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Northern Drakensberg range *Gulella* species (Gastropoda, Pulmonata, Streptaxidae): *Gulella inobstructa* van Bruggen, 1965, revisited, or types are not typical

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ABSTRACT

Gulella inobstructa van Bruggen, 1965, was described from two adult shells from Magoebaskloof. Additional material shows that the range of variation in shell dimensions is quite considerable and that the type specimens indeed are far from typical, also as regards apertural dentition. This taxon is a narrow-range endemic in a limited area in Mpumalanga/Limpopo provinces, South Africa. The partly sympatric *G. perspicua* (Melvill & Ponsonby, 1893) has a shell that in many respects is similar to that of the above taxon. However, apart from various minor differences, the suture of *G. perspicua* is always excavated, so that shells of both taxa normally can be differentiated without undue trouble.

KEY WORDS: Mollusca, Streptaxidae, *Gulella*, South Africa, Mpumalanga, Limpopo, taxonomy, forest fauna.

INTRODUCTION

The northern Drakensberg range, i.e. the eastern escarpment in the Mpumalanga and Limpopo provinces of South Africa, harbours a series of forests many of which are still reasonably intact. Ms Johanna L. Swaye (now Mrs J.L. Horn; University of KwaZulu-Natal, Pietermaritzburg) has studied the diversity, biogeography and conservation of the invertebrates of part of these forests in Limpopo Province (Swaye 2004). In sampling the leaf litter she came across large numbers of (micro)molluscs which were deposited in the KwaZulu-Natal Museum (NMSA). Dr Dai Herbert and Ms Linda Davis have kindly entrusted the evaluation of the material of the streptaxid genus *Gulella* Pfeiffer, 1856 to the present author. So far this has resulted in the description of the new species *G. johannae* van Bruggen, 2006. More material has been made available in 2009 and the discussion below reflects on *G. inobstructa* van Bruggen, 1965.

Abbreviations used are l/d for the ratio length/major diameter as an indication of the shape of the shell (l/d values are calculated from micrometer readings before conversion to mm), NHMUK for The Natural History Museum (London), and RMNH for the National Museum of Natural History/NCBNaturalis in Leiden.

TAXONOMY

Genus *Gulella* Pfeiffer, 1856

Gulella inobstructa van Bruggen, 1965

Figs 1–3, 7, Tables 1, 2

Gulella inobstructa: van Bruggen 1965: 21, figs 1, 4 (Type loc.: South Africa, [Transvaal] Limpopo province, Magoebaskloof, Woodbush Forest); Richardson 1988: 91; Aiken 1995: 17.

New material examined (all South Africa, Mpumalanga province, enumerated from south to north): Lydenburg area, 20 km SSE of Lydenburg, Uitsoek Forest (25°16.366'S:30°33.138'E), 1200 m, indigenous forest, in leaf litter, leg. J.L. Horn leg., L 112, 3.ii.2006 (1 shell, NMSA W4561); Buffelskloof Nat. Res. (25°16.118'S:30°31.139'E), *c.* 25 km S of Lydenburg, 1750 m, indigenous forest, leaf litter, J.L. Horn leg., L 180, 16.iii.2006 (2 shells, NMSA W4474, Fig. 1); Horseshoe Falls (25.13°S 30.7°E) near Sabie, *c.* 1130 m,

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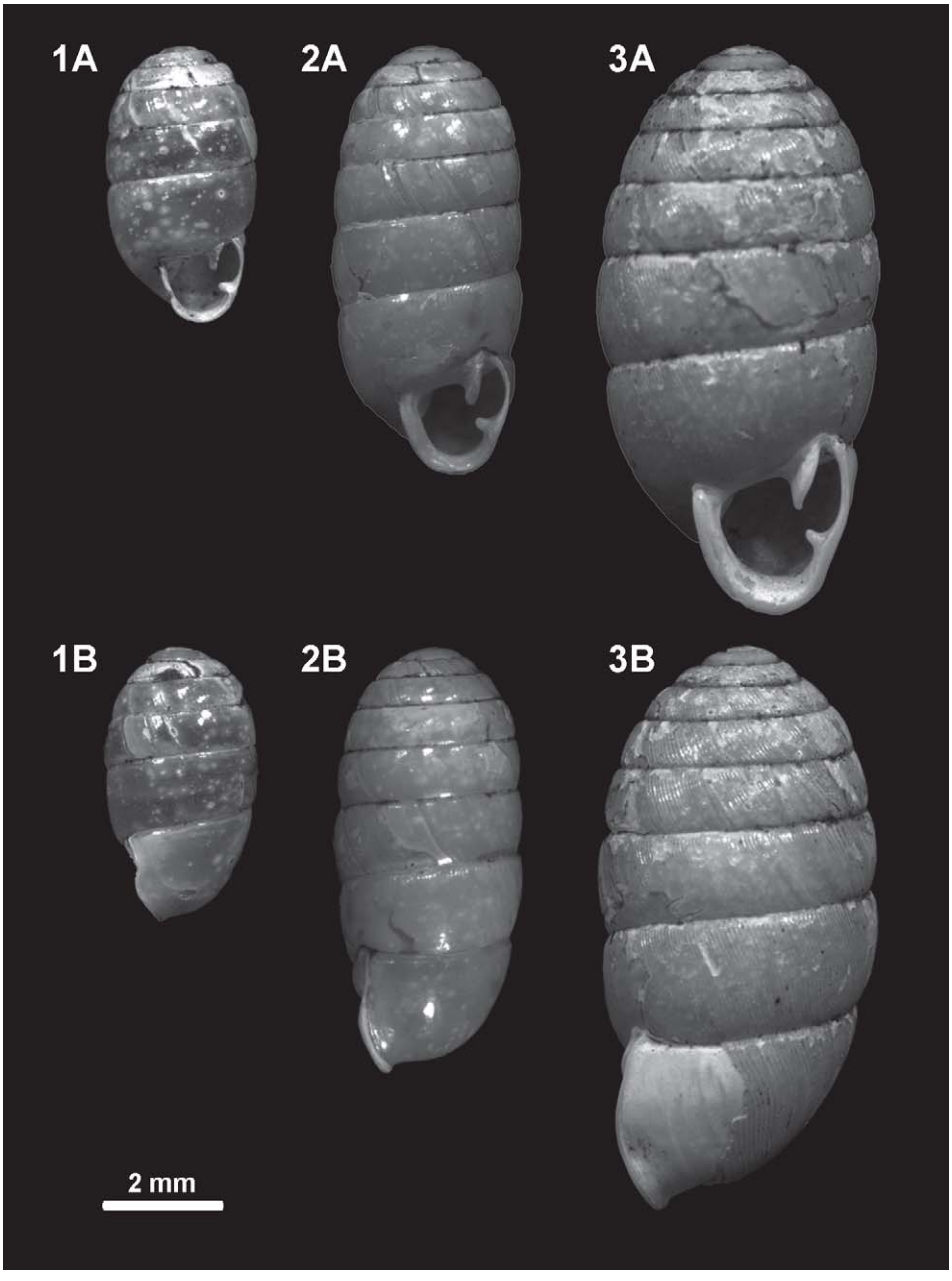

Figs 1–3. Shells of *Gulella inobstructa* van Bruggen, 1965, showing the range of variation in size, i.e. the smallest and largest specimens from Table 1 inclusive of an average shell: (1) Buffelskloof Nat. Res., NMSA W4474, length 4.4 mm (no. 1); (2) Mt Sheba Nat. Res., NMSA W4319, length 7.0 mm (no. 12); (3) Mariepskop Forest, NMSA W3502, length 9.4 mm (no. 24). Note absence of outer columellar process in the aperture. Photos Dr A.J. de Winter.

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leaf litter, 23.vii.1978, H.E. van Hoepen leg./don. (5 shells, RMNH); Mt Sheba Nat. Res.(24°56.340'S: 30°42.634'E), *c.* 5 km Wof Pilgrim's Rest, 1690 m, indigenous forest, leaf litter, J.L. Horn leg., MTS 14, 12.xii.2006 (29 shells, NMSA W5530; duplicates in RMNH); Mt Sheba Nat. Res. (24.931220°S: 30.709650°E), 1900 m, indigenous forest, on decaying log, A. Moussalli & D. Stuart-Fox leg., 25.ii.2004 [207-209] (5 shells, NMSA W4319, Fig. 2); Mt Sheba (24.9312°S 30.7097°E), 1900 m, afromontane forest, leaf litter, A. Moussalli & D. Stuart-Fox leg., 25.ii.2004 [207-209] (2 shells, NMSA W2423); Mariepskop Forest (24°34.015'S:30°51.899'E), 1520 m, indigenous afromontane forest, in leaf litter on forest floor, J.L. Horn leg., L 19, 1.iii.2005 (1 shell, NMSA W3502, Fig. 3); Mariepskop Forest (24°33.307'S:30°53.637'E), 1460 m, indigenous afromontane forest, in leaf litter on forest floor, J.L. Horn leg., L 31, 23.iv.2005 (3 shells, NMSA W3503).

Gulella inobstructa has also been collected in only two of the forest study sites of Swaye (2004: 35 (table 2.1) & 36 (fig. 2.1); Appendix 2 on p. 232), i.e. New Agatha (Mmakgowa) Forest and Forest Glens. Both are situated in Limpopo Province but are part and parcel of the northern Drakensberg range as opposed to the more northern Soutpansberg complex. This material has not been studied for the present paper.

When *G. inobstructa* was described (van Bruggen 1965: 21) it was diagnosed as follows: "A smooth, medium-sized species of *Gulella* with only four teeth in a little obstructed aperture, viz., a parietal, labral and two columellar processes." Only two adult shells were available and were considered sufficiently characteristic to warrant recognition as a separate taxon. In addition there was a juvenile shell without any apertural dentition.

Recently a number of similar specimens has been collected in the northern Drakensberg escarpment (see above) exhibiting considerable variation in size, shape, sculpture and apertural dentition. Metric data of this material (inclusive of the type material) are shown in Table 1, which may be summarized as 4.4–9.4 × 2.5–4.5 mm, l/d 1.75–2.48, with 6–8+ whorls, which implies that the smallest adult specimen is less than half the size of the largest shell. This is rare among species of *Gulella*, particularly those with a somewhat restricted distribution (see below).

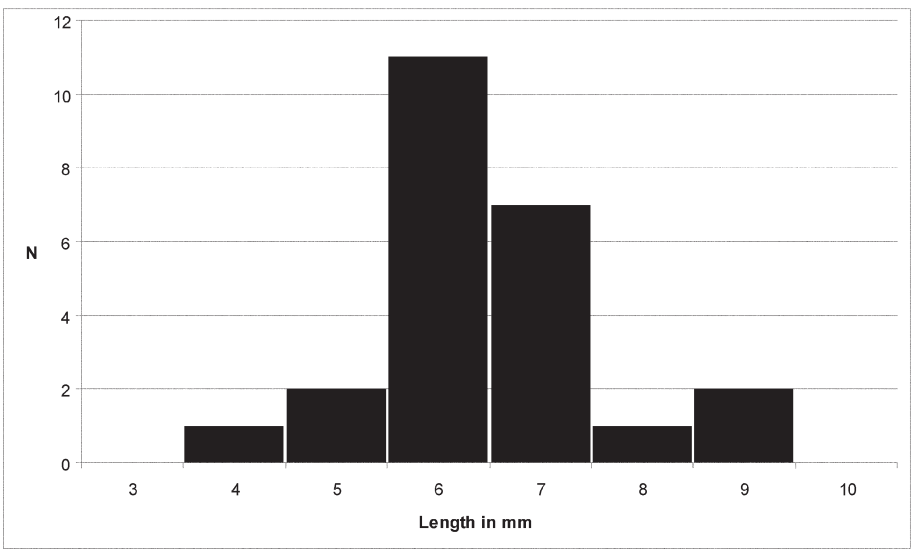

Fig. 4. Frequency diagram of the length of the shell of *Gulella inobstructa* with subdivisions of 1.0 mm. Diagram generated by Ms Sancia van der Meij.

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TABLE 1

Metric data of 24 adult shells considered to belong to *Gulella inobstructa*. An adult shell is here defined as a specimen exhibiting the full complement of apertural dentition.

no.	Length × major diameter, mm	l/d	Number of whorls	Additional data	Sample
1	4.4 × 2.5	1.75	6	adult shell: very small and very squat	NMSA W4474, Fig. 1
2	5.6 × 2.9	1.96	7	adult shell: small and squat	NMSA W4561
3	5.9 × 2.6	2.24	7+	–	NMSA W4474
4	6.2 × 3.0	2.08	7¾	–	NMSA W5530
5	6.2 × 3.1	2.00	*c*. 8	apex damaged	RMNH
6	6.5 × 2.9	2.26	8	–	NMSA W5530
7	6.5 × 3.1	2.08	7½	–	NMSA W5530
8	6.6 × 3.0	2.21	8	–	NMSA W2423
9	6.6 × 3.1	2.12	8-	–	NMSA W5530
10	6.6 × 3.2	2.04	<8	–	RMNH
11	6.9 × 3.1	2.20	8+	–	NMSA W5530
12	7.0 × 3.0	2.33	8	–	NMSA W4319, Fig. 2
13	7.0 × 3.0	2.33	8	some spiral sculpture present	NMSA W5530
14	7.0 × 3.1	2.24	8	–	NMSA W4319
15	7.1 × 3.1	2.28	8	–	NMSA W4319
16	7.1 × 3.1	2.28	8	–	NMSA W5530
17	7.1 × 3.2	2.19	<8	–	RMNH
18	7.2 × 3.2	2.23	8+	–	NMSA W5530
19	7.5 × 3.1	2.40	8	–	NMSA W4319
20	7.7 × 3.1	2.48	8+	–	NMSA W5530
21	7.7 × 4.2	1.82	8	shell squat and slightly costulate	NMSA W3503
22	8.3 × 4.2	1.98	8	paratype	NMSA
23	9.1 × 4.5	2.02	8	holotype	NMSA
24	9.4 × 4.5	2.08	8	shell large and slightly costulate	NMSA W3502, Fig. 3

Unfortunately there is only one sample containing a sufficient number of shells (27 adult shells) to reflect local variation in size and shape (NMSA W5530). A few other samples each encompass more than two adult shells (see Table 2). The data in this table more or less imply that local variation in size and shape is fairly limited. However, of the 24 specimens measured 11 are in the category 6.1–7.0 mm and 7 in 7.1–8.0 mm, or, conversely, 18 in the joint category 6.1–8.0 mm against only 3 in the category 4.1–6.0 mm and also only 3 in 8.1–10.0 mm (see Fig. 4). Incidentally, the sum total of the material is too limited for statistical analysis.

Looking at Table 1 it is clear that as regards shell length there are hardly any really significant gaps in the series – the only one that is seemingly aberrant being shell no. 1, 1.2 mm shorter than no. 2. The next gaps amount to no more than 0.3 mm. However, in the greater lengths (>7.7 mm) the gaps become increasingly larger, i.e. 0.6 mm (between nos. 21 and 22) and 0.8 mm (between the paratype, no. 22, and the holotype, no. 23).

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TABLE 2

Shell measurements in *Gulella inobstructa* populations of which more than two adult shells are available. Samples W4319 and W2423 may be combined (cf. locality data and date of collecting).

Measurements in mm	l/d	Number of whorls	Number of adult shells measured	Sample
6.2–7.1 × 3.1–3.2	2.00–2.19	<8	3	RMNH
6.2–7.7 × 2.9–3.2	2.08–2.48	7½–8+	9	NMSA W5530
6.6–7.5 × 3.0–3.1	2.21–2.40	8	4	NMSA W4319 + W2423

The major diameter or width of the shells varies from 2.5 to 4.5 mm. This is also unequally divided among the material, e.g. in the range 2.9–3.2 mm there are 18 shells, of which half (9) are 3.1 mm. Large gaps here are 2.6–2.9 = 0.3 mm, 3.2–4.2 mm = 1.0 mm, and 4.2–4.5 mm = 0.3 mm.

The ratio length/major diameter (l/d) varies from 1.75–2.45 implying that on the one hand there are fairly squat specimens as opposed to distinctly cylindrical shells (Table 1 and Fig. 5). However, this is another series with small gaps, varying from 0.02–0.08 with a value of 0.14 as the single exception (between nos. 21 and 2, i.e. 1.82 and 1.96). There is a cluster here too, i.e. there are 16 shells with l/d values of between (and inclusive of) 1.95 and 2.25.

The intergradation between 'smooth' and 'costulate' is slight; even pronounced growth striae may be considered costulae, so that no sharp delimitation is observed here. The

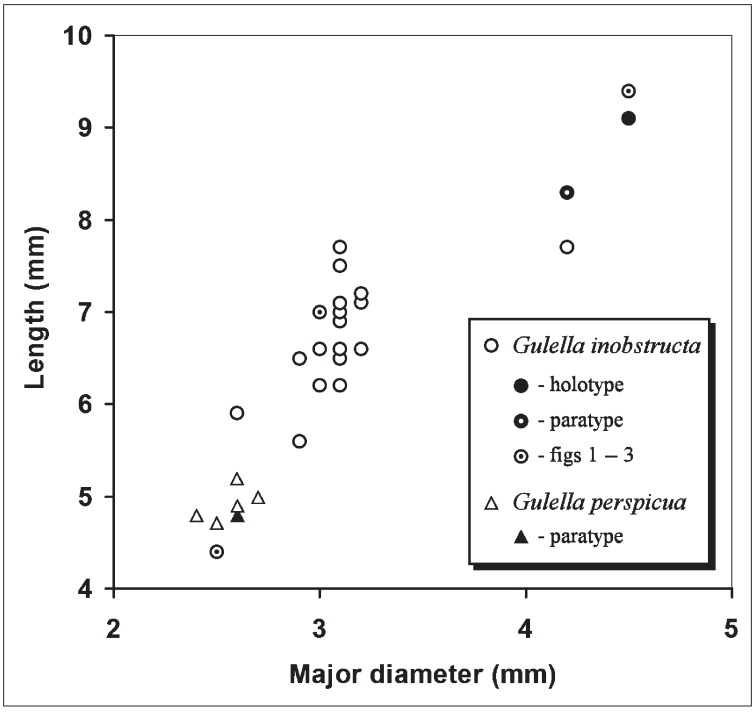

Fig. 5. Scatter plot of length against major diameter of the shells of *Gulella inobstructa* and *G. perspicua*.

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same applies to the outer columellar process. It appears that the superficial thickening of the columellar lip, originally considered an apertural process, is of rare occurrence and has so far only been found in the type material.

To summarize, there are small squat, medium elongate, large squat, and large elongate shells. Would this be an indication that more than one taxon is involved? This is a matter of personal interpretation – for the time being the present author prefers to consider this material only to represent *G. inobstructa* of which the populations live in a fragmented environment resulting in a noticeable amount of individual variation in shell shape and size.

The type material (two shells only) seems to represent close to the maximum length for the shell (Fig. 5). As regards shape and apertural dentition, the extremely limited type material also represents a slightly aberrant population. This leads to the conclusion that *G. inobstructa* is a valid taxon but subject to considerable variation in shell size and shape. These data once again show that 'type material' is at times far from 'typical' for the taxon involved.

The phenomenon of great variation in size, implying that the smallest adult specimen is approximately less than half the size of the largest shell, is rare among species of *Gulella*, particularly those with a somewhat restricted distribution (vide e.g., van Bruggen 1980; see also Herbert & Kilburn 2004). Some South African examples are *G. adamsiana* (Pfeiffer, 1859) with 6.5–11.0 mm (with a fairly large distribution in KwaZulu-Natal), *G. farquhari* (Melvill & Ponsonby, 1895) with 1.9–3.8 mm (includes data of van Bruggen, 1992, an in southern and East Africa very widely distributed species), *G. infrendens* (Von Martens, 1866) with 5.2–9.1 mm (a fairly widely distributed taxon in the Eastern Cape and KwaZulu-Natal), and *G. planti* (Pfeiffer, 1856) with 12.7–21.5 mm (a restricted endemic in KwaZulu-Natal).

The present taxon may now be redefined as follows:

A normally smooth, medium-sized species of *Gulella* with only three processes in a little obstructed aperture, viz., a parietal (angular), a labral, and a columellar process (Verdcourt's formula proposed in 1957/1962 1; 1; 0; 1); rimate or with closed umbilicus. In rare cases growth lines may develop into fairly insignificant costulation. Also, the outer columellar wall of the lip of the aperture may exhibit a swelling that may be interpreted as an outer columellar process so that the apertural dentition then must be considered four-fold instead of three-fold (Verdcourt's notation 1; 1; 0; 2). Anatomical and molecular data are as yet not available.

Connolly's group 3 (ii) should include this form, but all taxa are different in being smaller or having 4-fold instead of 3-fold dentition. Connolly's group 3 (ii) is partly covered by groups 2A and 2B in Herbert and Kilburn (2004: 155). Here, again, all taxa are different in being smaller or having 4-fold instead of 3-fold dentition. Also, none of the odd two dozen taxa of *Gulella* s.l. described since Connolly's treatise matches this diagnosis.

The range of *G. inobstructa* seems to be restricted to a limited area in SE Limpopo/NE Mpumalanga between 23°30'–25°30'S and 29°45'–31°00'E where it lives in the leaf litter of afromontane forest situated between *c.* 1100 and *c.* 1900. All new records are from Mpumalanga; the type locality (23°47'S:30°04'E) and the two records in Swaye's thesis are the only ones situated in Limpopo province.

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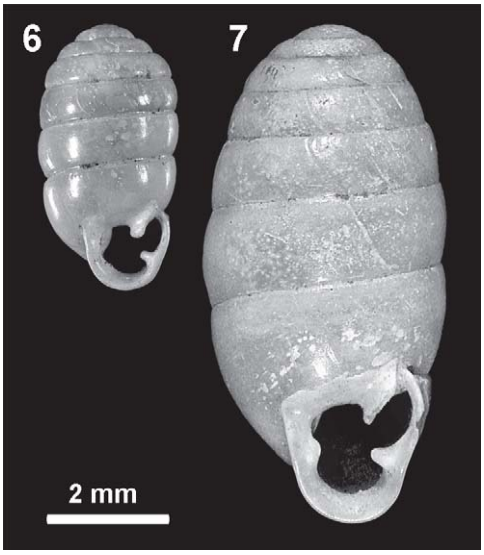

Figs 6, 7. Type specimens of *Gulella* species: (6) *G. perspicua*, "Transvaal" (= Middelburg), paralectotype, BM 1937.12.30.1123, length 4.8 mm; (7) *G. inobstructa*, Woodbush Forest/Magoebaskloof, holotype, NMSA 4123/T1087, length 9.1 mm; note presence of outer columellar process in the aperture. Photos Dr D. Herbert, layout of plate by Ms Sancia van der Meij.

GULELLA INOBSTRUCTA AND *G. PERSPICUA*

The shell of *Gulella perspicua* (Melvill & Ponsonby, 1893), partly sympatric with *G. inobstructa*, shows the same type of apertural dentition and comes within the range of measurements of the latter.

The following material was examined for this study (South Africa, Mpumalanga): Barberton, 25°47'S:31°03'E, *c.* 875 m, leg. G. Déglon, ex W. Falcon colln., don. Helen Boswell via A.C. van Bruggen (2 shells, RMNH); Waterval Boven, 25°38'S:30°21'E, *c.* 1350 m, leg./don. H.E. van Hoepen, 9.VII.1978 (1 shell, RMNH). The Barberton material is particularly valuable as it was mentioned and probably examined by Connolly himself (Connolly 1939: 33). Material was also personally studied in The Natural History Museum (London) in 1967 ["Transvaal", Ponsonby colln., 1903.3.11.44 (lectotype), 1937.12.30.1123 (paralectotype); Barberton (H.J. Puzey), 1945.8.23.261-266]. Dr Herbert has kindly supplied a photograph of the paralectotype shell from Middelburg (Mpumalanga)[1] in London (Fig. 6); this is in better condition than the now slightly damaged lectotype.

Available shell measurements (see Table 3) give a preliminary range of 4.7–5.2 × 2.4–2.7 mm, l/d 1.84–2.00, 7–7½ whorls, which is completely within the (lower parts of the) range of *G. inobstructa* (Fig. 5). As regards apertural dentition there is some variation within populations, e.g. in the NMHUK series from Barberton. Four of the six shells exhibit a weak to very weak basal process, while the remaining two do not show any basal process at all. Otherwise this small sample is remarkably uniform in size, shape and whorls.

[1]The type locality "Transvaal" was later restricted to Middelburg by Connolly (1912: 83).

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TABLE 3

Shell measurements of *Gulella perspicua* specimens studied in the context of this project.

Length × major diameter, mm	l/d	Number of whorls	Locality	Collection and/or additional data
4.7 × 2.5	1.88	<7	Waterval Boven	RMNH
4.8 × 2.4	2.00	7½	Barberton	fide Connolly (1939: 33)
4.8 × 2.6	1.84	*c.* 7	"Transvaal"	NMHUK, paralectotype, Fig. 6
4.9 × 2.6	1.86	7	Barberton	RMNH
5.0 × 2.7	1.86	7	Barberton	RMNH
5.2 × 2.6	2.00	7	Barberton	NMHUK

Differences between the two taxa are fairly subtle, such as *G. perspicua* having more convex whorls and a more prominent inner columellar process in a less ovate aperture; both taxa have rimate shells or a closed umbilicus. However, there is one consistent difference between *G. perspicua* and *G. inobstructa*. The suture of the former is narrowly indented, resulting in an excavated, trench-like line, which is visible under fairly high magnification. This has been described in detail by Herbert for his new species *Gulella deviae* Herbert, 2006. This author refers to the suture of *G. perspicua* (Herbert 2006: 1072) as an "unusual, roundly rebated suture".

Apart from Connolly (1939) only Aiken (1995: 6) has contributed detailed distribution data for *G. perspicua*: "Middelberg [sic!], Barberton, Waterval Boven, Ondersabie, Wyliespoort, Strydom Tunnels". His locality "Ondersabie", undoubtedly derived from the Johannesburg psychiatrist/shell collector Dr H.E. van Hoepen, is somewhat misleading. Officially there is only one Onder Sabie = Lower Sabie in South Africa, a well-known rest camp in the south-eastern districts of the Kruger National Park. This locality is in the Lowveld, characterized by a type of savannah vegetation utterly different from that of the afromontane forest on the Drakensberg escarpment. Van Hoepen did extensively collect in the escarpment forests in Mpumalanga. As a genuine Afrikaner, van Hoepen did most of his labelling in Afrikaans. This is the reason why the present author prefers to interpret "Ondersabie" as a lower lying area of or near the town of Sabie (25°06'S:30°47'E, *c.* 1000 m), nested in a deep valley on the escarpment, rather than the Kruger National Park locality. Thus the range of *G. perspicua* stretches further south than that of *G. inobstructa.* The type locality of the former, Middelburg (25°46'S:29°28'E, 1450 m), seems to be the southernmost limit of this taxon.

Pending anatomical and molecular research the above is sufficient evidence to consider *G. inobstructa* and *G. perspicua* to represent separate taxa.

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Dr N. Tebble. The author owes a special debt of gratitude to his colleague and friend Dai Herbert for critically reading the manuscript thereby considerably improving the text.

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