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A NEW SPECIES OF *LINOTRIGONIA* (MOLLUSCA: BIVALVIA) FROM THE CAMPANIAN OF ZULULAND

by

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ABSTRACT

A new species of *Linotrigonia*, *L. nibelaensis* sp. nov., is described from the mid-Campanian of the St Lucia Formation. The relationship of *Linotrigonia* to *Oistotrigonia* is discussed and it is suggested they are best treated as distinct genera. *Linotrigonia* is believed to be a southeast African endemic, currently restricted to the late Cretaceous.

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INTRODUCTION

The genus *Linotrigonia* was introduced by Van Hoepen (1929) for a group of closely allied species from the Santonian to early Campanian Mzamba Formation of the Transkei littoral. Recent collecting on the Nibela Peninsula in False Bay, Lake St Lucia, resulted in discovery of the present form. It occurs in association with a mid-Campanian (Marroti Zone) ammonite fauna which includes *Australiella australis* (Besairie), *Hoplitoplacenticeras plasticum* Paulcke, *Anapachydiscus subdulmensis* (Venzo), *A. wittekindi* (Schlüter) and *Baculites vanhoepeni* Venzo. Also abundant are a large flattened *Pycnodonte*, the pectinacean *Camptonectes* and less common *Exogyra*. It represents, therefore, the youngest occurrence of *Linotrigonia* within the Cretaceous successions of Zululand and the Transkei.

In this paper I use the descriptive term "carina" somewhat differently from other workers. As here used, a carina is a line of shell material, either continuous or discontinuous, which was secreted as such and which is raised above the level of the surrounding shell surface. An inflexion produced by a change in slope of the shell surface is not regarded as a carina. This is an angulation, a typical example of which, in other bivalves, is the umbonal ridge.

SYSTEMATIC PALAEONTOLOGY

Family TRIGONIIDAE Lamarck, 1811

Subfamily **PTEROTRIGONIINAE**
Van Hoepen, 1929
Genus *Linotrigonia* Van Hoepen, 1929
Type species *Linotrigonia linifera* Van Hoepen, 1929; by original designation.

Diagnosis

Small to moderately small, weakly inflated, subtrigonal to lunate and suborbicular. Ribbing dominates the flank ornament but may be lost in some species. Escutcheon distinct, with crenulated transverse costellae. Escutcheon carina obsolete; marginal carina, if present, restricted to nepionic stages. Oblique costation of area variable; it may be restricted to the early growth stages leaving most of the area smooth, or it may persist to a relatively late stage and even to maturity. Flank ornament is dominated by strongly oblique costae which are crenulated by growth lirae and which may bear small nodes. In some the ribbing weakens and may be effaced from much of the flank.

Discussion

The subfamilial position of *Linotrigonia* is problematical; it was referred to the Pterotrigoniinae by Van Hoepen (1929) but Kobayashi and Nakano (1957, p. 222) were "... of the opinion that *Linotrigonia* must be excluded from the Pterotrigoniinae, because *L. linifera* belongs to the Clavellatae rather than the Aliformis group". Whereas Saveliev (1958) accepted Van Hoepen's (1929) placement, Nakano (1974) included it in the Myophorellinae. Perez and Reyes (1985) do not attempt a subfamilial assignment.

Cox (1952, 1969) divided *Linotrigonia* into two subgenera; the nominate subgenus and *Oistotrigonia*, the latter distinguished by its less-prominent umbo, relatively wider area which is costate throughout, and denser flank costation.

The southeast African material of *Linotrigonia* shares the following characters with the Pterotrigoniinae: (1) a transversely costellate escutcheon, (2) obsolete escutcheon carina, (3) entire marginal carina restricted to the nepionic stages, (4) opisthogyrous umbones, and (5) strongly oblique flank costae. Moreover in several species, e.g. *L. venusta* Van Hoepen and *L. itongazi* (Little), the area is ornamented only by growth striae, as in *Pterotrigonia*.

The degree of inflation and lunate shape displayed by *Linotrigonia* can be matched by pterotrigoniines assigned to the genera *Ptilotrigonia* Van Hoepen, *Acanthotrigonia* Van Hoepen and *Scabrotrigonia* Dietrich. It is also no smaller than some undoubted pterotrigoniines, e.g. *Pisotrigonia mccarthyi* Cooper. The southeast African material gives no reason to believe, therefore, that *Linotrigonia* is anything but a neotonous derivative of some weakly inflated, lunate pterotrigoniine from which it differs in having the ribs dominate the flank ornament instead of being conspicuously tuberculate.

Species of *Oistotrigonia*, e.g. *O. spinosa* (Parkinson) (Lycett, 1875, p. 136, pl. 23, fig. 10, pl. 24, figs 8-9, pl. 28, figs 1-2), *O. ornata* (D'Orbigny) (Lycett, 1875, p. 139, pl. 24, figs 6-7), *O. archiaciana* (D'Orbigny) (Lycett, 1875, p. 140, pl. 23, fig. 7, pl. 25, fig. 10), *O. vicaryana* (Lycett) (1875, p. 141, pl. 25, figs 8-9), *O. upwarensis* (Lycett) (1875, p. 143, pl. 23, figs 8-9), *O. cunningtoni* (Lycett) (1875, p. 146, pl. 23, fig. 11), *Oistotrigonia toyamai* (Yehara) (1923, p. 78, pl. 9, figs 4-5) and *O. chongi* (Perez and Reyes) (1985, p. 137, pl. 1, figs 1-26) all have a sharp umbonal ridge corresponding to the position of the marginal carina and strong ornament to the area. The respiratory margin is also more sharply truncate and generally broader, while the area gives the impression of being concave. In the case of *O. toyamai* and *O. chongi*, there is a distinct, persistent, seemingly entire marginal carina.

Oistotrigonia pulchra (Kitchin) (1902, p. 109, pl. 10, fig. 9), *O. pygoscelium* (Wilckens) (1910, p. 39, pl. 2, fig. 21) and *O. antarctica* (Wilckens) (1910, p. 35, pl. 2, fig. 17) do not show the sharp umbonal ridge of the above species but also give the impression of being related only superficially to *Linotrigonia*. In view of rampant homoeomorphy within the trigoniacean bivalves (cf. Newell and Boyd, 1975), the writer prefers to maintain *Linotrigonia* and *Oistotrigonia* as distinct genera. Their true relationships must await a detailed phylogenetic analysis.

Linotrigonia displays a convergent resemblance to species of *Promyophorella*, e.g. *P. phillipsi* (Morris and Lycett) (Lycett, 1872, p. 38, pl. 6, figs 3-4), and *P. formosa* (Lycett) (1872, p. 35, pl. 5, figs 4-6), but these have the persistent beaded carinae typical of Myophorellinae.

While the present species shows a number of the characters of *Oistotrigonia* , e.g. a broad respiratory margin and broad, strongly ornamented area, it is so obviously descended from earlier *Linotrigonia* that the similarities are due to convergence.

Cox (1969) accords *Linotrigonia* a cosmopolitan distribution, with a time range from late Jurassic to early Cretaceous. However, the writer is unaware of any *Linotrigonia s.s.* outside southeast Africa where the earliest undoubted occurrence is Coniacian. Cox (1969: N483) erroneously gives the age of *Linotrigonia elegans* (Woods) as Albian; it is in fact from the Mzamba Formation of mid-Santonian to early Campanian age. A possible mid-Cretaceous (Lower Cenomanian) occurrence of *Linotrigonia* in Zululand is reported by Kennedy and Klinger (1975: 290), but I have not seen the material and am unable to confirm their identification.

Oistotrigonia, on the other hand, first appears in the Upper Jurassic (Upper Callovian) (Repman, 1967) and persists into the Maastrichtian (Perez and Reyes, 1985). It displays a near-cosmopolitan distribution.

The first *Linotrigonia* to appear in Zululand is the Coniacian *L. umkwelanensis* (Etheridge). By the late Santonian — early Campanian the genus had radiated and in the Transkei and southern Natal it is represented by the nominal species *L. elegans* (Woods), *L. linifera* Van Hoepen, *L. plumifera* Van Hoepen, *L. venusta* Van Hoepen and *L. itongazi* (Little). The species to be described below represents the youngest record of the genus from southern Africa, and is most closely allied to and probably descended from *L. venusta* .

Repository of material

The type material described herein is housed in the palaeontological collections of the Durban Natural History Museum.

Linotrigonia nibelaensis sp. nov.

Figs. 1–2

Type material

The original of the specimen figured as Fig.1A-B, DM-PCZ3353, is designated holotype. DM-PCZ3354 (Fig. 1C-D) and 3355 (Fig. 1E-F), both preserved as internal moulds, are paratypes.

Type locality

The type locality is a foreshore exposure of the St Lucia Formation at the southwest tip of the Nibela Peninsula (27°59'03" S, 32°24'36"E). This is locality 109 of Kennedy & Klinger (1975).

Etymology

nibelaensis (L.) — of the Nibela Peninsula.

Diagnosis

A species of *Linotrigonia* characterized by crenulated, non-tuberculate flank costae, a broad, conspicuously ornamented area, and a subtruncate respiratory margin. The flank costae persist onto the outer area where they form chevrons with the areal ornament.

Description

The holotype is a left valve of medium size (length 40 mm). It is strongly inequilateral, longer than high (H/L = 0,83) and sublunate in outline. The umbo is moderately prominent and situated about 22% of the shell length from the anterior end. The beaks are weakly incurved, opisthogyrous, nearly orthogyrous. The anterior margin is steep, gently convex, and curves imperceptibly into the broadly convex ventral margin. The broadly truncate respiratory margin is weakly convex, and the posterodorsal margin shallowly concave. The valves are weakly inflated (W/H = 0,28), with maximum inflation just posterior of the umbones.

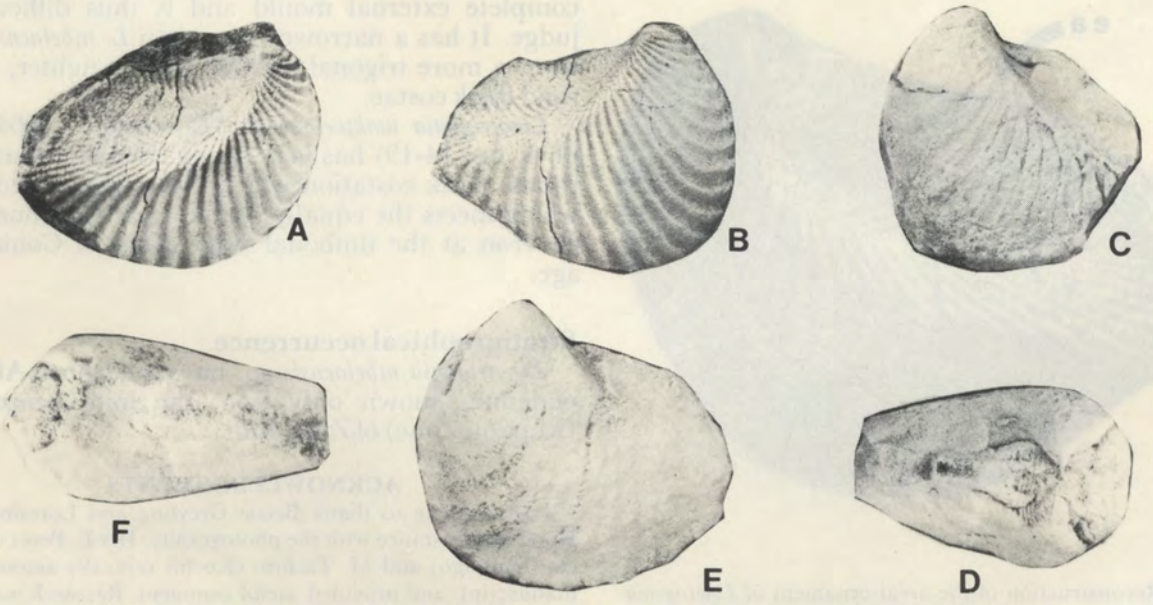


Figure 1. *Linotrigonia nibelaensis* sp. nov., x1. A-B. Lateral and dorsolateral views of the holotype, DM-PCZ3353. C-D. Lateral and dorsal views of a paratype, DM-PCZ3354. E-F. Lateral and dorsal views of a paratype, DM-PCZ3355.

The narrowly lanceolate escutcheon is about half the posterodorsal length. It is shallowly excavate and is ornamented with about 16 transverse costellae which are narrower than the interspaces and are crenulated by growth lamellae. An escutcheon carina is lacking. The area is broad and bipartite with a median furrow. It is separated from the escutcheon by a slight angulation and from the flanks by a strong marginal angulation. No true marginal carina is visible and if present must have been restricted to the nepionic stages. The area is ornamented throughout ontogeny by chevron-shaped, beaded costellae. The apex of the chevron is directed anteriorly and is situated midway between the marginal angulation and the median furrow. The outer limbs of these areal costellae represent a continuation of the flank costae. The inner limbs cross the median furrow, extending either to the shell margin or joining the costellae of the escutcheon. Flank ornament comprises about 30 fine, nontuberculate costae which are narrower than the interspaces. They are crenulated by dense, regularly spaced growth lamellae which strengthen across the ribs. Those costae terminating along the anterior and anteroventral commissure curve gently upwards distally, whereas those to the posterior are almost straight.

Discussion

Linotrigonia nibelaensis sp. nov. is closest to *L. venusta* Van Hoepen (1929: 17, pl. 7, figs 7-8) from the Mzamba Formation. The latter species is smaller and with a narrower area which becomes smooth in maturity. The areal ornament of the early and middle growth stages of *L. venusta* comprises oblique costellae which form a chevron with the flank costae at the umbonal ridge, not on the area as in *L. nibelaensis* sp. nov. As such, the flank costae of *L. venusta* do not extend onto the area as in *L. nibelaensis* sp. nov.

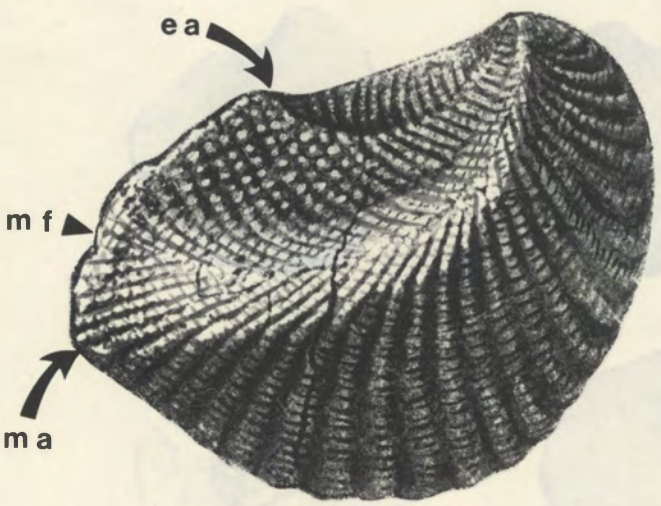


Figure 2. Reconstruction of the areal ornament of *Linotrigonia nibelaensis* sp. nov., x2,5. ma = marginal angulation, mf = median furrow, ea = angulation between escutcheon and area.



Figure 3. *Linotrigonia itongazi* Little, x1. A-B. The holotype (large specimen) in the Durban Natural History Museum.

Linotrigonia elegans (Baily) (1855: 461, pl. 13, fig. 3; Woods, 1906: 293, pl. 35, fig. 4 only; Van Hoepen, 1929: 16, pl. 7, figs. 5-6) is more orbicular in outline, has sparser, more distant flank costation with small beadlike tubercles, and lacks the chevron-shaped areal ornament of *L. nibelaensis* sp. nov.

Linotrigonia plumosa Van Hoepen (1929: 19, pl. 7, figs 9-10) has sparse distant flank costation which weakens distally and a narrower unornamented area in maturity. It is rather similar to *L. itongazi* (Little) (Fig. 3), but the latter species is larger and with the ribbing effaced distally, leaving most of the flank smooth.

Linotrigonia linifera Van Hoepen (1929: 15, pl. 7, fig. 4), the type of the genus, is based upon an incomplete external mould and is thus difficult to judge. It has a narrower area than *L. nibelaensis* sp. nov., a more trigonal outline, and straighter, more rigid flank costae.

Linotrigonia umkwelanensis (Etheridge) (1904: 75, pl. 1, figs 14-19) has very sparse, distant, relatively robust flank costation which is not crenulated and which meets the equally coarse areal costation in a chevron at the umbonal ridge. It is of Coniacian age.

Stratigraphical occurrence

Linotrigonia nibelaensis sp. nov. is a South African endemic, known only from the mid-Campanian (Marroti Zone) of Zululand.

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