

A new species of *Lobatus* (Caenogastropoda, Strombidae) from the Neogene of the Dominican Republic, with notes on further species from the Dominican assemblages

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New taxonomic insights on the strombid fauna in the Dominican Republic are presented. *Lobatus pascaleae* spec. nov. is described. *Strombus wilsonorum* Petuch, 1994, *Strombus (Lentigo) fetus* Jung & Heitz, 2001, and *Strombus (Tricornis) magolecciai* Macsotay & Villaroel, 2001, are all junior subjective synonyms of *Lobatus raninus* (Gmelin, 1791). An updated list is given of *Strombus* and *Lobatus* species from the Dominican Republic Neogene.

Key words: Gastropoda, Strombidae, *Lobatus*, taxonomy, Neogene, Dominican Republic.

INTRODUCTION

The rich assemblage of Strombidae in the Neogene deposits of the northern Dominican Republic was addressed recently by Freiheit & Geary (2009) as part of the “Dominican Republic paleontology project” (see Vokes, 1989). Their work provided a good account of the more common taxa found in Dominican Republic Neogene rocks and highlighted the dif-

ficulties of fossil strombid taxonomy and the great intraspecific variability within this group. However, a few of the less common species in the Dominican Republic were not recorded in Freiheit & Geary’s (2009) monograph.

Following the generic classification of the Caribbean Strombidae outlined by Landau et al. (2008) and Freiheit & Geary (2009), only two genera have so far been recognised in Dominican Republic Neogene assemblages, viz. *Strombus* Linnaeus, 1758, and *Lobatus* Iredale, 1921. In the present paper we add further comments on three of the less common *Lobatus* species found in these deposits, and describe one new species of that genus.

MATERIAL AND METHODS

The material described here is housed in the Naturhistorisches Museum Basel, Switzerland and the Bernard Landau collection, now deposited in the Naturhistorisches Museum, Vienna, Austria. Further material was studied in the Gijs Kronenberg collection, Eindhoven, The Netherlands.

Abbreviations: ANSP, Academy of Natural Sciences of Philadelphia, U.S.A.; BL, Bernard Landau collection, now deposited in the Naturhistorisches Museum Wien (NHMW); BM(NH), The Natural History Museum, London, U.K.; GK, Gijs Kronenberg collection, Eindhoven, The Netherlands; MHNG, Muséum d'histoire Naturelle de Genève, Geneva, Switzerland; NHMW, Naturhistorisches Museum Wien, Austria; NMB, Naturhistorisches Museum Basel, Switzerland; UF, University of Florida, Gainesville, U.S.A.; ZMA, Zoologisch Museum Amsterdam, The Netherlands; ZMMU, Zoological Museum of Moscow State University, Moscow, Russia.

SYSTEMATIC PART

Superfamily Stromboidea Rafinesque, 1815

Family Strombidae Rafinesque, 1815

Genus *Lobatus* Iredale, 1921

Type species (by monotypy): *Strombus bituberculatus* Lamarck, 1822 (= *S. raninus* Gmelin, 1791). Early Pliocene to Recent, West Indies and Florida.

Discussion. — Even if the name *Lobatus* was a historical accident as claimed by Jung & Heitz (2001: 40), referring to Abbott's (1960: 53) remarks, Iredale (1921: 208) made the name available. The name *Lobatus* was cited by Thiele (1929: 255) in the synonymy of Thiele's "sectio *Euprotomus* Gill 1869" as "*Lobatus* (Swainson) Anon., 1837, Iredale 1921". Subsequently *Lobatus* was saved from oblivion by Petuch (1994: 263) as a subgenus of *Strombus*. For further discussion see Kronenberg & Lee (2007).

Lobatus raninus (Gmelin, 1791) (Figs 1-4)

Strombus raninus Gmelin, 1791: 3511; Turton, 1802: 419; Bales 1942: 18, pl. 4c; Van Hyning, 1945: 95, fig. on p. 95 [not figs on pp 96-98]; Abbott, 1954: 175, pl. 5 fig. c; Warmke & Abbott, 1962: 89, pl. 2G; Rice & Kornicker, 1962: 373, pl. 5 figs 5, 10; De Jong & Kristensen, 1965: 26; Percharde, 1970: 75; Shoemaker, 1971: 72; Van Pel, 1973: 4; Humphrey, 1975: 101, pl. 8 fig. 5-5c; Dance, 1977: 85, bottom fig. middle column; Abbott & Dance, 1982: 76, middle row, second fig. from left; Domaneschi, 1983: 11, figs 5, 12; Odé, 1982: 16; Rios 1985:

53, pl. 14 fig. 200; Coomans, 1989: 50, text-fig. 51 (pl. 7); Seyer, 1994: 200; Merlano & Hegedus, 1994: 157, pl. 49 fig. 574; Reed, 1995a: 325, fig. 2c (penis), fig. 6a (section prostate gland); Reed, 1995b: 331; Redfern, 2001: pl. 24 fig. 201A-B; Shawl & Davis, 2004: 157; Oliva Rivera & De J. Navarrete, 2007: 155, fig. 4J (larval shell).

Strombus affinis Gmelin, 1791": 3520; Turton, 1802: 425.

Lambis curruca Röding, 1798: 64.

Strombus raninus Bosc, 1801: 250 (error pro. *raninus*, refers to Knorr Vergnügen 6, pl. 29 fig. 8).

Strombus sulcatus G. Fischer, 1807: 188 (junior primary homonym of *Strombus sulcatus* Holten, 1802; senior primary homonym of *S. sulcatus* Anton, 1839, and of Watson, 1886).

Strombus quadratus Perry, 1811: pl. 12 fig. 1 [see also Petit, 2003: 46].

Strombus bituberculatus Lamarck, 1822: 690; Defrance, 1827: 114; Wood, 1828: 14, pl. 4 fig. 15; Kiener, 1843: 15, pl. 10 fig. 1; Chenu, 1844: pl. 21 figs 3-5, pl. 22 figs 3, 4; Reeve, 1851: pl. 13 fig. 30; Chadwick, 1899: 77.

Strombus lobatus Swainson, 1823, caption to pl. 153; G. B. Sowerby II, 1842: 34, pl. 8 figs 76-78.

Strombus ranimus Bosc, 1830: 235 (error pro. *raninus*, refers to Knorr Vergnügen vol. 6, pl. 29 fig. 8).

Strombus costosomuricatus "Martyn" Mörch, 1852: 61.

Strombus raninus var. *pumilio* Mörch, 1877: 20 (nomen nudum).

Strombus (*Monodactylus*) *bituberculatus*. Tryon, 1885: 112, pl. 4 figs 32, 33.

Lobatus bituberculatus. Iredale, 1921: 208.

Strombus (*Strombus*) *raninus*. Clench & Abbott, 1941: pl. 1, left fig. (juvenile), 2, pl. 2.

Strombus (*Tricornis*) *raninus*. Abbott, 1960: 53; Robertson, 1961: 4; Abbott, 1974: 144, pl. 4, fig. 1585; Lindner, 1975: pl. 17 fig. 3; Wagner & Abbott, 1978: 09-656; Walls 1980: 85, 2 unnumbered figs bottom p. 86; Kronenberg & Berkhout, 1984: 310, pl. 3 fig. 3; De Turck et al., 1999: 31, pl. 51 figs 1-8, pl. 127 fig. 5; Karnekamp, 2000: 126.

Strombus raninus nanus Bales, 1942: 19, pl. 4a-b.

Strombus (*Lobatus*) *wilsonorum* Petuch, 1994: 75, 84, pl. 16 fig. K (junior primary homonym of *S. wilsonorum* Abbott, 1967).

Strombus praeranus Kronenberg & Dekker, 2000: 5 (replacement name for *Strombus wilsonorum* Petuch, 1994, non Abbott, 1967).

Strombus (*Lentigo*) *raninus*. Jung & Heitz, 2001: 39, figs 12-18.

Strombus (*Lentigo*) aff. *raninus*. Jung & Heitz, 2001: 39, fig. 19.

Strombus (*Lentigo*) *fetus* Jung & Heitz, 2001: 48, figs 25, 26A-D.

Strombus (*Tricornis*) *magolecciai* Macsotay & Villaroel, 2001: 51, pl. 13 figs 19, 21.

Tricornis raninus. Simone, 2005: fig. 22 (shell), figs 178-189 (anatomy), 189-191.

Type material and synonymy. — For *Strombus raninus* Gmelin (1791: 3511) referred to Knorr's (1775) Vergnügen, vol. 6, pl. 29 fig. 8. That figure, based on a specimen from the Houttuyn collection (fide H. H. Dijkstra, e-mail November 2009) is available on line at www.stromboidea.de/?n=Species.LobatusRaninus, and has the Dutch vernacular name "Roode Kikvorsch" (red frog, in ancient Dutch spelling, hence *raninus*), but shows the specimen from a somewhat unfortunate angle. However, in our opinion it is recognizable as a specimen of *Lobatus raninus*. Although some material of the Houttuyn collection is present in ZMA (H. H. Dijkstra, e-mail November 2009), this specimen could not be recognised (pers. comm. Rob Moolenbeek). The present whereabouts of this specimen are unknown. A type locality was not stated.

Strombus affinis: Gmelin (1791: 3511) referred to Lister (1688: 889 fig. 10). In our opinion, this figure most likely represents an immature specimen (terminology after Savazzi, 1991) of *L. raninus*. Gmelin possibly was aware that it was not an adult specimen, as he added "Lucifero affinis". To our knowledge this name has been cited only by two later authors: (1) Turton (1802: 425), who cited the same reference. He added a very brief description: "Shell transversely striate gibbous: spire unarmed, the first whorl crowned with tubercles". (2) Mörch (1852: 61), in his synonymy of *Strombus costosomuricatus*. Although it was not listed by Wilkins (1953), we cannot exclude the possibility that the specimen illustrated by Lister was once part of the Sloane collection and may still be present in BM(NH). A type locality was not stated. As first revisers, we select the name *Strombus raninus* as the valid name to be used for the species named both *Strombus raninus* and *Strombus affinis* by Gmelin (1791).

Lambis curruca: Röding referred to Gmelin (1791: 3511, species no. 11), Martini (1777: pl. 83 figs 836-837) and De Favanne & De Favanne (1780: pl. 21 fig. A 4). Röding's references are a mixture of two species; Gmelin's (1791: 3511, spec. no. 11) is *Strombus gallus* (here assigned to *Lobatus*), while Martini's figures clearly depict what is now referred to as *Lobatus raninus*. A type locality was not indicated. We se-

lect the specimen illustrated by Martini (1777, pl. 83 fig. 836 [dorsal view]) as the lectotype of *Lambis curruca* Röding, for further considerations for this lectotype designation see also Kronenberg (accepted).

Strombus rarinus: Bosc (1801) used the same reference as Gmelin (1791: 3511), viz. Knorr's (1775) Vergnügen vol. 6, pl. 29 fig. 8. We consider *S. rarinus* a lapsus calami for *S. raninus* (see also further below). A type locality was not indicated.

Strombus sulcatus: Lectotype and paralectotype present in ZMMU L-718. For further details see Ivanov et al. (1993), who illustrated both the lectotype (pl. 3 fig. 1) and a paralectotype (pl. 3 figs 4, 5). We concur with their conclusions. A type locality was not indicated.

Strombus quadratus: The whereabouts of Perry's specimen are not known. Type locality: "It has been found only in the West Indies" (Perry, 1811).

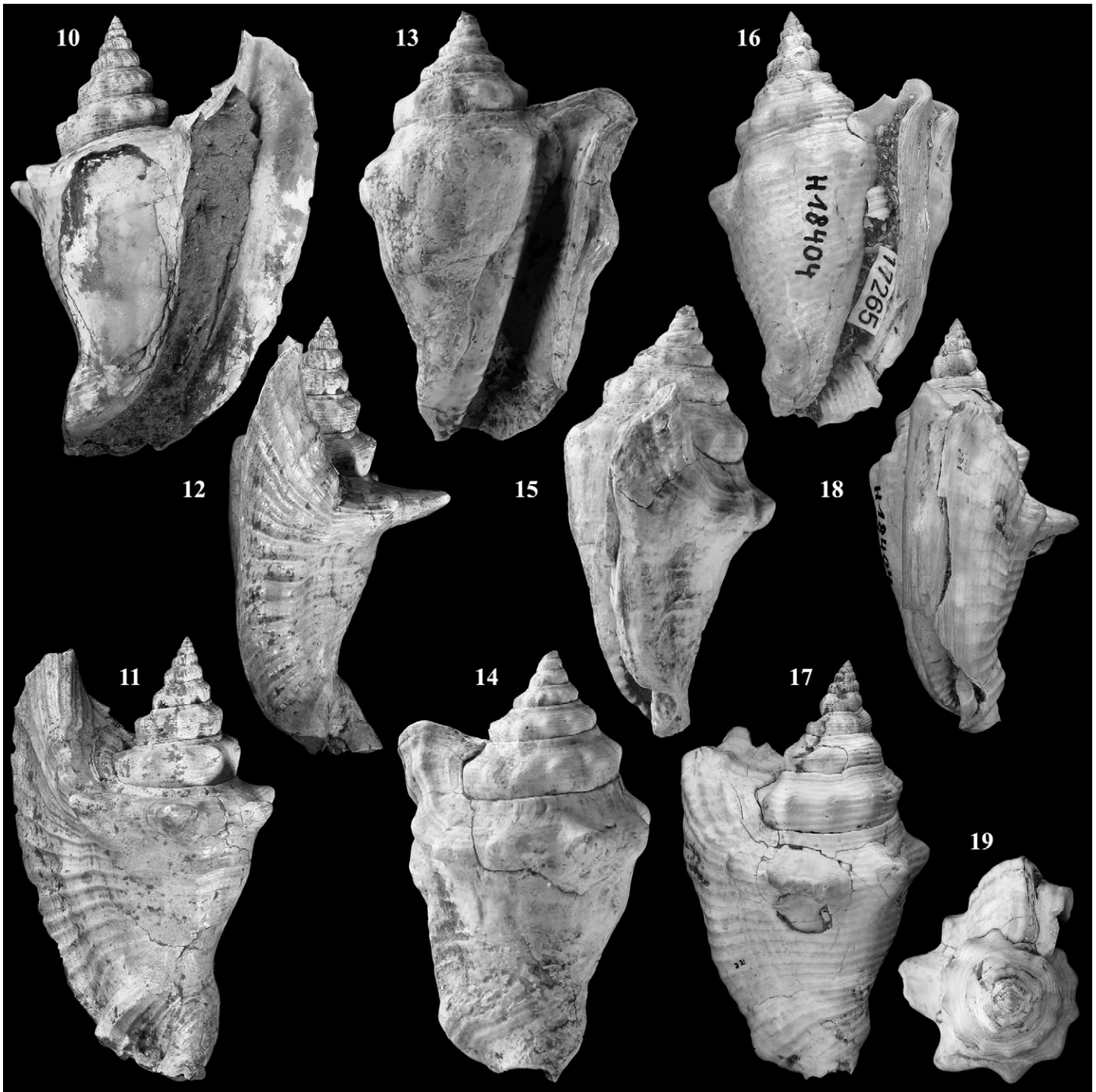
Strombus bituberculatus: One syntype present in MHNG, MHNG INVE 51949 (formerly MHNG 1100/41) (Figs 1, 2). The specimen illustrated is the only remaining syntype in the Lamarck collection in MHNG. Hand-written annotations by Lamarck's daughter in Lamarck's copy of "Animaux sans Vertèbres" in MHNG mention three specimens originally present in the collection (pers. comm. Yves Finet, MHNG, to GK, January 2010). The whereabouts of the two other syntypes are not known to us. Type locality: "Habite l'Océan des Antilles".

Strombus lobatus: Swainson's (1823: pl. 153) figures undoubtedly illustrate *L. raninus*. The whereabouts of the specimen are unknown to us. Type locality: "Found, in great

Figs 1-9. *Lobatus* spp. 1-2, *Lobatus raninus* (Gmelin, 1791), syntype of *Strombus bituberculatus*, MHNG INVE 51949 (ex MHNG 1100/41), height 88.6 mm; "Habite l'Océan des Antilles"; photographs Ph. Wagneur, MHNG; 3-4, *Lobatus raninus* (Gmelin, 1791), dwarf specimen, GK 5858, height 40.1 mm; Recent, Bastimentos Island, Bocas del Toro, Panama, leg. Monika Forner, don. Ron P. Voskuil, photographs Bernard Landau; 5-9, *Lobatus vokesae* Landau, Kronenberg & Herbert, 2008, NMB H18405, height 230.0 mm; Gurabo Formation, Late Miocene - Early Pliocene; Cibao Valley, Rio Gurabo, Loc. NMB 16810, Dominican Republic, leg. P. Jung & J. Geister, 17.III.1979, photographs Virgilio Liverani.



For legends see previous page



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abundance, in various parts of the West India seas.”

Strombus rarimus: Bosc (1830) again used the same reference as before (Bosc, 1801), viz. Knorr’s (1775) Vergnügen vol. 6, pl. 29 fig. 8. In all probability, *rarimus* is a second misspelling for *raninus*, i.e. yet another lapsus calami. Again, a type locality was not indicated.

Strombus costosomuricatus: Mörch (1852) used Martyn’s (1784) name as an available name. The work by Martyn was subsequently rejected in ICZN (Opinion 456, 1957), so the name must be attributed to Mörch. Type locality: Antill[es] (Mörch, 1852: 61).

Strombus raninus var. *pumilio* Mörch, 1877: According to Rosenberg (2009) this is a *nomen nudum*. Type locality: Vera Cruz.

Strombus raninus nanus: Holotype and 1 paratype ANSP 178696. Bales (1942: 18, pl. 4a, b) introduced this as a distinct subspecies, stating four differences: 1) the small size; 2) the length of the tip of the outer lip; 3) the darker coloration; and 4) the much finer “grain” of the shell. However, specimens matching the description by Bales occur throughout the range of *L. raninus* (see further below) and we conclude that this name is a junior synonym of *Lobatus raninus*. Type locality: southern end of Lake Worth, Palm Beach County, Florida, U.S.A.

Strombus (Lobatus) wilsonorum: Holotype UF66215. Petuch (1994: 263, pl 21K) differentiated his new species from *L. raninus* by having a narrower, more cylindrical shell, a higher,

more strongly stepped spire with more heavily sculptured whorls, more numerous, smaller knobs on the shoulder of the last whorl, and a more projecting, pointed lip. As for *S. r. nanus*, we find the distinguishing characters mentioned by Petuch expressed in Recent specimens from various localities, and therefore consider *S. wilsonorum* Petuch to be a junior synonym of *L. raninus*. Note that *Strombus praeranus* Kronenberg & Dekker, 2000 was introduced as a new name for *S. wilsonorum* Petuch, 1994 (a junior primary homonym of *S. wilsonorum* Abbott, 1967), and therefore the type material and locality for *S. praeranus* are the same as for *S. wilsonorum*, and *S. praeranus* is a further synonym of *L. raninus*. Type locality: Holey Land Fauna, Capeletti Bros. Pit #11, NW 47th west of Florida Turnpike, Miami, Dade County, Florida, U.S.A.

Strombus (Lentigo) fetus: Holotype NMB H 17854. Jung & Heitz (2001: 50) stated that *Strombus fetus* was not related to any of the other species discussed by them. This remark is surprising, as the only difference they mentioned from *S. raninus* is the absence of large knobs – referred to as spines by Jung & Heitz – in *S. fetus*. Like Jung & Heitz, we do not see any other differences. We have examined specimens of *L. raninus* with knobs of intermediate size between the common, coarsely sculptured form and the form named *S. fetus* by Jung & Heitz (2001) (GK). Therefore, we consider *S. fetus* to be a further junior synonym of *S. raninus*. Type locality: NMB locality 18677 (= Panama Paleontology Project locality 02178), 1 km east of Long Bay Point, N coast of Escudo de Veraguas, Bocas del Toro, Panama; Escudos de Veraguas Formation (late Pliocene).

Strombus (Tricornis) magolecciai: The holotype was never deposited in a reference collection, and remains in Oliver Macsotay’s private collection (Oliver Macsotay pers. comm. 2010). Described from the Recent fauna of the Margarita platform, Venezuela, *S. magolecciai* supposedly differs from *Lobatus raninus* in having the outer lip wing extending beyond the height of the spire in a single lobe rather than two, in having twelve small nodules on the last whorl rather than two large ones, and in having a yellowish white rather than red or blue aperture (Macsotay & Villaroel, 2001). While most specimens of *Lobatus raninus* do have two lobes on the

Figs 10-19. *Lobatus* spp. 10-12, *Lobatus galliformis* (Pilsbry & Johnson, 1917), NHMW 2010/0037/0001 (ex. BL), height 70.5 mm; Gurabo Formation, Late Miocene - Early Pliocene; Cibao Valley, Río Amina, Loc. TU 1219, Dominican Republic; 13-15, *Lobatus pascaleae* spec. nov., holotype, NHMW 2009z0094/0001 (ex. BL), height 42.5 mm; unnamed unit of same age as Cercado Formation (late Miocene), sandy facies just above mouth of Angostura Gorge, Río Yaque del Norte, Dominican Republic; 16-19, *Lobatus pascaleae* spec. nov., paratype, NMB H18404, height 48.0 mm; Baitoa Formation, late Early-early Middle Miocene, López Section, Río Yaque del Norte, Loc. NMB 17265, Dominican Republic; leg. P. Jung & J. Geister, 17.III.1979; photographs Bernard Landau.

posterior edge of the outer lip, we have Recent specimens at hand (GK) also with a single lobe from other localities, and the outer wing extension varies in length from below the apex to reaching beyond it. The number of smaller knobs corresponds with the form named *S. fetus* by Jung & Heitz. As far as the colour of the aperture is concerned, we have examined specimens with a white through off white, slightly pinkish to a reddish colour. A blue aperture has not been observed by us, and we consider it more likely that the exterior colour of the last whorl, which can have a bluish grey tone, shows through the inner lip callus layer of some specimens. In our opinion, *Strombus magolecciai* is another junior synonym of *L. raninus*. Type locality: quadrant G-17 of Macsotay & Villaroel (2001: map 2), Margarita platform, Venezuela.

Material and dimensions. — One specimen NMB H 17806, from NMB locality 18952 (= TU 1206), road cut at km 17, highway from Santiago to San José de las Matas, west of bridge over Rio Yaqué del Norte at Santiago de los Caballeros, Dominican Republic. Gurabo Formation (probably Early Pliocene). Height 77.3 mm, width 67.4 mm (illustrated by Jung & Heitz 2001, fig. 19A-D).

Remarks. — The shell illustrated by Jung & Heitz (2001: 38, fig. 19A-D) as *Strombus (Lentigo) aff. raninus* Gmelin fits well within the range of variation of this species. We (BL, CMS) have found no further specimens in Dominican Republic Neogene rocks.

Jung & Heitz (2001: 48, fig. 26A-D) described the new species *Strombus (Lentigo) fetus* from the Late Pliocene Escudo de Veraguas Formation, Escudo de Veraguas Island, Bocas del Toro. In their discussion they commented that despite the general shape and apical angle being similar to that of *S. raninus*, the resemblance was superficial and that the last two knobs on the shoulder of the last whorl were not developed as in *S. raninus*. *Lobatus raninus* is, like many strombids, quite variable in size, sculpture and colour, both on the shell exterior and within the aperture. The name *Strombus raninus nanus* Bales, 1942 was established for dwarf specimens from Lake Worth, Palm Beach County, Florida, U.S.A. Dwarfs are a rather common phenomenon in nearly all strombid taxa, and *L. raninus* is no exception. Dwarfs are

also known from Aruba (Karnekamp, 2000). Dwarf specimens in the GK collection are from Ambergris Cay, Belize (leg. H. Conley, don. Alan G. Beu), Bastimentos Island, Bocas del Toro, Panama (Figs 3, 4), Yupeh Isl., Panama, ex Rob Walburg, and Aruba, Paardenbaai (leg. et don. J. Berkhout). In our opinion, *S. fetus*, *S. raninus nanus* and *S. (Tricornis) magolecciai* Macsotay & Villaroel, 2001 are all trivial variants of *L. raninus*.

Distribution. — **Early Pliocene:** Gurabo Formation, Dominican Republic (Jung & Heitz: 2001). **Late Pliocene:** Escudo de Veraguas Formation, Escudo de Veraguas Island, Bocas del Toro, Panama (Jung & Heitz: 2001). **Plio/Pleistocene boundary:** Moín Formation, Costa Rica (Jung & Heitz: 2001). **Pleistocene:** Holey Land Unit of Petuch (1994), Florida, USA; Barbados (Jung & Heitz: 2001); Ground Creek Formation, Isla Colón, Bocas del Toro, Panama (Jung & Heitz: 2001); Haiti (Jung & Heitz: 2001). **Holocene:** Antigua (Jung & Heitz: 2001); Isla Margarita, Cubagua Island, Venezuela (BL). **Recent:** North Carolina to Brazil (Odé: 1982; Rios: 1985).

Lobatus vokesae Landau, Kronenberg & Herbert, 2008
(Figs 5-9)

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Lobatus vokesae Landau, Kronenberg & Herbert, 2008: 33, figs 1-7.

? *Lobatus dominator* (or *L. vokesae*?). Freiheit & Geary, 2009: 12, text-fig. 7.

? *Lobatus dominator*. Freiheit & Geary, 2009: pl. 8 figs 11-12 [in part; not pl. 8 figs 1-10; pl. 9 figs 1-9 = *Lobatus dominator* Pilsbry & Johnson, 1917]

Remarks. — As we were aware of each other's work on Dominican Strombidae, Dana Geary kindly made the manuscript of Freiheit & Geary (2009) available to the first two authors prior to publication. Based on this manuscript and knowing that it would not interfere with the work by Freiheit & Geary (2009), Landau et al. (2008) were able to describe a new species, *Lobatus vokesae* Landau, Kronenberg & Herbert, 2008, based on specimens collected by Landau during 2003-2007. Although it was not discussed in detail, *L. vokesae* subsequently was accepted by Freiheit & Geary (2009).

Lobatus vokesae is rare in the Dominican Republic deposits, and we take the opportunity to illustrate a beautiful large specimen from locality NMB 16810, in Gurabo Formation on the Gurabo River, in the NMB collections (NMB H18405). At the time of writing the initial description this specimen was out on loan, otherwise it would certainly have been chosen as the holotype. It was probably even larger than the paratype, as it is similar in size, and the anterior portion of the shell is missing. The position of the knobs on the last whorl is similar to that of the two type specimens, although the dorsal knob on the Basel shell is massively developed. The shape of the spire and the sculpture agrees with those in the original description. The posterior portion and periphery of the outer lip, missing in the type material, can now be described. Posteriorly, the outer lip develops a wide alation, which extends well beyond the apex.

Distribution. — **Early Pliocene:** Cercado and Gurabo Formations, Dominican Republic (Landau et al., 2008).

Lobatus galliformis (Pilsbry & Johnson, 1917) (Figs 10-12)

Strombus galliformis Pilsbry & Johnson, 1917: 170; Pilsbry, 1922: 366, pl. 31 figs 1-2.

Lobatus galliformis. Freiheit & Geary, 2009: 20, pl. 7 figs 1-5, 8-14 [in part; not figs 6-7 = *Lobatus pascaleae* spec. nov.].

Remarks. — Freiheit & Geary (2009: 21) commented that although *Lobatus galliformis* (Pilsbry & Johnson, 1917) is the least common strombid in the Dominican Republic assemblages, its temporal range exceeds that of *Lobatus dominator* (Pilsbry & Johnson, 1917) and *L. haitensis* (G.B. Sowerby I, 1850). All the specimens recorded by them are from the Gurabo Formation, except the single specimen from locality NMB 17265 on the Lopez section of the Yaque del Norte River (Freiheit & Geary, 2009: pl. 7, figs 6-7; Figs 16-19). Here we consider this specimen to represent a distinct species; *Lobatus pascaleae* spec. nov. Two specimens of *L. galliformis* are present in BL, one from locality TU 1219, Amina River, and the other from Maury's Bluff 1 on the Mao River. Both localities were assigned to Gurabo Formation by Saunders et al. (1986). It therefore seems that *L. galliformis* is restricted to the Gurabo Formation.

Lobatus galliformis is rare in the Dominican Republic assemblages, and we take this opportunity to illustrate a complete specimen (NHMW 2010/ 0037/ 0001, ex BL; Figs 10-12) with more strongly developed shoulder spines on the last whorl than any of the specimens figured by Freiheit & Geary (2009: pl. 7 figs 1-5, 8-14)

Distribution. — **Early Pliocene:** Gurabo Formation, Dominican Republic (Freiheit & Geary, 2009).

Lobatus pascaleae spec. nov. (Figs 13-19)

Type series. — Holotype NHMW 2009z0094/0001 (Figs 13-15; ex. BL), height 42.5 mm, from NMB locality no. 17265, unnamed unit of same age as Cercado Formation (late Miocene), clayey facies 2.5 km (0.7 km straight line) upstream from the mouth of Angostura Gorge, Rio Yaque del Norte, Dominican Republic (see Fig. 18); paratype, NMB H 18404 (Figs 16-19), height 48.0 mm, from nannofossil zone 5, Arroyo Hondo Section, Rio Yaque del Norte, Loc. NMB 17265 (Saunders et al., 1986: text-figure 21).

Etymology. — Named for Pascale Paques, friend of the first author, for her encouragement and support.

Diagnosis. — A small *Lobatus* species with a spire of medium height, sculpture of well developed knobs at the shoulder, spiral sculpture on spire whorls and the last whorl, an elongated last whorl, a narrow aperture, a narrowed and posteriorly flared outer lip extending just beyond the adapical suture of the penultimate whorl, a well-developed stromboid notch, and very strong lirations within the outer lip and columella.

Description. — Teleoconch with 6 whorls preserved, medium-sized, solid, with conical spire of medium height, somewhat scalate; last whorl elongate, relatively narrow. Protoconch missing; early teleoconch sculpture abraded. Spire whorls with broad, slightly concave subsutural ramp, periphery at shoulder, surface between shoulder and abapical suture flat to slightly concave. Suture impressed, linear. Fourth teleoconch whorl with axial sculpture of 14 ribs, developed clearly only at shoulder, where ribs form one row of strong, rounded, blunt knobs. Spiral sculpture of rather narrow, regular cords overriding shoulder knobs. Last whorl

elongate, with narrow, concave sutural ramp formed by one row of rounded to pointed knobs, weakly convex below knobs, with second, subobsolete row of knobs at mid-whorl; base slightly constricted. Spiral sculpture of relatively narrow cords, worn over mid-whorl on holotype, well preserved on paratype. Aperture elongate, narrow; outer lip thickened, with well-developed stromboid notch; strongly and deeply lirate within. Lip greatly but narrowly alate adapically, flared area extending almost to mid-spire, suture ascending with lip flare. Siphonal canal open, relatively short, somewhat recurved. Columellar callus well delimited, somewhat thickened, weakly expanded. Anterior and parietal portions of columella strongly lirate.

Geological setting. — The new species is represented by a specimen from an unnamed formation in the López section of the Yaque del Norte River, ascribed to the same age as the Cercado Formation (Late Miocene) by Vokes (1989: 19–20). It was found in a clayey unit in the river bed, close to the east bank, and is probably also of Late Miocene age (Emily Vokes, pers. comm.).

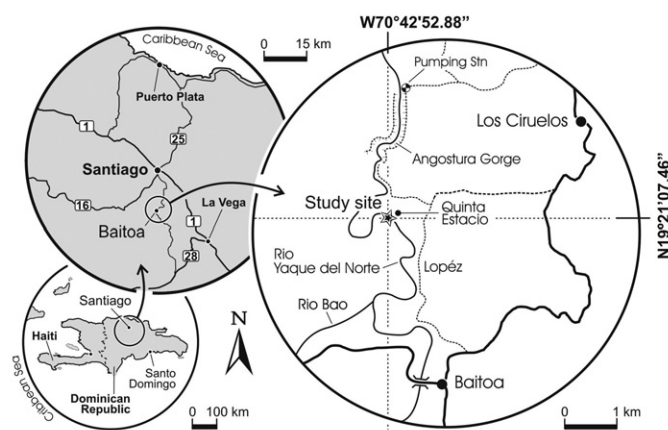


Fig. 20. Geographical location of study area. The star marks the type locality of *Lobatus pascaleae* spec. nov.

The bed of the Yaque del Norte River is very dynamic and accordingly the units exposed change rapidly. Conglomerate and coarse to fine sand and clay are exposed in different sections of the river bed when it is at its lowest. The clayey unit that the holotype of *Lobatus pascaleae* spec. nov. was collected from is situated about 2.5 km upstream (0.7 km in a straight line) from the mouth of Angostura Gorge, Rio Yaque del Norte. The paratype was also found on the Yaque del Norte River, further upstream on the east side, just below the mouth of Arroyo Hondo (locality NMB 17265). The rocks at NMB 17265 are slightly older than at the type locality according to Saunders et al. (1986, text figs 24, 25, table 3), and belong in the late Early or early Middle Miocene Baitoa Formation. *L. pascaleae* has a stratigraphic range from late Early Miocene to Late Miocene.

Remarks. — *Lobatus pascaleae* spec. nov. is the smallest of the Dominican Republic Neogene *Lobatus* species we are aware of. It is represented by only two specimens, which are both fully adult and are similar in size. Freiheit & Geary (2009) confused the new taxon with *Lobatus galliformis* (Pilsbry & Johnson, 1917), but that species differs in having a larger shell, its outer lip is thin-edged and more widely expanded, strongly alate on the posterior edge, extending further adapically, to the apex in many specimens. In *L. pascaleae* the outer lip is less expanded than in *L. galliformis*, resulting in a narrower aperture, it has a thickened edge, and the posterior alation is truncated, not extending above the middle of the spire. The position of the shoulder knobs on the last whorl is slightly higher in *L. galliformis* and the knobs are more strongly developed, especially the dorsal one (see Figs 10–12), whereas those of both specimens of *L. pascaleae* spec. nov. have rather stubby shoulder knobs. Also, although most specimens of *L. galliformis* have some lirae on the posterior and/or anterior portions of the outer lip and on the most anterior extremity of the columella (Fig. 8; Freiheit & Geary 2009: pl. 7 figs 3, 5, 9, 11, 14), none has well-developed striae covering the entire interior of the outer lip and columella as in *L. pascaleae* spec. nov.

Lobatus pascaleae spec. nov. resembles some “dwarf” specimens of *Lobatus raninus* (Figs 3–4). They share the same general shape and ornament and strong lirae on both the inside of the outer lip and the columella. However, the shell of

L. pascaleae spec. nov. has a more elongate form, the shoulder is placed slightly lower on the last whorl, the secondary rows of spiral knobs below the shoulder are hardly developed, the outer lip is less flared and less alate posteriorly, with a single lobe rather than a double one as usually seen in *L. raninus*, the stromboid notch is shallower, and the siphonal canal is shorter and less posteriorly recurved in *L. pascaleae* spec. nov. than in *L. raninus*. Also, the whole ventral side of the last whorl is covered in a thin columellar callous wash in *L. raninus*, whereas in *L. pascaleae* the columellar callus is well delimited and restricted to a narrow band bordering the left side of the aperture.

Comparison with the other Dominican Republic Neogene *Lobatus* species is hardly necessary, as *L. haitensis* (G. B. Sowerby I, 1850; see Petit (2009) for discussion on authorship), *L. dominator* (Pilsbry & Johnson, 1917) and *L. vokesae* Landau, Kronenberg & Herbert, 2008 are all much larger. Apart from size, *L. haitensis* has a very solid shell with a well-developed, elevated knob at the shoulder, whilst *L. dominator* and *L. vokesae* have a rather triangular cross-section at the shoulder of the last whorl due to a well-developed and often massive dorsal shoulder knob. In comparison, *L. pascaleae* spec. nov. has a more evenly circular cross-section, as its shoulder knobs are much smaller.

Allocation to *Lobatus* is made with a little hesitation, as the aperture is relatively narrow and the outer lip not as strongly dilated as in other species of *Lobatus*. The allocation to *Lobatus* is based on (1) the conspicuous extension of the outer lip, a character that is absent in *Persististrombus* Kronenberg & Lee, 2007, except for *P. kronenbergi* Harzhauser, 2009 from the early Miocene (Aquitanian) of Tanzania, which has this character only slightly developed, and (2) the presence of plicae on the columella in *L. pascaleae* spec. nov., a character not always expressed in Recent species allocated to *Lobatus*, but to our knowledge never found in species assigned to *Persististrombus*. Nevertheless we consider it useful to compare our new taxon with other tropical American Neogene taxa, especially those assigned to *Persististrombus*.

Persististrombus aldrichi (Dall, 1890) from the Early Miocene Chipola Beds of Florida is one of the earliest known members of the genus in the Caribbean. It also has a posteriorly expanded outer lip which can rise above the adapical

suture of the penultimate whorl, but this posterior extension to the lip is rounded and not narrowly elongate as in *L. pascaleae* spec. nov. The two can be distinguished immediately by the shape of the spire, which is more acute in *P. aldrichi*, the more expanded outer lip and the lesser number of more strongly developed shoulder knobs in *P. aldrichi*. Sympatric with *P. aldrichi* in the Chipola Beds is *P. mardieae* (Petuch, 2004). This differs from *P. aldrichi* in having more numerous shoulder knobs and a less expanded, straight outer lip, which does not rise above the shoulder of the penultimate whorl and has no posterior flare. Comparison of *P. mardieae* with *L. pascaleae* spec. nov. is hardly necessary, the two differing completely in the character of their outer lip.

Several other Tropical American Neogene taxa were included by Kronenberg & Lee (2007) in the genus *Persististrombus*. *Persististrombus toroensis* (Jung & Heitz, 2001) is known from two incomplete specimens found in the early Pliocene Cayo Agua Formation, Cayo Agua Island. *Persististrombus insulanus* (Jung & Heitz, 2001) is known from a single incomplete specimen from the middle Pliocene Escudo de Veraguas Formation, Escudo de Veraguas Island; these are both in the Bocas del Toro region of Caribbean Panama. Both species are members of the *P. granulatus* group, differing in details which fall within the huge range of variability of *P. granulatus*.

Persististrombus obliteratedus (Hanna, 1926) was described from Alverson Canyon, Coyote Mountain, Imperial County, California, and is probably of late Miocene age (Powell, 1988). The shell of this species is much shorter and stouter than that of *L. pascaleae* spec. nov., and is characterized by a row of prominent shoulder knobs (much more strongly developed than those of *L. pascaleae* spec. nov.), two rows of well developed spines on the last whorl and, placed abapically to these two rows, a third row of knobs fused into a spiral ridge. The outer lip is also much more dilated than in our new species. The distinct plicae visible in *L. pascaleae* spec. nov., on both the columellar as well as the ad-columellar side of the outer lip, are absent in *P. obliteratedus*. The shell of *L. pascaleae* spec. nov. is also considerably smaller (Hanna mentions 61.0 mm for *P. obliteratedus*), although strombids vary considerably in adult size within one species.

Lobatus pascaleae spec. nov. bears a superficial resem-

blance to *Strombus albirupianus* Dall, 1890 from the Late Eocene (Jackson) white limestone overlying the Claiborne sands, Claiborne Bluff, Alabama (U.S.A.), in the presence of plicae on the adapical part of the columella, spiral sculpture on spire whorls and (part of) the last whorl, a relatively well-defined border of the columellar callus, and the non-flared outer lip. However, the species differ by the presence of plicae on the abapical part of the columella and the adapertural part of the outer lip in *L. pascaleae* n. sp that are absent in *S. albirupianus*, a more sinuous columella in *S. albirupianus*, and the absence of the projecting tip of the adapical part of the outer lip in *S. albirupianus* that is rather well developed in *L. pascaleae* spec. nov. *Strombus albirupianus* was described from the Eocene and therefore is much older than the species currently under discussion. It is, however, possible that these deposits may be of Oligocene age (Harris & Palmer, 1947: 307; Palmer & Brann, 1966: 926). Kronenberg & Lee (2007) did not assign *S. albirupianus* to any of the American genera they discussed, nor can it be assigned to any of the modern American strombids, and probably needs a new genus.

Distribution. — **Early Miocene:** Baitoa Formation, Dominican Republic. **Late Miocene:** Cercado Formation, Dominican Republic.

STROMBUS AND LOBATUS SPECIES
OCCURRING IN THE DOMINICAN DEPOSITS

Following recent work on Dominican Neogene Strombidae, we can update the list of 5 species provided by Freiheit & Geary (2009), and increase it to eight: *Strombus bifrons* G. B. Sowerby I, 1850; *S. proximus* G. B. Sowerby I, 1850; *Lobatus dominator* (Pilsbry & Johnson, 1917); *L. haitensis* (G. B. Sowerby I, 1850); *L. galliformis* (Pilsbry & Johnson, 1917); *L. pascaleae* spec. nov.; *L. raninus* (Gmelin, 1791); *L. vokesae* Landau, Kronenberg & Herbert, 2008.

We have one further specimen of a relatively large *Lobatus* species (BL) from Maury's Bluff 1 on the Mao River (=Loc. TU 1293), Gurabo Formation, with a tall spire bearing prominent knobs and numerous elevated knobs at the shoulder of the spire whorls. It is certainly none of the species listed above and may be what Maury (1917) described as *Strombus*

maoensis from the same locality, also represented by an incomplete specimen. Unfortunately, our single specimen is incomplete and we await further material.

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