

Description of four new species of *Gulella* Pfeiffer, 1856 from Eastern Cape, South Africa, with additional notes on two poorly known species (Mollusca: Eupulmonata: Streptaxidae)

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Gulella bruggeni spec. nov., *G. bomvana* spec. nov., *G. tietzae* spec. nov. and *G. ndibo* spec. nov. are described from the Transkei region of Eastern Cape Province, South Africa. All are minute, smooth-shelled species with complex apertural dentition. Due to their limited ranges and continuing decline in extent and quality of habitat, *G. bruggeni* spec. nov., *G. bomvana* spec. nov. and *G. ndibo* spec. nov. are likely to meet the distribution-based criteria for red-listing as Critically Endangered and *G. tietzae* spec. nov. as Endangered. *G. aprosdoketa* and *G. chi* are discussed and illustrated for comparison and the known distribution of each is extended.

Introduction

On-going survey work focusing on the malacofauna of the forests of the Transkei region, Eastern Cape continues to bring to light undescribed taxa referable to the speciose streptaxid genus *Gulella*. In an earlier paper (Burse & Herbert, 2004) we described four new and highly distinctive, axially costulate species and in the present contribution we report on our conclusions concerning an assemblage of minute, smooth-shelled specimens. Detailed study of this material shows it to include four undescribed species which we now describe in this paper. For comparative purposes, we provide notes on two additional, poorly known species occurring in the same broader area, including new distribution data and illustrations.

All species discussed are endemic to South Africa's Eastern Cape province, and five constitute narrow-range species endemic to the Transkei coast, and are thus of conservation concern. The fact that new species with very restricted distributions continue to be discovered in this region highlights its significance as a focus of speciation and endemism, not only for plants (van Wyk & Smith, 2001), but also for terrestrial molluscs. In this case, the species are likely to be neoendemics, closely related to others in the region, as is typical for highly speciose genera and lineages. The Transkei coastal region is a biogeographical transition zone lying between the subtropical KwaZulu-Natal coast and the warm-temperate southern Cape coast, a factor perhaps enhancing speciation in forest dependent taxa, through the isolation of populations during Plio-Pleistocene climatic fluctuations.

Although live-collected specimens are available, such material has been collected only through the sorting of dry leaf-litter samples. Examination of the soft parts has therefore not been possible and descriptions thus relate to the shell only. However, since *Gulella* and its subgenera remain very poorly defined, such information even if available, would be of limited value in determining subgeneric relationships. We therefore refrain from assigning the species to subgenera and refer them simply to *Gulella sensu lato*.

Methods

The bulk of the material discussed was accumulated during the course of targeted malacological survey work undertaken in the E. Cape over the last ten years. Most originated from forest leaf-litter samples, subsequently dried, sieved and sorted in the laboratory. This was supplemented with older material already present in the collections of the Natal Museum and East London Museum. Micrographs of shells were taken using a Leica MZ16 stereomicroscope coupled with *Automontage Pro V5.0* (Syncroscopy) to generate fully focused images. Shell measurements were made using a Wild M4 stereomicroscope with a calibrated eye-piece graticule, and whorl counts were made according to the method outlined by Herbert & Kilburn (2004).

Abbreviations

Institutional abbreviations used in the text are as follows: NHM – Natural History Museum, London; ELM – East London Museum, South Africa; NMSA Natal Museum, Pietermaritzburg, South Africa; NMW – National Museum of Wales, Cardiff; RMNH – National Museum of Natural History, Leiden.

Taxonomy

Family Streptaxidae Gray, 1860

Genus *Gulella* Pfeiffer, 1856

Gulella bruggeni spec. nov.
(figs 1, 2)

Type material.— Holotype (NMSA W3182/T2474), length 2.75 mm, width 1.04 mm, length:width 2.65. South Africa, E. Cape, Transkei, Hluleka Nature Reserve (31.823°S: 29.3055°E), coastal forest, sorted from leaf-litter, leg. D. Herbert, L. Davis & M. Bursey, 20.iv.2005 (fig. 1). Paratypes: same data as holotype (NMSA W6672/T2475, one specimen; RMNH 113995, one specimen); South Africa, E. Cape, Transkei, Hluleka Nature Reserve, (31.817°S: 29.30°E), dune forest, in leaf-litter, leg. J.P. Marais, iii.2003 (NMSA W2498/T2476, one specimen; ELM D15943, one specimen).

Diagnosis.— Shell very small to minute, elongate-cylindrical; smooth and glossy; aperture quadrate, edge of columella lip shallowly indented and projecting outward; dentition 6-fold, including a parietal lamella, two labral teeth, upper small and sharp, lower much stronger and rounded, a mid-basal tooth near aperture edge, a well-developed, broad tooth on columella lip partially obscuring large simple columella lamella; umbilicus widely open.

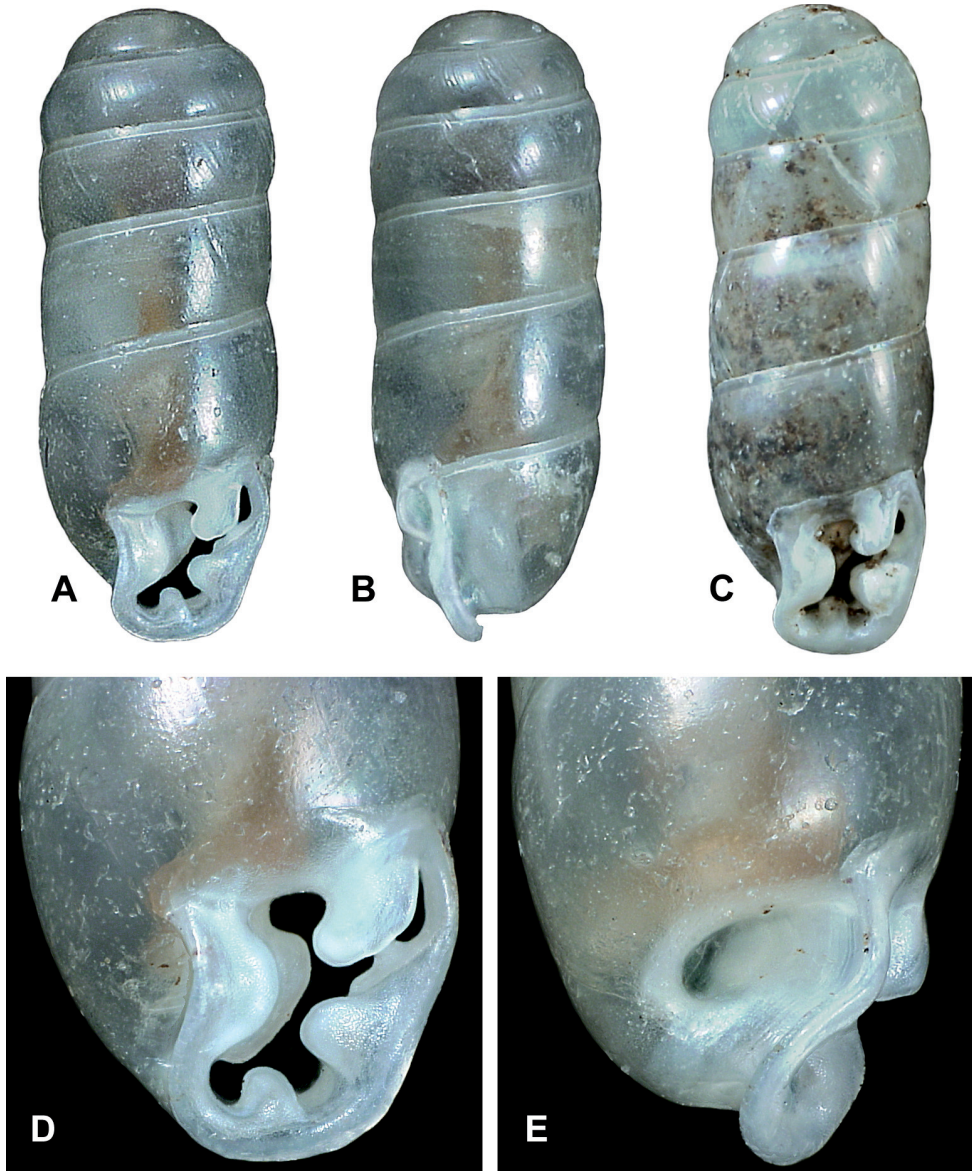


Fig. 1. *Gulella bruggeni* spec. nov. A-B, D-E, holotype (NMSA W3182/T2474), Hluleka Nature Reserve, E. Cape, length 2.75 mm, width 1.04 mm. C, paratype (NMSA W6672/T2475), Hluleka Nature Reserve, E. Cape, length 3.10 mm, width 1.08 mm. A, apertural view. B, side view. C, apertural view. D, oblique view into aperture. E, oblique view of base showing umbilicus.

Description (fig. 1).— Shell very small to minute, elongate-cylindrical, adult length 2.35-3.10 mm, width 1.0-1.08 mm, length:width 2.35-2.87 ($n = 5$). Embryonic shell approx. 2.25 whorls, smooth; junction between embryonic shell and teleoconch weakly evident. Teleoconch comprising approx. 4.5 whorls, the first convex, but subsequent

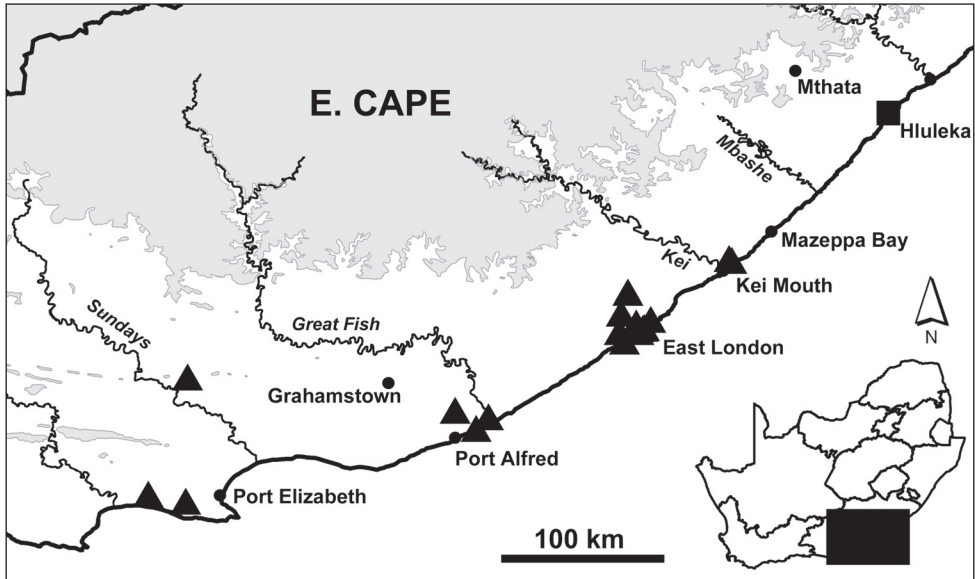


Fig. 2. Distribution map for *Gulella bruggeni* spec. nov. (square) and *G. chi* Burnup, 1926 (triangles). Contour at 1000 m.

ones flat-sided, smooth and glossy. Aperture quadrate, edge of columella lip shallowly indented, peristome thick and reflected. Dentition 6-fold (fig. 1D): 1) an oblique parietal lamella, tall, but not deeply in-running; 2-3) a labral plate with a small, sharp upper tooth and a much stronger, rounded lower tooth; 4) a peg-like mid-basal tooth near aperture edge; 5) a well-developed, broadly rounded superficial tooth on columella lip; 6) a large, simple, deep-set columella lamella. A small intermediate denticle may also occur on the labral plate between upper and lower teeth (as in holotype). Exterior of aperture with a pit behind reflected outer lip, underlying labral plate, another under mid-basal tooth. Columella lip projects forward in region of superficial columella tooth and is distinctly sinuous in profile, being cut back basally (fig. 1E). Umbilicus widely open, elongate-oval, with a deep indentation underlying superficial columella tooth and columella lamella. Shell almost transparent when fresh; orange coloration of dried tissue of animal visible internally.

Distribution (fig. 2). — Known only from the type locality, Hluleka Nature Reserve on the central Transkei coast, E. Cape.

Habitat. — Dune forest and tall coastal forest with large trees and an under storey of woody species; in leaf-litter.

Remarks. — In terms of its cylindrical shape and smooth, glossy sculpture, *Gulella bruggeni* resembles *G. pentheri* (Sturany, 1898) [E. Cape and KwaZulu-Natal], *G. wendalinae* Bruggen, 1975 [Mpumalanga], *G. appletoni* Bruggen, 1975 [Zululand] and *G. mariae* (Melvill & Ponsonby, 1892) [E. Cape and KwaZulu-Natal]. *G. pentheri* and *G. wendalinae* differ from the present species in having a closed umbilicus when fully mature and more simple, 3-4 fold apertural dentition, with a far less oblique (almost straight) parietal lamella, a simple, unicuspid labral tooth and no superficial columella tooth. In

both *G. appletoni* and *G. mariae* the superficial columella tooth, basal tooth and labral tooth are all smaller and the umbilicus narrower. The shell of *G. appletoni* is also smaller (attaining a length of only 1.9 mm).

In terms of its apertural dentition, *G. bruggeni* most closely resembles *G. chi* Burnup, 1926 (see below). However, in *G. bruggeni* the labral plate is less elongate-quadrate and more obviously bicuspid, and the superficial columella tooth and underlying columella lamella are two separate elements, with the superficial tooth being proportionately smaller and obscuring the underlying columella lamella to a lesser extent. In *G. chi* the superficial columella tooth and columella lamella form one more or less continuous structure, the superficial part obscuring most of the underlying element. In addition, in *G. chi* the columella lip is not sinuous in profile, its basal region not being cut back as in *G. bruggeni*, and it has distinct axial pleats behind the outer lip and around the umbilical margin. In terms of shell shape, *G. bruggeni* is considerably more slender than *G. chi* (length:width 2.35-2.87 compared to 1.88-2.21 ($n = 25$) in *G. chi*) and the whorls are noticeably less convex. *G. fraudator* Connolly, 1939 [coastal north-eastern E. Cape], also exhibits somewhat similar apertural dentition (discussed and figured by Herbert, 2006) and co-occurs with *G. bruggeni*, but in that species the basal tooth is more deep-set and the superficial columella tooth smaller, and the shell has a more pupiform profile (length:width 1.86-2.17, $n = 12$) with weak but distinct subsutural riblets. The very variable *G. farquhari* (Melvill & Ponsonby, 1895), for which there are very few records on the Transkei coast, is usually more ovate, retains some traces of axial sculpture even in smooth individuals, has a more deep-set mid-basal tooth and a low, elongate superficial columella tooth that does not produce a corresponding external indentation in the umbilical wall of the apertural tube.

Etymology. — It is a privilege to name this species in honour of Dr A.C. (Dolf) van Bruggen in recognition of his exceptional contribution to southern African malacology and to the genus *Gulella* in particular.

Gulella chi Burnup, 1926
(figs 2, 3)

Gulella chi Burnup, 1926:394, pl. 21, figs 36-39; Connolly, 1939:97. Type loc.: Signal Hill, East London, E. Cape, South Africa.

Type material. — Holotype NHM 1929.9.11.4, Signal Hill, East London, E. Cape, South Africa, leg. S. Kincaid. Paratypes: same data as holotype (NMSA 3558/T537, three specimens).

Material. — E. CAPE: Van Stadens Wild Flower Reserve (33.91200°S: 25.20507°E), 175 m a.s.l., gorge forest, in leaf-litter, leg. D. Herbert, L. Davis & M. Cole, 22.ix.2008 (NMSA W6559); Port Elizabeth area, Island Forest Reserve (33.98668°S: 25.37151°E), low coastal forest, in leaf-litter, leg. D. Herbert, L. Davis & M. Cole, 18.ix.2008; Kaboega Game Farm (33.26719°S: 25.42147°E), mixed woody vegetation in blind-ending kloof with stream and pools, in leaf-litter, leg. D. Herbert, L. Davis & M. Cole, 10.iii.2008 (NMSA W6245); Bathurst, Trappe's Valley (33.45°S: 26.9°E), ex Albany Museum, 1980 (NMSA E8213); Kap River Nature Reserve (33.48541°S: 27.08474°E), indigenous riverine forest, in leaf-litter, leg. A. Moussalli, D. Stuart-Fox & M. Bursey, 09.xii.2005 (NMSA W5447); Hickman's River mouth (33.069°S: 27.837°E), dune bush/forest, in leaf-litter, leg. D. Herbert, 04.iii.2000 (NMSA V8078; ELM D13418; ELM D15037); Umtiza Nature Reserve (33.0169°S: 27.80917°E), leg. M. Bursey, 08.iv.2002 (ELM D13897); East London (33.0°S: 27.917°E), ex F.J. Puzey, 1932 and Albany Museum, 1980 (NMSA W141, B7391); East London Golf Club (32.9986°S: 27.9394°E), leg. M. Bursey, 03.ix.2007 (ELM D15572); East London, Nahoon Point Nature

Reserve (32.9944°S: 27.9475°E), leg. M. Bursey, 24.v.2006 (ELM D14897); East London, between suburbs of Abbotsford and Vincent Heights (32.9695°S: 27.9030°E), indigenous forest, in leaf-litter, leg. D. Herbert, M. Bursey & G. Redman, 26.i.2002 (NMSA W38); East London, Bonza Bay (32.95°S: 27.983°E), dune forest, leg. M. Bursey, 23.xi.2006 (ELM D15025); Elizweni, near Nahoon Dam (32.91528°S: 27.8189°E), leg. M. Bursey, 18.iv.2006 (ELM D14885; W02983); Gonubie River, Slippery Drift (32.80056°S: 27.85583°E), leg. M. Bursey, 27.x.2006 (ELM D14948); Qolora Estuary, east bank (32.6167°S: 28.4167°E), leg. M. Bursey, 04.v.2006 (ELM D14855; D15066).

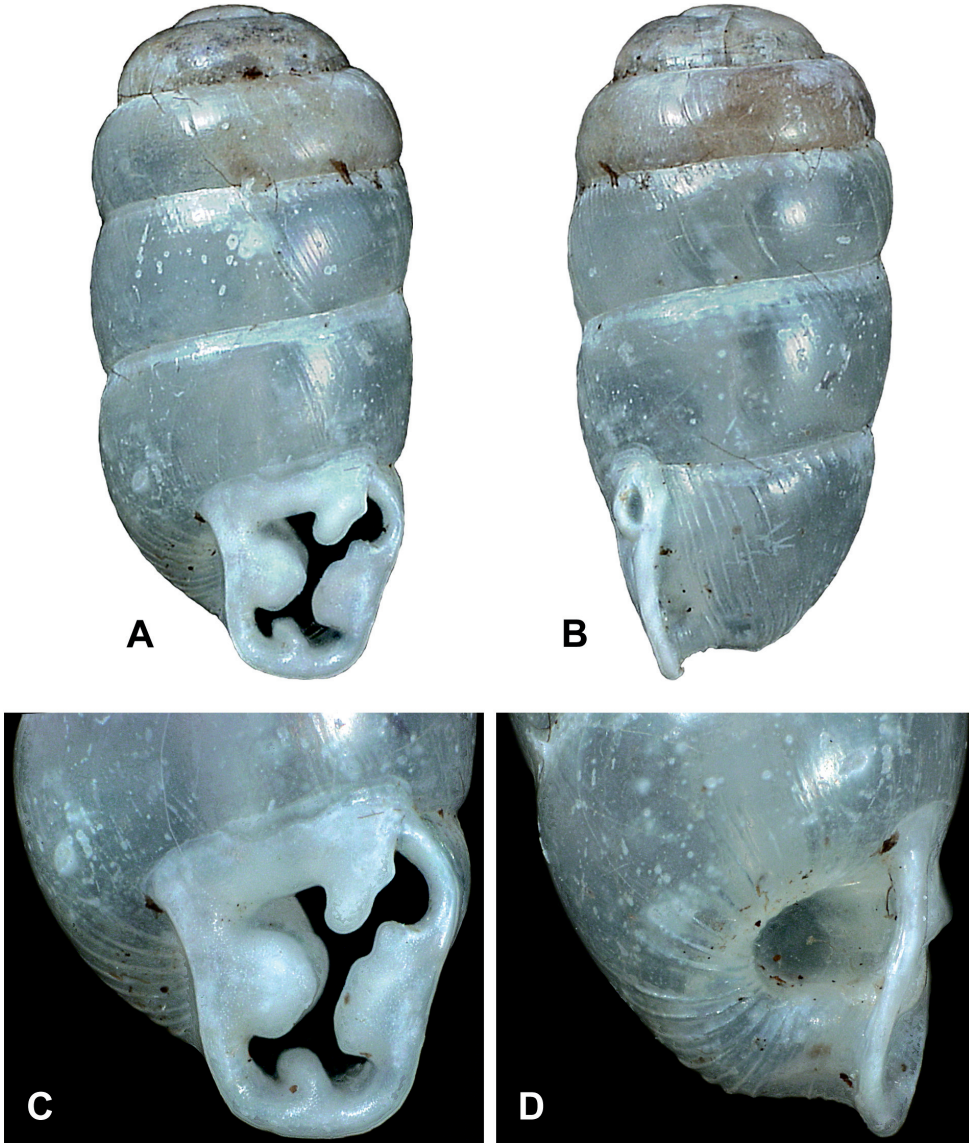


Fig. 3. *Gulella chi* Burnup, 1926, Hickman's River mouth, East London, E. Cape, length 2.33 mm, width 1.12 mm (NMSA V8078). A, apertural view. B, side view. C, oblique view into aperture. D, oblique view of base showing umbilicus.

Additional literature record. — E. CAPE: Great Fish River, 20 miles east of Kowie, leg. Smith (Connolly, 1939).

Distribution (fig. 2). — Endemic to E. Cape. Previously recorded from the coastal region between East London and Bathurst (Connolly, 1939), but newly collected material enables us to extend this both to the east and west, as well as inland. The extent of occurrence is now known to range from the hinterland of St Francis Bay (gorge of Van Stadens River) to the southern Transkei (Qolora River mouth), and inland to the Suurberge.

Habitat. — Evidently an inhabitant of wooded and forested habitats, largely in the coastal region; in leaf-litter.

Notes. — The shell of *Gulella chi* has been described in detail by both Burnup (1926) and Connolly (1939), but the only illustrations available are those of Burnup (1926) which were small and poor by today's standards. We therefore take this opportunity to refigure a fresh specimen of the species (fig. 3). It is characterised by its highly constricted, X-shaped aperture, minute size, squat profile, widely open umbilicus and convex whorls. Although *G. bruggeni* described herein has somewhat similar apertural dentition (compared above), its shell is markedly more slender than that of *G. chi*, has less convex whorls and lacks axial pleats behind the outer lip and around the umbilicus. In *G. fraudator* Connolly, 1939 the shell has a more pupiform profile, stronger sub-sutural riblets, narrower umbilicus, and the superficial columella tooth is smaller and clearly disjunct from the underlying columella lamella (Herbert, 2006).

Gulella bomvana spec. nov.
(figs 4, 5)

Type material. — Holotype NMSA W6673/T2491 (*ex* ELM D14359), length 1.76 mm, width 0.76 mm, length:width 2.32. South Africa, E. Cape, Transkei, Xora, Kumqolo Forest, (32.159233°S: 28.98533°E), 500 m upstream of Xora River mouth, steeply sloping forest on southern side, in leaf-litter, leg. M. Bursey & V. Mpumlwana, 25.x.2004. Paratypes: same data as holotype (NHM 20090235, two specimens; NMW.Z.2009.021.00001, one specimen; RMNH 113996, two specimens; all *ex* ELM D14359); E. Cape, Transkei, Xora, Kumqolo Forest, (32.159233°S: 28.98533°E), 500 m upstream of Xora River mouth, steeply sloping forest on southern side, in leaf-litter, leg. M. Bursey & D-J. Hodgkinson, 12.viii.2003 (ELM D14264, one specimen, NMSA W6676/T2492, one specimen); E. Cape, Transkei, Nkanya area (32.193508°S: 28.957503°E), dune forest, in leaf-litter, leg. M. Bursey & V. Ndibo, 17.ix.2005 (ELM D15342, two specimens, NMSA W6675/T2493, two specimens); E. Cape, Transkei, Cwebhe Nature Reserve, east side of Mbashe River mouth (32.226422°S: 28.899756°E), coastal scarp forest, in leaf-litter, leg. M. Bursey & D-J. Hodgkinson, 04.ii.2004 (ELM D13853, two specimens; NMSA W6674/T2494, two specimens).

Diagnosis. — Shell minute, cylindrical, glossy but with fine growth-lines; apertural dentition 6 to 7-fold, including a large, in-running labral plate with ridge-like border running deeply into aperture, a deep-set, oblique, ridge-like basal tooth to left of centre and an inset tricuspid columella lamella; umbilicus open, narrow.

Description (fig. 4). — Shell minute, cylindrical, adult length 1.55-1.86 mm, width 0.72-0.78 mm; length:width 2.15-2.50 (n = 15). Apical whorls smooth, limit of embryonic shell not evident, embryonic shell plus teleoconch comprising approx. six whorls; first two whorls roundly convex, but subsequent ones relatively flat-sided; sculptured with fine growth-lines. Aperture quadrate, rounded at base, parietal callus well developed, peristome thickened. Aperture markedly constricted by teeth, dentition 6 to 7-fold (fig.

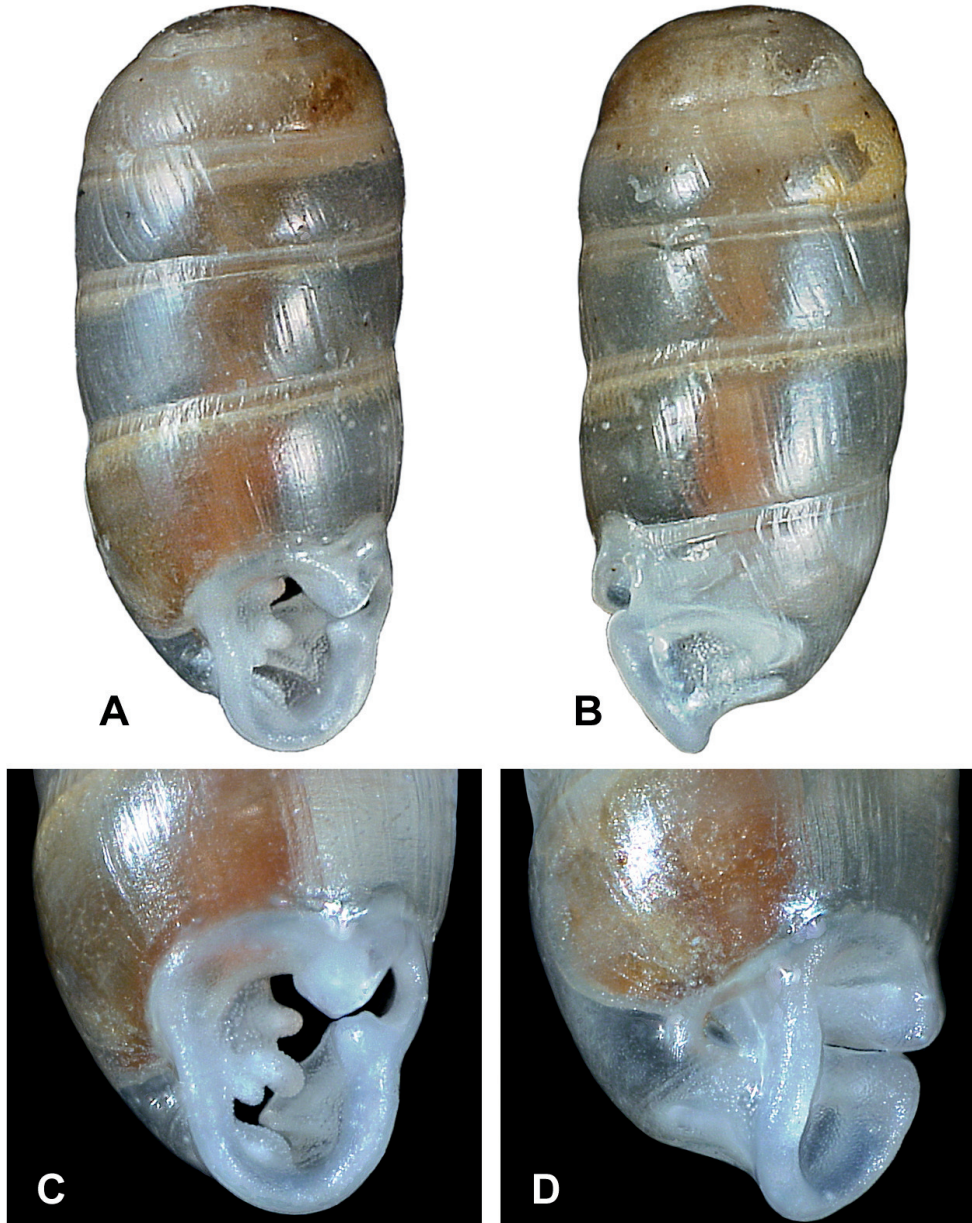


Fig. 4. *Gulella bomvana* spec. nov. holotype (NMSA W6673/T2491, ex ELM D14359), Kumqolo Forest, Xora, E. Cape, length 1.76 mm, width 0.76 mm. A, apertural view. B, side view. C, oblique view into aperture. D, oblique view of base showing umbilicus.

4C): 1) a strong parietal lamella, outer portion oblique and then curving inward so that the remainder runs into aperture more or less at right angles; 2) a large labral complex in the form of an in-running plate with a sharp upper margin, defining lower part of labral sinus at lip edge and running into aperture more or less parallel to parietal la-

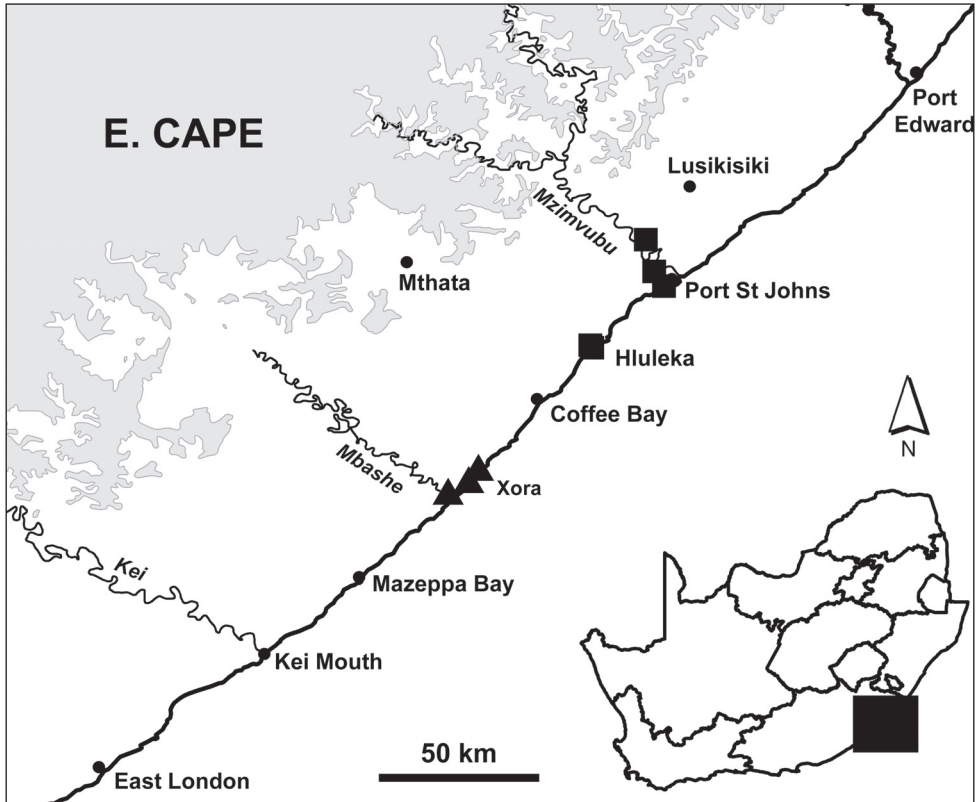


Fig. 5. Distribution map for *Gulella bomvana* spec. nov. (triangles) and *G. tietzae* spec. nov. (squares). Contour at 1000 m.

mella, then curving round deep inside aperture and with lower margin inset and not reaching lip edge; labral plate runs deep into aperture past level of columella lamella (in apertural view); 3) a very small, deep-set, basal denticle to right of centre may be present (not present in holotype); 4) a deep-set, oblique in-running ridge-like basal tooth to left of centre; 5-7) a large inset columella lamella with three teeth, the middle one largest and basal one shortest. Columella lip lacking a superficial tooth. Labral complex visible externally by transparency when fresh and corresponds with a shallow indentation behind thickened outer lip. Umbilicus narrowed to a small trigonal perforation (fig. 4D). Shell almost transparent when fresh; orange dried tissue of animal visible internally.

Distribution (fig. 5).— Known only from a small section of the coast between the Xora and Mbashe Rivers, E. Cape, a straight-line distance of only 12 km.

Habitat.— Dune and coastal scarp forest; in leaf-litter.

Remarks.— *Gulella bomvana* most closely resembles *G. tietzae* described below (fig. 6), from which it differs in having a more distinctly tricuspid columella that is clearly inset behind the aperture lip. In terms of the tricuspid columella tooth, *G. bomvana* also resembles *G. aprosdoketa* Connolly, 1939 (fig. 9) and to a lesser extent *G. ndibo* (fig. 7). In

both those species, however, the basal tooth is longer and projects at the aperture lip. In addition, the tricuspid columella tooth is more deep-set in *G. bomvana*. *G. aprosdoketa* is also larger and has a relatively wider umbilicus with a pleated margin.

Another similar species is *G. sylvia* (Melvill & Ponsonby, 1903). This was treated as a widespread and variable species by Herbert & Kilburn (2004), but they noted that Transkei material might form part of a separate, unnamed species. Further study of this material has shown that several unnamed species are in fact present, including *G. bomvana*, as well as *G. tietzae* and *G. ndibo* described below. Topotypic material of *G. sylvia* differs from *G. bomvana* in being larger (length ± 2.5 mm) having the basal tooth situated further to the left of centre, a bicuspid rather than a tricuspid columella lamella and there is frequently a low rounded tooth in the middle of the columella lip. In addition, the labral tooth of *G. sylvia* is a simple, bicuspid and largely superficial structure, rather than a complex, deeply in-running plate as it is in *G. bomvana*, *G. tietzae* and *G. ndibo*.

Etymology.— Named in honour of the amaBomvana people whose ancestral home lies between the Mthatha and Mbashe rivers.

Gulella tietzae spec. nov.
(figs 5, 6)

Type material.— Holotype NMSA W3064/T2477, length 2.04 mm, width 0.8 mm, length:width 2.55. South Africa, E. Cape, Transkei, Hluleka Nature Reserve (31.8233°S: 29.3055°E), coastal forest, in leaf-litter, leg. D. Herbert, L. Davis & M. Bursey, 20.iv.2005. Paratypes: same data as holotype (NMSA W3188/T2487, one specimen); E. Cape, Transkei, Hluleka Nature Reserve (31.817°S: 29.30°E), dune forest, in leaf-litter, leg. J.P. Marais, iii.2003 (NMSA W2406/T2488, one specimen); E. Cape, Transkei, Port St. Johns, Silaka Nature Reserve (31.65056°S: 29.5072°E), coastal forest, in leaf-litter, leg. D. Herbert & M. Bursey, 05.iii.2003 (ELM D14387, one specimen); E. Cape, Transkei, Port St. Johns, Isinuka sulphur springs and travertine deposit (31.60953°S: 29.47989°E), woodland/forest, in leaf-litter, leg. D. Herbert & M. Bursey, 04.iii.2003 (NMSA W3100/T2486, four specimens; NHM 20090236, one specimen; NMW.Z.2009.021.00002, one specimen; RMNH 113997, one specimen); E. Cape, Transkei, Port St. Johns area, crater-like travertine deposit on southern side of Mzimvubu River valley (31.52053°S: 29.45662°E), valley thicket, sorted from leaf-litter, leg. D. Herbert, L. Davis & M. Bursey, 22.iv.2005 (NMSA W3172/T2478, two specimens; ELM D15944, two specimens).

Diagnosis.— Shell minute, cylindrical; smooth; apertural dentition 6 to 7-fold, including a large, labral plate extending deep into aperture, a deep-set basal tooth to left of centre and a robust columella complex with a large, trigonal central tooth, a low rounded tooth on its basal margin and a more deeply-set, papilla-like tooth on its upper margin; umbilicus relatively wide.

Description (fig. 6).— Shell minute, cylindrical, adult length 1.78–2.23 mm, width 0.8–0.88 mm; length:width 2.23–2.55 ($n = 15$). Embryonic shell comprises approx. 2.25 whorls; smooth; junction between embryonic shell and teleoconch weakly evident. Teleoconch comprising approx. 4.5 whorls, the first convex, but subsequent ones flat-sided, smooth except for weak growth-lines. Aperture quadrate, rounded at base, peristome thickened, parietal region covered with thin callus. Aperture markedly constricted by teeth, dentition 6 to 7-fold (fig. 6c): 1) a strong parietal lamella, outer portion oblique, margin smoothly convex; 2) a large labral complex in the form of a low, in-running plate, with a sharp ridge around its border, upper portion with a distinct tooth at lip edge, defining lower part of labral sinus, the cusp may be at the upper end of a low,

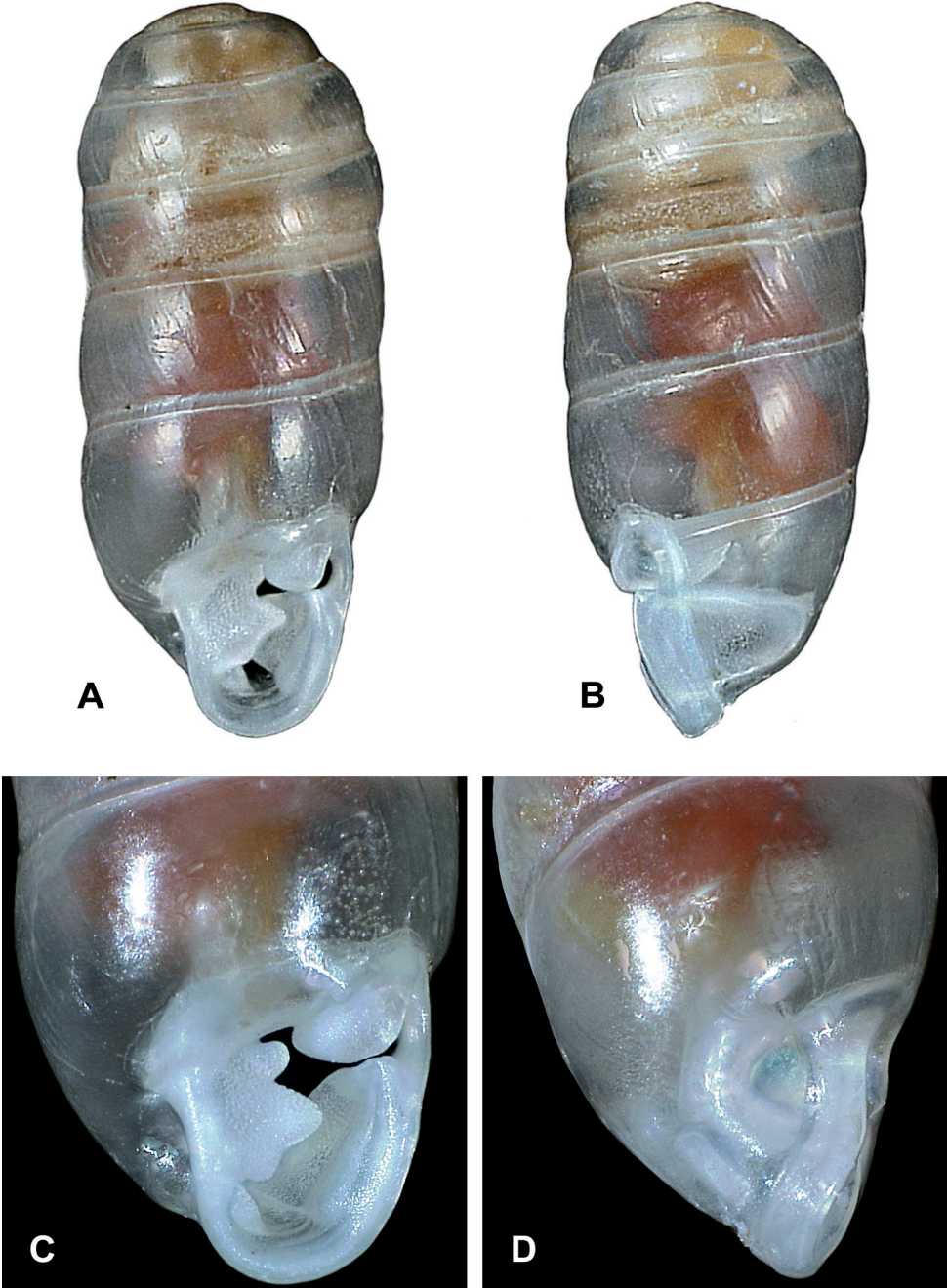


Fig. 6. *Gulella tietzae* spec. nov. holotype (NMSA W3064/T2477), Hluleka Nature Reserve, E. Cape, length 2.04 mm, width 0.8 mm. A, apertural view. B, side view. C, oblique view into aperture. D, oblique view of base showing umbilicus.

vertical ridge at aperture edge, lower margin of labral plate inset and not reaching lip edge; labral plate runs deep into aperture beyond level of columella lamella in apertural view; 3) a deep-set, ridge-like basal tooth to left of centre, largely obscured by columella lamella; 4-6) a very large columella complex which extends outward at its base almost to aperture edge, and which bears a large, trigonal central tooth, with a low rounded tooth on its lower margin (sometimes little more than a swelling), and a more deeply-set, papilla-like tooth on its upper margin, partially obscured by parietal region; 7) a minute sinular denticle (sometimes present). Labral complex visible externally by transparency when fresh and corresponds with a shallow indentation behind thickened outer lip. Umbilicus open, relatively wide and deep with a conspicuous pit underlying columella lamella (fig. 6D); umbilical margin more or less smooth, lacking obvious pleats. Shell almost transparent when fresh; red/orange dried tissue of animal visible internally.

Distribution (fig. 5). — Endemic to the north-eastern E. Cape; known only from the Port St Johns area (Mzimvubu River) south to Hluleka Nature Reserve, a straight-line distance of approx. 30 km, ranging up to 15 km inland of Port St. Johns.

Habitat. — Known from forest habitats near the coast and in woodland/subtropical thicket associated with thermal springs and travertine deposits inland of Port St Johns; in leaf-litter.

Remarks. — In terms of its small size, smooth glossy shell and large, deeply in-running labral complex, *Gulella tietzae* resembles *G. bomvana* (fig. 4) and *G. ndibo* (fig. 7) described herein. *G. tietzae* is distinguished by its robust, columella complex with small deeply set upper tooth, large, trigonal central tooth and low basal tooth. The columella complex somewhat resembles that of *G. ndibo*, but in that species the upper columella tooth is ridge-like and not deeply set. Additionally, in *G. ndibo* the ridge-like basal tooth to left of centre projects at the lip edge. *G. sylvia* differs *inter alia* (see remarks under *G. bomvana* above) in having a more deep set columella lamella and a basal denticle that lies in front of the lamella and further to the left of centre.

Etymology. — Named for Nancy Tietz, retired Director of the East London Museum, in acknowledgement of her encouragement and assistance on field trips to the Transkei coast.

Gulella ndibo spec. nov.
(figs 7, 8)

Type material. — Holotype NMSA W3456/T2495, length 2.37 mm, width 0.97 mm, length:width 2.52. South Africa, E. Cape, Transkei, Hluleka Nature Reserve (31.820267°S: 29.30303°E), coastal forest, sorted from leaf-litter, leg. D. Herbert, L. Davis & M. Bursey, 20.iv.2005. Paratype: same data as holotype (NMSA W6677/T2496, one specimen).

Diagnosis. — Shell minute, cylindrical, smooth and glossy; apertural dentition 7-fold, including a broad in-running labral plate, a ridge-like basal tooth which projects at lip edge and a large superficial columella complex with two teeth, upper one a narrow transverse ridge, lower one broader and with a low swelling on its basal margin; umbilicus closed at full maturity.

Description (fig. 7). — Shell minute, cylindrical, adult length 2.20-2.37 mm, width 0.94-0.97 mm; length:width 2.34-2.45 (n = 2). Embryonic shell smooth, comprising approx. 2.25 whorls, junction between embryonic shell and teleoconch poorly defined.

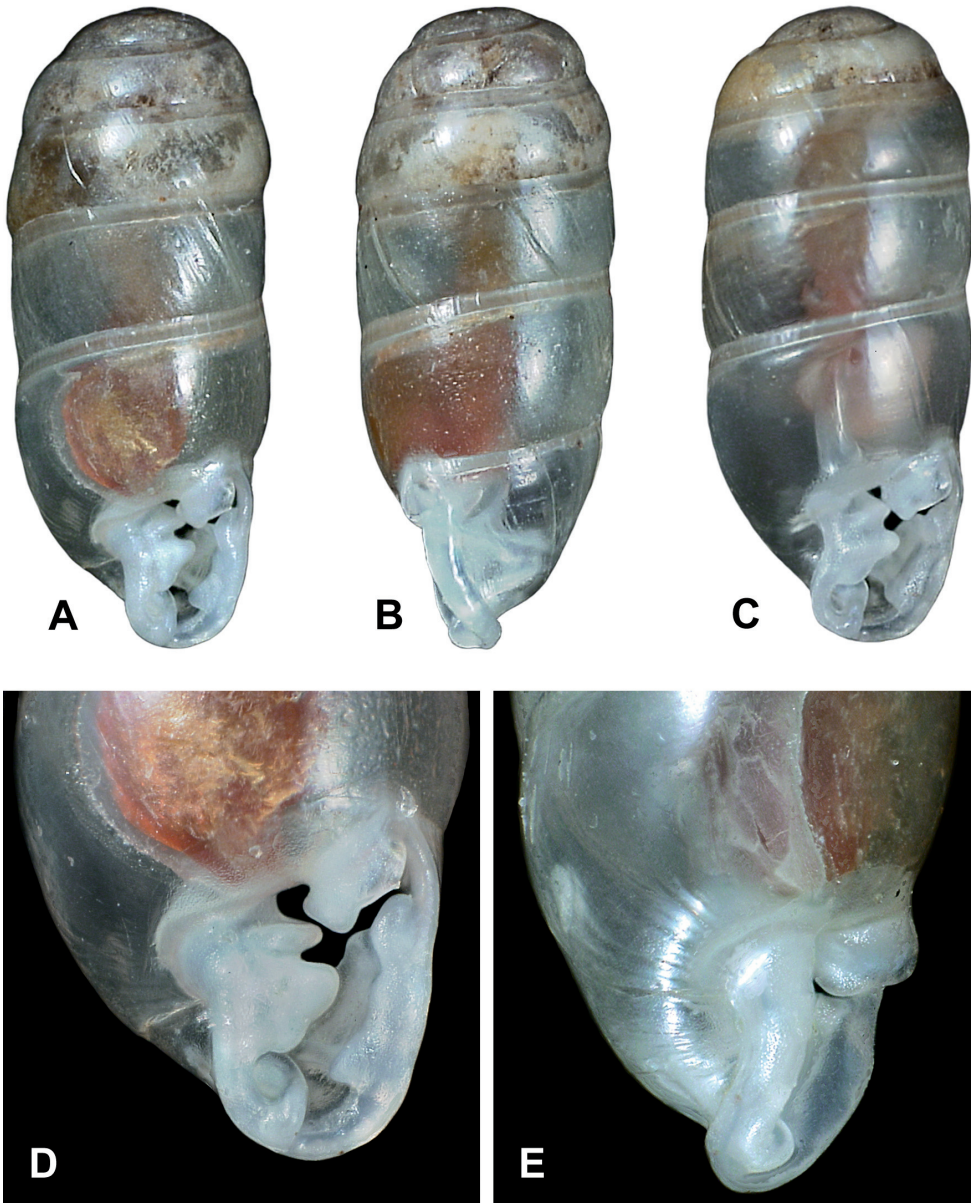


Fig. 7. *Gulella ndibo* spec. nov. A-B, D-E, holotype (NMSA W3456/T2495), Hluleka Nature Reserve, E. Cape, length 2.37 mm, width 0.97 mm. C, paratype (NMSA W6677/T2496), Hluleka Nature Reserve, E. Cape, length 2.20 mm, width 0.94 mm. A, apertural view. B, side view. C, apertural view. D, oblique view into aperture. E, oblique view of base showing umbilicus.

Teleoconch comprising approx. 4.0 whorls, the first convex, but subsequent ones flat-sided; glossy and smooth except for weak growth-lines. Aperture obliquely quadrate, rounded at base and with indented columella lip; peristome thick and reflected. Aper-

ture constricted by teeth, dentition 7-fold (fig. 7D): 1) an oblique parietal lamella with a notch in its lower margin; 2-3) a complex labral tooth comprising a low vertical ridge at aperture edge with a cusp at upper and lower ends from which a low in-running plate bordered above and below by a raised ridge extends deep into aperture; 4) a very small, deep-set, basal denticle to right of centre; 5) a long, in-running, ridge-like basal tooth to left of centre, protruding at lip edge and curving toward columella as it runs into aperture; 6-7) a large, complex columella lamella which extends to lip edge at its base and bears two teeth, upper one narrow, transverse and ridge-like, lower one larger and broader, with an additional very low swelling on its basal margin. Labral complex visible externally by transparency in fresh material and corresponds with a shallow indentation behind thickened outer lip. Umbilicus closed in holotype (fig. 7E), but remaining narrowly open in subadult paratype, opening almost horizontally into a conspicuous pit underlying columella lamella. Shell almost transparent when fresh; red/orange dried tissue of animal visible internally.

Distribution (fig. 8). — Known only from the type locality, Hluleka Nature Reserve on the central Transkei coast, E. Cape.

Habitat. — Tall coastal forest with large trees and an under storey of woody species; in leaf-litter.

Remarks. — The general form of the apertural dentition of *G. ndibo* is similar to that of *G. aprosdoketa* (see below) and both species share the somewhat unusual, well-developed, in-running, ridge-like basal tooth that projects at the aperture margin. In *G. aprosdoketa*, however, the columella complex is clearly tricuspid, whereas in *G. ndibo* it has only two distinct teeth with a mere swelling along its basal margin. *G. ndibo* is also significantly smaller than *G. aprosdoketa* (adult length 2.20-2.37 mm vs. 2.9-4.0 mm), and has a smooth umbilical region and closed umbilicus when fully mature, while the umbilicus of *G. aprosdoketa* is widely open and its margin bears distinct axial pleats.

G. tietzae, described above, is closer to *G. ndibo* in size and also has somewhat similar dentition. However, the basal ridge-like tooth ends well before the aperture edge and the umbilicus remains open. Additionally, in *G. ndibo* the vertical ridge at the apertural edge of the labrum is much stronger, with a cusp at both the upper and lower ends, and the upper tooth on the columella lamella is not deeply set. In topotypic specimens of *G. sylvia* (see remarks under *G. bomvana* above) the columella lamella is much more deep set, and the basal tooth and labral plate far less deeply in-running.

Etymology. — Named for Victor Ndibo, assistant in the Malacology Department at the East London Museum, who has helped us on many field trips to the Transkei coast and collected much valuable material.

Gulella aprosdoketa Connolly, 1939
(figs 8, 9)

Gulella aprosdoketa Connolly, 1939:73, pl. 2, fig. 4; Herbert & Kilburn, 2004: 209, text figure and map. Type loc. Isinuka sulphur spring, Port St Johns, E. Cape, South Africa (W. Falcon).

Type material. — Holotype plus three paratypes NHM 1937.12.30.687-90, Isinuka sulphur spring, Port St Johns, E. Cape, South Africa (leg. W. Falcon); 12 additional paratypes from type locality, ii.1934, NMSA W0823/T531 (W. Falcon coll'n).

Material. — E. Cape: Lusikisiki area, Magwa Falls (31.44553°S: 29.6387°E), 400 m a.s.l., ex W. Falcon

(NMSA W781); Port St Johns (31.633°S: 29.53°E), W. Falcon, pre 1956, ex Durban Museum, 1998 (NMSA V7373); Port St Johns, Silaka Nat. Reserve (31.6513°S: 29.50918°E), coastal forest, in leaf-litter, leg. D. Herbert, 05.iii.2003 (NMSA W555); Mpande (31.74738°S: 29.37078°E), coastal forest north of Sinangwana River, in leaf-litter, leg. D. Herbert, L. Davis & M. Bursey, 21.iv.2005 (NMSA W2853); Xora River Mouth, Kumqolo Forest (32.15888°S: 28.98481°E), coastal forest, leg. M. Bursey, 12.viii.2003 (ELM D13678); Xora River mouth (32.15°S: 28.983°E), leaf-litter from coastal bush, leg. SA Conch. Soc., vi.1998 (NMSA V6600); Mbashe River mouth (32.25°S: 28.883°E), leg. W. Falcon, 01.iv.1940 (NMSA W786); Mazeppa Bay area, Manubi Forest (32.44433°S: 28.598367°E), coastal forest, in leaf-litter, leg. D. Herbert & L. Davis, 22.ii.2006 (NMSA W3985).

Distribution (fig. 8). — Known only from the north-eastern coastal region of E. Cape. Previously recorded only from Port St Johns south to the Xora River mouth (Herbert & Kilburn, 2004), but through the identification of previously undetermined material and the collection of additional specimens during recent field surveys, the known range is extended to both the north and south, ranging from the Lusikisiki area south to Mazeppa Bay, a straight-line distance of ca 150 km.

Habitat. — Recorded only from Transkei coastal scarp forest; in leaf-litter.

Notes. — Connolly's description of this species was good, but the figure provided was poor. To facilitate comparison with the new species described herein, we provide

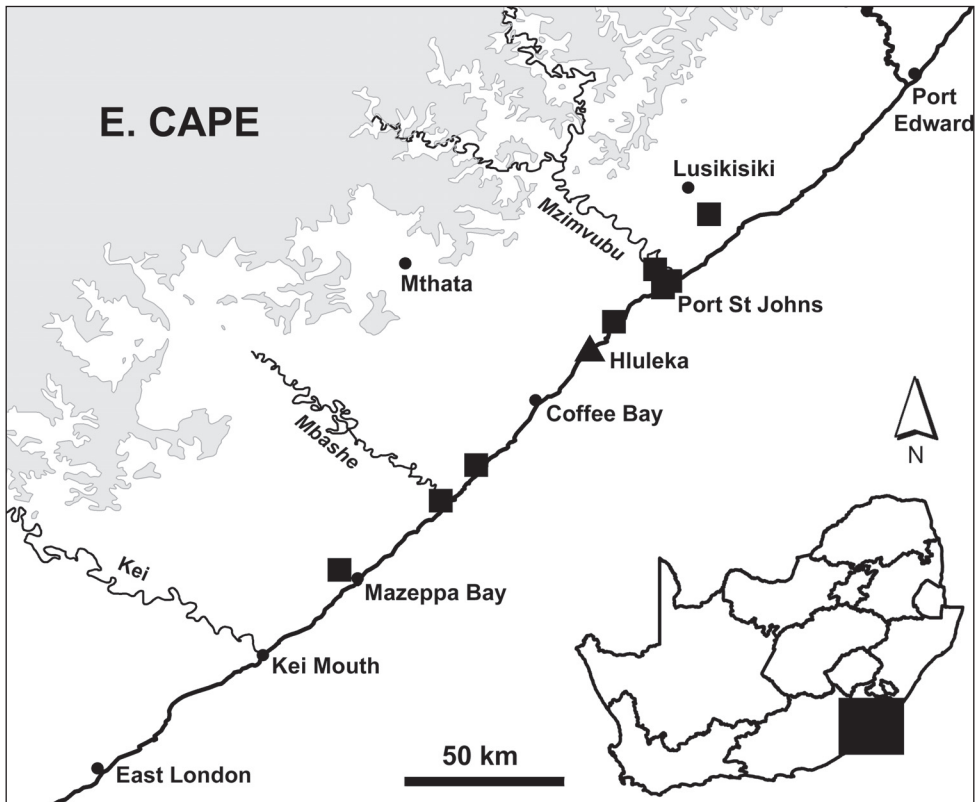


Fig. 8. Distribution map for *Gulella ndibo* spec. nov. (triangle) and *G. aprosdoketa* Connolly, 1939 (squares). Contour at 1000 m.

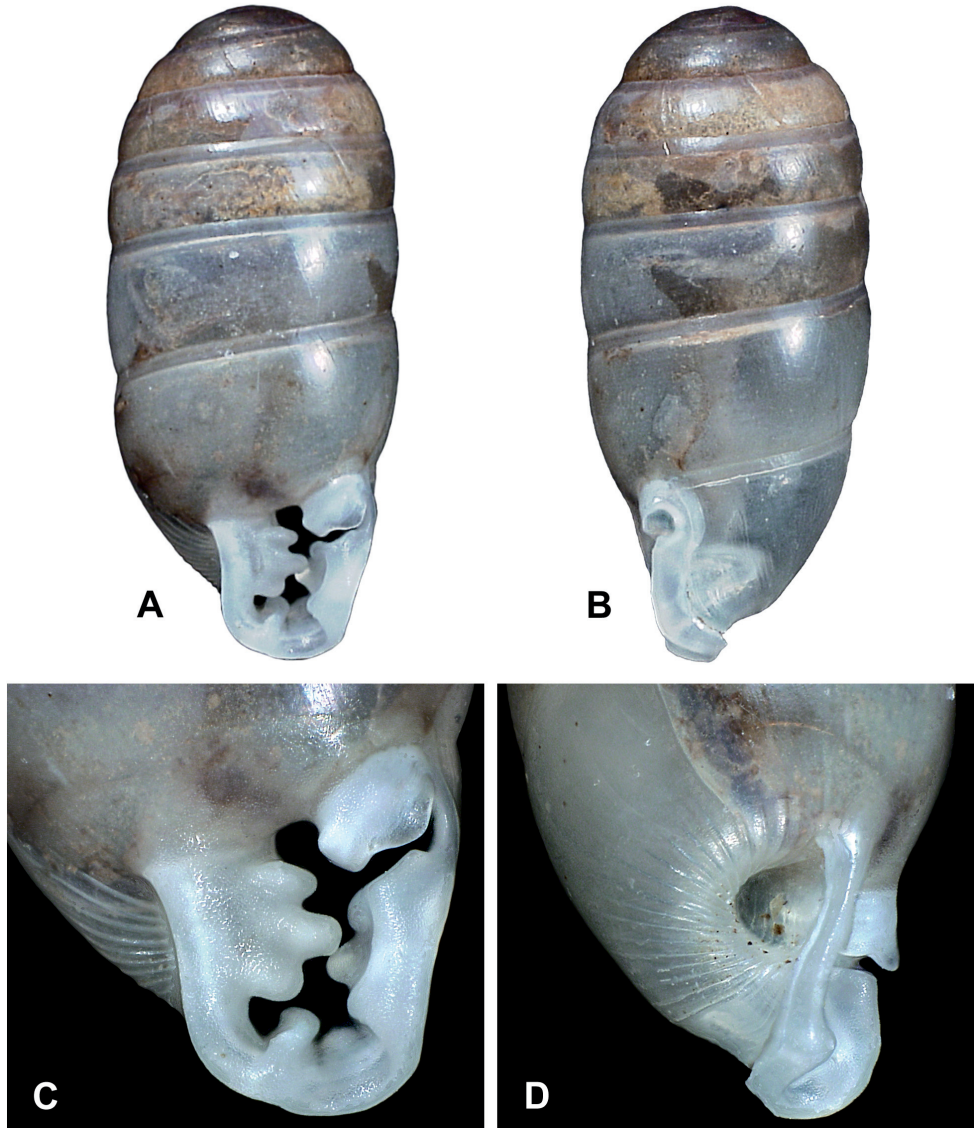


Fig. 9. *Gulella aprosdoketa* Connolly, 1939, Kumqolo Forest, Xora, E. Cape, length 2.87 mm, width 1.29 mm (ELM D13678). A, apertural view. B, side view. C, oblique view into aperture. D, oblique view of base showing umbilicus.

additional illustrations of a fresh specimen (fig. 9). Amongst local species of *Gulella*, *G. aprosdoketa* is characterised by the large, superficial tricuspoid tooth on the columella lip and the well-developed, ridge-like, basal tooth to the left of centre which projects at the aperture margin. Other local species with complex columella dentition include *G. bomvana*, *G. ndibo*, *G. tietzae* described above and some forms of the variable *G. sylvia* (Melvill & Ponsonby, 1903), but these are all conspicuously smaller than *G. aprosdoketa* (adult

length <2.6 mm vs. 2.9-4.0 mm) and lack axial pleats around the umbilicus. In *G. bomvana* and some forms of *G. sylvia*, which also have a conspicuously tricuspid columella, the tricuspid tooth is inset well behind the aperture lip. Additionally, in *G. bomvana*, *G. sylvia* and *G. tietzae* the basal tooth ends well before the lip edge. Further comparison with *G. ndibo* is given above. The species is currently listed as Endangered B1ab(iii) in the IUCN Red List (IUCN 2008).

Conservation

All four new species are endemic to the Transkei region of E. Cape. All are narrow-range endemics restricted to the coast and coastal hinterland, with two species *G. bruggeni* and *G. ndibo* being known only from a single locality, Hluleka Nature Reserve. Even the most widely ranging species, *G. tietzae* is recorded over a linear distance of only 30 km; this too includes the Hluleka Nature Reserve. The known range of *G. bomvana* spans a linear distance of only 12 km. Although further sampling in the central Transkei coastal hinterland would undoubtedly result in further records for these species within and close to their known ranges, the Transkei coast as a whole is now relatively well sampled and these narrow distribution patterns probably reflect a natural phenomenon. In terms of the IUCN categories and criteria for red-listing threatened species (IUCN, 2001), *G. bruggeni*, *G. ndibo* and *G. bomvana* are likely to meet the distribution-based criteria for listing as Critically Endangered, and *G. tietzae* as Endangered.

All four species have been found in nature reserves under the jurisdiction of the E. Cape Parks Board. Hluleka Nature Reserve, in which three of the species occur, is 772 ha in extent and comprises two forests, the Congwane Mtombo Forest and the Ndabeni Hluleka Forest. *G. tietzae* also occurs in the Silaka Nature Reserve at Port St. Johns, while *G. bomvana* occurs in Cwebhe Nature Reserve. All three reserves comprise mainly tall, species-rich and structurally diverse, multi-layered forests, with well developed canopy and under storey tree layers (Mucina & Rutherford, 2006). A notable feature of the under storey is *Buxus natalensis*. Although uncontrolled use of forest resources in these reserves is a conservation problem, it occurs to a lesser degree than in forests outside protected areas. Thus these reserves, protecting Transkei coastal forests, although small in extent, are extremely important for conserving the region's malacofauna.

Collapse of traditional authorities in Transkei has led to uncontrolled use of forests formerly protected under the authority of headmen and chiefs. Although these forests are legally protected under current forestry policy, effective management is lacking and implementation of policies remains a challenge (Lawes et al., 2004). We have many observations of cutting of trees for poles (in particular *Buxus macowanii*), bark stripping, grazing by cattle and hunting in the Kumqolo Forest at Xora, type locality for *G. bomvana*, and in many other headman's forests. In spite of intense human pressure, this small forest of only approximately 10 ha, contains a wealth of terrestrial snails, including at least eight species endemic to the Transkei coast. Kumqolo Forest is also the type locality for another recently described species, *Gulella latimerae* Bursey & Herbert 2004. Three species listed as threatened in the IUCN (2008) Red List occur here (*Gulella aprosdoketa*, *Natalina beyrichi* (Martens, 1890) and *Sheldonia puzeyi* Connolly, 1939).

The species described in this paper provide further evidence of the importance of small forest patches for conservation of invertebrate biodiversity.

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