NASSARIUS (MOLLUSCA:NEOGASTROPODA) FROM THE NEOGENE OF NORTHWESTERN ECUADOR

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ABSTRACT

The nassarid fauna from the Neogene formations of northwestern Ecuador consists of five species, none of which are known from either the Recent or fossil faunas of the Caribbean or Pacific. There is one species with affinities to the western Pacific Recent fauna, one with affinities to Recent species in both the Caribbean and eastern Pacific faunas, the remaining three species are known only from the Ecuadorian Neogene, one of which, *Nassarius mcmakini*, n. sp., is confined to the Angostura Formation.

INTRODUCTION

It is generally accepted that there was free passage of water between the Caribbean Sea and the Pacific Ocean, through the Isthmus of Panamá, for much of the Tertiary Period, allowing exchange of molluscan species. It has been suggested that the closure took place about 3.5 MA (Saito,1976). Jones and Hasson (1985) accepted this date as the most likely time when migration of species ended, with final emergence of the Isthmus at about 3 MA or later.

The Neogene faunas of northwestern Ecuador have either direct or indirect relationship to Caribbean or Pacific faunas, both Recent and fossil. This paper will discuss nassarid species from two Neogene formations of northwestern Ecuador, ranging in age from Late Miocene to Late Pliocene, and their relationship to Caribbean and Pacific faunas. It is not intended to be a monograph of the Family Nassariidae.

The five species discussed in this paper are all endemic to the Neogene of northwestern Ecuador. One species, *N. mcmakini*, n. sp., from the Angostura Formation has affinities with species in the Recent East Pacific, as well as the Caribbean Recent and fossil faunas. *Nassarius mastus* Olsson, 1964, was described from the Picaderos Formation, and occurs in both the Angostura and Onzole formations. Other species include: *N. thielei* Olsson, 1964, from the Esmeraldas beds, with affinities to an Indo-Pacific species; *N. hylus* Olsson, 1964, known only from the the Esmeraldas beds; and one species *N. repetiti* Olsson, 1964, known only from the Onzole Formation.

The Angostura Formation of Late Miocene age (planktic foraminiferal zone N. 16) is the oldest formation discussed in this paper. The name was first published by Stainforth (1948, pp. 142, 143, 146) following an unpublished report of the International Ecuadorian Petroleum Company (*fide* Bristow and Hoffstetter, 1977, p. 32).

The name "Esmeraldas Formation" was proposed by Olsson (1942, p. 260) for the highly foraminiferal tuffaceous shales exposed along the coast of Esmeraldas Province and the Esmeraldas River. Bristow and Hoffstetter (1977, p. 143) recognized the name Esmeraldas Formation but considered it to be part of the Onzole Formation. Vokes (1988, p. 4) found it difficult to accept the name Onzole Formation for the mollusk-rich deposits along the Esmeraldas coast from Punta Gorda to Camarones and used the term "Esmeraldas beds" for these deposits exposed at the top of the Onzole Formation.

Olsson (1964, p. 10), in discussing fossils from the Picaderos Formation, stated that the name came from the village of Picaderos, which is near the center of the outcrop on the Río Santiago. He listed 16 species of mollusks from the Picaderos Formation. Of these five occur at Picaderos, four occur at Playa de Tigre, three are not mentioned in the text, two only occur at Cueva de Angostura (Angostura Formation), one is from Playa de Tigre and Picaderos, and one is in the text but not on the faunal list.

Olsson described the Picaderos Formation as occurring along the Río Santiago near the village of Picaderos; however, in the text he shows two

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Picaderos species as occurring along the Río Onzole and considerd some Picaderos species as being from the Borbon Formation.

Bristow and Hoffstetter (1977, p. 219, 232) state that the name Picaderos Formation is in disuse and consider it to be equal to the Onzole Formation. The Servicio Nacional de Geología y Minera (Cuadro no. 83) also considers the Picaderos Formation to be equal to the Onzole Formation; however, it places Olsson's Playa de Tigre locality at the border of the Onzole and Angostura formations and within the Angostura Formation. Olsson's collecting data is not precise enough to know exactly how close to Playa de Tigre he made his collections, thus it is difficult to know in which formation this locality should be placed. Olsson, in the text, also listed some species as occurring at Picaderos; Borbon Formation. It is possible that some of his collecting data is in error and we may never know where some of his specimens were really collected.

ABBREVIATIONS FOR REPOSITORY INSTITUTIONS

CASG - California Academy of Sciences, San Francisco, California.
USNM - United States National Museum of Natural History, Washington D.C.
PRI - Paleontological Research Institution, Ithaca, New York.

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SYSTEMATIC PALEONTOLOGY

Phylum MOLLUSCA Cuvier, 1797

Class GASTROPODA Cuvier, 1797
Subclass PROSOBRANCHIA Milne-Edwards, 1848
Superorder CAENOGASTROPODA Cox, 1959
Order NEOGASTROPODA Thiele, 1925
Superfamily MURICOIDEA Rafinesque, 1815
Family NASSARIIDAE Iredale, 1916
Subfamily NASSARIINAE

Genus NASSARIUS Dumeril, 1806

Nassarius DUMERIL, 1806, Zool. Anal., p. 166.
Type species: Buccinum arcularia Linn., 1758, by monotypy.

Subgenus NASSARIUS s.s.
NASSARIUS (NASSARIUS) REPETITI Olsson
Plate 1, figure 4

Nassarius repetiti OLSSON, 1964, Neogene Moll. Northwest. Ecuador, p. 146, pl. 24, figs. 6, 6a.

Description: "The shell is small, subovate, with an elevated sharp spire of about seven whorls, including that of the small nucleus consisting of one turn. The sculpture of the spire whorls consists of three rows of sharply beaded spiral cords which stand high above the adjacent sutural zones, which thus appear as if deeply excavated, the fine suture itself lying away in the bottom as if hidden. The spirals on the apertural side of the body whorl number about seven with an additional eight or nine, much smaller ones, partly smooth lying along the basal sulcus and over the short beak in front. The spiral cords are neatly beaded by small axials which faintly undulate the spiral interspaces. On mature specimens, the sculpture is obsolete on the back of the body whorl, replaced there by a large smooth patch. The aperture is broadly subovate with a short longitudinal posterior canal at its junction with the parietal wall. The outer lip is thickened by a rib on the back, and bears on its inner side four or more small denticles. There is a thin spread of callus over the inner lip through which the underlying spiral cords still show through; the parietal callus extends downward over the pillar is a small shelflike feature *[sic]*, bearing four small denticles along it. The siphonal canal notch is deep, its sides a little elevated, its fasciole marked with small smooth spirals but has no bordering keel." (Olsson, 1964)

Holotype: USNM 643999; height 14.6 mm, diameter 7.8 mm.

Type locality: Onzole Formation, Telembi, Esmeraldas Prov., Ecuador.

Occurrence: Onzole Formation, Ecuador.

Discussion: Nassarius repetiti is similar to *N. complanatus* (Powys, 1835) from the Tropical East Pacific but differs in being larger, more slender with the spire whorls slightly convex rather than straight sided. Olsson (1964, p. 145) placed Telembi in the Angostura Formation; however, Bristow and Hoffstetter (1977, p. 218) place the locality at Telembi within the Onzole Formation.

NASSARIUS (NASSARIUS) MCMAKINI
Pitt and Pitt, n. sp.
Plate 1, figure 1

Description: Shell small; five whorls, plus a protoconch of about two rounded, smooth whorls, end broken. First spire whorl expanding abruptly, axial sculpture appearing immediatly, but eroded on early whorls; remaining spire whorls with eleven axial ribs crossed by about six spiral grooves (both specimens worn). Suture distinct. Body whorl large with nine strong, retractive axial ribs from suture to base, crossed by numerous, spiral, rounded grooves, interspace of equal width. First axial posterior to aperture with signs of numerous spiral bands; however, shell too worn to determine number or extent. Apertural callus pad heavy, covering all of shell face; outer lip thickened. Anterior canal narrow, recurved. Outer lip with about six lirations with short secondary lirations between.

Etymology: This new species is named for Allan McMakin from Astoria, Oregon, who has done most of the photography for this and past papers.

Holotype: CASG 67832.01; height 8.0 mm, diameter 5.1 mm.

Paratype: PRI 44212; height 8.7 mm, diameter 5.9 mm.

Type locality: P-103, Angostura Formation, sea cliffs about 300 meters west of Punta Verde, about 2 1/4 km east of the mouth of Río Verde and about 22 km east of the bridge over Río Esmeraldas, Esmeraldas Prov., Ecuador.

Occurrence: Angostura Formation, Ecuador.

Discussion: Nassarius mcmakini, n. sp., may be compared to the Tropical East Pacific species *N. iodes* (Dall, 1919), *N. moestus* (Hinds, 1844), and *N. tiarula* (Kiener, 1841), which occurs as far north as San Francisco, California [as *N. tegula* (Reeve, 1853), see Skoglund, 1992, p. 85]. *Nassarius iodes* differs from *N. mcmakini* in having three or four weak lirations on the inner side of the outer lip and one much larger one posterior to the others at about the center of the aperture. The body whorl of *N. iodes* has ten axial ribs, fading out on the last one-third of the whorl, which are crossed by seven spiral grooves; the columellar callus pad is thin. *Nassarius moestus* differs in having four short lirations on the inner side of the outer lip and one much larger than the rest, posterior to the others at the center of the aperture. In *N. moestus* the body whorl has ten beaded, axial ribs with smooth interspaces, fading out on the last one-third of the whorl. *Nassarius tiarula* differs in having five short lirations on the inner side of the outer lip with one much larger liration posterior to the rest, at the center of the aperture. The Plio-Pleistocene and Recent western Atlantic and Caribbean species *N. vibex* (Say, 1822), differs in having four lirations on the inner side of the outer lip and one much larger liration posterior to the rest, at the center of the aperture. The body whorl has nine axial ribs, crossed by twelve spiral bands, not fading out on the last one-third of the whorl, and the columellar callus is not well developed.

Subgenus PROFUNDINASSA Thiele, 1929

Profundinassa THIELE, 1929, Handbuch der Systematische Weichtierkunde, pt. 1, p. 323.

Type species: Nassarius babylonicus Watson, 1882, by monotypy.

NASSARIUS (PROFUNDINASSA) THIELEI
Olsson
Plate 1, figures 5,6

Nassarius (Profundinassa) thielei OLSSON, 1964, Neogene Moll. Northwest. Ecuador, p. 145, pl. 24, fig. 7.

Description: "Shell small, subovate, the spire twice the height of the aperture. The nucleus is relatively large, turbinate, with two or three smooth convex whorls. Postnuclear whorls,

about four, are shouldered around the upper third, the angle of which carries a strong cord. The body whorl is large and forms about a half the whole shell, quadrate in shape, widest about the middle, the base strongly contracted. The sculpture is formed by about eight axial riblets which are noded by the shoulder cord and by flat closeset spiral threads which cover the surface between the shoulder angle and the beak. The space above the shoulder angle is essentially smooth, except for small spirals. Aperture subovate, with a calloused shelf on the parietal wall, the outer lip thin, smooth within. There is a short, nassoid beak formed by the contraction around the base. End of columellar pillar with a sharp keel which margins the siphonal canal notch. Siphonal fasciole strong, bordered by a nassoid keel." (Olsson, 1964)

Holotype: USNM 644190; height 14.1 mm, diameter 7.2 mm.

Type locality: Esmeraldas beds, Punta Gorda, Esmeraldas Prov., Ecuador.

Occurrence: Esmeraldas beds, Ecuador.

Discussion: In comparing our specimens of *N. thielei* to specimens from Olsson, 1964, we find *N. thielei* to be a quite variable species. Our specimens from Punta Gorda (fig. 6), mostly incomplete and worn, have the shoulder angle from almost turreted to moderately angled, the shoulder cord is almost non-existant in some specimens. The axial ribs vary from vertical in the figured specimen to protractive. The spiral threads are weak in our specimens, although this appears to be due to wear. The whorls on the figured specimen are straight sided, although on some of the fragmentary specimens they are more rounded. If we had more specimens this could possibly prove to be an undescribed species.

This common species, as noted by Olsson, is similar to *N. babylonica* Watson, 1882, from the Philippine Islands but has a single cord at the shoulder rather than a double cord and the protoconch whorls are not carinate. *Nassarius babylonica* occurs in the Recent western Pacific and Indian Oceans.

Subgenus UZITA H. Adams and A. Adams, 1853

Uzita H. ADAMS and A. ADAMS, 1853, The genera of Recent Mollusca, v. 1, p. 120.

Type species: Buccinum miga Bruguière, 1789, by subsequent designation, Cossmann, 1901.

NASSARIUS (UZITA) HYLUS Olsson
Plate 1, figure 2

Nassarius (Uzita) hylus OLSSON, 1964, Neogene Moll. Northwest. Ecuador, p. 145, pl. 37, figs. 10, 11.

Description: "Shell small, subovate, stout, the spire about twice the aperture and composed of about six whorls. The nuclear whorls are large, with a turbinate coil of two and one-half to three rapidly enlarging smooth turns developing a small keel and a few axials near the end. The sculpture consists of low, narrow, axial riblets (12 to 14) crossed by alternating spiral threads producing a coarse cancellation. The aperture is subovate, rimmed with a narrow, nearly continuous, calloused peristome, finely denticulated on both lips. Beak short, encircled by a fasciolar fold." (Olsson, 1964)

Holotype: USNM 644000; height 10.5 mm, diameter 5.8 mm.

Type locality: Esmeraldas beds, Quebrada Camarones, Esmeraldas Prov., Ecuador.

Occurrence: Esmeraldas beds, Ecuador.

Discussion: Nassarius exsarsus (Dall, 1908), a deep water species from the Galápagos Islands, is similar in outline; however, the spire whorls are turreted, the axial and spiral sculpture is closer together and more subdued.

NASSARIUS (UZITA) MASTUS Olsson
Plate 1, figure 3

Nassarius (Uzita) mastus OLSSON, 1964, Neogene Moll. Northwest. Ecuador, p. 146, pl. 38, fig. 7.

Description: "The shell is small, stout, pupoid, its protoconch unusually large for its size, the nuclear stage followed by a single, sculptured turn (that of the body whorl). The large protoconch is composed of four, smooth convex whorls, the first small, the others enlarging rapidly to form a turbinate coil. The nuclear stage is followed by the sculptured body whorl. Assumption of the adult sculpture is gradual with the appearance of a few widely spaced axial lines intersected by two or three spiral

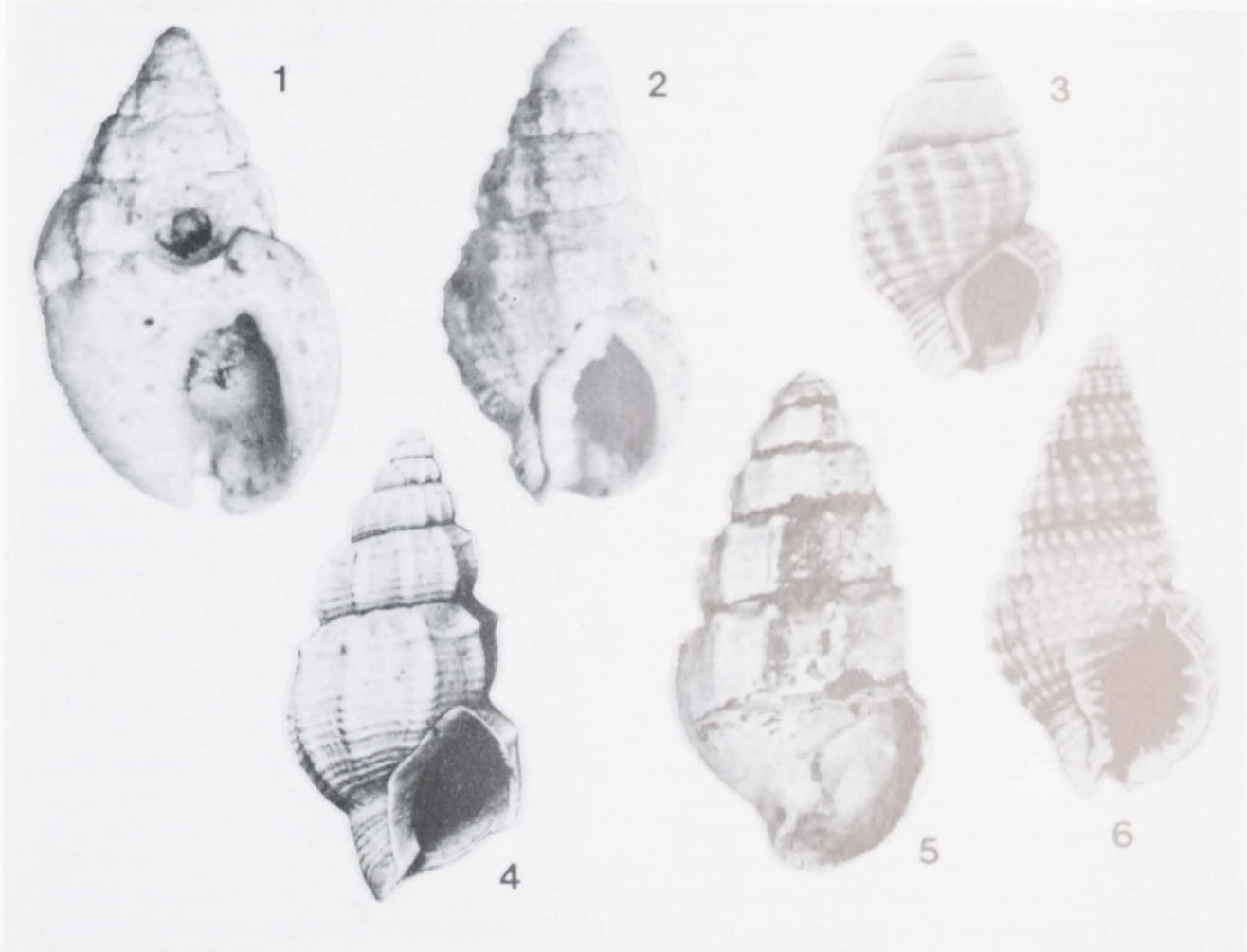

PLATE 1

Figures

1. *Nassarius (Nassarius) mcmakini* Pitt and Pitt, n. sp. 137
   CASG 67832.01 (holotype); height 8.0 mm, diameter 5.1 mm (X6.5).
   Locality: P-103, Angostura Formation.
2. *Nassarius (Uzita) hylus* Olsson, 1964 138
   CASG 67833.01; height 11.1 mm, diameter 5.9 mm (X4.5).
   Locality: P-100, Onzole Formation, Ecuador.
3. *Nassarius (Uzita) mastus* Olsson, 1964 138
   USNM 644194 (holotype); after Olsson, pl. 38, fig. 7); height 2.9 mm, diameter 1.8 mm (X12.1).
   Locality: Onzole Formation, Ecuador.
4. *Nassarius (Nassarius) repetiti* Olsson, 1964 136
   USNM 645278 (paratype, after Olsson, pl. 24, fig. 6); height 13.5 mm, diameter 6.4 mm (X3.6).
   Locality: Onzole Formation, Ecuador.
5. *Nassarius (Profundinassa) thielei* Olsson, 1964 137
   USNM 644190 (holotype; after Olsson, pl. 24, fig. 7a); height 14.1 mm, diameter 7.2 mm (X3.4).
   Locality: Onzole Formation, Ecuador.
6. *Nassarius (Profundinassa) thielei* Olsson, 1964 137
   CASG 67834.01; height 12.0 mm, diameter 5.9 mm (X4.4).
   Locality: P-99, Onzole Formation, Ecuador.

threads, the axials number about 12 and the spirals finally to eight or nine, their points of intersection forming small nodes on the final portion of the whorl. The base is narrowly constricted a little above the short beaked anterior canal, but there is no definite fasciole or a nassoid keel. The outer lip is thickened and a little reflected, marked with lirations within. Columellar area is deeply excavated, smooth, the end of the pillar with a small plait." (Olsson, 1964)

Holotype: USNM 644194, height 2.9 mm, diameter 1.8 mm (not found).

Type locality: Onzole Formation, Picaderos, Esmeraldas Prov., Ecuador.

Occurrence: Angostura and Onzole formations, Ecuador.

Discussion: Olsson (1964, p. 146) noted that this species has a large protoconch and only one post-nuclear whorl, which gives the appearance of an immature shell; however, this single whorl is sculptured and the outer lip is thickened and lirate within as would be expected in an adult shell. We have no explanation for this condition unless, as happens in some Recent Tropical East Pacific species, after the eggs are laid, the adults leave the area. The juveniles could have been covered by some natural condition and fossilized with no adults present.

We have not been able to locate the holotype at USNM. There are two vials containing numerous specimens, one marked "Picaderos" and the other "various localities."

LOCALITY DATA

The following are Pitt fossil collecting localities:

P-99. Esmeraldas beds, Punta Gorda (intertidal), about 8 km west of Las Palmas, Esmeraldas Prov., Ecuador.

P-100. Esmeraldas beds, east bank of Estero Camarones, east of the village of Camarones, about 10 km east of the mouth of Río Esmeraldas, Esmeraldas Prov., Ecuador.

P-103. Angostura Fm., sea cliffs about 300 meters west of Punta Verde, about 2 1/4 km east of the mouth of Rió Verde and about 22 km east of the bridge over Rió Esmeraldas, Esmeraldas Prov., Ecuador.

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