

A new species of *Turbo* from the Red Sea (Gastropoda, Turbinidae)

AART M. DEKKERS

Koewijzend 12-b, NL-1695 CG Blokker, The Netherlands; aart.dekkers@wxs.nl

HENK DEKKER

Naturalis Biodiversity Center, P.O. Box 9517, NL-2300 RA Leiden, The Netherlands;
henk.dekker@naturalis.nl

A new species of *Turbo* Linnaeus, 1758 endemic to the Red Sea is described as *Turbo* (*Turbo*) *moolenbeeki* spec. nov. in honour of Robert G. Moolenbeek. This new species was previously confused with the similar *Turbo petholatus* Linnaeus, 1758.

Key words: Turbinidae, *Turbo*, new species, Red Sea.

ABBREVIATIONS

AMD = collection A.M. Dekkers (Blokker, The Netherlands); DK = collection Daniel Korkos (Tel Mond, Israel); H = height; HD = collection Henk Dekker (Winkel, The Netherlands); LvG = collection Leo van Gemert (Zeist, The Netherlands); MLRV = collection Mary Lyn Rusmore-Villaume (Portland, USA); RMNH = collection of Naturalis Biodiversity Center (Leiden, The Netherlands); W = width; w/o = with operculum.

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INTRODUCTION

Turbo petholatus Linnaeus, 1758, is the type species of the genus *Turbo* Linnaeus, 1758. It ranges from Eastern Africa to the tropical Western Pacific Ocean. This species is very variable in shell colour and colour pattern (Alf & Kreipl, 2003), but some features such as the colour of the apex, columella and operculum are rather constant. However, some populations differ significantly and likely fall outside the range of intraspecific variation of the nominate species. Specimens formerly included in *T. petholatus* from coastal Western Australia and the Northern Territory have consistently different shell characteristics and have been recognized as a different species and described as *T. walteri* Kreipl & Dekker, 2009. The specimens of the alleged "*T. petholatus*" from the Red Sea have also characteristics that set them apart from *T. petholatus*. The differences are seen in the shell shape and size, absence of shoulder angulation, colour pattern, and operculum. The constant differences observed indicate that the Red Sea specimens belong to a different species which is herein described as new.

SYSTEMATIC PART

Family Turbinidae Rafinesque, 1815

Subfamily Turbininae Rafinesque, 1815

Turbo Linnaeus, 1758

subgenus *Turbo* Linnaeus, 1758

Type species: *Turbo petholatus* Linnaeus, 1758 (designation by Montfort, 1810). Recent, Indo-Pacific Ocean. Gender masculine.

The subgenus *Turbo* consists of species with almost smooth shells and a smooth or nearly smooth operculum. The operculum is useful to discriminate subgenera in the genus *Turbo*, as delineated by Williams (2008). Several molecular studies (Williams & Ozawa, 2006; Williams, 2007; Williams, Karube & Ozawa, 2008) have shown that the subgenus *Turbo* is a clearly defined clade within the genus *Turbo*. Other species assigned to this subgenus are *T. jourdani* Kiener, 1839, *T. reevii* Philippi, 1847 (Alf & Kreipl, 2003; Williams, 2007), and *Turbo walteri* Kreipl & Dekker, 2009.

***Turbo moolenbeeki* spec. nov.**
(Figs 1-10, 15)

Turbo petholatus – Sturany, 1903: 56, nr. 242; Lamy, 1938: 80; Mastaller, 1978: 129; Mastaller, 1979: 37; Sharabati, 1984: 46, pl. 3 figs 10-10a; Vine, 1986: 129, textfigs; Dekker & Orlin, 2000: 18, nr. 15; Zuschin et al., 2009: 108, pl. 15 figs 4a-4b; Heiman et al., 2012: 6, 7 figs.
Turbo (Turbo) petholatus Linnaeus, 1758 – Alf & Kreipl, 2003: 22 (in part), pl. 1 fig. 6; Rusmore-Villaume, 2008: 24, 3 figs.

Type material. — Holotype RMNH 5004021 (Figs 3, 15), H 46.8 mm, W 42.6 mm. Egypt, Red Sea, Gulf of Aqaba, East Sinai Peninsula, 5–7 km north of Dahab Bedouin village. Collected by snorkling at night on coral reef in shallow water, vii.2001, w/o, ex DK.

Paratypes (all from Egypt): type locality, AMD [6 w/o, ex DK], HD 34386 [5 w/o, ex DK], DK [2 w/o]; eastern side Red Sea, AMD [1 w/o & 1 beached, Figs 6-7]; Hurghada, LvG [2 beached, 1 beached fresh dead w/o]; Hurghada area, by diving, 1992, leg. G. Hali, HD 1653 [1, Fig. 5]; between Marsa Alam & Ras Banas, by diving, iv-1997, leg. E. Meijs, HD 1619 [1, Fig. 4]; Torfa El Sheikh, 24.671°N 35.122°E, by diving, leg. M.L. Rusmore-Villaume, 2003, HD 19682 [1]; Marsa abu Makhadiq (= Makadi Bay), 4.x.1999, leg. H. Dekker, HD 3280 [1, aperture broken by octopus]; Sinai, Dahab, under rocks in coral reef, 6–11 m, 1994, leg. I. Geva, HD 21871 [2 w/o, Figs 8-9]; Wadi Gimal, iii.2000, MLRV 0003.237 [1]; Safaga Bay, Tubya Arba Island, vii.2001, MLRV 0107.1071 [1]; Torfa Sheikh Reef, 24.668°N, 35.109°E, i.2003, MLRV 0301.4 [1]; at Shams Alam Beach Hotel, reef, i.2003, MLRV 0301.410 [1]; Nabq North, 28.244°N, 34.416°E, v.2008, MLRV 0805.1919 [1].

Other material examined. — Egypt: Hurghada, beached, LvG [4, and 6 juveniles]; Hurghada, at El Samaka Hotel, 22-31.viii.1989, in sand from local construction work, Pleistocene-Holocene, leg. H. & S. Dekker & C. Dekker-Rentenaar, HD 24615 [1]; Sinai, Ras Umm Sid, leg. H. & S. Dekker & C. Dekker-Rentenaar, HD 24616 [1]; Ras Abu Soma, construction work, Pleistocene, leg. H. & S. Dekker & C. Dekker-Rentenaar, HD F1124 [5, Fig. 10]; Torfa Sheik Reef, 24.668°N, 35.108°E, i.2003, MLRV 0301.3 [1]; at Shams Alam Beach Hotel, reef, iv.2005, MLRV 0504.328 [1]; Quseir, xi.2003, MLRV 0311.50 [1]; Nabq North, 28.244°N, 34.416°E, v.2008, MLRV 0805.1920 [1].

Type locality. — Egypt, Red Sea, Gulf of Aqaba, East Sinai Peninsula, 5–7 km north of Dahab Bedouin village.

Description. — Shell conical with rounded base, heavy, thick-walled, height up to 66 mm (Heiman et al., 2012: 6). With a height/width ratio nearly 1:1, slightly higher than wide. Protoconch very small, approximately one whitish whorl, followed by red teleoconch whorls. The first two whorls bear a low spiral rib with tiny knobs on it, lost on the later whorls. The whorls are shiny, growth lines visible, looking smooth at the naked eye but with fine striae

between the growth lines at 10x magnification. Columella evenly curved, thickened and sloping dorsally anteriorly, continuing as the thin edge of the outer lip. The aperture is almost circular and thickens only at the very apical end where a rather deep canal divides it from the parietal part of the columella. Siphonal fasciole present, nearly smooth, same ground colour as the shell, bordered by a small gutter. Aperture white nacreous internally. Umbilicus closed.

Ground colour of whorls olive- to red-brown, with five dark greenish-black spiral bands, interrupted with small cream lines or chevrons. The first band is directly below the suture, below this first band the cream axially aligned flecks are larger and stretched towards the second band. In some specimens a peripheral band of cream flecks occurs. The fifth band, closest to the columella, has also larger cream markings running from this band towards the siphonal fasciole. Columellar callus white with a dark green colour where it reaches the shell, in adult specimens the apertural margin is also dark green.

Operculum calcareous and thick, glossy, almost round with a small projection at the place of the anterior canal, outer surface covered with minute pustules on the labial side where it is orange brown coloured; smooth at the columellar side. A touch of blue-green centrally, also smooth.

Etymology. — Named in honour of Mr. Robert G. Moolenbeek, Ankeveen, the Netherlands, former Collection Manager of the Mollusc Department of the (now closed) Zoological Museum Amsterdam, now retired.

Distribution. — *Turbo moolenbeeki* spec. nov. is endemic to the Red Sea. The species apparently first occurred in the Pleistocene of Egypt (Fig. 10).

Habitat. — This herbivorous species lives on coral reef slopes below the low water mark. It is regularly observed living by divers, or found dead at octopus middens. Singer (1993: 1) mentions that octopus drill holes are very small, pin-sized, and often overlooked. Other predators are parrot fishes, which can smash open the body whorl facing the aperture, so exposing the soft tissue of the snail (Singer, 1993: 2).

Remarks. — *Turbo moolenbeeki* is compared with *T. petholatus* and *T. walteri* in Table 1.

The differences of *Turbo moolenbeeki* spec. nov. with *T. petholatus* (Figs 12–14) are the smaller maximum size, the consistently rounded whorls (often angulated in adult *T. petholatus*), and the white columella with a thin dark green margin (which in *T. petholatus* is usually broader and stained with yellow to greenish). The shell of *T. moolenbeeki* spec. nov. is less slender (H/W = 1.1) than in many *T. petholatus* (H/W = 1.2), but in some *T. petholatus* the shell is as broad as high, or

	<i>T. moolenbeeki</i>	<i>T. petholatus</i>	<i>T. walteri</i>
maximum adult height	66 mm	100 mm	56 mm
whorl shape	rounded	rounded or angulated	rounded
height/width ratio	1.1	(0.8-)1.2	0.9
colouration of apex	reddish	dark orange	yellowish to greenish
colouration of columella	white, with dark green rim at the edge	bright yellow, golden orange, yellowish green, dark green	greenish yellow
colouration of operculum	white at columellar side, blue-green central blotch, brown along labial edge	white at columellar side, blue-green central blotch, brown to orange along labial edge	white at columellar side, brown central blotch, brown along labial edge
surface of operculum	centrally smooth, with rim of small pustules along labial edge	centrally smooth, with rim of small pustules along labial edge	centrally smooth, around it surface wrinkled, with rim of small pustules along labial edge

Table 1. Comparison of *Turbo petholatus* and related species. Characters of *T. petholatus* based on samples from the following countries: New Caledonia [10 (including 3 "*euthymi*")]; Vanuatu [1]; Australia [6]; Philippines [12]; Micronesia, Pohnpei [1]; Thailand, Andaman Sea [11]; Madagascar [2]; unknown [2]. Characters of *T. walteri* based on 10 specimens from Australia.

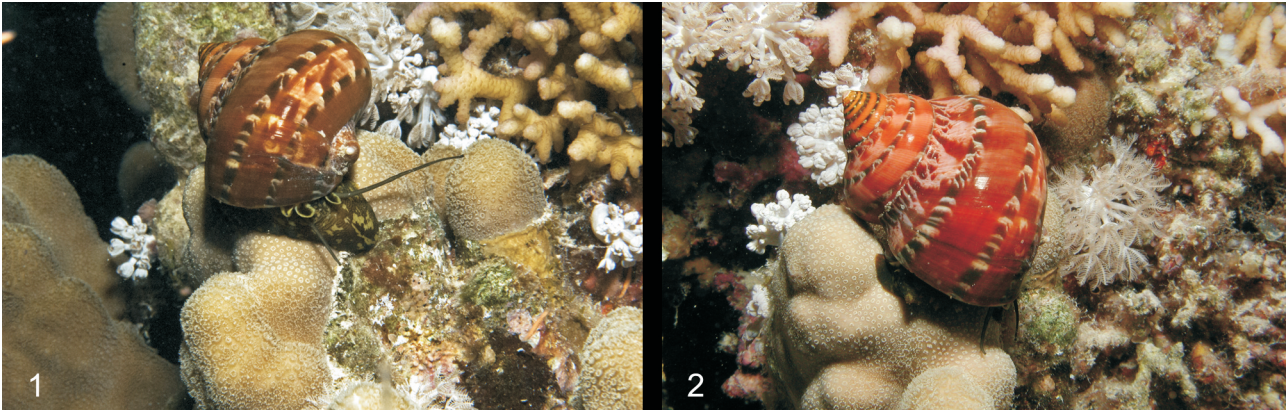
even broader than high ($H/W = 1.0-0.8$). *Turbo petholatus* has usually narrow intermediate colour spirals in between the major colour spirals, lacking in *T. moolenbeeki*, giving a less crowded impression of the colour pattern in the latter. Both species are allopatric; *T. moolenbeeki* occurs only in the Red Sea whereas *T. petholatus* occurs from East Africa towards the Western Pacific Ocean.

The differences of the new species compared with *T. walteri* Kreipl & Dekker, 2009, are the differently coloured apex, the green instead of brown opercular colouration and the dark green colour of the columella, which is greenish-yellow in *T. walteri*. *Turbo walteri* has many small interrupted green bands on a light greyish-brown to greenish background and mostly a rather smooth and thick reflected siphonal fasciole (Alf & Kreipl, 2011: 71, pl. 99 figs 4-5). *Turbo walteri* is restricted to coastal Western Australia and

the Northern Territory.

The new species might also be confused with *Turbo reevii* Philippi, 1847, although this species is less similar to *T. moolenbeeki* than *T. petholatus* or *T. walteri*. *Turbo reevii* has a differently ornamented and coloured operculum (Figs 16-17), it is smooth and very shiny, with a low depression and of a rather uniform either green or white colour. The columella is always white, not bordered by a green stain as in the new species. The cream fasciole is a little raised and not bordered by a groove (as in the new species). The shells are mostly of a netted or flamed cream and brown colour, or bright green or bright yellow. Furthermore, the whorls are more inflated in *T. reevii* than in the new species, resulting in deeper sutures. *Turbo reevii* occurs from Japan south to the Philippines (Alf & Kreipl, 2003: 22).

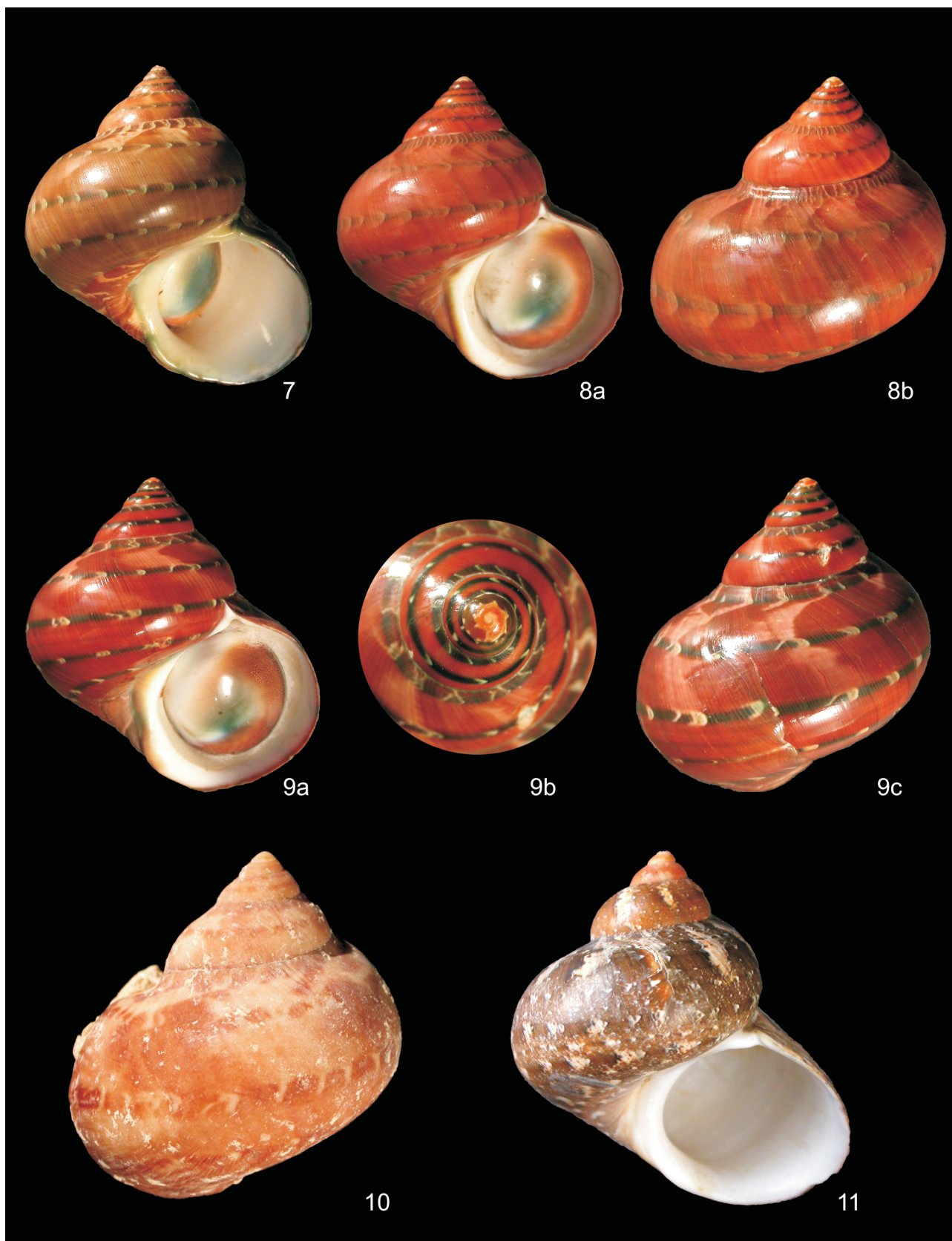
We feel that it is important to clarify an issue of



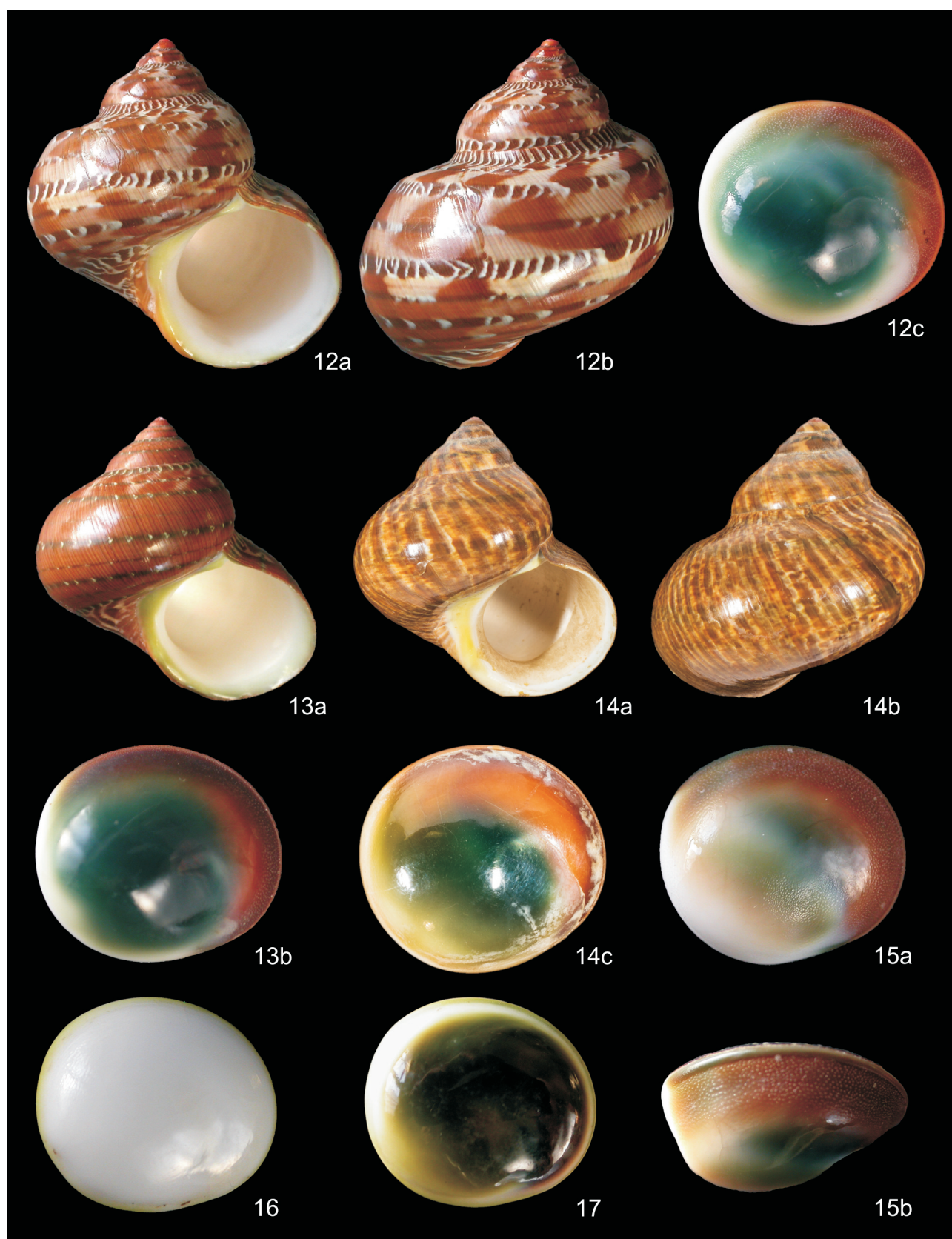
Figs 1-2. *Turbo moolenbeeki* spec. nov. 1-2, Egypt, Red Sea, Marsha Shagra, in situ, 2004, photographs by Anne Frijsinger & Mat Vestjens (the Netherlands, www.natuurlijkmooi.net).



Figs 3-6. *Turbo moolenbeeki* spec. nov., Egypt, Red Sea. **3**, Sinai, Gulf of Aqaba, vii.2001, holotype RMNH.5004021, H 46.8 mm. **4**, between Marsa Alam and Ras Banas, dived, v.1997, leg. E. Meijs, paratype HD 1619, H 43.2 mm. **5**, Hurghada area, dived, 1992, leg. G. Hali, paratype HD 1653, H 56.6 mm. **6**, Sinai, Gulf of Aqaba, vii.2001, leg. D. Korkos, paratype HD 34386, H 45.1 mm.



Figs 7-11. *Turbo* species. **7-10**, *Turbo moolenbeeki* spec. nov., Egypt, Red Sea; **7**, Egypt, Sinai, Gulf of Aqaba, vii.2001, ex DK, paratype HD 34386, H 62.4 mm. **8-9**, Egypt, Sinai, Gulf of Aqaba, Dahab, under rocks in coral reef, 6-11 m, 1994, leg. I. Geva, paratype HD 21871, **8**, H 44.5 mm, **9**, H 37.8 mm. **10**, Egypt, Ras Abu Soma, 26.ix-03.x.2001, raised reefs, Pleistocene, leg. H. & S. Dekker & C. Dekker-Rentenaar, HD F1124, H 43.0 mm. **11**, *T. reevii*, Philippines, Pilas Island, AMD, H 53.7 mm.



Figs 12-17. *Turbo* species. **12-14**, *Turbo petholatus*; 12, Micronesia, Pohnpei, 2005, HD 19857, H 63.4 mm (12c, operculum, W 26.7 mm). 13, Philippines, Bohol, 10-25 m, 2013, AMD, L 56.2 mm (13b, operculum, W 23.0 mm). 14, one of two syntypes of *T. euthymii*, New Caledonia, MNHN-IM-2000-31142 (14c, operculum). **15**, *T. moolenbeeki* spec. nov. Egypt, Sinai, Red Sea, Gulf of Aqaba, vii.2001, operculum of holotype, RMNH.5004021, W 20.7 mm. **16-17**, *T. reevii*; 16, Philippines, Pilas Island, AMD, operculum of specimen in Fig. 11, W 22.5 mm. 17, Philippines, 1970's, HD 36911, operculum, W 20.6 mm.

nomenclature here. Philippi (1847: 48, pl. 12 figs 1–2) introduced *Turbo reevii* as a nomen novum for *T. variabilis* Reeve, 1842 (non Grateloup, 1828). At that time it was the custom when Latinizing the name of a person to use stem augmentation and add *i* after it, resulting in two *ii* at the end. Therefore, *reevii* is not a printing or writing error for *reevei* as some authors have concluded. *Turbo reevii* is the correct original spelling and *reevei* is an incorrect subsequent emendation and should not be used. Alf & Kreipl (2003) did not notice this spelling problem and used only *reevei* as the spelling, but Williams (2007, 2008) already correctly spelt it as *reevii*.

DISCUSSION

There are a number of synonyms of *Turbo petholatus* (see Bouchet & Rosenberg, 2015), but we are confident that none of them can be applied to our new species. A photograph of a syntype of *T. petholatus* is shown on the website of the Linnaean Society of London (P.Z 0010626), a shell marked with “612”, the number of *T. petholatus* given in the 12th edition of Linnaeus’ *Systema Naturae*. The type locality given by Linnaeus (1758: 762) is Barbados, but this is obviously wrong. This syntype of *T. petholatus* has a clearly angulate periphery, as mentioned also by Linnaeus (1758: 762). M. Smith (1907) discriminated two forms of *Turbo petholatus*, with angulated or rounded whorls. For the angulated form he introduced the name *Turbo petholatus* var. *humerosus* M. Smith, 1907, but there is no logic to use this name (as done sometimes by shell dealers) as the Linnaean type is also strongly angulated.

An almost overlooked name in the literature is *Turbo euthymi* Jousseaume, 1881, described from New Caledonia. The two syntypes are present in MNHN, one of which is herein figured for the first time (Fig. 14). Those specimens have rounded whorls and the colouration is dominated by whitish undulating lines following the growth lines. *Turbo petholatus* specimens from New Caledonia usually have a pale yellow bordered columella and an operculum with a dark orange rim (Fig. 14c), opposed to a more brownish rim (Figs 12c, 13b) from elsewhere in the distribution range. It might be that this population constitutes a cryptic species, but this has to be shown by molecular studies. Williams (2008: 4) already mentioned that genetic studies of *T. petholatus* suggest that it might comprise a complex of cryptic species, referring to unpublished data by Meyer & Paulay.

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