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## Neogene melongenid gastropods from the Paraguaná Peninsula, Venezuela

By JACK GIBSON-SMITH and WINIFRED GIBSON-SMITH<sup>1)</sup>

### ABSTRACT

From the early Miocene of the Paraguaná Peninsula, Venezuela, three new species of melongenid gastropods are described: *Melongena venezuelana* and *Torquifer barbascoana* from the Burdigalian Cantaure Formation, and *Melongena candelariana* from the underlying Burdigalian (?) La Candelaria beds. *T. barbascoana* is the second taxon to be assigned to the genus *Torquifer* ROTH, 1981, the type of which, *T. pittorum*, is from the middle Miocene(?) lower part of the Gatun Formation, Panamá. *Melongena colombiana* WEISBORD, 1929, known from the Miocene of Colombia, Venezuela, Trinidad, Ecuador and Peru, is reassigned to the genus *Torquifer*.

### ZUSAMMENFASSUNG

Drei neue Arten von Melongeniden werden aus dem unteren Miozän der Paraguaná-Halbinsel von Venezuela beschrieben: *Melongena venezuelana* und *Torquifer barbascoana* aus der burdigalen Cantaure-Formation und *M. candelariana* aus den liegenden La-Candelaria-Schichten (Burdigal?). *T. barbascoana* ist die zweite Art der Gattung *Torquifer* ROTH, 1981, deren Typusart *T. pittorum* aus dem unteren Teil (mittleres Miozän?) der Gatun-Formation von Panamá stammt. *Melongena colombiana* WEISBORD, 1929, ist aus dem Miozän von Kolumbien, Venezuela, Trinidad, Ecuador und Peru bekannt und wird hier der Gattung *Torquifer* zugewiesen.

### Introduction

The publication recently of the melongenid taxon *Torquifer pittorum* ROTH, 1981 (gen. et spec. nov.) from the middle Miocene(?) lower part of the Gatun Formation, Panamá, led to a search for this species in our Venezuelan Neogene collections, a none too onerous task as melongenids are present only at a few early Miocene localities near Cantaure, Paraguaná Peninsula. Although the search was unsuccessful with regard to *T. pittorum*, it did result in the identification of three new melongenid species: *Melongena venezuelana*, *Melongena candelariana* and *Torquifer barbascoana*. Furthermore, a fourth taxon, *Melongena colombiana* WEISBORD, 1929, is reassigned to the genus *Torquifer*. Thus, support is lent to the presently monotypic *Torquifer*, even though the validity of the type species might be questioned.

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Abbreviations for the institutions referred to are the following:

British Museum (Natural History)	BM (NH)
Natural History Museum, Basel	NHMB
Paleontological Research Institution, Ithaca	PRI
Universidad Central de Venezuela, Escuela de Geología	UCVG

## Systematic Descriptions

### Family Melongenidae

Genus *Melongena* SCHUMACHER, 1817

*Melongena venezuelana* Gibson-Smith & Gibson-Smith, n.sp.

Fig. 1-5, 13

*Melongena melongena consors* (G.B. SOWERBY I, 1850) JUNG (1965), Bull. amer. Paleont. 49/223, p.536, Pl. 72, Fig. 11.

**Description.** – Shell large reaching a height of 180 mm, broadly pyriform, widest at the shoulder. Spire low, broadly conical, angle varying between 50 and 70 degrees. Protoconch missing, 6 or 7 teleoconch whorls remaining. Initial sculpture of 9 strong, rounded axial ribs, soon becoming triangularly spinose at the shoulder. Suture undulating around the tips of the spines. Bodywhorl strongly shouldered; shoulder carrying a double row of massive spines, curved slightly abaperturally, upper row the stronger and tending to be inclined adapically; a third row of spines on the lower half equal in strength to the lower row of the shoulder. Anterior fasciole strong, irregular, comprised of coarser and finer U-shaped lamellae. On gerontic specimens the anal fasciole similarly defined. Over all spiral sculpture of flat to slightly convex subequal cords. Outer lip expanded, edge thin and crenated by the spiral cords; no internal lirae. Columella concave, smooth. Thick callus covering large parietal area and anterior fasciole. Anterior canal short, deep and inclined slightly to the left.

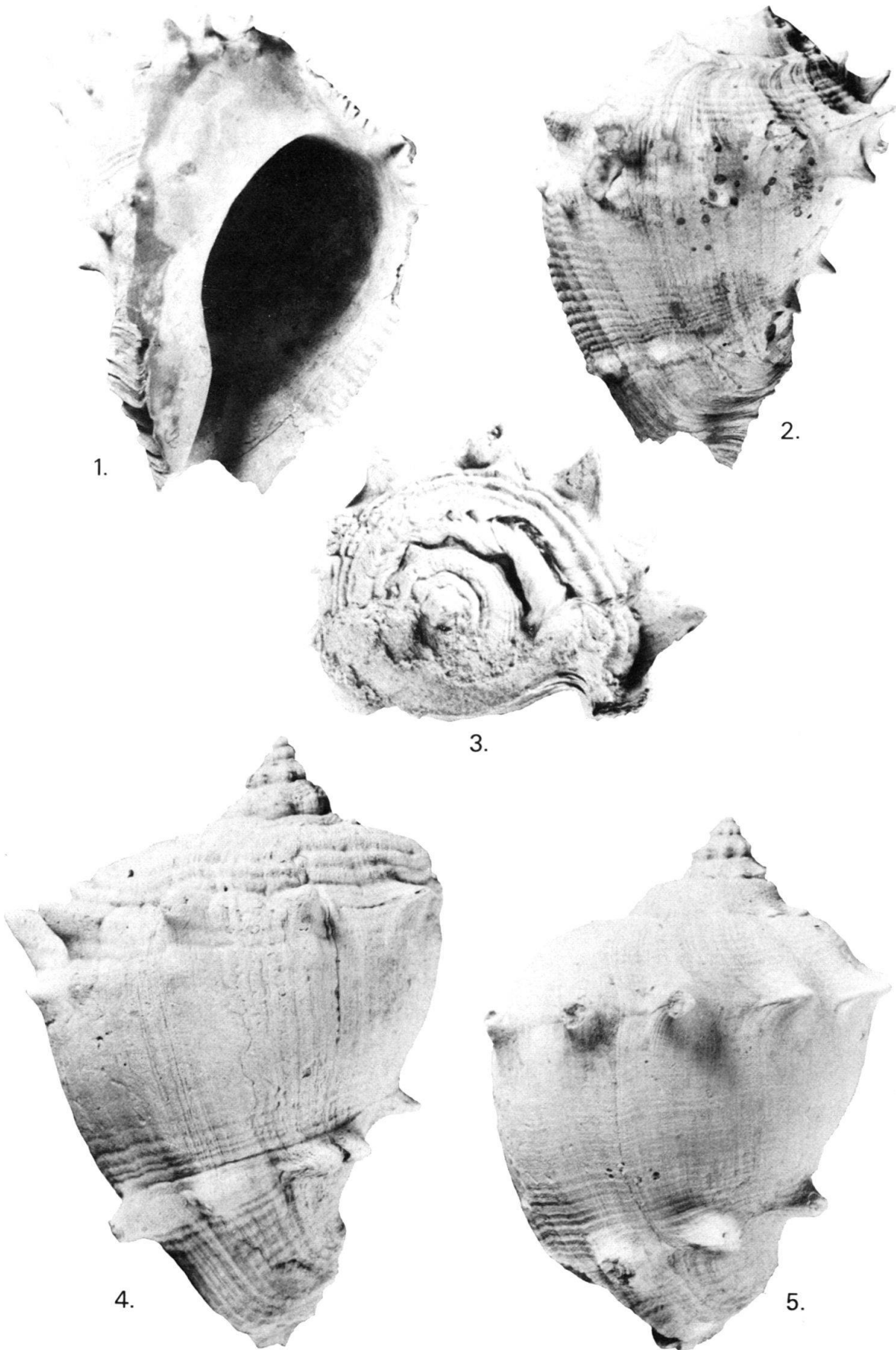
**Holotype.** – NHMB H 17094. Height 170 mm, diameter 127 mm (excluding spines).

**Type locality.** – Lower shell bed of the early Miocene (Burdigalian), Cantaure Formation, Paraguaná Peninsula, Venezuela (GS-1).

**Paratypes.** – PRI 8226; BM (NH).

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Fig. 1-5. *Melongena venezuelana* GIBSON-SMITH & GIBSON-SMITH, n.sp. 1, 2 = Holotype, NHMB H 17094; height 170 mm, diameter 127 mm (excluding spines). Locality: GS-1-PGNA, lower shell-bed, Cantaure Formation, Paraguaná Peninsula, Venezuela. 3, 4 = UCVG 7060; height 60.1 mm, diameter 40.3 mm. Locality: GS-33-PGNA, La Candelaria beds, Paraguaná Peninsula, Venezuela. 5 = UCVG 7061; height 44.3 mm, diameter 31.3 mm. Locality: GS-6-PGNA, upper shell bed Cantaure Formation, Paraguaná Peninsula, Venezuela.



*Range.* – Known from the lower and upper (GS-2A, 6, 10, 122) shell beds of the Cantaure Formation and from the underlying Burdigalian(?) La Candelaria beds (GS-33). The presence in the Cantaure Formation of two shell beds with faunal differences was discussed by GIBSON-SMITH & GIBSON-SMITH (1979, p. 22); it can be added here that the lower shell bed has a thickness of 5 m and the upper of 2 m, being separated by a 3 m thick shale; these beds were assigned to the *Globigerinatel-la insueta* Zona by HUNTER & BARTOK (1974, p. 147). The La Candelaria beds were named informally by GIBSON-SMITH & GIBSON-SMITH (1979, p. 12, 13, 21); they lie unconformably below the Cantaure Formation with probably a major hiatus. Specimens from the limestones of the Cauderalito Member, Agua Clara Formation, are in the form of internal moulds with some shell adhering; they can only be assigned tentatively to *M. venezuelana* n.sp. This is the first reporting of these beds on the Paraguaná Peninsula; they lie unconformably below the La Candelaria beds, most likely with a major hiatus (GS-24).

*Remarks.* – The type material consists of 55 specimens from the lower shell bed of the Cantaure Formation. Not included are 16 specimens from the upper shell bed and 9 from the La Candelaria beds. There are variations in the sculpture of the ramp, discussed later; the suture may lie above the shoulder spine, at mid-spine, or below, resulting in variations in the height and acuteness of the spire. The anterior fasciole may run almost parallel to the anterior row of spines, or diverge from it, giving a shorter or longer anterior canal.

*Comparisons* – *Melongena venezuelana* n.sp. resembles *M. consors* SOWERBY from the Miocene of the Dominican Republic, which was made a subspecies of the Caribbean Recent form *M. melongena* (LINNÉ 1758) by OLSSON (1932, p. 176). *M. venezuelana* differs in being more strongly, or more angulately, shouldered and in never having more than a double row of shoulder spines. Whereas *M. m. consors* may develop a triple row of spines at a height of about 100 mm, *M. venezuelana* at a height of 180 mm still has only a double row. This height is slightly more than the maximum of 150 mm reported for *M. m. consors* by PILSBRY (1922, p. 347). The relationship with *M. m. consors* from the early Miocene Zorritos Formation of Peru (OLSSON 1932, p. 176) is problematical; the figure is of a specimen broken in life, which thereafter failed to reproduce the previously established double(?) row of shoulder spines. OLSSON (1932, p. 176) was surprised to find *M. m. consors* as a rare and restricted member of the Peruvian fauna and thought it to be, “but a temporary resident on the West Coast”. It might equally well be *M. venezuelana*. Again, there is no certainty that *M. m. consors* from the early Miocene Angostura Formation, Ecuador (OLSSON 1964, p. 144), is not *M. venezuelana*; it is known from one, probably immature, specimen. *M. m. consors* has been reported from the early Miocene Castilletes Formation of the Guajira Peninsula of Colombia and Venezuela (THOMAS 1972, p. 115). This fauna is closely related to that at Cantaure, not far distant across the Gulf of Venezuela (HUNTER 1978, Fig. 1) and there can be little doubt that this is *M. venezuelana*; out of 36 specimens none had more than two rows of shoulder spines. An earlier reporting of *M. m. consors* from the Guajira Peninsula is that of OLSSON & RICHARDS (1961, p. 10); neither locality nor stratigraphical data were available to them and a tentative upper Oligocene age was

assigned. The square shoulder at the top of the outer lip, seemingly undamaged, is uncharacteristic of any known melongenid; its placement remains problematical. WOODRING (1964, p.273) records *M. m. consors* from Panamá in the lower and middle parts of the Gatun Formation of Mio-Pliocene age; it carries a triple row of shoulder spines. At the same time he reports it from the early Miocene Baitoa Formation of the Dominican Republic, but whether with two, or three, rows of shoulder spines is not said.

*M. m. consors* is generally thought to be the ancestor of both the Recent Caribbean form *M. melongena* and of the Panamic form *M. patula* (BRODERIP & SOWERBY 1829). However, *M. patula* reaches a greater height (250 versus 150 mm), generally lacks the lower row of spines on the lower part of the shell and develops only a single row of shoulder spines, or none (WOODRING 1964, p.273). Furthermore, according to OLSSON (1932, p. 176), *M. patula*, "differs constantly from *melongena* ... by its strongly shouldered body-whorl". In these characteristics *M. patula* is closer to *M. venezuelana* than to *M. m. consors*. It is probable, therefore, that *M. venezuelana* is the ancestor of *M. patula*, not *M. m. consors*.

*Melongena candelariana* GIBSON-SMITH & GIBSON-SMITH, n.sp.

Fig. 6, 7

*Description.* – Shell of medium size reaching a height of about 55 mm, biconic, *Vasum*-like. Spire low, broadly conical with an angle of almost 90 degrees. Protoconch missing,  $4\frac{1}{2}$  whorls remaining, earliest two teleoconch whorls decorticated. Sculpture on spire whorls of 9 strong ribs with equal interspaces, crossing the sloping ramp from suture to suture and terminating in flatly triangular shoulder spines; spines closed to a slit on the adapertural face. Suture undulating around the ends of the spines with the parietal callus intercalated over the last  $\frac{3}{4}$  turn of the bodywhorl. Bodywhorl very strongly shouldered, the shoulder peripheral and carrying 9 strong spines; ribs accompanying the spines muted over the ramp and dying out below. A row of 5 strong anterior spines, slightly curved abaperturally and more openly spinose than the shoulder spines. Anterior fasciole well-developed, encircling an umbilical depression. Over all spiral sculpture of fine, closely spaced, primary and secondary threads. Edge of outer lip missing, no internal lirae. Columella concave, smooth; anal notch narrow, V-shaped; anterior canal short, deep and bent to the left. Moderately thick callus covering a large parietal area.

*Holotype.* – NHMB H 17095. Height 49.0 mm, diameter 38.0 mm (excluding spines).

*Type locality.* – Known only from the early Miocene (Burdigalian?) La Candelaria beds, Paraguaná Peninsula (GS-33).

*Remarks.* – Two specimens only available; the paratype has a concave rather than a planar ramp and one more shoulder spine.

*Comparisons.* – *Melongena candelariana* n.sp. appears much like a cross between *Melongena* and *Vasum* and, at first glance, can be mistaken for *Vasum* cf. *V. tuberculatum* GABB also present, but it lacks columellar folds. The only close relative is the



similarly *Vasum*-like *Melongena orthacantha* PILSBRY & JOHNSON, 1917, from the Miocene of the Dominican Republic. Perhaps that also is early Miocene in age from the Baitoa Formation. The spiral sculpture of the two is very different and *M. orthacantha* has 2 or 3 more shoulder spines at a smaller size.

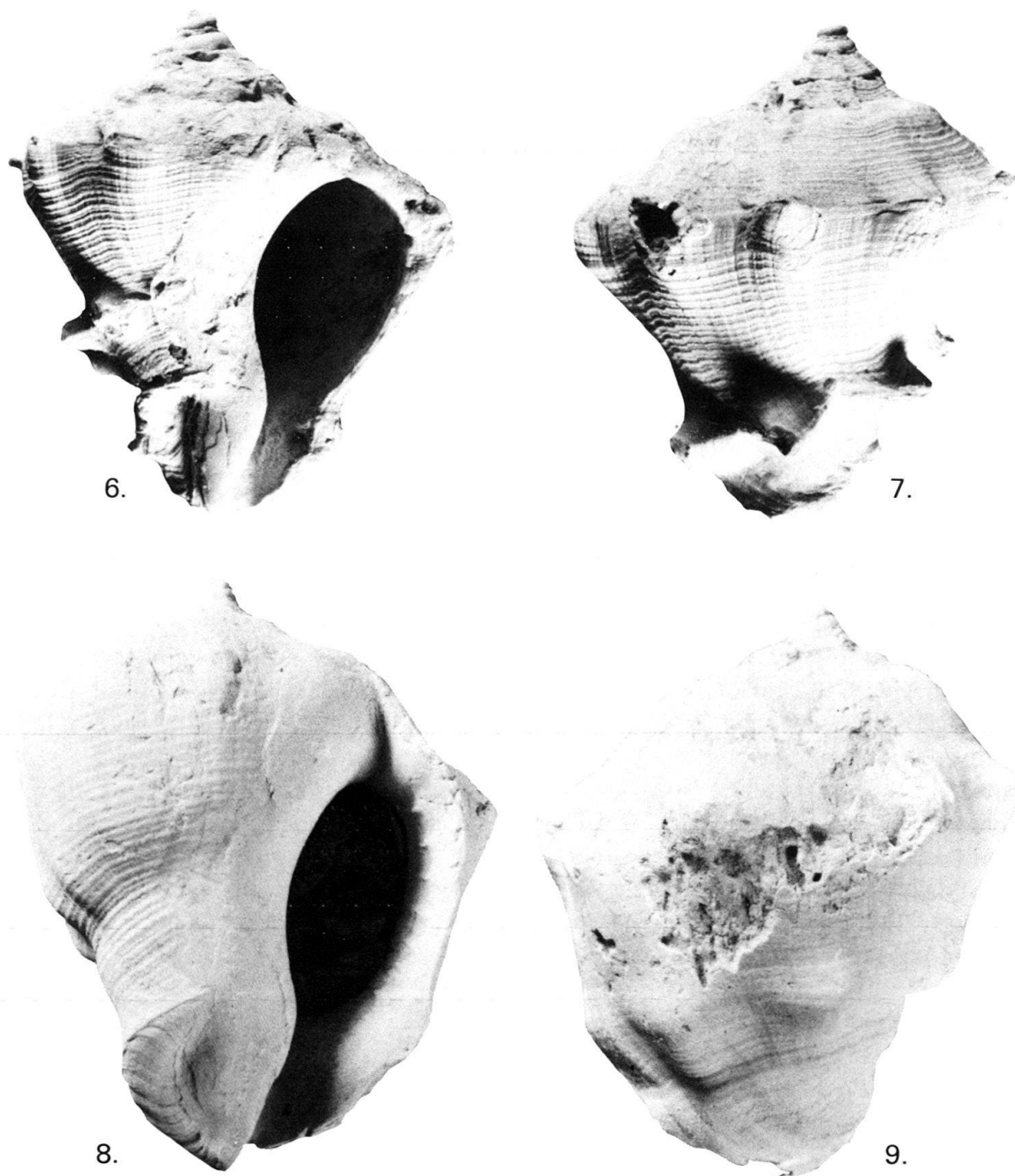


Fig. 6-9. 6, 7 = *Melongena candelariana* GIBSON-SMITH & GIBSON-SMITH, n.sp. Holotype, NHMB H 17095; height 49.0 mm, diameter 38.0 mm (excluding spines). Locality: GS-33-PGNA, La Candelaria beds, Paraguaná Peninsula, Venezuela. 8, 9 = *Torquifer barbascoana* GIBSON-SMITH & GIBSON-SMITH, n.sp. Holotype, NHMB H 17096; height 49.5 mm, diameter 37.0 mm (excluding spines). Locality: GS-2A-PGNA, upper shell bed, Cantaure Formation, Paraguaná Peninsula, Venezuela.

Genus *Torquifer* ROTH, 1981

ROTH (1981), Tulane Stud. Geol. Paleont. 16/4, p. 149.

*Type species* (by original designation) – *Torquifer pittorum* ROTH*Torquifer pittorum* ROTH, 1981

*Discussion.* – It was said earlier that the type species of the genus *Torquifer* might be questioned, the question being whether *T. pittorum* is a junior synonym of *M. colombiana* WEISBORD, 1929, from the Miocene of Colombia (WEISBORD 1929, p.43)? The Colombian specimen illustrated (Fig.10, 11, 12) is from the Shell Company collections for which locality data are no longer available, except that collecting was done in the area of Tubará and on the coast west of Puerto Colombia. *M. colombiana* is known also from the Miocene of Venezuela (HEDBERG 1937, p.2012), Trinidad (MAURY 1925, p.208, as *M. consors*; reassigned by WOODRING 1964, p.273), Ecuador (MARKS 1951, p.118) and Peru (OLSSON 1932, p.177). The type locality of *T. pittorum* is the lower part of the Gatun Formation of Panamá of middle Miocene(?) age; it is known from the holotype and a spire. *M. colombiana* and *T. pittorum* lived at about the same time in the same subprovince and have attributes in common not found in the coexisting melongenids of the region. Nevertheless they were not differentiated by ROTH (1981, p.149). The shared characteristics include a similar medium size and stout outline, a very heavy parietal callus, a single row of shoulder spines, a noded substural cord and a constricted concavity between the anterior row of spines and the siphonal fasciole. In *T. pittorum*, however, the subsutural cord is more finely and closely noded, the nodes being bifid; the sculpture of the ramp is made more complex by strong spiral cords, one or two of which may also be noded; the lower row of spines is less well-developed and, finally, the shoulder spines are coronated. What is clear, nevertheless, is that the affinities of *M. colombiana* lie less with *Melongena* than with *Torquifer*, to which genus it is here transferred. The sculpture of the ramp is more exaggerated in *T. pittorum* than is usual amongst the melongenids. Another instance of exaggerated sculpture occurs in *M. venezuelana* in the suite from the La Candelaria beds, in five out of the nine specimens. The sculpture on the ramp consists of 3 or 4 strong, rounded spiral cords with deep grooves between; in one instance the two cords immediately above the two rows of shoulder spines are strongly noded (Fig.3, 4, 13). Eight of the nine specimens are small (average height 55 mm), but seem adult; they are interpreted as a dwarf community living in less than ideal conditions, resulting in sculptural aberrations on the ramp. It is permissible, therefore, to question whether *T. pittorum* is only an aberrant form of *T. colombiana*, which lived in an adverse environment. If the two species do coexist, then the Venezuelan form of *T. colombiana*, as illustrated by HEDBERG (1937, p.2012), may have to be reassigned to *T. pittorum*. It seems that only by the finding of more specimens can this problem be resolved.

The strong resemblance between *Torquifer* and the Eocene genus *Cornulina* Conrad, was discussed by ROTH (1981, p.177), the essential difference being the presence of a *Pseudoliva*-like spiral groove below the anterior row of spines in



*Cornulina*, ending with a tooth in the aperture and with a change in direction of the growthlines across the groove. Although *T. pittorum* was said to be larger than any recorded *Cornulina*, with a height of 83 mm it is smaller than a specimen of *C. armigera* Conrad from the Mexican Eocene, which may have reached 100 mm (GARDNER 1945, p.203).

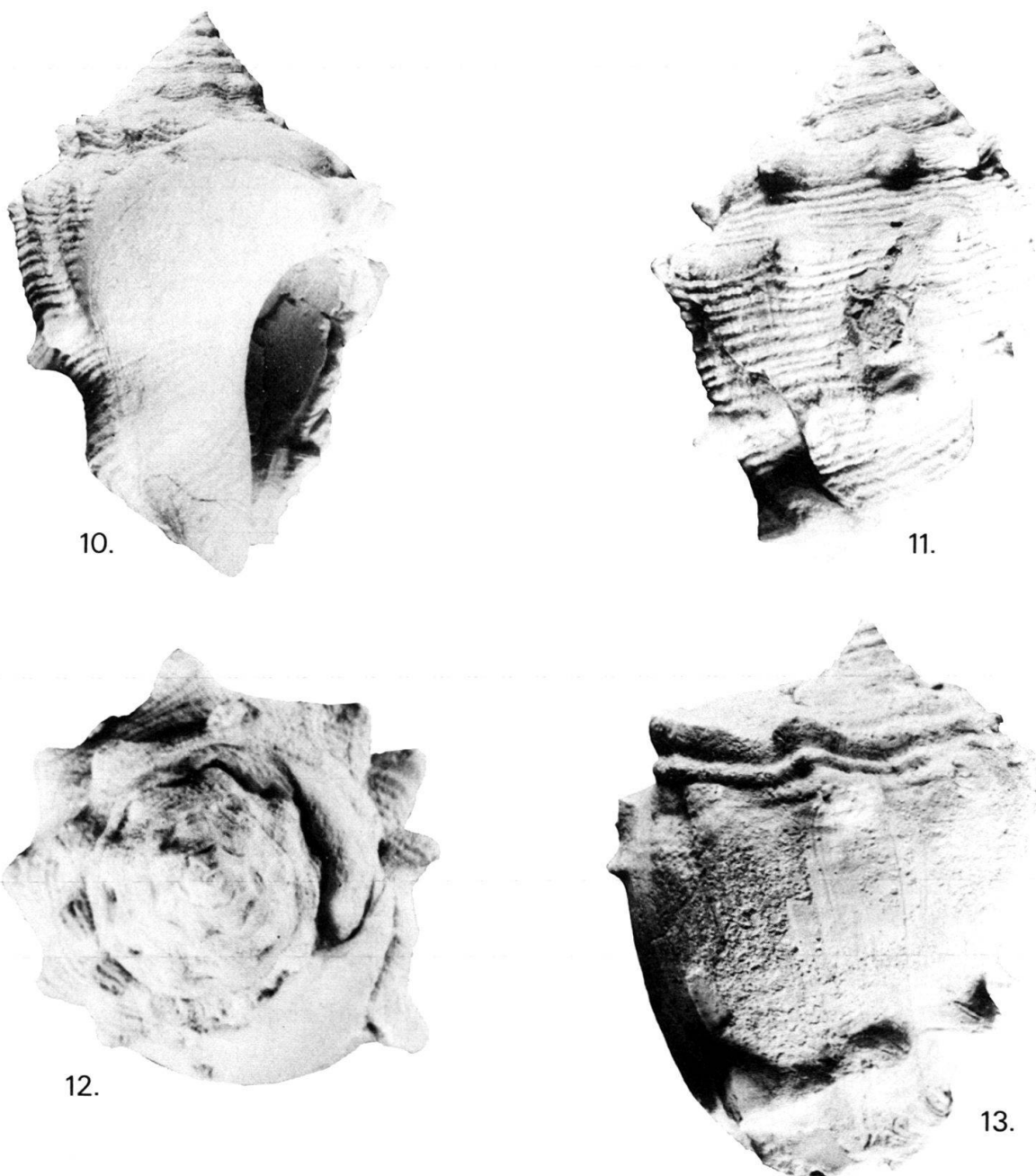


Fig. 10-13. 10-12 *Torquifer colombiana* (WEISBORD 1929). UCVG 7062: height 41.4 mm, diameter 21.1 mm. Locality: Mio.Pliocene, Tubará-Puerto Colombia area, Colombia. 13 = *Melongena venezuelana* GIBSON-SMITH & GIBSON-SMITH, n.sp. UCVG 7063: height 51.7 mm, diameter 38.2 mm. Locality: GS-33-PGNA, La Candelaria beds, Paraguaná Peninsula, Venezuela.

*Torquifer barbascoana* Gibson-Smith & Gibson-Smith, n. sp.

Fig. 8, 9

*Description.* – Shell of medium size reaching a height of about 50 mm, stout, strongly shouldered at the periphery, bodywhorl more than  $\frac{3}{4}$  of the height. Spire short, broadly conical. Protoconch worn, about  $1\frac{1}{2}$  whorls; teleoconch of about  $4\frac{1}{2}$  whorls. Spire whorls with 8 axial ribs crossing the sloping ramp, the suture undulating around the ribs. On the bodywhorl the ramp becomes convexly dome-shaped and lacks ribs. On the shoulder are 8, flattened, spirally elongate nodes, later nodes sometimes openly spinose on the adapertural face. On the lower half of the shell is a second row of up to 7 axially elongate nodes; profile concave between upper and lower paired nodes. Bodywhorl constricted across the anterior row of nodes to produce a neck down to the anterior fasciole; around the neck lies a broad, low fold with an occasional weak node. Anterior fasciole strong, separated by a fine spiral ridge and encircling an umbilical depression. Edge of outer lip thin with from 12 to 25 subequal lirae within, not extending far back and stopping well short of the lip edge, which not crenated. Columella concave, smooth, callus extending well onto the parietal wall. Anterior canal short, deep, inclined to the left; anal notch narrowly V-shaped. Over all spiral sculpture of fine, subequal cords, interrupted by growth striae.

*Holotype.* – NHMB H 17096. Height 49.5 mm, diameter 41.2 mm.

*Type locality.* – Upper shell bed of the early Miocene (Burdigalian) Cantaure Formation, Paraguaná Peninsula, Venezuela (GS-2A).

*Range.* – Known only from the lower (GS-1) and upper (GS-2A, 6) shell beds of the Cantaure Formation in the neighbourhood of Cantaure.

*Paratypes.* – PRI 8227; BM(NH).

*Remarks.* – The type material consists of 4 specimens from the upper shell bed and 2 from the lower; they show no particular variation.

*Comparisons.* – *Torquifer barbascoana* n.sp. is not unlike small specimens of *Melongena venezuelana* (Fig. 5), but that lacks the anterior, *Cornulina*-like restriction on the bodywhorl. It differs from *T. colombiana* and *T. pittorum* in lacking the row of nodes below the suture and the complicated sculpture of the ramp in the latter; these forms, moreover, lack lirae within the outer lip. Considering these differences, it may be that *T. barbascoana* merits subgeneric rank under *Torquifer*.

### Locality data

Reference can be made to two published maps: JUNG (1965, Text Fig. 2) and DIAZ DE GAMERO (1974, Text Fig. 1). Both show a single house at Cantaure, but a second now stands adjacent to the road, 260 m on a bearing of 172 degrees from the old; it straddles the Cantaure fault. All references are to the new Casa Cantaure.

GS-1-PGNA. Cantaure Fm(lower shell bed): 300 m SSE of Casa Cantaure.

GS-2A-PGNA. Cantaure Fm(upper shell bed): 450 m south of Casa Cantaure on southern slope of Loma Barbasco (= Re 1148).

GS-6-PGNA. Cantaure Fm(upper shell bed): 1050 m WSW of Casa Cantaure and 250 m NW of Casa La Libertad.

GS.10-PGNA. Cantaure Fm(upper shell bed): 375 m ESE of Casa Cantaure (= Re 1154).

GS-24-PGNA. Cauderalito Mb., Agua Clara Fm: 250 m SSW of Casa Cantaure, adjacent to and west of the Cantaure fault, the upthrown side.

GS-33-PGNA. La Candelaria beds: 1600 m west of Casa Cantaure and 50 m north of Casa La Candelaria.

GS-122-PGNA. Cantaure Fm(upper shell-bed): 550 m southeast of Casa Cantaure (approx. 100 m south of Re 1153).

#### REFERENCES

- GARDNER, J. (1945): Mollusca of the Tertiary formations of northeastern Mexico. – Mem. geol. Soc. Amer. 11, 1-332.
- GIBSON-SMITH, J., & GIBSON-SMITH, W. (1979): The genus *Arcinella* (Mollusca: Bivalvia) in Venezuela and some associated faunas. – Geos 24, 11-32.
- HEDBERG, H.D. (1937): Stratigraphy of the Rio Querequal section of northeastern Venezuela. – Bull. geol. Soc. Amer. 48, 1971-2024.
- HUNTER, V.F. (1978): Foraminiferal correlation of Tertiary mollusc horizons of the southern Caribbean area. – Geol. en Mijnb. 57/2, 193-203.
- HUNTER, V.F., & BARTOK, P. (1974): The age and correlation of the Tertiary sediments of the Paraguaná Peninsula, Venezuela. – Bol. (inform.) Asoc. venez. Geol. Min. Petroleo 17/7-9, 143-154.
- JUNG, P. (1965): Miocene mollusca from the Paraguaná Peninsula, Venezuela. – Bull. amer. Paleont. 49/223, 387-652.
- MARKS, J.G. (1951): Miocene stratigraphy and paleontology of southwestern Ecuador. – Bull. amer. Paleont. 33/139, 271-432.
- MAURY, C.J. (1925): A further contribution to the paleontology of Trinidad(Miocene horizons). – Bull. amer. Paleont. 10/42, 1-250.
- OLSSON, A.A. (1932): Contributions to the Tertiary paleontology of northern Peru. Pt. 5. The Peruvian Miocene. – Bull. amer. Paleont. 19/68, 1-272.
- (1964): Neogene mollusks from northwestern Ecuador. – Paleont. Res. Inst., Ithaca, N.Y., p. 1-61.
- OLSSON, A.A., & RICHARDS, H.G. (1961): Some Tertiary fossils from the Goajira Peninsula of Colombia. – Notulae Naturae Acad. nat. Sci. Philadelphia 350, 1-16.
- PILSBRY, H.A. (1922): Revision of W.M. Gabb's Tertiary Mollusca of Santo Domingo. – Proc. Acad. nat. Sci. Philadelphia 73, 305-435.
- ROTH, B. (1981): A remarkable melongenid gastropod from the Gatun Formation, Panamá. – Tulane Stud. Geol. Paleont. 16/3-4, 149-153.
- THOMAS, D.J. (1972): The Tertiary geology and systematic paleontology (Phylum Mollusca) of the Guajira Peninsula, Colombia, South America. – Ph.D. thesis, State Univ. New York (Binghamton).
- WEISBORD, N.E. (1929): Miocene Mollusca of northern Colombia. – Bull. amer. Paleont. 14/54, 1-57.
- WOODRING, W.P. (1964): Geology and paleontology of Canal Zone and adjoining parts of Panamá. Description of Tertiary mollusks (gastropods: Columbelloidea to Volutidae). – Prof. Pap. 306-C, U.S. geol. Surv. 241-297.