

Description of *Volutoconus hargreavesi calcarelliformis* subsp. nov. (Mollusca: Volutidae) from northwestern Australia

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Abstract – *Volutoconus hargreavesi calcarelliformis* subsp. nov. is described from the outer continental shelf off Port Hedland, northwestern Australia. The new subspecies is compared with *V. hargreavesi hargreavesi* (Angas, 1872), and *V. hargreavesi daisyae* Weaver, 1967, which is recognised as a valid subspecies.

Keywords: Subspecies, volute, *Volutoconus*, Gastropoda, Volutidae, Western Australia

INTRODUCTION

The volute genus *Volutoconus* is a small group of five species which are restricted to northern Australia, adjacent areas of the east and west coasts of the continent, and eastern Indonesia. The type species, *V. coniformis* (Cox, 1871), occurs along the north coast of Western Australia from the Dampier Archipelago to the west Kimberley. Further north, *V. bednalli* (Brazier, 1878) extends across the north Kimberley to Torres Strait, Queensland and throughout the Timor Sea to eastern Indonesia, including Irian Jaya. *Volutoconus grossi* (Iredale, 1927) ranges southward along the east coast of Australia from Townsville, Queensland to Port Macquarie, New South Wales. Two subspecies are generally recognised: *V. grossi grossi* (Iredale, 1927), which occurs south from Keppel Bay, Queensland and *V. grossi mcMichaeli* Habe and Kosuge, 1966, which occurs further north in the Townsville area. The fourth species, *V. hargreavesi* Angas, 1872, occurs widely along the west coast of Western Australia, from Mandurah to North West Cape, and along the north coast as far as the western Kimberley. Another species, *V. capricorneus*, was described by Wilson (1972) from west of Point Cloates and provisionally placed in *Volutoconus*. The generic placement of the species has varied, but the most recent analysis (Willan, 1995) places it in *Volutoconus*.

Weaver (1967) described a geographical variant of *Volutoconus hargreavesi* as the subspecies *V. hargreavesi daisyae*, which occurs along the west coast of Western Australia from North West Cape south to about Mandurah. Weaver restricted the nominate subspecies, *V. hargreavesi hargreavesi*, to the north coast of the state. However, Weaver and DuPont (1970) subsequently reported that further

collecting had narrowed the gap between the two forms, and that subspecies status was not justified. Wilson and Gillett (1971) retained the separation of the subspecies, but stated that the finding of intermediates might show that the separation was not warranted. Wilson (1994) later considered that there was no need to separate the two subspecies. Poppe and Goto (1992) separated the two, but as forms, which have no taxonomic standing.

Recent curation of the volutes in the collection of the Western Australian Museum has uncovered a deep-water subspecies in the *V. hargreavesi* complex, which is described here. In addition, *V. hargreavesi daisyae* is recognised as a valid subspecies.

Institutional acronyms: AMNH, American Museum of Natural History; DMNH, Delaware Museum of Natural History; NTM, Northern Territory Museum, WAM, Western Australian Museum.

SYSTEMATICS

Family Volutidae

Genus *Volutoconus* Crosse, 1871

Volutoconus Crosse, 1871: 306

Type species

Voluta coniformis Crosse, 1871, by original designation.

Diagnosis

(Adapted from Weaver and DuPont [1970]). Moderately large (60 to 130 mm) volutes, solid, with a range of colour patterns. Spire variable, elevated

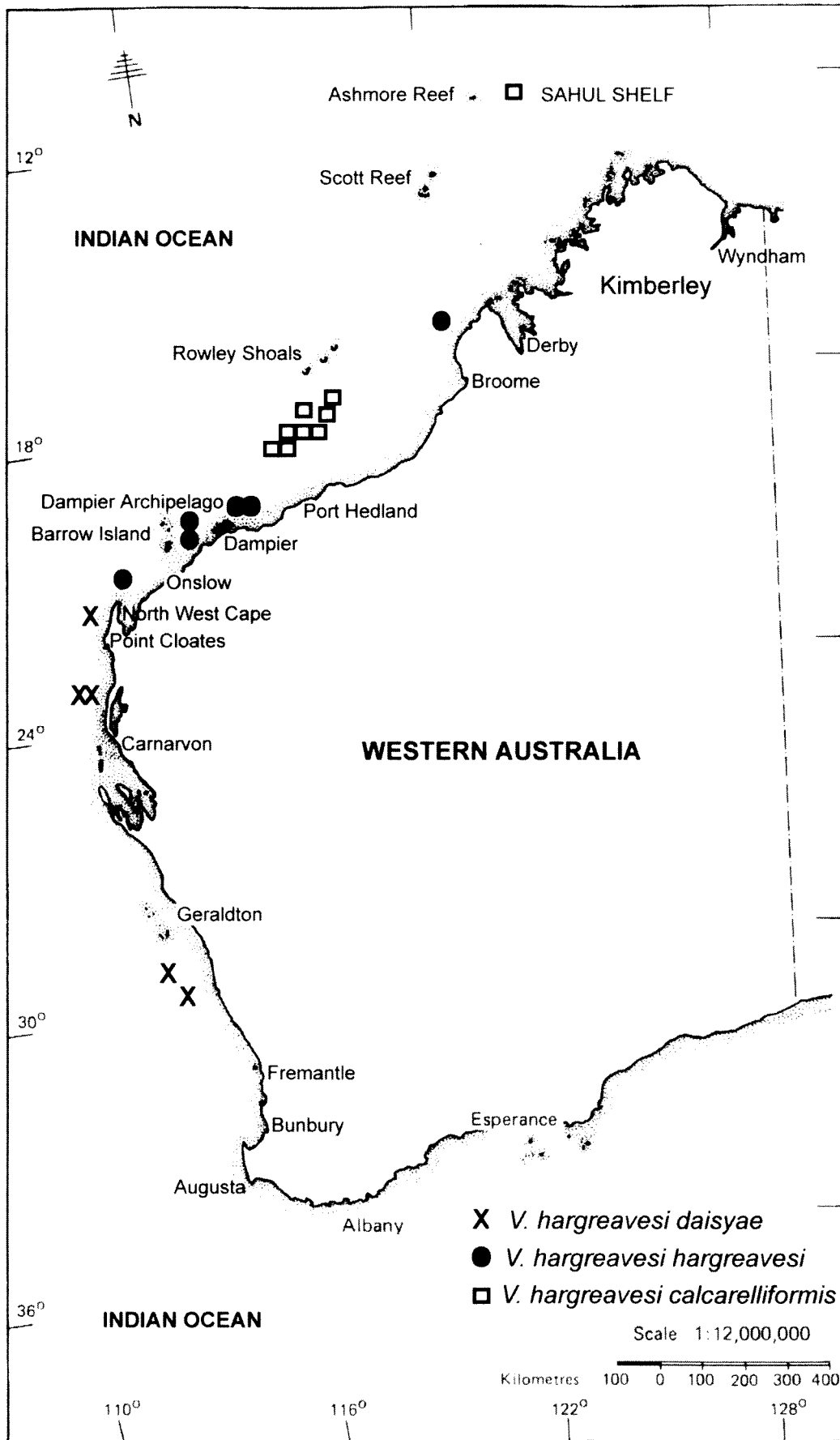


Figure 1 Distribution of *Volutoconus hargreavesi calcarelliformis* subsp. nov., *V. hargreavesi hargreavesi* (Angas, 1872), and *V. hargreavesi daisyae* Weaver, 1967.

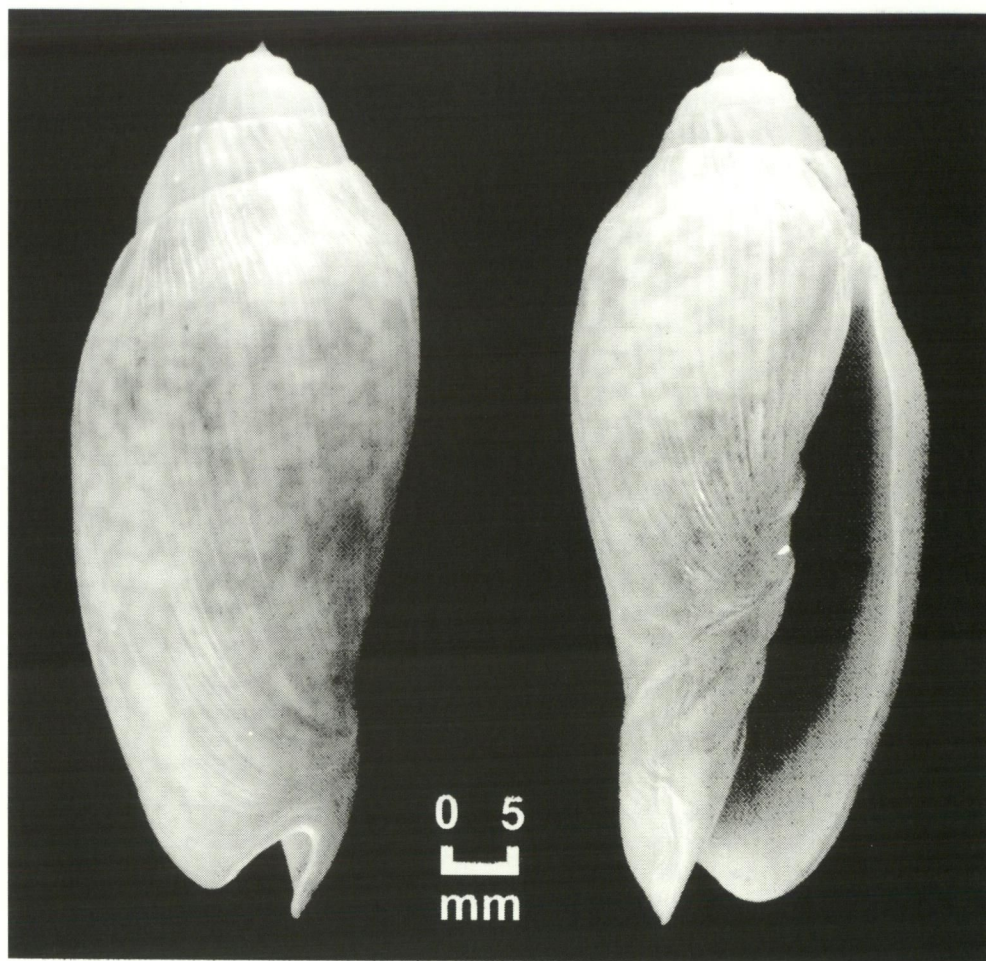


Plate 1 Holotype of *Volutoconus hargreavesi calcarelliformis* subsp. nov. (WAM S 14359)

or depressed. Protoconch smooth or radially ribbed, usually possessing a sharp apical spire (calcarella). Columella with four or more plaits. Periostracum and operculum absent. Radula (where known) uniserial, with large, tricuspid teeth, cusps strongly arched and fang like, median cusp much longer than laterals.

Remarks

The genus is restricted to northern Australia and Indonesia, ranging over the entire northern coastline of the continent, with individual species extending down both the west and east coasts. The systematics of *Volutoconus* have been examined in detail by Abbott (1958); McMichael (1960); Weaver (1967); Weaver and duPont (1970); Wilson and Gillett (1971); Wilson (1972; 1994) and Poppe and Goto (1992). The genus occurs from intertidal areas to at least 200 m. Fossils previously included in the genus were considered to belong to *Nannamoria* by Darragh (1988). Darragh recorded only a single fossil specimen of an unidentified *Volutoconus*, which he considered to closely resemble *V. hargreavesi*.

***Volutoconus hargreavesi hargreavesi* (Angas, 1872)**
Plates 2c, 3c, Figure 1

Voluta hargreavesi Angas, 1872: 613–614, plate 42, figure 13 (locality unknown); Weaver, 1960: 1, 3 front page plate (4 shells on left); Weaver, 1967: 302, 304, plate 41, figures 1–4, map; Weaver and duPont, 1970: 138, plate 61E–F; Matsukuma *et al.*, 1991: p. 99, plate 97, figure 3; Poppe and Goto, 1992: 212, plate 107, figures 3–5, 7.

Cymbiola (Volutoconus) hargreavesi (Angas): Abbott, 1958: 4

Volutoconus hargreavesi hargreavesi (Angas): Wilson and Gillett, 1971: 74, plate 49, figure 5.

Type material

Location of type unknown.

Weaver (1967) states the holotype is lodged in the American Museum of Natural History, number AMNH 8304. Weaver & DuPont (1970) questioned whether this is in fact the holotype as there are differences between the colour pattern on the shell and the illustration.

The published catalogue of the AMNH (Boyko and

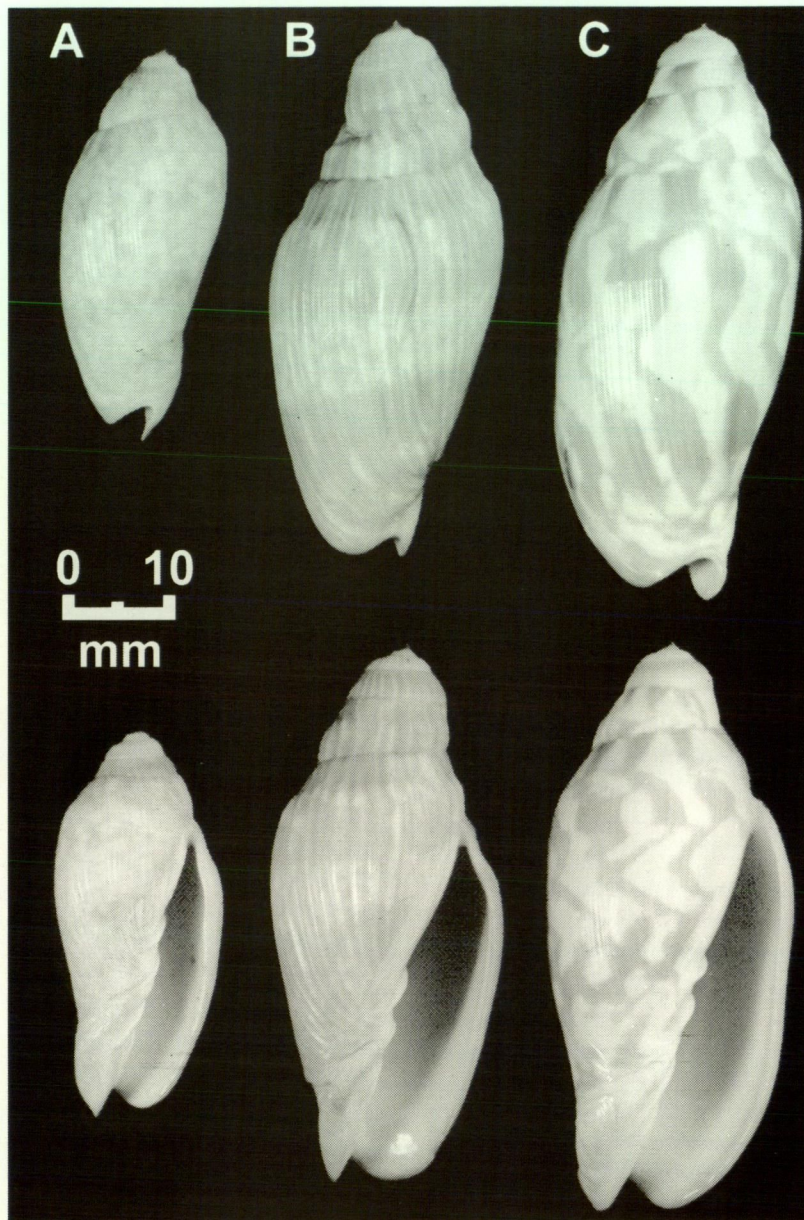


Plate 2 Comparison of shells of *Volutoconus hargreavesi*. a. Holotype of *V. hargreavesi calcarelliformis* subsp. nov. (WAM S 14359). b. *V. hargreavesi daisyae* Weaver, 1967 (WAM S 14358). c. *V. hargreavesi hargreavesi* (Angas, 1872) (WAM S 14348).

Cordeiro, 2001) states: "AMNH 8304. ex Steward Collection #1971. Richards and Old (1969: 117) summarized the limited information about this shell. They noted that it did not match exactly the size given by Angas (1872) for his unique specimen. AMNH 8304 is the same size as the figure of the shell in Angas (1872: plate 42, figure 13) and matches the description. However, the AMNH shell is much more worn than suggested by Angas's (1872) figure, and the color pattern is quite different. Based on the available evidence, we are inclined to consider AMNH 8304 an old specimen of this taxon, but we think its holotype status is unlikely."

Type locality

Angas (1872) did not provide a type locality for

V. hargreavesi. Weaver (1960) subsequently designated Bedout Island in the Dampier Archipelago as the type locality.

Material examined: Australia: Western Australia: WAM S 14348, 2 specimens, NW of Roebuck Bay, S of Lacepedes Island (16°52'S; 122°08'E); WAM S 14349, 1 specimen, off Cape Lambert (20°36'S; 117°10'E); WAM S 14350, 1 specimen, 26 m, Dampier Archipelago, approximately 18 km W of Eaglehawk Island, (20°39'S; 116°18'E); WAM S 14351, 1 specimen, 97 m, Onslow, 13 km N of Long Island (20°55'S; 115°51'E); WAM S 14352, 1 specimen, no data (seized by Australian Customs); WAM S 12669, 1 specimen, 103 m, North West Cape (21°36.22'S; 114°11.11'E), on sand and mud.

Diagnosis

Calcarella small, orange colour, very finely ribbed. First two whorls of teleoconch white with very fine axial ribbing. Upper whorls with very fine ribbing. Body whorl with distinct, but fine ribbing. Colour variable, mottled orange and white, generally with 2 indistinct bands, one on shoulder of body whorl, one at base of whorl, sometimes a third intermediate band is present at base of body whorl. Four high, narrow columellar plaits. Anterior canal with deep notch, margin raised. Interior pale fawn to white.

Range

North West Cape to west Kimberley, Western Australia

Depth range

Intertidal to about 100 m.

Animal

Not known.

Remarks

The three subspecies of *V. hargreavesi* are geographically distinct (Table 1). The nominate subspecies, *V. hargreavesi hargreavesi*, occurs along the continental coastline, from about North West Cape to the west Kimberley. Most specimens are from shallow water, but there are two lots in the WAM from about 100 m. *Volutoconus hargreavesi daisyae* occurs further to the south, along the west coast of Western Australia, from about Mandurah to North West Cape, in depths of 40 to 134 m. There is an area at North West Cape where the species ranges may or may not overlap. In contrast, *V. hargreavesi calcarelliformis* lives in deeper waters

(150–202 m) on the North West Shelf from the Rowley Shoals to Cartier Island.

Compared to *V. hargreavesi calcarelliformis*, *V. hargreavesi hargreavesi* has a smaller calcarella for the size of the shell. The shell of *V. hargreavesi hargreavesi* is bigger with a smoother surface. *Volutoconus hargreavesi hargreavesi* differs from *V. hargreavesi daisyae* in being a broader shell with fine growth lines instead of the more pronounced ribs found on *V. hargreavesi daisyae*.

Volutoconus hargreavesi daisyae Weaver, 1967

Plates 2b, 3b

Volutoconus "species" Angas, Weaver, 1960: 1, 3 front page plate (large centre shell).

Volutoconus hargreavesi daisyae Weaver, 1967: 302, 304, plate 41, figures 5–9, map; Wilson and Gillett, 1971: 74, plate 49, figure 6.

Volutoconus hargreavesi (Angas): Weaver and duPont, 1970: 138, plate 61G; Poppe and Goto, 1992: 212, plates 106, figure 1,2; Wells and Bryce, 1986: 118, figure 456; Wilson, 1994: 118, plate 21, figure 4 a–e.

Type material

Holotype, DMNH 10022.

Type locality

Southwest of North West Cape, central Western Australia, 22°00'S; 113°45'E.

Material Examined

Australia: Western Australia: WAM S 14355, 1 specimen, 134 m, NW of Shark Bay (23°39'S; 113°11'E); WAM S 14356, 1 specimen, 134 m, NW of

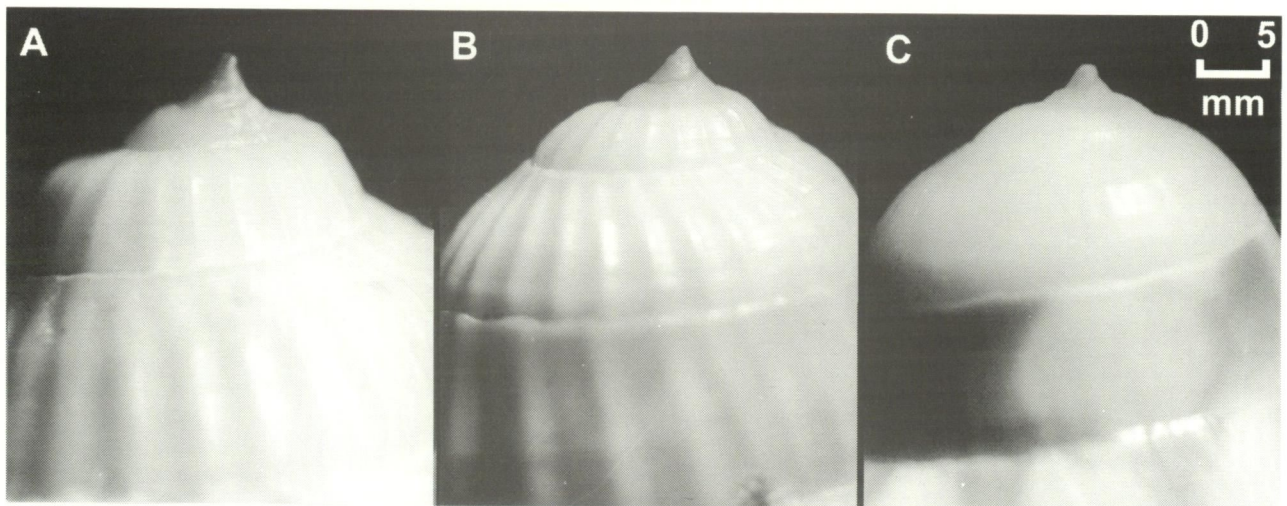


Plate 3 Comparison of protoconchs of *Volutoconus hargreavesi*. a. Holotype of *V. hargreavesi calcarelliformis* subsp. nov. (WAM S 14359). b. *V. hargreavesi daisyae* Weaver, 1967 (WAM S 14358). c. *V. hargreavesi hargreavesi* (Angas, 1872) (WAM S 14348).

Shark Bay (23°39'S; 113°11'E); WAM S 14357, 1 specimen, 110 m, 92 km W of Dongara (29°07.5'S; 113°57.4'E), sponges and stone rubble; WAM S 14358, 1 specimen, off Greenhead (30°04'S 114°58'E).

Diagnosis

Calcarella small, orange colour. Shell fusiform. First two whorls of teleoconch white with strong axial ribbing. Upper whorls with very strong ribbing extending onto body whorl. Body whorl heavily ribbed. Colour variable, mottled orange and white with 2 indistinct bands, one on upper body whorl, one lower on whorl. Four high, narrow columellar plaits. Anterior canal with deep notch, margin raised. Interior pale fawn to white.

Range

West coast of WA; Mandurah to North West Cape, Western Australia

Depth

Approximately 40 m to 134 m.

Animal

Not known.

Remarks

Volutoconus hargreavesi daisyae differs from *V. hargreavesi hargreavesi* in having a narrower shell with pronounced axial ribbing instead of the fine growth lines found on *V. hargreavesi hargreavesi*. *Volutoconus hargreavesi daisyae* differs from *V. hargreavesi calcarelliformis* in being longer, more robust, with a similar protoconch, but a brighter orange colour. The ribs of *V. hargreavesi daisyae* are much heavier.

Volutoconus hargreavesi calcarelliformis
subsp. nov.

Plates 1, 2a and 3a

Holotype

WAM S 14359, 150–160 m, 239 km NE of Cape Lambert (18°42.8'S; 118°03.2'E), Western Australia, Australia, sand, rubble and dead shells, collected by L.M. Marsh *et. al.* on 18 August 1995.

Paratypes

Australia: Western Australia: WAM S 14360, 6 specimens, 173–193 m, 70 km S of Cunningham Island, Imperieuse Reef, Rowley Shoals (18°06.9'S; 118°56.7'E), sand, rubble and dead shells; WAM S 14361, 5 specimens, 150–160 m, 239 km NE of Cape Lambert (18°42.8'S; 118°03.2'E), rubble and dead shells; WAM S 14362, 1 specimen, 150–160 m, 239 km NE of Cape Lambert (18°38.6'S; 118°07'E), sand,

rubble and dead shells; WAM S 14363, 2 specimens, 154 m, 184 km N of Port Hedland (18°47'S; 117°58'E), grey mud and shell rubble; WAM S 14364, 2 specimens, 154 m, 184 km N of Port Hedland (18°47'S; 117°58'E), grey mud and shell rubble; WAM S 14365, 1 specimen, 201–202 m, 217 km N of Port Hedland (18°20.5'S; 118°27.7'E), grey mud; WAM S 14389, 1 specimen, 150–160 m, 239 km NE of Cape Lambert (18°42.8'S 18°39.6'S), sand rubble and dead shells. NTM P8581, 1 specimen, 180 m, 20 km south of Barracouta Shoal, west of Cartier Reef, Sahul Shelf (12°42.86'S; 123°57.98'E), coarse broken shell substrate; Mike Claydon private collection, 1 specimen, trawled by scampi boats, on sand mud and shell, 220 m, NW of Point Samson.

Description

Calcarella prominent, tall, smooth sided, lacking axial ribbing. Bright orange colour. First two whorls of teleoconch white, with strong axial ribbing. Lower whorls also heavily ribbed with mottled fawn to orange patterning. Body whorl finely ribbed, mottled brown with 3 faint bands, one below suture, one on outer body whorl, one lower on whorl. Four high, narrow columellar plaits. Anterior canal with deep notch. Interior white, some shells with pale fawn to white on inside of outer lip.

Shell measurements

Table 1 shows the measurements of the type series.

Geographical range

North West Shelf, Western Australia, from about Rowley Shoals to Cartier Island.

Depth

150–202 m.

Animal

Not known.

Etymology

Named after the distinctive calcarella at the apex of the shell spire.

Remarks

The key feature of *Volutoconus hargreavesi calcarelliformis* is the prominent size of the calcarella for the size of the shell. It differs from *V. hargreavesi hargreavesi* in being smaller, with fine ribbing, strongly ribbed protoconch, and it lives in slightly deeper water. *Volutoconus hargreavesi hargreavesi* has a smoother shell with fine growth lines. *Volutoconus hargreavesi calcarelliformis* differs from *V. hargreavesi daisyae* in being shorter, more robust, with a similar protoconch, but a brighter orange colour. The ribs

Table 1 Comparison of shell characteristics of *Volutoconus hargreavesi hargreavesi* (Angas, 1972), *V. hargreavesi daisyae* Weaver, 1968, and *V. hargreavesi calcarelliformis* subsp. nov.

Species	Range		Protoconch	Teleoconch Sculpture	Plaits on Columella	Shell measurements			
	Geographic	Depth (m)				N	Length (mm) Mean ± 1 S.E.	Width (mm) Mean ± 1 S.E.	Length/ Width Mean ± 1 S.E.
<i>V. hargreavesi hargreavesi</i> (Angas, 1872)	North coast of WA; North West Cape to west Kimberley	0-201	Small calcarella, orange colour, finely ribbed.	Shell broad, first two whorls of teleoconch white with with very fine axial ribbing. Upper whorls with very fine ribbing. Body whorl with distinct, but fine ribbing. Colour variable, mottled orange and white, generally with 2 indistinct bands, one on shoulder of body whorl, one at base of whorl, sometimes a third intermediate band is present at base of body whorl. Four high, narrow columellar plaits. Anterior canal with deep notch, margin raised. Interior pale fawn to white.	4 high, narrow	5	18-105 63 ± 15	8-37 25 ± 6	2.17-2.84 2.48 ± 0.12
<i>V. hargreavesi daisyae</i> Weaver, 1968	West coast of WA; Mandurah to North West Cape	0-134	Small calcarella, orange colour	Shell fusiform. First two whorls of teleoconch with strong axial ribbing, white. Upper whorls with very strong ribbing extending onto body whorl. Colour mottled orange and white. Body whorl heavily ribbed. Colour variable, mottled orange and white with 2 indistinct bands, one on outer body whorl, one lower on whorl. Anterior canal with deep notch, margin raised. Interior pale fawn to white.	4 high, narrow	3	76-78 77 ± 1	28-32 30 ± 1	2.38-2.78 2.61 ± 0.12
<i>V. hargreavesi calcarelliformis</i> subsp. nov.	North West Shelf, W.A.	150-202	Tiny calcarella, smooth sided, tall, lacks axial ribbing. Bright orange colour.	First two whorls of teleoconch with strong axial ribbing, white. Lower whorls also heavily ribbed with a mottled fawn to orange patterning. Body whorl finely ribbed, mottled brown with 3 faint bands, one below suture, one on outer body whorl, one lower on whorl. Anterior canal with deep notch. Interior white, some with pale fawn to white on inside of outer lip.	4 high, narrow	14	38-64 50 ± 2	16-26 21 ± 1	2.14-2.94 2.41 ± 0.05

of *V. hargreavesi daisyae* are much stronger than those of *V. hargreavesi calcarelliformis*.

The dwarf form of *V. grossi* (Iredale, 1927) from deep water off the Great Barrier Reef, Queensland, is very similar to *V. hargreavesi calcarelliformis*. Further material is required before the relationships between *V. grossi* and *V. hargreavesi* can be fully understood. In addition to the considerable geographic separation with a shallow water barrier between them, dwarf specimens of *V. grossi* can be separated from *V. hargreavesi calcarelliformis* by having a narrower shell and finer ribbing, and white calcarella.

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