TULANE STUDIES IN GEOLOGY AND PALEONTOLOGY

Volume 22, Number 4 December 28, 1989

MURICIDAE (MOLLUSCA:GASTROPODA) OF THE ANGOSTURA FORMATION, NORTHWESTERN ECUADOR

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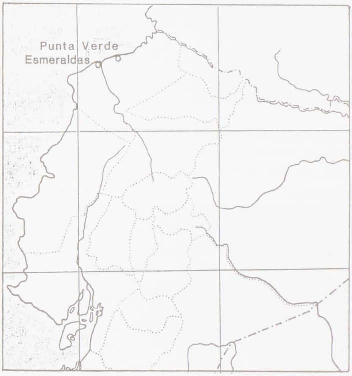
CONTENTS

I. ABSTRACT

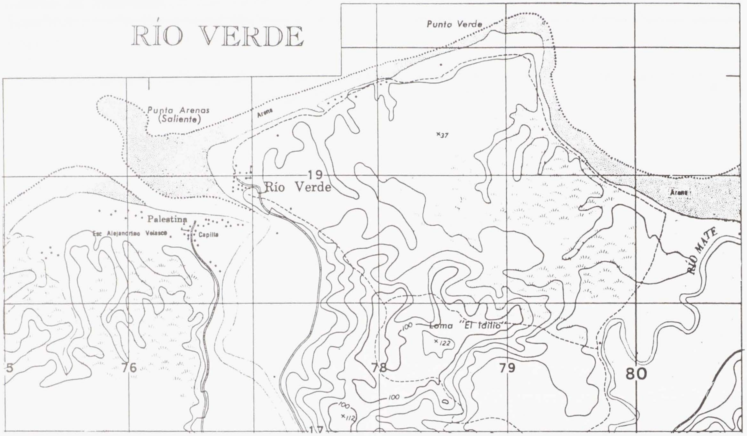
The muricid fauna of the Late Miocene Angostura Formation, northwestern Ecuador, includes two species previously known from the Gatun Formation of Panama, the Esmeraldas Beds of Ecuador, and other localities in the Caribbean Tertiary. There are also two new species described herein. One, *Eupleura olssoni,* is most closely related to an unnamed Gatun species; the second, *Ceratostoma (Microrhytis) ecuadorium,* is most closely related to *C. (M.) pecki* (Emerson), described from the Atlantic side of the Isthmus of Tehuantepec, Mexico. Thus, the muricid fauna has a closer affinity with the Tertiary beds of the western Atlantic than with the Recent fauna of the eastern Pacific.



Text-figure 1. Map of northwestern Ecuador, showing study area.

II. INTRODUCTION

Olsson (1964, p. 8) noted that the Miocene section along the Río Santiago, in northwestern Ecuador, begins with the Angostura Formation, stating: "The lowest part of the Miocene sequence is formed by the Angostura formation, named from the Angostura gorge, and consists predominantly of coarse sandstones and beds of conglomerates, about 150 meters in thickness." He added that, although the Angostura beds are largely barren, in places there are lenses of finely preserved fossils, the principal localities in the area being the so-called "Cueva de Angostura," on the Río Santiago, and Telembi, an Indian village on the Río Cayapas, which parallels the Río Santiago to the west. An attempt by the author to re-collect these two



Text-figure 2. Map of Río Verde area, Province of Esmeraldas, Ecuador.

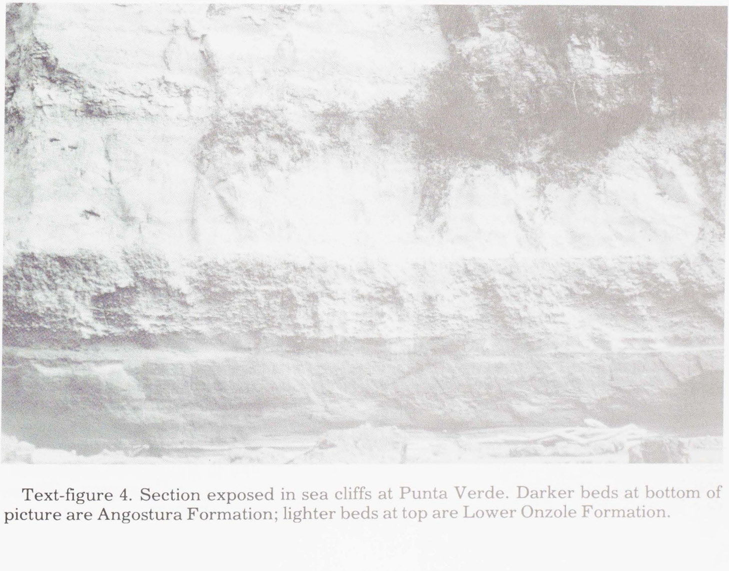
localities was foiled by the caprices of nature – water too low on the Río Santiago, and, at the same time, too high on the Río Cayapas.

Fortunately, there is another excellent section of the Angostura Formation exposed along the coast east of Río Verde, a fishing village at the mouth of the Río Verde, about 30 km east of the city of Esmeraldas (see text-figs. 1, 2). There a magnificent section is exposed (text-figs. 3, 4), which, according to Whittaker (1988, p. 10), consists of the Middle Miocene Viche Formation (planctic foraminiferal zone N 12) at the base and the Late Miocene Lower Onzole Formation (N 16) at the top, with the Angostura Formation in between (text-fig. 5). Whittaker describes the Angostura Formation at this location as resting "with a sharp conformable contact on the Viche mudstones," but the contact is markedly eroded (text-figs. 6, 7) and is better classified as disconformable.

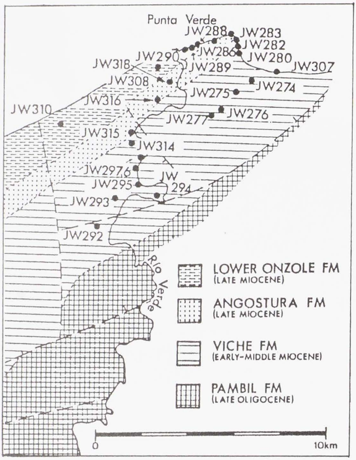
The age of the Angostura Formation is uncertain, as there are no diagnostic planktic foraminifera in these shallow-water beds. However, as the beds of the Lower Onzole Formation, resting immediately above the Angostura at Punta Verde, are dated as latest Miocene (Whittaker, 1988, p. 11), the assumption is that the Angostura Formation is probably Late Miocene in age. If this is the case, then the unit may be slightly older than the Gatun Formation of Panama, with which it was correlated by Olsson (1964, p. 8). This is reflected in the molluscan fauna, which, as Olsson noted, is closely related to the Gatun and "many Angostura species described as new differ from related Gatun species only in small particulars."

The reason why the Angostura fauna has such a strong resemblance to that of the Gatun is more a matter of facies than time. The two formations are identical in facies, both being shallow-water, near-shore units. Many of the species, at first glance, seem to be the same as those in the Gatun but, upon closer examination, prove to be, as Olsson noted, slightly different, which should make evolutionary gradualists very happy. Of the four muricid species treated herein, Olsson had two from the Angostura beds at Cueva de Angostura and Telembi: *Haustellum polynematicus* (Brown and Pilsbry), which also occurs in the Gatun Formation, the Esmeraldas beds, and unnamed beds in southern Colombia (see Vokes, 1988, p. 17); and *Eupleura olssoni*, n. sp., which is

Text-figure 3. Sea cliffs, exposed along coast at Punta Verde, Province of Esmeraldas, Ecuador.



Text-figure 4. Section exposed in sea cliffs at Punta Verde. Darker beds at bottom of picture are Angostura Formation; lighter beds at top are Lower Onzole Formation.



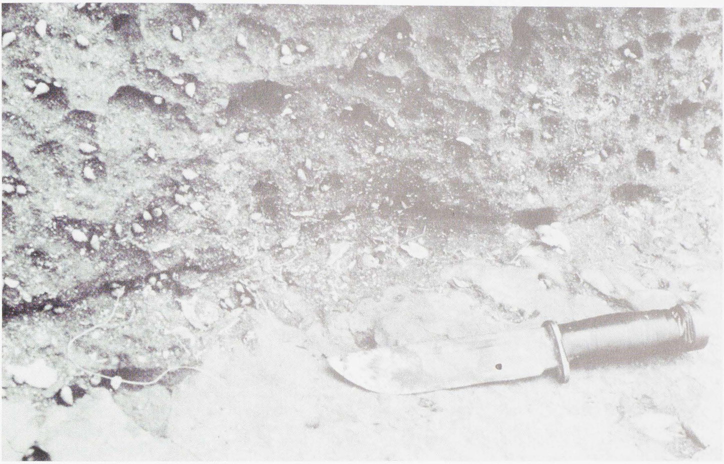
Text-figure 5. Geologic map of Río Verde area (from Whittaker, 1988, figure 2; numbers are his collecting sites). Our locality is approximately the same as JW 288.

related to another Gatun species (not *E. thompsoni* Woodring, as indicated by Olsson). He also listed *Typhis alatus* Sowerby from the Picaderos [= Onzole] Formation, which overlies the Angostura on the Río Santiago. This long-ranging latter species occurs throughout the Caribbean from the Middle Miocene of the Dominican Republic to the Early Pliocene Gatun Formation. The only other muricid species, described herein as *Ceratostoma (Microrhytis) ecuadorium*, is most closely related to *C. (M.) pecki* (Emerson), described from Middle Miocene (N 13-14) beds in the Isthmus of Tehuantepec, Mexico.

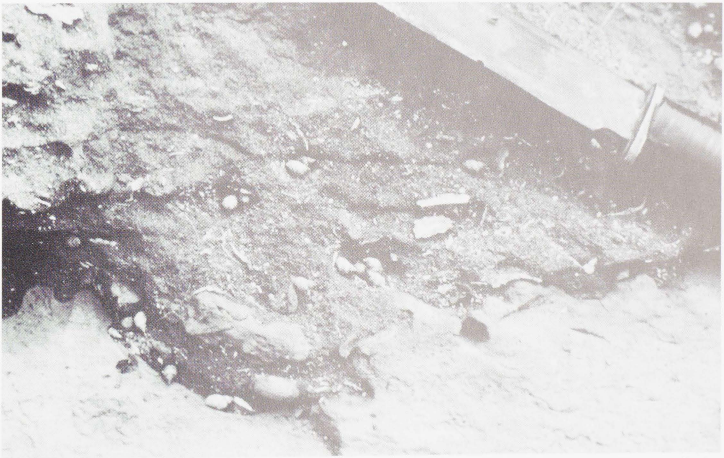
The locality at Punta Verde was originally discovered by Roger Bristow and John Whittaker, of the British Geological Survey and the British Museum (Natural History), Department of Palaeontology, respectively. They told William and Lois Pitt about the locality and, together with Mr. and Mrs. Pitt, my husband and I first visited Punta Verde in 1986. There we found that, as one walks along the beach eastward from the town, the northwesterly dip of the beds gradually exposes the complete section. Initially, the cliffs are composed of an unfossiliferous gray silt, which Whittaker refers to the Lower Onzole Formation. The first (stratigraphically highest) fossiliferous beds consist of a indurated, massive sandstone, containing numerous pectens, sand-dollars, and many specimens of *Ostrea haitensis* Sowerby, 1850, a common fossil throughout the Caribbean. This is underlain by a sandy lens filled with rather chalky pelecypods and gastropods of many species. Beneath this is a non-fossiliferous zone and, finally, at the base of the Angostura Formation, where it rests on the Viche, there is another lens of molluscan fossils. This latter zone is crowded with specimens of *Turritella,* but it is also in this level that the muricid specimens occur. The first time we visited Punta Verde there was a small area with well-preserved fossil mollusks in the wave-cut bench exposed at low tide. However, when we returned in 1988, sand had completely covered this outcrop and we could find no trace of it.

Beneath the Angostura Formation lies the Viche Formation, which has no fossil mollusks in it. The contact is highly irregular, with many burrows extending from the Angostura down into the indurated clay of the Viche beds. The majority of the best-preserved fossils lie just above this contact. The Angostura Formation presumably represents a trangression over the semi-lithified beds of the Viche Formation. The contact with the overlying Onzole Formation is gradational and probably represents the natural deepening of the basin.

The Angostura muricid fauna is rich neither in numbers of species nor in individuals. However, as the oldest fauna in the transgressive sequence that culminates in the rich muricid fauna of the Esmeraldas Beds, it is of interest to see the make-up of the shallow-water facies. In the same area today there are living the descendants of just one of these species, *Eupleura olssoni,* n. sp. No longer is there any species that can be related to *Haustellum polynematicus, Typhis alatus,* or *Ceratostoma (Microrhytis) ecuadorium,* n. sp.



Text-figure 6. Contact of Angostura Formation on older Viche Formation, Punta Verde, Ecuador.



Text-figure 7. Closeup of Viche-Angostura contact, showing irregular contact (most of the gastropods in this photograph are living specimens of *Littorina*, but one can see pebbles and shells near the basal contact of the Angostura Formation).

III. ACKNOWLEDGMENTS

The greatest thanks are extended to both C. Roger Bristow, British Geological Survey, and John E. Whittaker, British Museum (Natural History), Department of Palaeontology, for all the information that they have made available (both published and non-published) concerning the geology of the coast of Ecuador. For the loan of specimens I am grateful to George M. Davis and Elena Benamy, Academy of Natural Sciences, Philadelphia, and Thomas R. Waller and Warren Blow, U. S. National Museum. William and Lois Pitt, of Sacramento, California, have been tireless collectors and cheerful traveling companions, offering all manner of help and moral support in our on-going Ecuadorian paleontological studies.

IV. SYSTEMATIC PALEONTOLOGY

Class GASTROPODA
Order NEOGASTROPODA
Superfamily MURICACEA
Family MURICIDAE Rafinesque, 1815
Subfamily MURICINAE Rafinesque, 1815
Genus HAUSTELLUM Schumacher, 1817

Haustellum SCHUMACHER, 1817, Essai Nouv. Syst. Vers Test., p. 213.

Type species: *Murex haustellum* Linn., 1758, by tautonomy.

HAUSTELLUM POLYNEMATICUS
(Brown and Pilsbry)
Plate 1, figs. 1, 2

Murex (Murex) polynematicus BROWN and PILSBRY, 1911, Acad. Nat. Sci. Phila., Proc., v. 63, p. 353, pl. 26, fig. 1; OLSSON, 1964, Neogene Moll. Northwest. Ecuador, p. 137, pl. 29, figs. 2, 2a.

Murex (Murex?) polynematicus Brown and Pilsbry. WOODRING, 1959, U. S. Geol. Surv., Prof. Paper 306-B, p. 215, pl. 36, figs. 2, 3; pl. 37, figs. 6-9.

Murex (Murex) gilli polynematicus Brown and Pilsbry. VOKES, 1963, Tulane Stud. Geol., v. 1, no. 3, p. 101, pl. 2, fig. 5.

Murex messorius Sowerby. VOKES, 1963, Tulane Stud. Geol., v. 1, no. 3, pl. 3, fig. 8 only (*not* of Sowerby).

Chicoreus (Siratus) gilli polynematicus (Brown and Pilsbry). VOKES, 1965, Tulane Stud. Geol., v. 3, no. 4, p. 183.

Not *Murex (Murex) polynematicus* Brown and Pilsbry. JUNG, 1965, Bulls. Amer. Paleontology, v. 49, no. 223, p. 520, pl. 69, fig. 6 [= *H. gilli* (Maury)].

Murex (Haustellum) polynematicus Brown and Pilsbry. VOKES, 1988, Tulane Stud. Geol. Paleont., v. 21, no. 1, p. 17, pl. 1, fig. 6.

Holotype: ANSP 1719; height 54.5 mm, diameter 33.7 mm.

Type locality: Gatun Formation; Gatun Locks, Panama.

Occurrence: Angostura Formation and Esmeraldas Beds, Ecuador. Gatun Formation, Panama; unnamed formation, Nariño, Colombia; Pliocene.

Figured specimens: Fig. 1, USNM 445397; height 41.5 mm, diameter 27.4 mm; locality TU 1507. Fig. 2, USNM 445398; height 43.0 mm, diameter 25.5 mm; locality TU 1433.

Discussion: The generic placement of the species originally named *Murex polynematicus* and its close relative, originally named *Fusus gilli* Maury, 1910, has long been a problem to the writer. In a recent work (Ponder and Vokes, 1988) on the genus *Murex* s.s. in the Indo-Pacific, it was determined that the muricine species in the New World, which have been customarily assigned to *Murex* s.s., are better placed in the genus *Haustellum*. This causes problems for a few of the more spinose forms, but it is obvious that *Haustellum* is the correct genus for both *H. polynematicus* and its ancestor *H. gilli*. There should be no more changes for these two species, at least.

Haustellum polynematicus has been discussed in detail in a previous study on the Esmeraldas Beds (Vokes, 1988, p. 17) and little can be added at this point. The species, so far as we know, has no living descendants, although it was the most abundant and widespread muricid in the shallow-water of the Pliocene Panamic Province. Curiously, it never extended its range into the more northern Dominican Republic, where *H. messorius* (Sowerby, 1841) occupies the same ecologic niche, nor is it found in the Río Banano Formation of Costa Rica, which is only about 300 km from the contemporary occurrence in the Gatun Formation in Panama. In the Río Banano, *H. messorius* is also the *Haustellum* species that occurs. Obviously, *H. messorius* was a better competitor, as is borne out by the fact that *H. messorius* is still living today throughout the Caribbean and no trace of *H. polynematicus* is to be seen.

Subfamily THAIDINAE Jousseaume, 1888
Genus CERATOSTOMA Herrmannsen, 1846

Cerostoma CONRAD, 1837, Acad. Nat. Sci. Phila., Jour., v. 7, p. 263.

Type species: *Murex (Cerostoma) nuttalli* Conrad, 1837, by monotypy.

Ceratostoma HERRMANNSEN, 1846, Indicis Generum Malakoz., v. 1, p. 206. New name for *Cerostoma* Conrad, 1837, *non* Latreille, 1802.

Subgenus MICRORHYTIS Emerson, 1959

Microrhytis EMERSON, 1959, Amer. Mus. Novitates, no. 1974, p. 6.

Type species: *Pterorytis (Microrhytis) pecki* Emerson, 1959, by original designation.

Discussion: In a study of the genera of the Muricidae (Vokes, 1964, p. 23) I placed the subgenus *Microrhytis* in synonymy with the genus *Ceratostoma*, as both taxa are characterized by trivaricate shells that have a denticulate aperture and a strong labral tooth. However, the early whorls of *Ceratostoma* s.s. bear no varices but are simply cancellate until approximately the fifth teleoconch whorl, at which point three varices develop. In contrast, in *Microrhytis* (as in the genus *Pterorytis* Conrad, 1863, to which it is also closely related) on the early teleoconch whorls there are numerous small lamellar varices, which on approximately the fifth teleoconch whorl reduce their number to three.

The question arises as to whether *Microrhytis* is more closely allied with *Ceratostoma* or with *Pterorytis*. To me, the large open aperture with strong denticulations on the inside of the outer lip indicates a closer relationship with *Ceratostoma*, in contrast to the more circular, non-denticulate aperture of *Pterorytis*. In *Pterorytis* there are no intervarical nodes (even in specimens with only four varices) and the labral tooth is much larger than that seen in *Ceratostoma*. In addition, species of *Pterorytis* retain the more numerous varices (the least number in any species is four) and these varices are more wing-like and expanded than in *Microrhytis*. But, the case could be made for either placement with equal validity. The only species heretofore known of *Microrhytis* is the type, described from an unnamed formation in southern Mexico, in beds that have been dated by Akers (1972, p. 11) as late Middle Miocene (N 13-14) (TU 635, "Encanto Formation" of Akers). Until we have more material, placement of this taxon remains questionable.

CERATOSTOMA (MICRORHYTIS) ECUADORIUM Vokes, n. sp.
Plate 1, figs. 3, 4

Description: Shell of average size, probably six teleoconch whorls in adult; protoconch unknown. Spiral ornamentation on early teleoconch whorls of two strong cords, which persist up to the body whorl, where they form one weaker cord at the shoulder and another somewhat stronger cord just anterior to it. These supplemented by a third cord near base of the body whorl and numerous weaker threads between, and anterior to, the three major cords. Axial ornamentation on earliest whorls of approximately 12 small lamellar varices, crenulated by spiral cords; gradually reducing in number until on approximately the fifth teleoconch whorl becoming three varices with one strong intervarical node between each pair. Varices fimbriated on adapertural face, slightly recurved abaperturally, with a weak fold at shoulder. In addition to varices, the shell surface shagreened by numerous axial growth lines. At juncture of body whorl and siphonal canal a sharp adaperturally directed labral tooth, causing the varix to be enfolded behind it. Aperture large, ovate; columellar lip smooth, adnate posteriorly, free-standing anteriorly. Inner side of outer lip with approximately seven strong elongate denticles. Siphonal canal moderately long, wide, sealed over by an extension of shell material from columellar side; distal end slightly recurved. Paratype still showing color pattern of white spiral stripes overlying the major spiral cords on a solid brown background.

Holotype: USNM 445399; height 23.2 mm, diameter 15.5 mm (Plate 1, fig. 3).

Paratype: USNM 445400; height 26.8 mm, diameter 16.9 mm (Plate 1, fig. 4).

Type locality: TU 1507, Angostura Formation; Punta Verde, large point just east of Río Verde, or about 30 km east of Río Esmeraldas, Province of Esmeraldas, Ecuador.

Occurrence: Angostura Formation, Ecuador.

Discussion: There are just two specimens of this new species, one that is complete but immature, and a second that is mature but lacks the apertural side. Nevertheless, the form is so distinctive there is no question of its relationship with the Middle Miocene *Ceratostoma (Microrhytis) pecki* (Emerson), type of the subgenus. The Mexican species, described from the Gulf Coastal Plain side of the Isthmus of Tehuantepec, differs from the Ecuadorian one in lacking the relatively strong spiral cords and the shoulder fold in the varices, but otherwise the two are remarkably similar. These two species are the only known representatives of the subgenus *Microrhytis*.

The type locality of *C. (M.) pecki* (University of California, Museum of Paleontology A-8125) is the same as our locality TU 636, and is only 0.1 mile (0.16 km) from our locality TU 635 (= UCMP A-2184, locality of three paratypes), which, as noted above, has been dated as Middle Miocene. The fauna at these two localities indicates extremely shallow water with numerous specimens of a *Strombus* sp. cf. *S. proximus* Sowerby, 1850, described from the shallow-water Cercado Formation of the Dominican Republic. There is a large amount of fine gravel, and the assemblage, in general, looks as though it was almost intertidal. However, there is a good planktic foraminiferal fauna, which would not be found intertidally, and it is assumed that the mega-fossils were transported into the deep-water environment by a gravity-flow.

EUPLEURA OLSSONI Vokes, n. sp.

Plate 1, figs. 6, 7

Eupleura thompsoni Woodring subspecies. OLSSON, 1964, Neogene Moll. Northwest. Ecuador, p. 139, pl. 29, fig. 9.

Description: Shell small, seven teleoconch whorls; protoconch unknown. Spiral ornamentation on earliest teleoconch whorls of two sharp cords set very near anterior suture, leaving a wide, smooth, sloping shoulder ramp. On about sixth teleoconch whorl a weaker cord intercalated onto shoulder ramp. On body whorl about 12 cords, one at shoulder, one weaker on the shoulder ramp, and approximately 10 weaker ones anterior to shoulder, becoming progressively less strong anteriorly, very faint on siphonal canal; between each pair of major cords three to five extremely faint threads. Axial ornamentation on earliest teleoconch whorls of about 12 small lamellae, gradually reducing in number until on approximately the fifth teleoconch whorl only eight in number, with every fourth one becoming an expanded varix; three nodes remaining between each pair of varices. Varices aligned on opposite sides of the shell, with the varices of each successive whorl slightly in advance of varices on previous whorl, leaving a visible offset with varices not fused together. Intervarical nodes persisting as rounded knobs, over which the spiral ornamentation is diminished so that the knobs appear relatively smooth. Varices extended as a series of webbed scallops between points formed by extensions of the spiral cords, that at the shoulder the longest and adapically directed; on varical faces spiral cords expressed as grooves into which the shell laminae are enfolded. Aperture elongate-oval; inner lip appressed to columellar wall, with a few faint rugae reflecting underlying spiral cords. Margin of outer lip folded into the grooves of the varical face, especially at the shoulder; six strong denticles developed on inner side of outer lip, positioned between the grooves. Siphonal canal moderately long, straight, almost closed but open by a narrow slit.

Holotype: USNM 445402; height 26.3 mm, diameter 17.2 mm (Plate 1, fig. 6).

PLATE 1

Figures

1, 2. *Haustellum polynematicus* (Brown and Pilsbry) (X 1 1/2)
  1. USNM 445397; height 41.5 mm, diameter 27.4 mm.
     Locality: TU 1507, Angostura Formation, Punta Verde, Ecuador.
  2. USNM 445398; height 43.0 mm, diameter 25.5 mm.
     Locality: TU 1433, Gatun Formation, Prov. of Colón, Panama.

3, 4. *Ceratostoma (Microrhytis) ecuadorium* Vokes, n. sp. (X 2)
  3. USNM 445399 (holotype); height 23.2 mm, diameter 15.5 mm.
  4. USNM 445400 (paratype); height 26.8 mm, diameter 16.9 mm.
     Locality of both: TU 1507, Angostura Formation, Punta Verde, Ecuador.

5. *Typhis (Talityphis) alatus* Sowerby (X 2)
   USNM 445401; height 23.3 mm, diameter 14.8 mm.
   Locality: TU 1507, Angostura Formation, Punta Verde, Ecuador.

6, 7. *Eupleura olssoni* Vokes, n. sp. (X 2)
  6. USNM 445402 (holotype); height 26.3 mm, diameter 17.2 mm.
  7. USNM 445403 (paratype A); height (incomplete) 20.4 mm, diameter 18.0 mm.
     Locality of both: TU 1507, Angostura Formation, Punta Verde, Ecuador.

PLATE 1

Paratype A: USNM 445403; height (incomplete) 20.4 mm, diameter 18.0 mm; locality same as holotype (Plate 1, fig. 7).

Paratype B: USNM 643957; height 27.6 mm, diameter 18.2 mm; locality, Telembi, Río Cayapas, Ecuador (figured by Olsson, 1964, pl. 29, fig. 9).

Type locality: TU 1507, Angostura Formation; Punta Verde, large point just east of Río Verde, or about 30 km east of Río Esmeraldas, Province of Esmeraldas, Ecuador.

Occurrence: Angostura Formation, Ecuador.

Discussion: This is the species that Olsson (1964, p. 239) identified as "*Eupleura thompsoni* Woodring subspecies" but the two are no more than generically related. This new species is much more closely related to a second species of *Eupleura* that also occurs in the Gatun Formation, along with *E. thompsoni*, and it is possible that Olsson had specimens of this undescribed form included with *E. thompsoni*. In any case, the resemblance between the Gatun species, described elsewhere in this volume, and *E. olssoni*, n. sp., is very close. The two may be distinguished by the more scabrous appearance of the Gatun species, which has stronger secondary threads between the major cords and many axial growth lines that cause the surface of the shell to be laciniated. The Gatun species also has one more major spiral cord on the body whorl and the shoulder spines appear to be slightly more "upturned," *i. e.*, more adapically directed.

The shell of the new species here described is smoother than the Gatun form, and is more like the shell of "typical" *Eupleura*. It is an exciting example of evolutionary gradualism to see the changes from this species to the somewhat more ornamented Gatun form, to the extremely scabrous and nodulose *E. nitida* (Broderip, 1833), the representative of the line still living on the coast of Ecuador. The reader is referred to the accompanying paper (Vokes, 1989) for further discussion on this evolutionary sequence.

Eupleura olssoni bears a superficial similarity to the living Panamic species *E. muriciformis* (Broderip, 1833), which was reported from the Jama and Canoa formations of Ecuador by Pilsbry and Olsson (1941, p. 37*), but the Recent species has a much smoother surface texture; the spiral ornamentation appears almost as though the cords are under the surface of the shell, which is draped over them. These indistinct cords are the only spiral ornament; there are no secondary threads between them. There are also no spiral cords developed on the early whorls of *E. muriciformis*, nor is the cord on the shoulder, which gives rise to a varical spine between the suture and the shoulder spine, present. The shoulder spines of *E. olssoni* are not as long and are more adapically directed, having more the appearance of *E. triquetra* (Reeve, 1844), another living Panamic species that is sometimes confused with *E. muriciformis*.

This new species is undoubtedly a descendant of the Early Miocene *E. kugleri* Jung, 1965, described from the Cantaure Formation of the Paraguaná Peninsula, Venezuela. The most noticable difference between the two forms is the fact that, as Jung noted, on the body whorl of *E. kugleri* "the shoulder disappears" (Jung, 1965, p. 524). In *E. olssoni* the shoulder is marked on all of the whorls from the earliest up to and including the body whorl by a strong cord that gives rise to an extended shoulder spine. The shoulder ramp of *E. kugleri* is very flattened and the major spiral cord, and resulting spine, is that one at the periphery, so that the overall shape of the shell is more oval.

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*The material (Academy of Natural Sciences, Philadelphia, no. 15210) upon which this identification is made is truly a mixed bag. There are four specimens: two from the Jama Formation at Puerto Jama, of which one is *E. muriciformis* and the other, although poorly preserved, is probably *E. pectinata* (Hinds, 1844); the other two are from the Canoa Formation at Punta Blanca and include one example of *E. muriciformis* and one specimen of *Pteropurpura centrifuga* (Hinds, 1844)! Today the latter species does not extend farther south than Panama (Keen, 1971, p. 534) and the more southern equivalent is *P. deroyana* Berry, 1968, endemic to the Galapagos Islands. This occurrence provides the "missing link" between the two present day forms.

Subfamily TYPHINAE Cossmann, 1903

Genus TYPHIS Montfort, 1810

Typhis MONTFORT, 1810, Conchyl. Syst., v. 2, p. 614-615.

Type species: *Typhis tubifer* (Bruguière, 1792), by original desig.

Subgenus TALITYPHIS Jousseaume, 1882

Talityphis JOUSSEAUME, 1882, Rev. Mag. Zool., (Ser. 2) v 7, p. 338.

Type species: *Typhis expansus* Sowerby, 1874, by original desig.

TYPHIS (TALITYPHIS) ALATUS Sowerby

Plate 1, fig. 5

Typhis alatus G. B. SOWERBY, 1850, Geol. Soc. London, Quart. Jour. , v. 6, p. 48, pl. 10, fig. 4.

Typhis (Talityphis) alatus Sowerby. OLSSON, 1964, Neogene Moll. Northwest. Ecuador, p. 141; GERTMAN, 1969, Tulane Stud. Geol. Paleont., v. 7, no. 4, p. 159, text-fig. 3 (holotype); VOKES, 1983, Tulane Stud. Geol. Paleont., v. 17, no. 4, p. 124, pl. 1, figs. 1-3; VOKES, 1988, Tulane Stud. Geol. Paleont., v. 21, no. 1, p. 46, pl. 6, figs. 3, 4; VOKES, 1989, Bulls. Amer. Paleontology, v. 97, no. 332, p. 76, pl. 10, figs. 2-5, text-fig. 20 (holotype).

Holotype: British Museum (Natural History) GG. 20084; height 29.5 mm, diameter 18.0 mm.

Type locality: Gurabo Formation; Río Yaque, Dominican Republic (designated by Gertman, 1969, p. 160).

Occurrence: Esmeraldas Beds, Angostura and "Picaderos" [= Onzole] formations, Ecuador. Unnamed Middle Miocene formation, Dominican Republic. Gatun Formation, Panama; Gurabo Formation, Dominican Republic; Pliocene.

Figured specimen: USNM 445401; height 23.3 mm, diameter 14.8 mm; locality TU 1507.

Discussion: As has been noted previously in the Esmeraldas study, one specimen of *Typhis alatus* has been taken from each of the three units in the Ecuadorian Neogene – the Angostura, the Onzole (as Picaderos by Olsson, 1964, p. 141), and the Esmeraldas Beds (Vokes, 1988, p. 46). None are especially well-preserved, but in each case the identification is unmistakable, as each shows the characteristic elongated ridge anterior to the intervarical tube. As was also noted previously (Vokes, *ibid.*), the species is more common in deep-water deposits but there is a shallow-water example from the Gatun Formation (Vokes, 1983, pl. 1, fig. 2), so apparently the species did sometimes make its way into shallow water. The poor condition of the Angostura shell would indicate that it was probably a beach specimen.

With occurrences in Ecuador, Panama, and the Dominican Republic, in beds ranging in age from mid-Miocene to mid-Pliocene, *T. alatus* is one of the most widespread molluscan species in the amphi-American Tertiary. It is, however, never common. Even in the Gurabo Formation of the Dominican Republic, the "type area" of the species, we usually have no more than one or two specimens at any locality.

V. LOCALITY DATA

The following are Tulane University fossil locality numbers:

635. Unnamed formation, roadcut on Mexico Highway 185, 1.4 miles (2.3 km) south of bridge over Río Jaltepec, at Oaxaca-Veracruz state line, Mexico (= University of California, Museum of Paleontology locality A-8124; see Emerson, 1959, p. 6).

636. Unnamed formation, roadcut on Mexico Highway 185, 1.5 miles (2.4 km) south of bridge over Río Jaltepec, at Oaxaca-Veracruz state line, Mexico (= University of California, Museum of Paleontology locality A-8125; see Emerson, *ibid.**).

1433. Gatun Formation, north side of Boyd-Roosevelt Highway, clearing behind Urbanization San Martin, approximately 0.5 km east of junction of road to Refinería Panama, S.A., at Cativá, Prov. of Colón, Panama.

1507. Angostura Formation, large point just east of Río Verde, or approximately 30 km east of Río Esmeraldas, Prov. of Esmeraldas, Ecuador.

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*Although there is a slight discrepancy in the mileage/kilometrage, we have searched the area for a third locality and it does not exist. We are sure the two Tulane localities and the two Museum of Paleontology localities are the same.

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A NEW SPECIES OF *EUPLEURA* (GASTROPODA:MURICIDAE) FROM THE GATUN FORMATION, PANAMA

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In the process of determining the identity of the species cited by Olsson (1964, p. 139) as "*Eupleura thompsoni* Woodring subspecies," from the Angostura Formation of northwestern Ecuador, it became obvious that there are two species of *Eupleura* in the Gatun beds of Panama. One of these is the species named *Eupleura thompsoni* Woodring, 1959, and compared by him to the living *E. muriciformis* (Broderip, 1833). However, the similarity is much greater to the more spinose and long-canaled *E. pectinata* (Hinds 1844), which is found on the west coast of tropical America, from Mexico to Panama.

The second is a smaller form that is more closely related to another species living on the west coast of tropical America, *Eupleura nitida* (Broderip, 1833), characterized by nodulose intervarical areas and a scabrous surface texture. From the appearance of the new Gatun species, it is almost certainly ancestral to the rather atypical *E. nitida*.

In the Gatun Formation, *E. thompsoni* is by far the more common and widespread form. In the Tulane Collections we have over 500 specimens from seven localities. The new species is much rarer – it has only been taken at two localities, with just 50 specimens. The majority of these (47) are from one locality, TU 958, which must represent a different environment from most of the Gatun localities, as it was here that we also collected a large number of *Poirieria (Panamurex) gatunensis* (Brown and Pilsbry, 1911) (see Vokes, 1970, p. 42).

The genus *Eupleura* is a small group with but six Recent species (all well-figured by Radwin and D'Attilio, 1976, pl. 19, figs. 1-7), all found in the Western Hemisphere. Two of these are living today in the western Atlantic: *E. caudata* (Say, 1822), type of the genus, and *E. sulciden-*