

Revision of the genus *Valvobifarina* Hofker, 1951 (Foraminiferida).

STEFAN A. REVETS

Koninklijk Belgisch Instituut voor Natuurwetenschappen, Dept. of Palaeontology, Vautierstraat 29, B1040 Brussels, Belgium.

ABSTRACT – The genus *Valvobifarina* is exhaustively revised to include three species; *V. mackinnonii* (Millett), the type species, *V. robusta* (Sidebottom), and *V. niobeae* sp.nov. All species are typified. *Bifarina elongata* Millett, 1900 is excluded from *Valvobifarina*.

INTRODUCTION

The genus *Valvobifarina* is little known, perhaps because of its relative rareness and occurrence in more shallow water zones. Millett (1900) described *Bifarina mackinnonii* as being very rare in the Malay Archipelago, but he had seen some more specimens in gatherings from Raine Island, the famous 'Challenger' Station 185, and from the Straits of Macassar. Heron-Allen and Earland (1915) found two specimens in the Kerimba Archipelago and a few in samples from Madagascar. They commented that the species had a wide distribution in shallow tropical waters.

The genus *Valvobifarina* was created by Hofker in 1951. He apparently mistook *V. mackinnonii* for an arenaceous taxon, but described it correctly as lacking any indication of a toothplate. The new genus was classified in the Valvulinidae.

Loeblich & Tappan (1964) classified *Valvobifarina* in the Pavonininae, close to *Reussella*. They supported Hofker's arguments that neither *Loxostoma* nor *Valvobifarina* are related to the bolvinids, the former having a granular wall and lacking a toothplate and *Valvobifarina* having a triserial, rather than a biserial early development. In the discussion of *Bigenerina*, they indicate that *B. elongata* Millett, 1900 ought to be removed to *Valvobifarina*.

In their latest classification, Loeblich & Tappan (1987) reinstated the Reussellidae, including *Valvobifarina* in this family. No mention is made of the presence or absence of a toothplate.

The generic revision of the reussellid taxa showed that *Valvobifarina* amongst other genera, had to be removed from the Buliminacea to be reclassified in the Pavoninidae (Reverts 1991).

SYSTEMATIC DESCRIPTIONS

Order Foraminiferida Eichwald, 1835

Suborder Rotaliina Lankester, 1885

Superfamily Pavoninacea Eimer & Fickert, 1899

Family Pavoninidae Eimer & Fickert, 1899

Genus *Valvobifarina* Hofker, 1951

1951 *Valvobifarina* Hofker: 39

Description. Test free, elongate, initially triserial but quickly biserial and laterally compressed, final chambers may be uniserial; triserial chambers rounded to subtetrahedral, biserial chambers cuneate; aperture

at the apex of the chamber, an elongate slit bordered by a distinct lip, no toothplate; wall calcareous, hyaline, coarsely perforate, pores at the apex of low mounds, sparsely and irregularly scattered over the surface.

Type species. *Bifarina mackinnonii* Millett, 1900, original designation.

Valvobifarina mackinnonii (Millett, 1900)

(Pl. 1, figs 1-12)

1900 *Bifarina mackinnonii* Millett: 281, pl. 2, fig. 15

1924 *Bifarina mackinnonii* Millett; Cushman: 20

1937 *Bifarina mackinnoni* Millett; Cushman: 200, pl. 23 fig. 6 only, err. cit.

1951 *Valvobifarina mackinnoni* (Millett); Hofker: 40, figs 16, 17, err. cit.

1964 *Valvobifarina mackinnoni* (Millett); Loeblich & Tappan: 565, figs 445-8, 9, err. cit.

1991 *Valvobifarina mackinnonii* (Millett); Revets: 12, Pl. 5, Figs 10-12

Lectotype. 1955:11:1:121, British Museum (Natural History), London. Designated by Revets

Type locality. Straits of Macassar, -45fms, Malay Archipelago, Recent.

Material examined. Lectotype and paralectotypes (1955:11:1:122-125); 1962.9.7.1-5, from Macassar Strait, ex Millett coll.; Macassar Strait, ex coll. Sidebottom; Sulu, ex coll. Sidebottom; Timor Sea, -30fms, ex coll. Heron-Allen & Earland; Java, ex coll. Millett; specimens from the Kerimba Archipelago, ex Heron-Allen & Earland coll.; British Museum (Natural History). Specimens from 'Galathea' Station 379, 4°38'N 103°39'E, -40m, off Kerteh, Trengganu; 'Galathea' Station 404, 5°09'N 106°47'E, -63m, South China Sea; 'Galathea' Station 490, 5°25'S 117°03'E, -570m, Bali Sea. Thailand, Andaman Sea, Phuket Station 24. Geological Museum, Copenhagen.

Description. Test free, elongate, early stage triangular in section, later stage laterally compressed, two first whorls triserial, last whorls twisted biserial to biserial; initial chambers rounded tetrahedral, outer edge may bear a small spine, biserial chambers large, cuneate, laterally compressed, outer edges prolonged into a distinct spine; sutures distinct, somewhat depressed, arcuate; aperture apical, slit-like, running

along the upper edge of the chamber, bordered by a slightly everted lip; wall calcareous, hyaline, optically distinctly radial, perforate, pores large, at the apex of small mounds, arranged preferentially along the chamber edges.

Remarks. The specimens described from Samoa by Cushman are lost (*vide* Cushman, 1924, p.20).

Valvobifarina robusta (Sidebottom, 1918)

(Pl. 2, figs 1-7)

1918 *Bifarina mackinnonii* var. *robusta* Sidebottom: 125, pl. 3, figs 17, 18

1937 *Bifarina mackinnoni* var. *robusta* Sidebottom; Cushman: 201, pl. 23, fig. 8, err. cit.

Lectotype. ZF 4900, British Museum (Natural History), London, herein designated.

Type locality. East Coast of Australia, 29°22'S 153°51'E, 465fms, Pteropod Ooze, H.M.S. 'Dart' Station 19.

Material examined. Two syntypes; 'Challenger' Station 185, off Raine Island, ex coll. Sidebottom; Timor Sea, -30fms, ex coll. Heron-Allen & Earland; British Museum (Natural History). Specimens from 'Galathea' Station 404, 5°09'N 106°47'E, -62m, South China Sea; 'Galathea' Station 490, 5°25'S 117°03'E, -570m, Bali Sea.

Description. Test free, elongate, early stage irregular in section, later stages laterally compressed, biserial tending towards uniseriality; juvenile chambers rounded to subtetrahedral, rather low and small, adult chambers laterally compressed, cuneate, tending to become trapezoidal, upper edge somewhat arched, lateral edges crossing the peripheral edge, lowest edge of the chamber with a strong spine; sutures unclear, a depressed zone between the chambers; aperture apical, slit-like, running along the entire chamber length, bordered by a thickened and slightly everted lip, outer extremities pointed; wall calcareous, hyaline, optically distinctly radial, perforate, pores very large, at the apex of small mounds, few, arranged parallel to the long axis of the chambers, usually in one row plus a few scattered ones.

Remarks.

The specimens described by Sidebottom (1918) from the 'Dart' Station 19, have been found in the collections of the British Museum of Natural History. All the specimens are located on a number of faunal slides labelled 'Dart'. These contain besides figured specimens also a number of syntypes.

Valvobifarina niobeae sp.nov.

(Pl. 2, figs 8-12)

1915 *Bifarina mackinnonii* Millett; Heron-Allen & Earland: 634, pl. 48, Figs 36, 37

1937 *Bifarina mackinnonii* Millett; Cushman: 200, pl. 23, fig. 7 only.

Holotype. CC 21915, Smithsonian Institution, Washington D.C.

Type locality. 'Albatross' Station H4881, Blake Reef, S. Japan

Material examined. The type. Java, ex coll. Millett; 1955:10:21:66, Kerimba Archipelago, Station 11, ex coll. Heron-Allen & Earland;

Macassar Strait, ex coll. Sidebottom; Macassar Strait, ex coll. Earland; Vavau Anchorage, Friendly Isles, ex coll. Heron-Allen & Earland; British Museum (Natural History).

Description. Test free, elongate, early stage rounded in section, later stage laterally compressed, at first triserial but soon reduced to twisted biserial; initial chambers obscured by thick secondary lamination, last 5 chambers subcuneate, laterally compressed, edges broadly rounded, lower ends not spinose and not crossing the edges of the test; sutures obscured, chambers not clearly delineated; aperture apical, slit-like, slightly twisted, running along the upper edge of the chamber, bordered by a thickened somewhat everted lip; wall calcareous, thickened by heavy secondary lamination, perforate, pores large, tending to crowd near the chamber borders.

Remarks. This species differs from *V. mackinnonii* in possessing much heavier secondary lamination which obscures the individual chambers, chambers which do not cross the periphery and do not bear any form of spinosity. The outer edges of the test and the individual chambers are also much more rounded. There is also a tendency in this species for the chambers not to embrace the previous aperture within their lumen, but to build the chamber on the apertural lip.

Species excluded from *Valvobifarina*

1900 *Bifarina elongata* Millett: 539, pl. 4, figs 1, 2

1937 *Bifarina elongata* Millett; Cushman: 200, pl. 22, fig. 35

1964 *Valvobifarina elongata* (Millett); Loeblich & Tappan: 654.

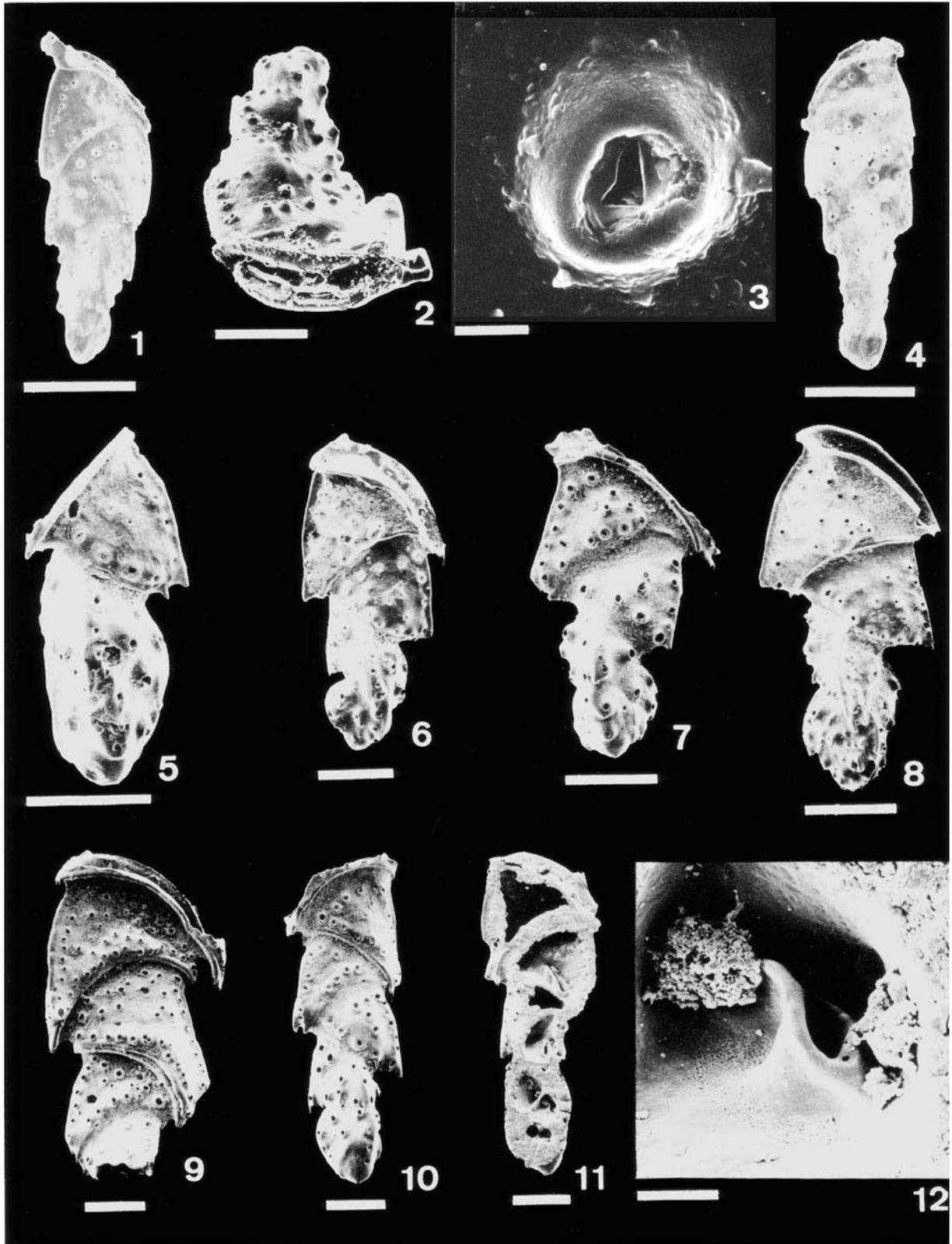
DISCUSSION

Valvobifarina poses some interesting questions concerning the way in which genera are related. Comparing the morphology of the species herein studied with some of the taxa treated earlier (Revets 1991), it has become more difficult to delineate the genera in question as sharply as has been the case until now. *Valvobifarina mackinnonii* is an archetypal example of *Valvobifarina*, but *V. robusta* can be seen as a step towards *Bifarinella ryukyuensis* Cushman & Hanzawa. *Bifarinella* in its turn could be one step away from *Pavonina*. The underlying trend lies not only in the gradual reduction of the amount and size of the triserially coiled chambers, but also in the increase in embracing of the biserial chambers. The relation between *Valvobifarina* and *Bifarinella* is more strongly pronounced when one takes into account that many *Bifarinella* specimens have at least some semi-cuneate chambers before building the typically reniform uniserial chambers.

The biogeographic distributions of this genus repeats the pattern found in *Orthoplecta* (see Revets & Whittaker, 1991): there is a distinct clustering in the Malayan part of the Indo-Pacific Province, but specimens have been found in West Africa between Madagascar and the African continent (Fig. 1). This recurrent pattern cannot at present be explained, since the benthic genera found on both sides of the Indian Ocean do not seem to occur in the Indian or Arabian sub-province.

Explanation of Plate 1

Valvobifarina mackinnonii Millett, 1900. Lectotype, BMNH 1952:11:1:121. Fig. 1, Habitus (200µm). Fig. 2, Apertural details (100µm). Fig. 3, Close-up of a 'tubulopore' (5µm). Fig. 4, Paralectotype, slightly abraded, BMNH 1952:11:1:122, habitus (200µm). Figs 5-7, Specimens from the South China Sea, arranged as an ontogenetic series. Note the sudden change from triserial tetrahedral to biserial cuneate chambers (100µm). Figs 8-10, Specimens from Phuket, Thailand (100µm). Fig. 11, Opened specimen, showing the early triserial coiling (100µm). Fig. 12, Opened specimen, showing the disposition of the foraminal lip and how it protrudes into the chamber (10µm)



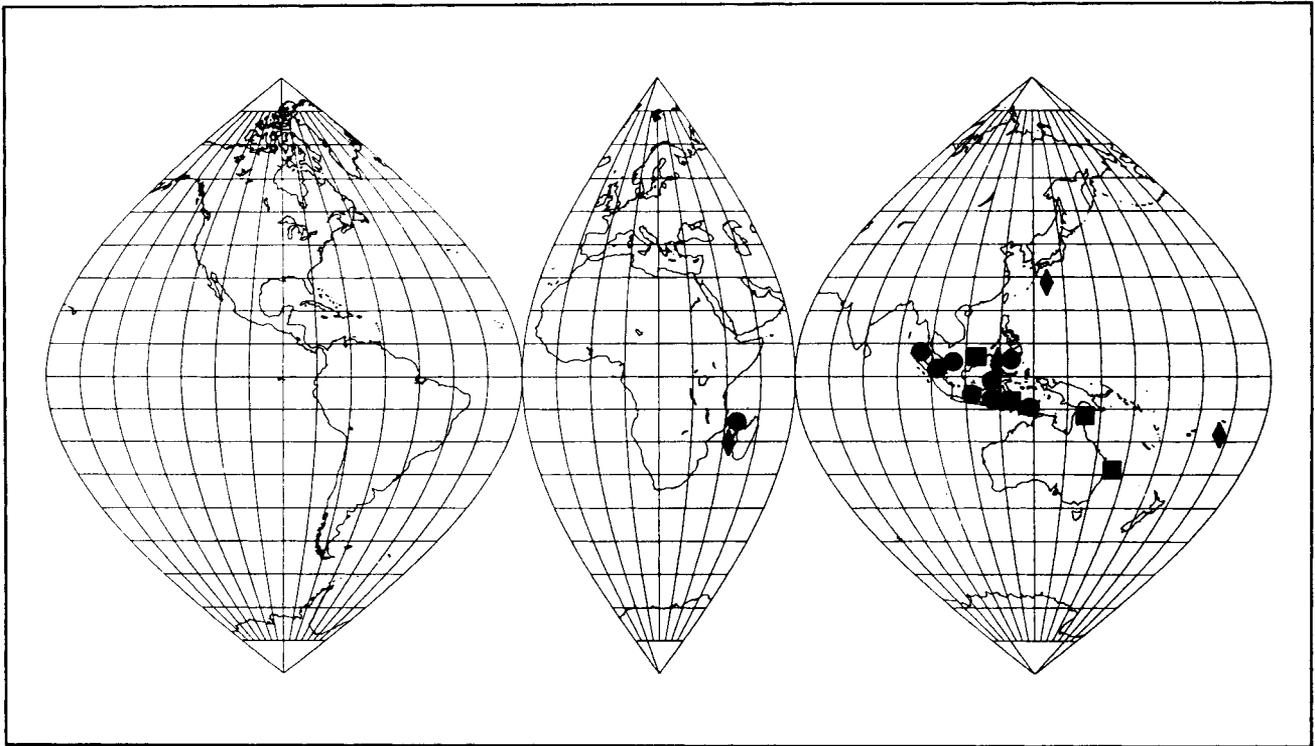


Fig. 1. The biogeographic distribution of the species of *Valvobifarina*. ● *V. mackinnonii*, ■ *V. robusta*, ▲ *V. niobeae*.

Not enough information is at present available to venture any serious suggestions as to the evolutionary history of this enigmatic genus and its species

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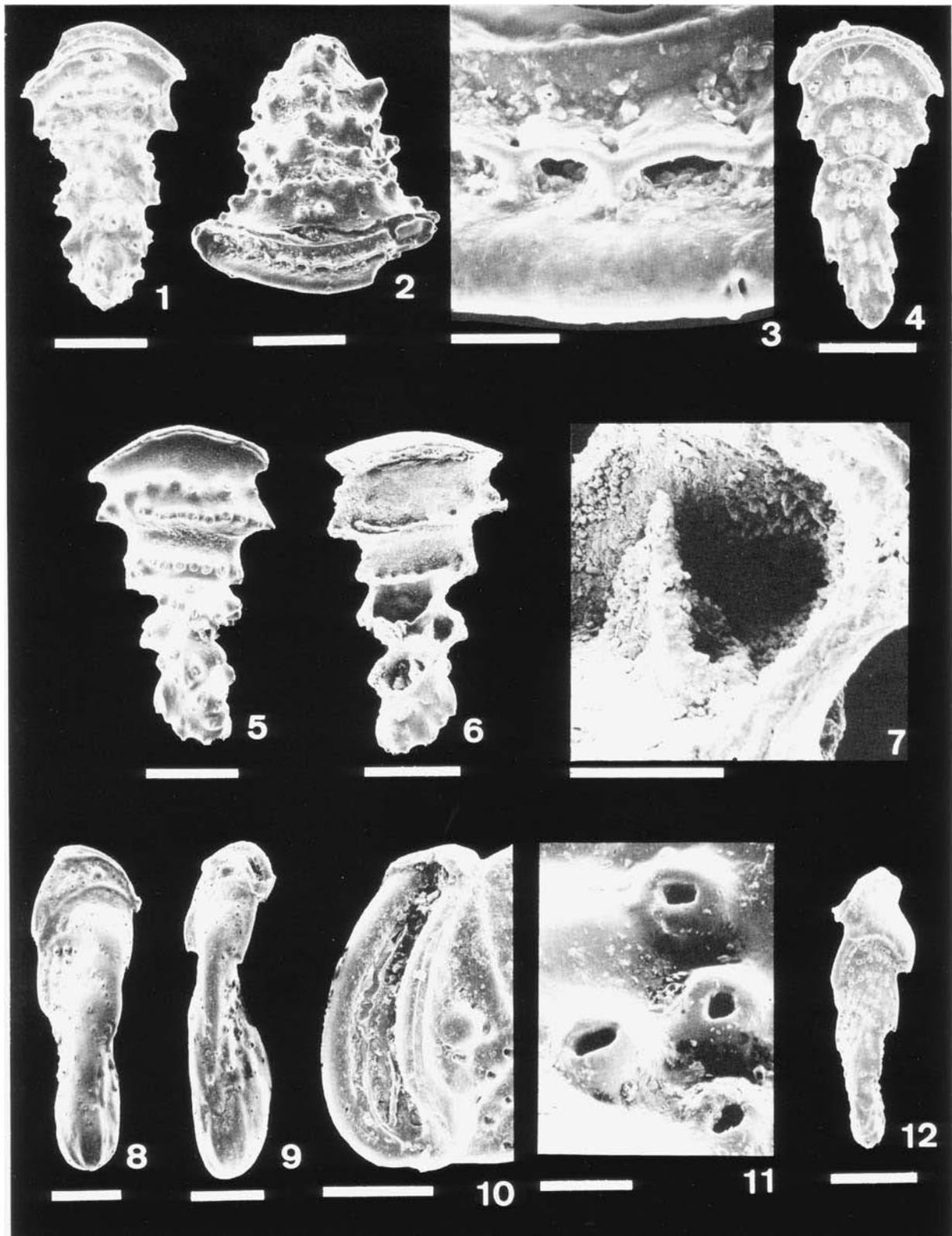
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Explanation of Plate 2

Figs 1-7, *Valvobifarina robusta* (Sidebottom, 1918). Lectotype, BMNH ZF 4900. Fig. 1, Habitus (150µm). Fig. 2, End-view, clearly showing the prominent 'tubulopores' and the aperture (150µm). Fig. 3, Close-up of the aperture. Note the presence of a ridge with multiple gate-like entrances (20µm). Paralectotype, BMNH ZF 4901. Fig. 4, Habitus (200µm). Figs 5-7, Specimens from the Bali Sea. Fig. 5, Habitus (100µm). Fig. 6, An opened specimen, showing the disposition of the individual chamber, with the previous lip protruding into the chamber (20µm).
 Figs 8-12, *Valvobifarina niobeae* sp.nov. Holotype, CC21915, Smithsonian Institution. Fig. 8, Habitus (200µm). Fig. 9, Side view of the test (200µm). Fig. 10, Close-up of the aperture (100µm). Fig. 11, Detail of the chamber wall. Note the relatively low 'tubulopores' (50µm). Fig. 12, Specimen from Macassar Straits BMNH ZF 4902, habitus (300µm).



CORRIGENDA

The generic revision of the Reussellids (Foraminiferida) Stefan A. Revets, 1991, *J. micropalaeontol.*, **10** (1), 1-15.

Page 1, last line but one, second column:

"*Acostinarystalidinella*" should read: "*Acostina, Chrysalidinella*"