), two other "guide-fossils" to the Caloosahatchee beds. As the writer discussed in a previous paper (Vokes, 1966, p. 68), *T. scolymoides* does not appear in the Pinecrest Beds either, and this is thought to be due to the fact that the Pinecrest was somewhat cooler in water temperature. Olsson (*in* Olsson and Petit, 1964, p. 517) stated that the Pinecrest fauna has a "decidedly Chesapeake Miocene aspect." The Pinecrest, at that time, was considered to be upper Miocene, as were the correlative beds of the Yorktown Formation, and the writer suggested that the change in temperature between the Miocene and Pliocene (*i.e.,* the Pinecrest and Caloosahatchee) was due to the closing of the Isthmian landbridge, which was thought to take place then. Basically nothing has changed except that the time is now considered to be the end of the middle Pliocene, on both the basis of the land animal migration across this bridge, as well as the planktonic foraminifer and calcareous nannofossil dating of the marine beds (see Akers, 1972 and 1974). The resultant changes in the currents, which created the Gulf Stream, would surely have brought a warmer current across south Florida (then shallow submarine banks) and with it the animals of a somewhat more tropical habitat. The change was probably not great – a few degrees at most – but enough to modify the fauna so that it is recognizably different. It would have been the same slight temperature shift that moved mangroves and *Calotrophon ostrearum* into North Carolina during this same time interval.

Certainly the genus was living somewhere in the Caribbean area, and it is only lack of outcrops of the appropriate age that prevents our having a better knowledge of the sequence. Unfortunately the group has no record in the more southern areas such as Venezuela or Colombia where we might hope to fill in the gap. But it seems obvious that the group crossed through the Isthmian passage sometime before the landbridge sealed off the route, for in the Recent Pacific fauna are two species that are closely related to the Atlantic fossil form. The type species of the genus, *A. incompta* (Berry), is a smooth form, more akin to the Recent Atlantic *A. philippiana* than to the ornamented *A. striata.* The more heavily ornamented Pliocene specimens of *A. striata*

PLATE 3

Figures	Page
1-9. *Calotrophon ostrearum* (Conrad)	105

1. USNM 240654; height 26.2 mm, diameter 12.5 mm.
2. USNM 240655; height 24.4 mm, diameter 12.8 mm.
3. USNM 240656; height 20.2 mm, diameter 11.7 mm.
   Locality: TU 1000. Upper Pinecrest Beds, middle Pliocene.
4. USNM 240657; height 24.7 mm, diameter 14.0 mm.
5. USNM 240658; height 24.9 mm, diameter 13.2 mm.
6. USNM 240659; height 27.4 mm, diameter 13.2 mm.
7. USNM 240660; height 24.6 mm, diameter 12.0 mm.
   Locality: TU 519. Caloosahatchee Fm., upper Pliocene.
8. USNM 240661; height 31.5 mm, diameter 15.0 mm.
   Locality: TU 539B. Caloosahatchee Fm., upper Pliocene.
9. USNM 647695; height 20.0 mm, diameter 10.7 mm.
   Locality: Fairmont, North Carolina. Duplin Fm., (?) middle Pliocene.

(All figures magnified X 2)

PLATE 3

(e.g., pl. 7, figs. 4, 7, & 9) bear a strong resemblance to the Recent eastern Pacific species *"Murex" carduus* Broderip, 1832 (figured by Keen, 1971, fig. 1041).

This species was referred to the trophonine subgenus *Acanthotrophon* Hertlein and Strong, 1951, by Berry (1969, p. 162) together with his then new species *A. sentus* (see Keen, 1971, fig. 1042). When one examines *A. sorensoni* Hertlein and Strong, 1951, type of *Acanthotrophon,* it gives added strength to the writer's conviction that the subfamily "Trophoninae" is polyphyletic. There is a seeming line of morphological development from *Attiliosa carduus* (the latin word *carduus* – a thistle – is a noun and does not change to agree with the feminine *Attiliosa*), which is heavily ornamented, to *Acanthotrophon sentus,* moderately ornamented, to *Acanthotrophon sorensoni,* which is barely ornamented. The manner of forming the shoulder spines is identical in all three. But *A. carduus* has the large umbilicus and labial denticles of *Attiliosa* and the other two lack these features. *Acanthotrophon sorensoni* has every appearance of being a true *Trophon* and has the thin, chalky shell of a deep-water species (the holotype is from 60 fms). In addition, information provided by Radwin and D'Attilio *(in litt.)* shows that the radulae are totally different. Although *Acanthotrophon* is muricine, it is very unlike *Attiliosa.*

The writer is of the opinion that the boreal species of Trophoninae, those which have a muricoid operculum,* are derived

---

*As opposed to the southern forms with a purpuroid operculum, which are probably derived from a *Urosalpinx*-like ancestor. The type of *Trophon, T. geversianus* (Pallas), is of this group and hence the true Trophoninae are also. It may well be that many of the northern members, such as *Boreotrophon, Pagodula, Acanthotrophon,* etc., should be placed in the Muricinae. Certainly the type species of *Actinotrophon, T. actinophora* Dall, is a *Poirieria* s.s. (see Bayer, 1971, p. 157). The radulae of these northern forms differ very little

PLATE 4

Figures	Page
1-11. *Calotrophon ostrearum* (Conrad)	105

1. USNM 240662; height 21.5 mm, diameter 10.4 mm.
Locality: TU 726. Caloosahatchee Fm., upper Pliocene.
2. USNM 240663; height 21.4 mm, diameter 10.8 mm.
Locality: TU 726. Caloosahatchee Fm., upper Pliocene.
3. USNM 240664; height 20.6 mm, diameter 10.4 mm.
Locality: TU 767. Caloosahatchee Fm., upper Pliocene.
4. USNM 240665; height 22.3 mm, diameter 11.1 mm.
Locality: TU 767. Caloosahatchee Fm., upper Pliocene.
5. USNM 240666; height 24.0 mm, diameter 12.0 mm.
Locality: TU 727. Bermont Fm., lower Pleistocene.
6. USNM 240667; height 25.3 mm, diameter 13.0 mm.
Locality: TU 727. Bermont Fm., lower Pleistocene.
7. USNM 240668; height 23.5 mm, diameter 12.0 mm.
Locality: TU 978. Bermont Fm., lower Pleistocene.
8. USNM 240669; height 28.3 mm, diameter 14.8 mm.
Locality: TU 759. Bermont Fm., lower Pleistocene.
9. USNM 240670; height 35.3 mm, diameter 17.0 mm.
Locality: TU 978. Bermont Fm., lower Pleistocene.
10. USNM 240671; height 21.5 mm, diameter 11.5 mm.
Locality: TU 978. Bermont Fm., lower Pleistocene.
11. USNM 240672; height 17.3 mm, diameter 9.4 mm (protoconch only figured).
Locality: TU 201. Bermont Fm., lower Pleistocene.

(All figures magnified X 2, except fig. 11, which is X 10)

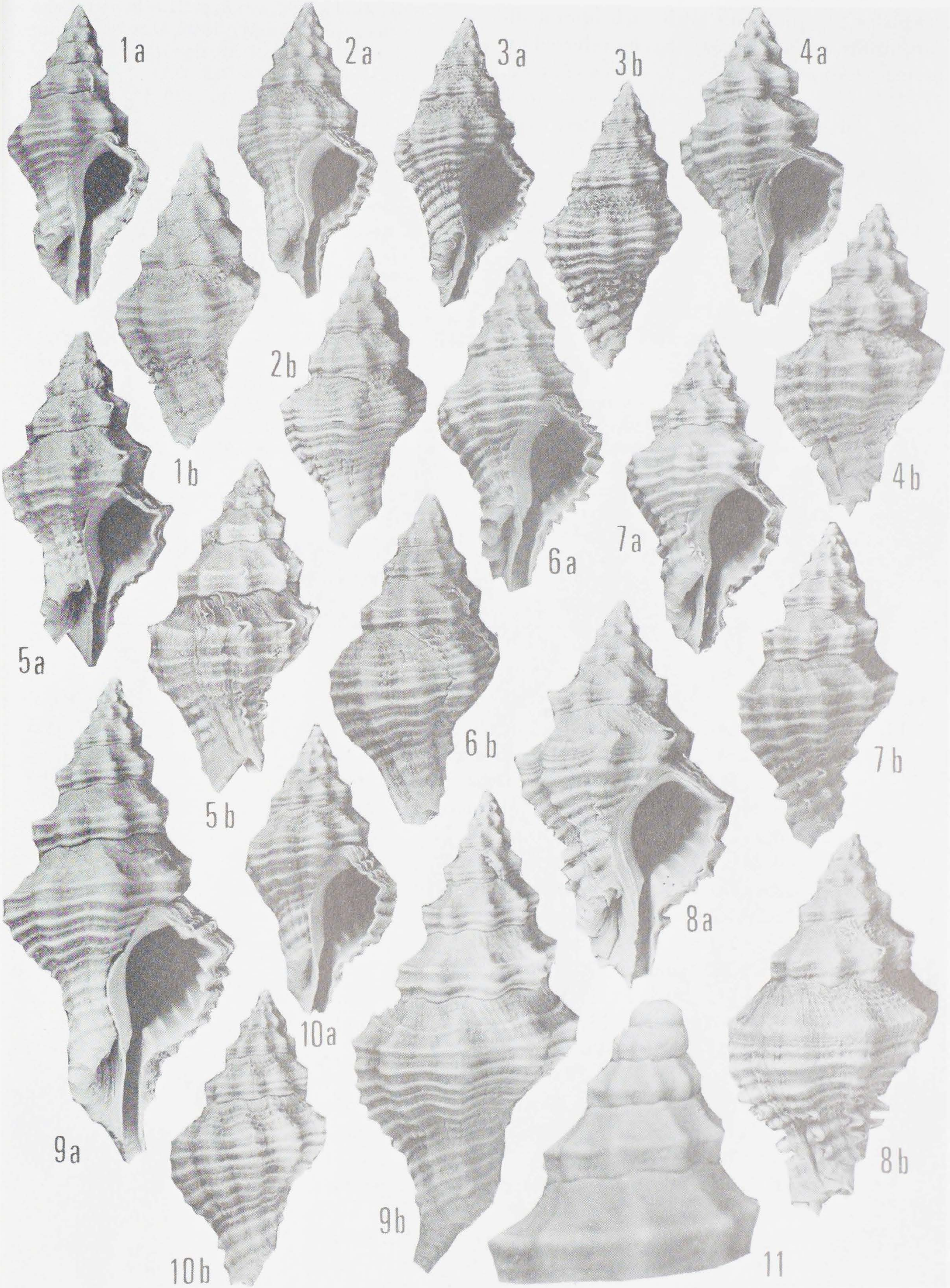


PLATE 4

from a *Poirieria*-like ancestor. This also explains the problems with such intermediate forms as the Japanese species referred by some to *Nipponotrophon* Kuroda and Habe, 1971 (type species: *Boreotrophon echinus* Dall) and to *Poirieria* by the writer. Inasmuch as *Attiliosa* is also believed to have come from a *Poirieria* ancestor, the resemblances between *Attiliosa* and the trophonine species would seem to be parallelism.

ATTILIOSA PHILIPPIANA (Dall)
Plate 8, figs. 12-14

Muricidea philippiana DALL, 1889, Harvard Mus. Comp. Zool., Bull., v. 18, p. 213 (in part, Cabo Catoche specimen only); 1902, U.S. Natl. Mus., Proc., v. 24, p. 504, pl. 29, fig. 5.

Not *Muricidea philippiana* Dall. DALL, 1889, U.S. Natl. Mus., Bull. 37, p. 120 [= *A. striata* (Gabb)].

Muricidea philippiana Dall. JOHNSON, 1934, Boston Soc. Nat. Hist., Proc., v. 40, p. 116 (in part only).

Muricidea philippiana Dall. M. SMITH, 1953, Illus. Cat. Recent Species Rock Shells, p. 12 (in part only).

Not *Coralliophila philippiana* (Dall). M. SMITH, 1953, Illus. Cat. Recent Species Rock Shells, p. 33, pl. 20, fig. 20 [= *A. striata* (Gabb)].

Not *Attiliosa philippiana* (Dall). S. E. HOERLE, 1970, Tulane Stud. Geol. Paleont., v. 8, no. 2, p. 63 [= *A. striata* (Gabb)].

[Calotrophon (Attiliosa)] philippiana (Dall). E. H. VOKES, 1971, Bulls. Amer. Paleontology, v. 61, no. 278, p. 81 (in part only).

Calotrophon (Attiliosa) philippiana (Dall). ABBOTT, 1974, Amer. Seashells, 2nd Ed., p. 188 (? in part only).

Diagnosis: "Shell short, acutely fusiform, solid, with about five whorls; spire acute, suture flexu-

---

from the normal muricine one, whereas that of *T. geversianus* is more like that of the Ocenebrinae (G. E. Radwin, personal communication). However, the laminated varices, considered "typical" of the Trophoninae appear in both groups and must represent convergence rather than close relationship. The same sort of situation is seen in *Pterynotus* and *Pteropurpura*, two extremely similar, but distantly related, genera.

PLATE 5

Figures		Page
1-11. *Calotrophon ostrearum* (Conrad)		105

1. USNM 240673; height 24.6 mm, diameter 11.7 mm.
   Locality: TU 580. Bermont Fm., lower Pleistocene.
2. USNM 240674; height 22.0 mm, diameter 11.2 mm.
   Locality: TU 580. Bermont Fm., lower Pleistocene.
3. USNM 240675; height 24.1 mm, diameter 12.5 mm.
   Locality: TU 777. Anastasia Fm., upper Plesitocene.
4. USNM 240676; height 20.0 mm, diameter 10.7 mm.
   Locality: TU 529A. Ft. Thompson Fm., upper Pleistocene.
5. USNM 240677; height 19.0 mm, diameter 10.1 mm.
   Locality: TU 529A. Ft. Thompson Fm., upper Pleistocene.
6. USNM 240678; height 25.7 mm, diameter 13.7 mm.
   Locality: TU 977. Post-Pleistocene.
7. AMNH 100637A; height 27.9 mm, diameter 14.4 mm.
   Locality: Off Egmont Key, Florida; 25 fms. Recent.
8. USNM 711108; height 22.4 mm, diameter 11.6 mm.
   Locality: TU R-9. Recent.
9. USNM 711109; height 25.3 mm, diameter 12.8 mm.
   Locality: TU R-220. Recent.
10. USNM 711110; height 24.4 mm, diameter 12.3 mm.
    Locality: TU R-220. Recent.
11. FSBC I 11240; height 23.2 mm, diameter 14.0 mm.
    Locality: "Hourglass" Station K, off Ft. Myers, Florida; 20 fms. Recent.

(All figures magnified X 2)

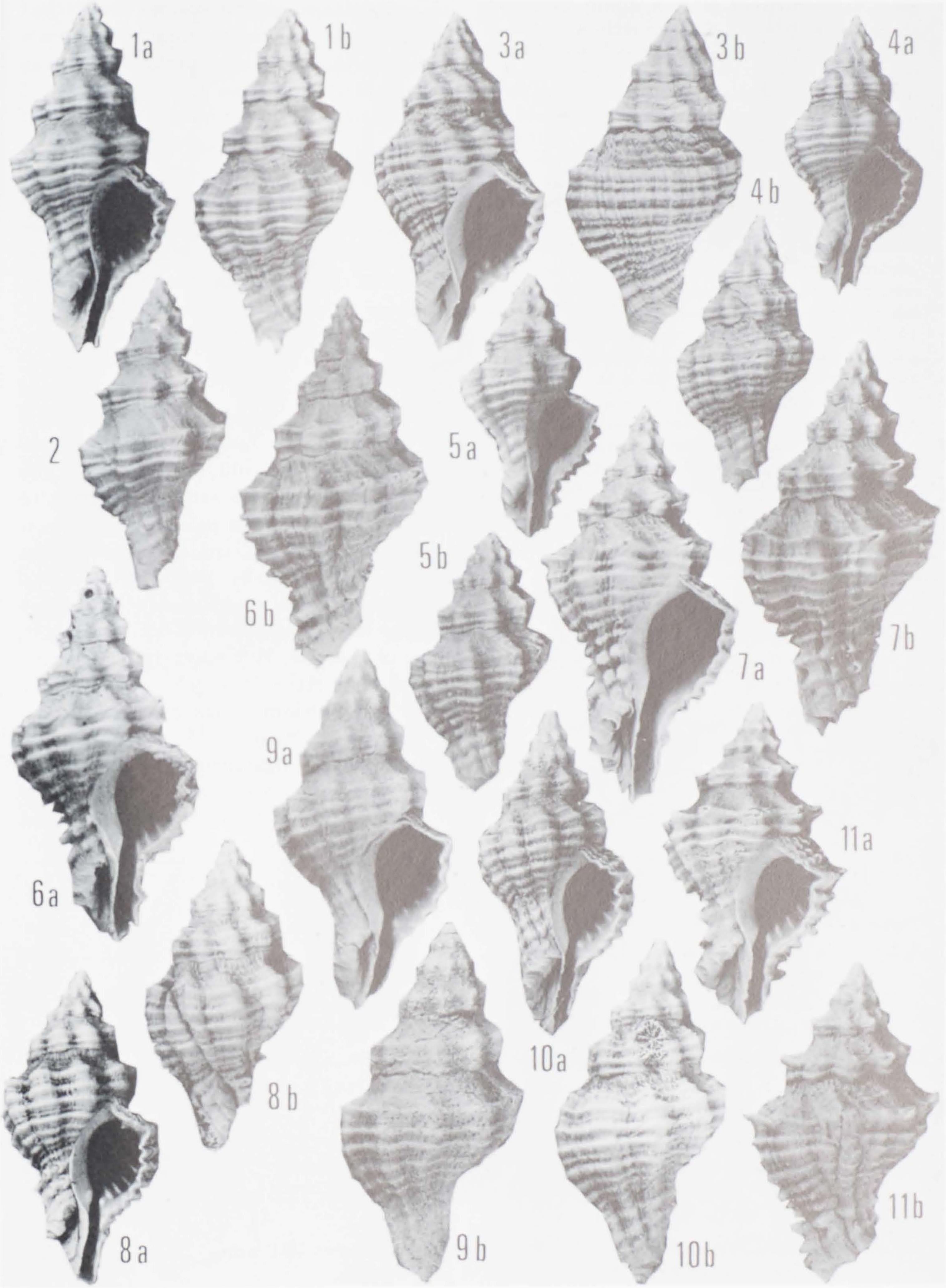


PLATE 5

ous, appressed; slope of the spire nearly flat, the turns being flattened or even slightly excavated above the periphery; transverse sculpture of lines of growth, and of (on the last whorl nine) peripheral undulations or ribs with about equal interspaces; these are almost confined to the periphery; in one specimen these are crossed by three or four about equidistant spiral ridges, faint, becoming prominent and keeled or nodulous on the ribs; this one has also two strong ridges on the canal, and is pure white; another specimen has only faint spiral striae on the canal, the periphery is smooth, the ribs lumpy, the color white with spiral brown lines toward the periphery; in still another the posterior row of nodulations becomes short, sharp, and spinous, the revolving threads seem more numerous on the base; canal short, rapidly tapering, open, pointed; a well marked siphonal fasciole is normal, one hardly shows it, another has it funicular; aperture elongate oval, outer lip with 5-7 strong lirae within; margin simple, acute; throat porcelain-white with a tendency to rosy or purple; columella smooth with a dash of rose or purple in some specimens, and two or three faint granulations, in the perfectly adult, near its anterior edge." (Dall, 1889).

Dimensions of lectotype: height 14.9 mm, diameter 8.8 mm.

Lectotype: USNM 93337 (here designated).

Type locality: U.S. Fish Comm. Station 2362, off Cabo Catoche, Quintana Roo, Mexico, 25 fms.

Occurrence: Recent only, southern Florida and northern Yucatán.

Figured specimens: Fig. 12, USNM 93337 (lectotype). Fig. 13, FSBC I 11242; height 14.4 mm, diameter 8.0 mm; locality, about 35 miles north of Cabo Catoche, Mexico, 20 fms. Fig. 14, AMNH 183198; height 17.0 mm, diameter 10.0; locality, off Palm Beach County, Florida, 16 fms.

Discussion: Dall (1889, p. 213) admitted when he described this species that it had puzzled him "for some time." He is not alone, for this small, rare species has been an enigma to all who have followed him, and the present writer is by no means certain of the present resolution of the problem. It may well be that *A. philippiana* is no more than a smooth ecotype of the ornamented *A. striata.* The specimens of *Attiliosa* are extremely variable, and with as few examples as there are available in collections, the range of variation is not well established.

In the type lot of *A. philippiana* there are two specimens, one from Cabo Catoche, Mexico (USNM 93337), and the second from Key West, Florida (USNM 34642). It is the Cabo Catoche specimen that Dall subsequently figured (1902, pl. 29, fig. 5). The two specimens do not appear to belong to the same species. The unfigured Key West specimen clearly is *A. striata* and, in part, is the shell described by Dall in his original description. The dimensions cited there ("Max. lon. of shell, 17.4; of last whorl, 12.4; of aperture, 10.0 max. lat. of aperture, 4.5; of shell, 10.5.") refer to this specimen as do the portions of the description concerning spiral ridges and ornamentation. However, as the figured specimen is the one which has been taken by subsequent workers to be the standard for the species (and

---

PLATE 6

Figures Page

1,2. *Calotrophon ascensus* E. H. Vokes, n. sp. 110
  1. USNM 240679 (holotype); height 14.7 mm, diameter 8.7 mm.
  2. USNM 240680 (paratype); height 12.7 mm, diameter 8.0 mm.
  Locality: TU 954. Moín Fm., lower Pleistocene.

3-6. *Calotrophon andrewsi* E. H. Vokes, n. sp. 110
  3. USNM 711111 (holotype); height 20.0 mm, diameter 11.4 mm.
  Locality: TU R-44. Recent.
  4. USNM 711112 (paratype A); height 19.0 mm, diameter 11.4 mm.
  Locality: 80 miles west of Marco, Florida, 28 fms. Recent.
  5. USNM 711113 (paratype B); height 17.6 mm, diameter 12.0 mm.
  Locality: TU R-44. Recent
  6. AMNH 183197 (paratype C); height 16.0 mm, diameter 10.0 mm.
  Locality: west of Shark River, Florida, 4 fms. Recent.

(All figures magnified X 3, except figs. 2c and 6c which are X 10)

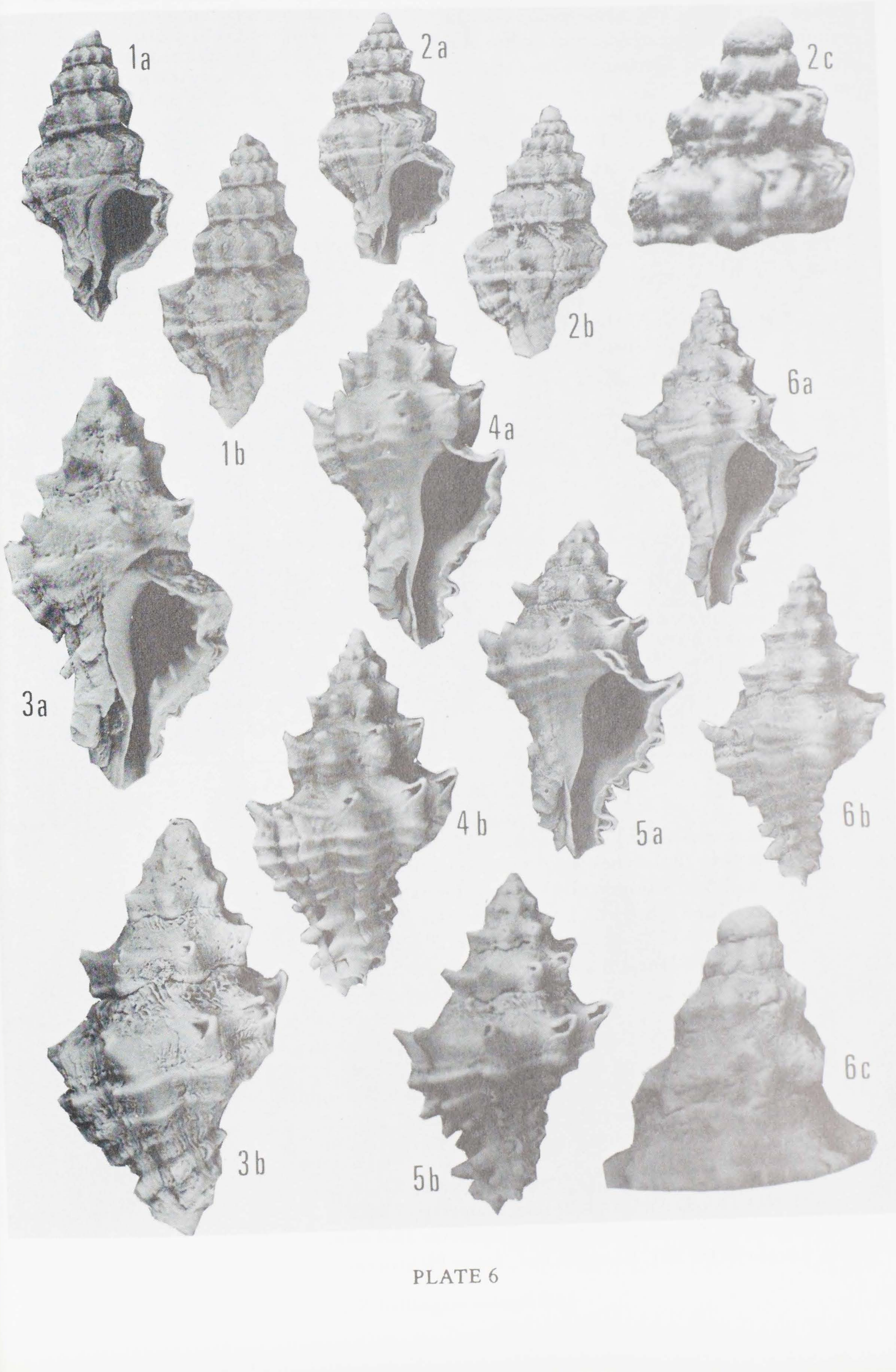


PLATE 6

inasmuch as there is certainly nothing to be gained by placing the name *philippiana* in synonymy and creating another for the form) the figured specimen is here selected as lectotype.

The range of *A. philippiana* seems confined to the southern Florida, northern Yucatán area. The range is essentially identical to that of *A. striata* and, in fact, the two forms have been taken together off Palm Beach County, Florida (see pl. 8, figs. 1-3, 14).

ATTILIOSA ALDRIDGEI

(Nowell-Usticke)

Plate 8, figs. 9-11

Vasum aldridgei NOWELL-USTICKE, 1969, Suppl. List New Shells St. Croix, p. 18, pl. 4, no. 834.
Attiliosa aldridgei (Nowell-Usticke). NOWELL-USTICKE, 1971, Suppl. Listing New Shells, Revised Edition, p. 11, pl. 2, no. 680.

Diagnosis: "A smallish, solid, pointed, whitish shell of about 7 whorls, with concavely sloping shoulders, and 6 or 7 strong, swollen rounded varical ribs on the body whorl. On the spire just above the suture, the top of each rib is ornamented with 2 short, raised, horizontal orange lines; on the body whorl, in addition to these 2 raised horizontal orange lines on the periphery, there are 2 more short horizontal lines below the middle, and a weak orange patch at the base.

"The body is covered with faint spiral ribbing. There is a smooth white callus on the parietal wall, with two weak columella folds low down. The mouth is smoothly rounded and has 6 teeth inside the outer lip. The siphonal canal is straight, and the base recurved." (Nowell-Usticke, 1971)

Dimensions of holotype: height 30 mm, diameter 20 mm (*fide* Nowell-Usticke).

Holotype: In collection of Mr. G. Nowell-Usticke, St. Croix, U.S. Virgin Islands.

Type locality: Rat Island, Antigua, B.W.I.

Occurrence: Recent only, western Atlantic, from Bahamas and Belice (British Honduras) to Lesser Antilles and Panamá.

Figured specimens: Fig. 9, AMNH 168901 (paratype); height 22.4 mm, diameter 14.0 mm; locality, same as holotype. Fig. 10, USNM 711114; height 10.4 mm, diameter 6.0 mm; locality TU R-98. Fig. 11, FSBC I 11237; height 28.8 mm, diameter 18.3 mm; locality, Andros Island, Bahamas, reef top.

Discussion: Attiliosa aldridgei is apparently not a rare shell, but because of the normal appearance, completely encrusted with coralline algae (see pl. 8, fig. 11), it is not well represented in collections. This protective camouflage serves a reef or coralline dwelling animal, such as this is, very well. From the material available it appears that the species is found throughout the tropical western Atlantic, exclusive of the Gulf of Mexico area. The known specimens are from Belice (ANSP 281825), Puerto Rico (AMNH

PLATE 7

Figures Page
1-9. *Attiliosa striata* (Gabb) 111
1. ANSP 3249 (holotype); height 12.3 mm, diameter 7.0 mm.
Locality: Santo Domingo. Unknown formation.
2. USNM 240681; height 23.7 mm, diameter 13.5 mm.
Locality: TU 727. Bermont Fm., lower Pleistocene.
3. USNM 240682; height 26.4 mm, diameter 15.7 mm.
Locality: TU 726. Caloosahatchee Fm., upper Pliocene.
4. USNM 240683; height 31.9 mm, diameter 18.0 mm.
Locality: TU 991. Caloosahatchee Fm., upper Pliocene.
5. USNM 240684; height 16.4 mm, diameter 9.4 mm.
Locality: TU 638. Agueguexquite Fm., middle Pliocene.
6. USNM 240685; height 30.7 mm, diameter 17.3 mm.
Locality: TU 759. Bermont Fm., lower Pleistocene.

7. USNM 240686; height 18.9 mm, diameter 11.0 mm.
8. USNM 240687; height 26.0 mm, diameter 17.1 mm.
9. USNM 240688; height 26.3 mm, diameter 15.4 mm.
Locality: TU 201. Bermont Fm., lower Pleistocene.

(All figures magnified X 2)

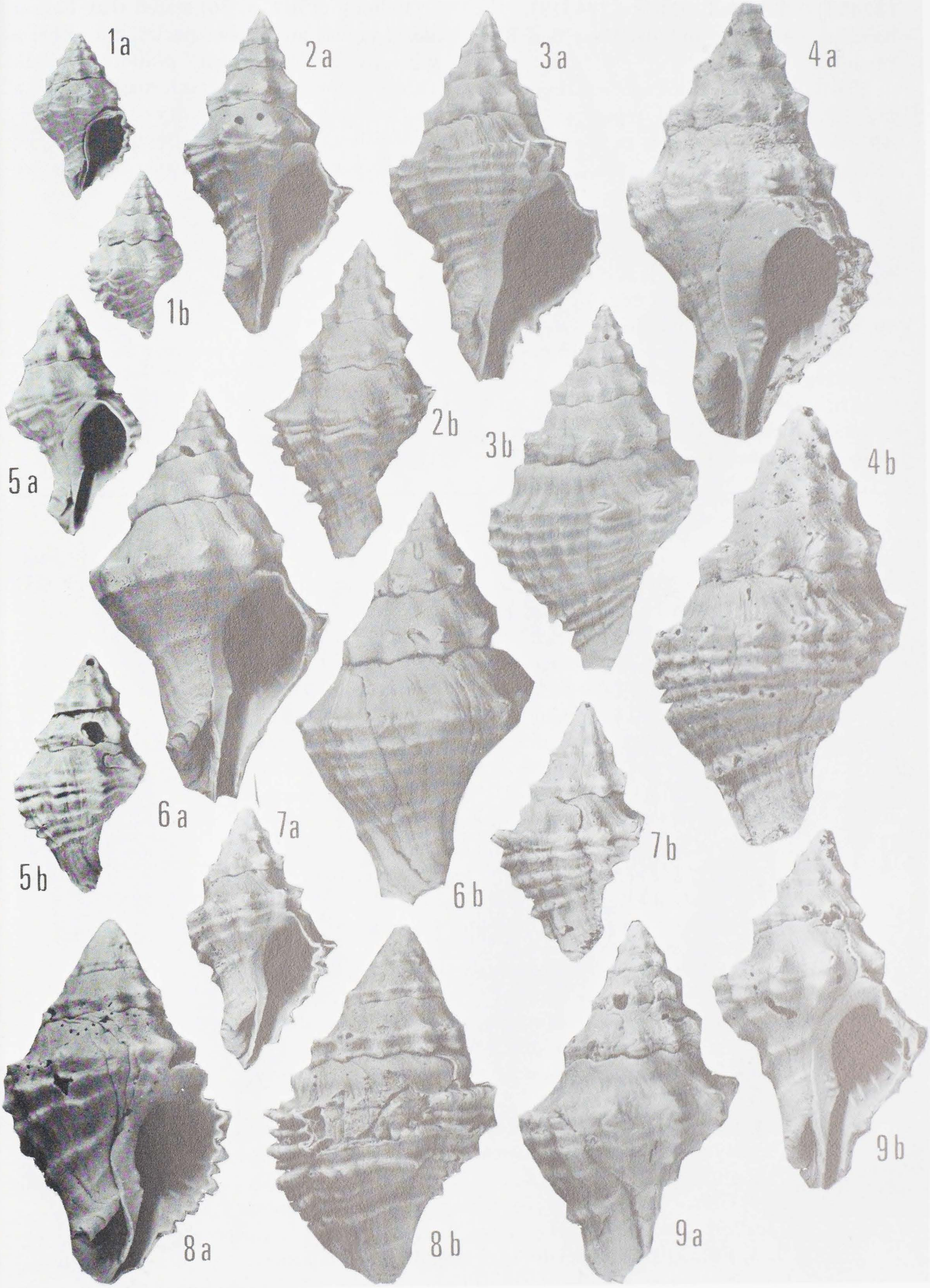


PLATE 7

182494), Trinidad (MCZ 274319), the Bahamas, Antigua, and off Cape San Blas, Panamá.

This is a heavy, robust species, larger than the other Atlantic living representatives of *Attiliosa.* It is comparable to the Pacific *A. incompta* (Berry), which is also commonly covered with lime (see Emerson, 1968, plate 53, figs. 4, 5). One of the most diagnostic features, and one of the few easily observed on the encrusted shells, is the two or three dark brown spots on the edge of the outer lip, which are a continuation of the orange spiral color bands on the outside. It may also be distinguished from other Recent species of *Attiliosa* by the relatively heavy spiral ornamentation, consisting of three strong cords and numerous finer threads.

Bullock (1969, p. 76) stated that *Vasum aldridgei* was not a new species, but rather a synonym of *"Muricopsis" philippiana* Dall. This opinion was, however, based upon a misconception of the identity of *A. philippiana* (Bullock, personal communication). The two forms have generic similarities but are by no means synonymous.

V. LOCALITY DATA

The following are Tulane University locality numbers:

60. Jackson Bluff Fm., borrow pits at Jackson Bluff, Ochlockonee River (NW ¼ Sec. 21, T1S, R4W), Leon Co., Florida.
72. Jackson Bluff Fm., Alum Bluff (upper beds), Apalachicola River (NE ¼ Sec. 24, T1N, R8W), Liberty Co., Florida.

PLATE 8

Figures Page

1-8. *Attiliosa striata* (Gabb) 111
   1. (X 2) AMNH 183200; height 14.6 mm, diameter 9.0 mm.
   2. (X 2) AMNH 183200; height 20.0 mm, diameter 12.5 mm.
   3. (X 2) AMNH 183200; height 17.4 mm, diameter 11.0 mm.
   Locality: Off Palm Beach Co., Florida; 17 fms. Recent.
   4. (X 2) FSBC I 11238; height 20.0 mm, diameter 12.5 mm.
   Locality: "Hourglass" Station C, off Tampa Bay, Florida; 20 fms. Recent.
   5. (X 2) AMNH 182709; height 23.6 mm, diameter 12.5 mm.
   Locality: southwest of Sanibel, Florida; 30 fms. Recent.
   6. (X 2) AMNH 183199; height 24.8 mm, diameter 13.2 mm.
   Locality: Off Briar Reef, Florida. Recent.
   7. (X 2) MCZ 258185; height 17.6 mm, diameter 10.0 mm.
   Locality: Windy Key, Florida. Recent.
   8. (X 3) USNM 34642 (as *Muricidea philippiana* Dall); height 17.0 mm. diameter 9.6 mm.
   Locality: Key West, Florida; on coral, low water. Recent.

9-11. *Attiliosa aldridgei* (Nowell-Usticke) 124
   9. (X 2) AMNH 168901 (paratype); height 22.4 mm, diameter 14.0 mm.
   Locality: Rat Island, Antigua, B.W.I. Recent.
   10. (X 4) USNM 711114; height 10.6 mm, diameter 6.0 mm.
   Locality: TU R-98. Recent.
   11. (X 1¼) FSBC I 11237; height 28.7 mm, diameter 18.2 mm.
   Locality: Andros Island, Bahamas; on coral, low water. Recent.

12-14. *Attiliosa philippiana* (Dall) 120
   12. (X 3) USNM 93337 (lectotype); height 14.9 mm, diameter 8.8 mm.
   Locality: Cabo Catoche, Quintana Roo, Mexico; 25 fms. Recent.
   13. (X 3) FSBC I 11242; height 14.4 mm, diameter 8.0 mm.
   Locality: about 35 miles north of Cabo Catoche, Mexico; 20 fms. Recent.
   14. (X 2) AMNH 183198; height 17.0 mm, diameter 10.0 mm.
   Locality: same as figs. 1-3.

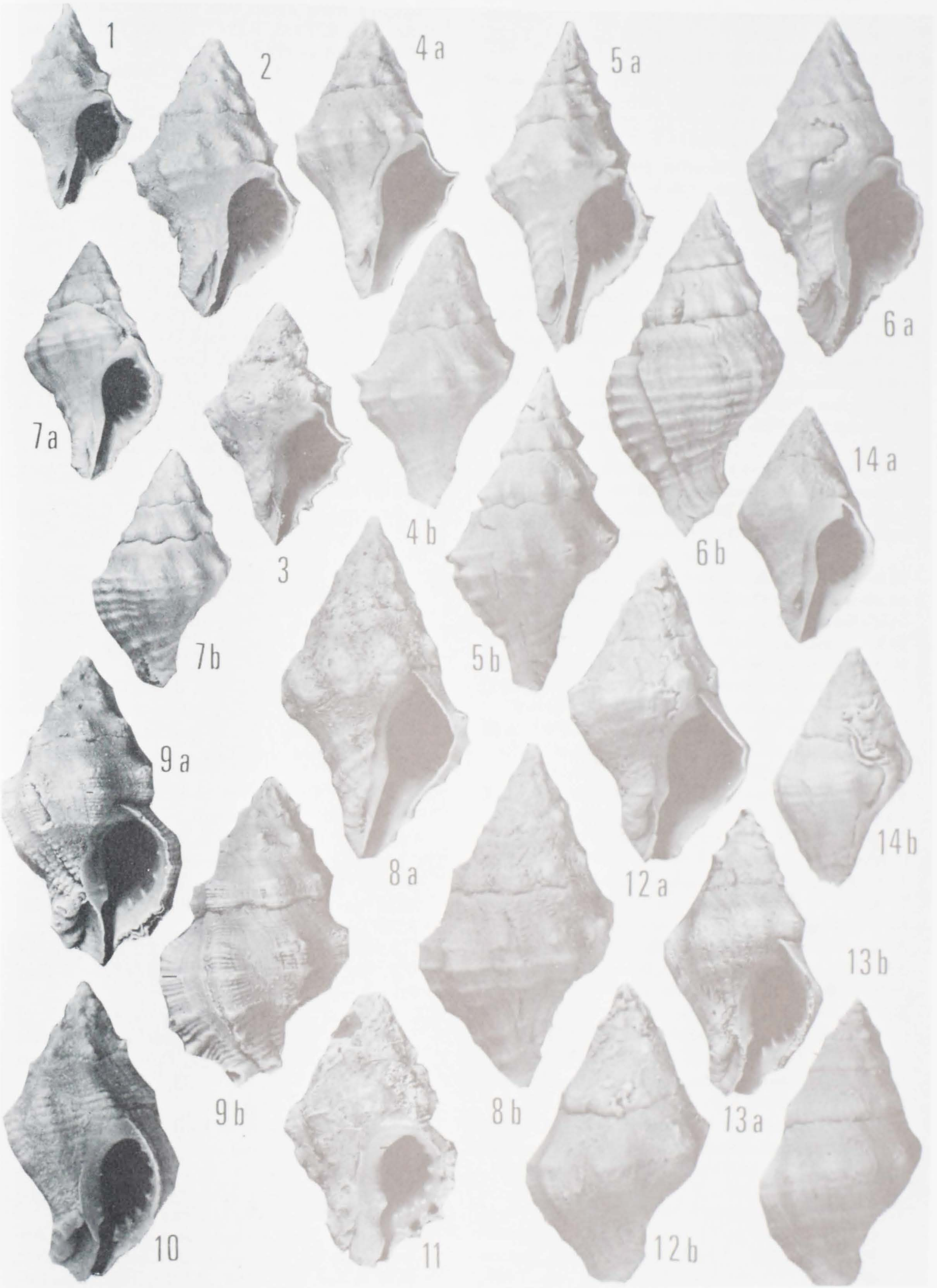


PLATE 8

79. Caloosahatchee Fm. and Bermont Fm. mixed, spoil banks north and south side of Caloosahatchee River, at Ortona Lock (Sec. 27, T42S, R30E), Glades Co., Florida.

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.

200. Pinecrest Beds, borrow pits about one mile southwest of Acline (Sec. 29, T41S, R23E), Charlotte Co., Florida.

201. Bermont Fm., spoil banks at pit just south of Belle Glade (at Belle Glade Camp), Palm Beach Co., Florida.

202. Caloosahatchee Fm., south bank of Caloosahatchee River, about two miles west of La Belle (SE ¼ Sec. 12, T43S, R28E), Hendry Co., Florida.

203. Caloosahatchee Fm., north bank of Caloosahatchee River, about two miles east of Fort Denaud (SW ¼ Sec. 11, T43S, R28E), Hendry Co., Florida.

283. Pinecrest Beds and Bermont Fm. mixed, spoil banks on cross-canal 1.3 miles southwest of Port Charlotte Railroad Station (formerly Murdock), on Florida Highway 771 (Sec. 12, T40S, R21E), Charlotte Co., Florida.

458. Chipola Fm., east bank of Chipola River, above Farley Creek (SW ¼ Sec. 20, T1N, R9W), Calhoun Co., Florida.

519. Caloosahatchee Fm., Harney Pond Canal spoil banks, at Florida Highway 78, northwest side of Lake Okeechobee (NW ¼ Sec. 18, T40S, R33E), Glades Co., Florida.

520. Pinecrest Beds, spoil banks, canal 0.9 mile east of Brighton on Florida Highway 70 (Sec. 25, T37S, R32E), Highlands Co., Florida.

522. Pinecrest Beds, Harney Pond Canal spoil banks, three miles northwest of Florida Highway 78 (NE ¼ Sec. 36, T39S, R32E), Glades Co., Florida.

523. Pinecrest Beds, Harney Pond Canal spoil banks, six miles northwest of Florida Highway 78, Brighton Indian Reservation (NW ¼ Sec. 22, T39S, R32E), Glades Co., Florida.

525. Pinecrest Beds, U.S. Highway 41, at "Forty-mile Bend," Dade Co., Florida.

527. Caloosahatchee Fm., north shore Lake Okeechobee, Pumping Station no. 127 (NE ¼ Sec. 35, T39S, R33E), Glades Co., Florida.

529a. Fort Thompson Fm., same as TU 529b, but stratigraphically higher.

529b. Caloosahatchee Fm., north bank of Caloosahatchee River, about two miles west of La Belle (SE ¼ Sec. 12, T43S, R28E), Hendry Co., Florida.

532. Pinecrest Beds, spoil banks 1¾ miles south of Florida Highway 771, on canal 1.3 miles southwest of Port Charlotte Railroad Station (formerly Murdock) (SE ¼ Sec. 24, T40S, R21E), Charlotte Co., Florida.

536. Caloosahatchee Fm., south bank of Caloosahatchee River about one mile east of La Belle (Sec. 3 & 4, T43S, R29E), Hendry Co., Florida. (Designated as type locality of the Caloosahatchee Formation by Olsson *in* Olsson and Petit, 1964, p. 519.)

539a. Bermont Fm., Shell Creek (upper beds), about eight miles east of Cleveland (Sec. 30, T40S, R25E), Charlotte Co., Florida. (Designated as type locality of the Bermont Formation by DuBar, 1974, p. 221.)

539b. Caloosahatchee Fm., Shell Creek (lower beds), about eight miles east of Cleveland (Sec. 30, T40S, R52E), Charlotte Co., Florida.

540. Pinecrest Beds, Miami Canal spoil banks, one to three miles south of pumping station at Palm Beach county line, Broward Co., Florida.

546. Chipola Fm., Ten Mile Creek, about 1¾ miles west of Chipola River (NE ¼ Sec. 12, T1N, R10W), Calhoun Co., Florida (= USGS 2212, "one mile west of Bailey's Ferry").

579. Caloosahatchee Fm., Miami Canal spoil banks, four miles north of pumping station at Broward county line, Palm Beach Co., Florida.

580. Bermont Fm., North New River Canal spoil banks, one mile south of South Bay, Palm Beach Co., Florida.

582. Bermont Fm., "Rim Ditch" spoil banks, just north of Florida-East Coast Railroad crossing (Sec. 29, T36S, R39E), St. Lucie Co., Florida.

583. Caloosahatchee Fm., Miami Canal spoil banks, seven miles north of pumping station at Broward county line, Palm Beach Co., Florida.

638. Agueguexquite Fm., roadcut and quarry on Mexico Highway 180, 14 miles east of junction with side road into Coatzacoalcos, Veracruz, Mexico.

725. Bermont Fm., North New River Canal spoil banks, three miles south of South Bay, at Okeelanta, Palm Beach Co., Florida.

726. Caloosahatchee Fm., Hendry County rock pit, ½ mile north of Florida Highway 80, three miles west of La Belle (SE ¼ Sec. 14, T43S, R28E), Hendry Co., Florida.

727. Bermont Fm., borrow pits 2.2 miles east of U.S. Highway 27, 15 miles south of South Bay, Palm Beach Co., Florida.

728. Pinecrest Beds, spoil banks on west side of Kissimmee Canal and east side of Kissimmee River, just across from U.S. Corps of Engineers Structure 65-D (Sec. 33, T36S, R33E), Okeechobee Co., Florida.

729. Pinecrest Beds, spoil banks on west side of Kissimmee Canal and east side of Kissimmee River, approximately ½ mile south of U.S. Corps of Engineers Structure 65-D (S ½ Sec. 33, T36S, R33E), Okeechobee Co., Florida.

730. Pinecrest Beds, embankment of Seaboard Airline Railroad, just west of Kissimmee River, (NW ¼ Sec. 20, T36S, R33E), Highlands Co., Florida.

731. Bermont Fm., West Palm Beach Canal spoil banks, at Twenty Mile Bend Recreation area just east of junction of U.S. Highways 441 and 98, Palm Beach Co., Florida.

733. Bermont Fm., North New River Canal spoil banks, one mile north of Florida Highway 80, at South Bay, Palm Beach Co., Florida.

736. Pinecrest Beds and Caloosahatchee Fm. mixed, spoil banks on south side of Florida Highway 70 and east side of Kissimmee River, Okeechobee Co., Florida.

740. Pinecrest Beds, levee fill, L-28, 3.6 miles west and 2.6 miles south of pumping station on Miami Canal at Broward-Palm Beach county line, Broward Co., Florida.

745. Caloosahatchee Fm., Miami Canal spoil banks, 10.8 miles north of pumping station at Broward county line, Palm Beach Co., Florida.

746. Bermont Fm., North New River Canal spoil banks, 5.3 miles north of pumping station at Broward county line on U.S. Highway 27, Palm Beach Co., Florida.

747. Bermont Fm., North New River Canal spoil banks, two miles south of South Bay, Palm Beach Co., Florida.

750. Bermont Fm., spoil banks cross-canal 3.1 miles south of Lake Harbor on Miami Canal, Palm Beach Co., Florida.

752. Pinecrest Beds, spoil banks on south side of Canal 41-C ("Slough Ditch") at crossing of country road, 4.3 miles east of Brighton and 1.4 miles south of Florida Highway 70 (SE ¼ Sec. 33, T37S, R33E), Highlands Co., Florida.

754. Bermont Fm., south bank of Indian Prairie Canal, at west side of crossing of Florida Highway 721 (SW ¼ Sec. 14, T38S, R32E), 3.8 miles south of Brighton, Highlands Co., Florida.

755. Caloosahatchee Fm., Miami Canal spoil banks, 17.4 miles north of pumping station at Broward county line, Palm Beach Co., Florida.

759. Bermont Fm., spoil banks north side of Caloosahatchee River, two miles west of Ortona Lock (NE ¼ Sec. 29, T42S, R30E), Glades Co., Florida.

767. Caloosahatchee Fm. and Bermont Fm. mixed, spoil banks north side of Caloosahatchee River, five miles west of Ortona Lock (NW ¼ Sec. 36, T42S, R29E), Glades Co., Florida.

768. Caloosahatchee Fm. and Bermont Fm. mixed, spoil banks north side of Caloosahatchee River, 5½ miles west of Ortona Lock (NW ¼ Sec. 35, T42S, R29E), Glades Co., Florida.

769. Pinecrest Beds, spoil banks east side of Kissimmee River, 1½ to two miles south of U.S. Corps of Engineers Structure 65-D (NE ¼ Sec. 35, T36S, R33E), Okeechobee Co., Florida.

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.

777. Anastasia Fm., pits on north side of Florida Highway 710, two miles west of Florida's Turnpike overpass, Palm Beach Co., Florida.

788. Pinecrest Beds and Bermont Fm. mixed, Port Charlotte Development, spoil banks at U-shaped canal on north side of Florida Highway 771, 3.4 miles southwest of U.S. Highway 41 (Sec. 15, T40S, R21E), Charlotte Co., Florida.

790. Ft. Thompson Fm., banks of Florida Cross-State Barge Canal, just south of Inglis, 1.5 miles west of U.S. Highway 19, Citrus Co., Florida.

792. Caloosahatchee Fm., borrow pits just west of Florida Highway 80, about two miles southwest of La Belle (SW ¼ Sec. 7, T43S, R29E), Hendry Co., Florida.

793. Bermont Fm., borrow pits just east of Florida Highway 80, 2½ miles southwest of La Belle (NW ¼ Sec. 18, T43S, R29E), Hendry Co., Florida.

796. Pinecrest Beds, material exposed during construction of "Alligator Alley," 12.8 miles east of Florida Highway 29 (T49S, R32E), Collier Co., Florida.

797. Pinecrest Beds, material exposed during construction of "Alligator Alley," 13.3 miles east of Florida Highway 29 (T49S, R32E), Collier Co., Florida.

803. Bermont Fm., spoil banks south side of Caloosahatchee River, two miles west of Ortona Lock (NE ¼ Sec. 29, T42S, R30E), Glades Co., Florida.

808. Bermont Fm., spoil banks west side of Florida Highway 29, 3.3 miles north of Felda and 16.7 miles south of La Belle, Hendry Co., Florida.

815. Bermont Fm., pits ¾ mile northwest of Ruskin (NW ¼ Sec. 6, T32S, R19E), Hillsborough Co., Florida.

816. Caloosahatchee Fm. and Bermont Fm. mixed, borrow pits, Cecil M. Webb Wildlife Management Area, 1.8 miles east of U.S. Highway 41 and 7.2 miles north of the Lee county line, Charlotte Co., Florida.

870. Waccamaw Fm., pits on east side of North Carolina Highway 130, 2.8 miles north of Old Dock School, Old Dock, Columbus Co., North Carolina.

932. Pinecrest Beds, east side of Kissimmee Canal and ½ mile south of Seaboard Airline Railroad, south of Fort Basinger (SE ¼ Sec. 20, R36S, R33E), Okeechobee Co., Florida.

933. Pinecrest Beds, material exposed during construction of "Alligator Alley," 21.5 miles east of Florida Highway 29, Collier Co., Florida.

936. Anastasia Fm., ditches beside Florida's Turnpike, ten miles north of Ft. Pierce Interchange, St. Lucie 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.

973. Bermont Fm., spoil banks on canal L-38W, 0.8 mile south of Terrytown (which is at Broward-Palm Beach county line), on U.S. Highway 27, Broward Co., Florida.

977. Unnamed post-Pleistocene formation, mudlump no. 90, mouth of South Pass, Mississippi River delta, Plaquemines Parish, Louisiana.

978. Bermont Fm., spoil banks at pit on south side of waterworks, about 1½ miles northeast of South Bay, Palm Beach Co., Florida.

981. Pinecrest Beds, Port Charlotte Development, spoil banks on south side of U.S. Highway 41, on canal 3.3 miles northwest of Florida Highway 771 (Sec. 3, T40S, R21E), Charlotte Co., Florida.

982. Pinecrest Beds, Port Charlotte Development, spoil banks on northwest side of Florida Highway 771, on canal 3½ miles southwest of junction with U.S. Highway 41 (Sec. 15, T40S, R21E), Charlotte Co., Florida.

985. Pinecrest Beds, Port Charlotte Development, spoil banks about ½ mile northeast of Florida Highway 771, on U-shaped canal 3.3 miles southwest of junction of U.S. Highway 41 (Sec. 10, T40S, R21E), Charlotte Co., Florida.

987. Bermont Fm., spoil banks south side West Palm Beach Canal, at Loxahatchee, on U.S. Highway 98, Palm Beach Co., Florida.

988. Bermont Fm., spoil banks, West Palm Beach Canal at Twenty Mile Bend Recreation Area, about one mile east of junction of U.S. Highway 98 and 441, Palm Beach Co., Florida.

989. Anastasia Fm., Palm Beach county rock pit, Forest Hill Blvd., just east of overpass of Florida's Turnpike, nine miles west of U.S. Highway 1, West Palm Beach, Palm Beach Co., Florida.

990. Anastasia Fm., Powell rock pit, west of Florida Highway 7, between Lake Worth and Lantana, Palm Beach Co., Florida.

991. Caloosahatchee Fm., Cochran rock pit, 2½ miles west of La Belle, on north side of Florida Highway 80, Hendry Co., Florida.

1000. Pinecrest Beds, borrow pit at east end of 17th Street (T36S, R19E), about 8 miles east of U.S. Highway 30 at Sarasota, Sarasota Co., Florida.

1044. Pinecrest Beds, spoil banks, west side of L-28 Interceptor Canal, 3½ miles north of junction with Hendry County Highway 833, north side of Big Cypress Indian Reservation (T47S, R33E), Hendry Co., Florida.

1177. Caloosahatchee Fm., Mule Pen Quarry, north of Florida Highway 846, 9.1 miles east of U.S. Highway 41 at Naples Park (SE ¼ Sec. 24, T48S, R26E), Collier Co., Florida.

The following are Tulane University Recent locality numbers:

R-9. Dredged in 3 to 5 fms. off Longboat Key, Sarasota, Sarasota Co., Florida.

R-17. Southern end of Sunshine Skyway, Tampa Bay, south of St. Petersburg, Manatee Co., Florida.

R-20. Sanibel Island, Lee Co., Florida.

R-44. Isla Mujeres, open ocean side, Quintana Roo, Mexico.

R-46. Puerto Juarez, Quintana Roo, Mexico.

R-98. *Anton Bruun* Cruise 10, dredged in 22 fms., NW of Holandes Cay and ENE of Cape San Blas, Panamá; 9°37'N, 78°50.3'W.

R-105. *Hernan Cortez* Cruise 17, dredged in 18 fms. off Highland Point, 25°33'N, 81°23'W, Monroe Co., Florida.

R-164. Isla Contoy (second island north of Isla Mujeres), Quintana Roo, Mexico.

R-271. Isla Mujeres, northwestern corner of the island, on the sheltered (lagoon) side, Quintana Roo, Mexico.

R-220. Tarpon Bay, in very shallow water, Sanibel Island, Lee Co., Florida.

R-279. Sand bar in front of San Felipe, Yucatán, Mexico.

R-304. Cabo Catoche, about 35 kms east of village of Holbox, Isla Holbox, Quintana Roo, Mexico.

R-306. Playa Sombreron (local name only), rocky beach between two headlands, 22 kms south of Campeche (city), Campeche (state), Mexico.

R-350. Punta Checuzum, north coast of Yucatán, about one-half way between Punta Yalkubul and San Felipe, Yucatán, Mexico.

R-351. Isla El Cerrito, small rocky island with mangroves, about 5 kms west of San Felipe, Yucatán, Mexico.

R-352. Paso del Cerro, rocky point with mangroves, on mainland behind Isla El Cerrito, about 5 kms west of San Felipe, Yucatán, Mexico.

R-353. Yucum Balam, sandy beach with mangroves, about 25 kms north of Campeche (city), Campeche (state), Mexico.

R-354. Rubbly beach at Rancho Niop, 10 kms north of bridge at Champoton, Campeche, Mexico.

VI. LITERATURE CITED

AKERS, W. H., 1972, Planktonic foraminifera and biostratigraphy of some Neogene formations, northern Florida and Atlantic Coastal Plain: Tulane Stud. Geol. Paleont., v. 9, p. 1-139, pls. 1-60, 4 figures, 1 map.

AKERS, W. H., 1974, Age of Pinecrest Beds, south Florida: Tulane Stud. Geol. Paleont., v. 11, no. 2, p. 119-120, 1 figure.

AKERS, W. H., and P. E. KOEPPEL, 1973, Age of some Neogene formations, Atlantic Coastal Plain, United States and Mexico *in* G.C.A.G.S. Symposium Calcareous Nannofossils, Proc., L. A. SMITH and JAN HARDENBOL, editors, p. 82-93, pls. 1-4.

BAKER, F. C., 1891, Notes on a collection of shells from southern Mexico: Acad. Nat. Sci. Phila., Proc., v. 43, p. 45-55.

BAYER, F.M., 1971, New and unusual mollusks collected by R/V *John Elliott Pillsbury* and R/V *Gerda* in the tropical western Atlantic: Bull. Marine Sci., v. 21, no. 1, p. 111-236, figs. 1-72.

BERRY, S. S., 1964, Notices of new eastern Pacific Mollusca – VIII: Leaflets in Malacology, v. 1, no. 26, p. 159-166.

BUCQUOY, M. E. J., PHILIPPE DAUTZENBERG, and G. F. DOLLFUS, 1882-1886, Les Mollusques marins du Roussillon, v. I–Gasteropodes. Paris. 570 p. (p. 1-84 publ. 1882), 66 pls.

BULLOCK, R. C., 1969, Review – Nowell-Usticke, G.W. 1969, A supplementary listing of new shells: Nautilus, v. 83, p. 76-77.

CARLTON, J. M., 1974, Land-building and stabilization by mangroves: Environmental Conservation, v. 1, no. 4, p. 285-294, 7 text figures.

DALL, W. H., 1884, On a collection of shells sent from Florida by Mr. Henry Hemphill: U.S. Natl. Mus., Proc., v. 6, no. 384, p. 318-342, pl. 10.

DALL, W. H., 1889, Report on the Mollusca (Blake Expedition); Part II, Gastropoda: Harvard Mus. Comp. Zool., Bull. 18, Report 29, 492 p., 31 pls.

DALL, W. H., 1890, Contributions to the Tertiary fauna of Florida: Wagner Free Inst. Sci., Trans., v. 3, pt. 1, p. 1-200, pls. 1-12.

DALL, W. H., 1892, Contributions to the Tertiary fauna of Florida: Wagner Free Inst. Sci., Trans., v. 3, pt. 2, p. 201-473, pls. 13-22, 1 map.

DALL, W. H., 1902, Illustrations and descriptions of new, unfigured, or imperfectly known shells, chiefly American, in the U.S. National Museum: U.S. Natl. Mus., Proc., v. 24, no. 1264, p. 499-566, pls. 27-40.

DUBAR, J. R., 1974, Summary of the Neogene Stratigraphy of southern Florida *in* Post-Miocene Stratigraphy central and southern Atlantic Coastal Plain, R. J. OAKS, JR. and J. R. DUBAR, editors, Utah State University Press, p. 206-231, figs. 1-5, tables 1-7.

EMERSON, W. K., 1968, Taxonomic placement of *Coralliophila incompta* Berry, 1960, with the proposal of a new genus, *Attiliosa* (Gastropoda: Muricacea): Veliger, v. 10, no. 4, p. 379-381, pl. 53, text-figs. 1-5.

GABB, W. M., 1873, On the topography and geology of Santo Domingo: Amer. Phil. Soc., Trans., (N.S.) v. 15, p. 49-259, 2 maps.

GARDNER, JULIA, 1947, The molluscan fauna of the Alum Bluff Group of Florida, Part 8: U.S. Geol. Surv. Prof. Paper 142-H, p. 493-656, pls. 52-62.

HERTLEIN, L. G., and A. M. STRONG, 1951, Eastern Pacific expeditions of the New York Zoological Society. XLIII. Mollusks from the west coast of Mexico and Central America. Part X: Zoologica, v. 36, pt. 5, p. 67-120, pls. 1-11.

JAUME, M.L., 1946, Moluscos marinos litorales del Cabo Catoche, Yucatán, Mexico: Soc. Malac. Habana, Revista, v. 4, no. 3, p. 95-110, 1 map.

JOUSSEAUME, FELIX, 1880, Division méthodique de la famille des purpuridés: Le Naturaliste, Annee 2, no. 42, p. 335-336.

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, Marine mollusks from Baja California to Peru. Second Edition. Stanford, California. i-xiv, 1-1064 p., 22 color plates, ca. 4000 figures, 6 maps.

MANSFIELD, W. C., 1930, Miocene gastropods and scaphopods of the Choctawhatchee Formation of Florida: Florida Geol. Surv., Bull. 3, 189 p., 21 pls.

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; Pt. 2: Stratigraphy: *ibid.*, v. 5, no. 30, p. 416-460, pls. 66-68, correlation chart.

MAURY, C. J., 1922, Recent Mollusca of the Gulf of Mexico and Pleistocene and Pliocene species from the Gulf States. Pt. 2. Scaphopoda, Gastropoda, Amphineura and Cephalopoda: Bulls. Amer. Paleontology, v. 9, no. 38, p. 33-173.

MCLEAN, J. H., and W. K. EMERSON, 1970, *Calotrophon,* a New World muricid genus (Gastropoda:Muricacea): Veliger, v. 13, no. 1, p. 57-62, 1 pl., 17 text figs.

OLSSON, A. A., and ANNE HARBISON, 1953, Pliocene Mollusca of southern Florida, with special reference to those from North Saint Petersburg: Acad. Nat. Sci. Phila., Monograph 8, 457 p., 65 pls.

OLSSON, A. A., and R. E. PETIT, 1964, Some Neogene Mollusca from Florida and the Carolinas: Bulls. Amer. Paleontology, v. 47, no. 217, p. 509-574, pls. 77-83.

RADWIN, G.E., and H. W. WELLS, 1968, Comparative radular morphology and feeding habits of muricid gastropods from the Gulf of Mexico: Bull. Marine Sci., v. 18, p. 72-85, 19 text figs., 2 tables.

REHDER, H. A., 1946, Notes on some groups in the Muricidae of the west Atlantic, with description of a new subgenus: Nautilus, v. 59, p. 142-143.

SWAINSON, WILLIAM, 1840, A treatise on malacology. London. 419 p., 130 figs.

VOKES, E. H., 1966, Observations on *Turbinella:* Tulane Stud. Geol., v. 4, no. 2, p. 63-71, 2 pls.

VOKES, E. H., 1970, Cenozoic Muricidae of the western Atlantic region. Part V–*Pterynotus* and *Poirieria:* Tulane Stud. Geol. Paleont., v. 8, no. 1, p. 1-50, pls. 1-7, 1 text fig.

VOKES, E. H., 1971, Catalogue of the genus *Murex* Linné (Mollusca:Gastropoda); Muricinae, Ocenebrinae: Bulls. Amer. Paleontology, v. 61, no. 268, p. 1-141.

VOKES, E. H., 1975, Cenozoic Muricinae of the western Atlantic region. Part VI–*Aspella* and *Dermomurex:* Tulane Stud. Geol. Paleont., v. 11, no. 3, p. 121-162, pls. 1-6, 2 tables, 1 text fig.

WEISBORD, N. E., 1926, Notes on marine mollusks from the Yucatán Peninsula, Mexico: Nautilus, v. 39, p. 81-87.

WOODRING, W. P., 1959, Geology and Paleontology of Canal Zone and adjoining parts of Panama; Description of Tertiary mollusks (Gastropods:Vermetidae to Thaididae): U.S. Geol. Surv. Prof. Paper 306-B, p. 147-239, pls. 24-38.

REVIEWS

CONTRIBUTIONS TO THE HISTORY OF GEOLOGY, edited by George W. White, a series of classical works in geology, reprinted in facsimile with introductory biographical and bibliographical commentaries by the editor and other distinguished students of the history of geology, These volumes are handsomely and skillfully reproduced and were carefully selected to make essential but almost unobtainable titles available to students and historians at relatively modest cost. Published by Hafner Publishing Company, Inc., New York.

7. AN ESSAY ABOUT THE ORIGINE AND VIRTUES OF GEMS, by Robert Boyle: facsimile of the 1672 edition, with an introduction by A. F. Hagner and a foreword by George W. White. New York, 1972, xliv +185 pp., $14.95

This edition of Boyle's masterful work on minerals and crystal chemistry was published on the three hundredth anniversary of the original edition, a most fitting way to celebrate this event, which marked the very beginning of chemical mineralogy and founded geochemistry. From his experiments in the laboratory, his observations in the field, and the study of his specimens, Robert Boyle reasoned by analogy and derived his recognition of the relationship of crystal form and structure to the chemical constituents of minerals. He observed the thin plates which formed and stacked one upon another to produce large, thick crystals in the laboratory and compared these with the similar features of natural crystals. He grew crystals from solutions and concluded that transparent gemstones have a similar origin and structure, stating that it is unlikely "that bodies that were never fluid should have the arrangement of their constituent parts, that is requisite to transparency," and noted that the interior "grain" of certain gems and other minerals is visible, and that muscovite and diamond are easily cleaved along the visible plates and along this "grain". In this work he gives a chemical explanation of the supposed mystical or medicinal effects, or "virtues", of gemstones. He explains the petrification of fossils as a replacement process, much as we understand it today. This work by Boyle is clearly one of the true foundation stones of modern geology.

(continued on page 136)