A New Allogromiini Genus (Rhizopoda: Foraminiferida) from the Vellar Estuary, Bay of Bengal

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ABSTRACT
This paper reports what we believe to be the first record of allogromiid foraminifers from coastal Indian waters. Two species from the Vellar Estuary on the east coast of India south of Madras are described and placed in a new genus Vellaria. The foraminifers live at or near the sediment-water interface and are characterised by the development of a flared, conical or trumpet-shaped apertural structure which apparently serves to attach the test to small sand grains. Allogromiids are delicate and inconspicuous organisms which may be more widespread in esturine and brackish water settings than is currently realised. *J. Micropalaeontol.*, 11 (2): 233-239, December 1992.

INTRODUCTION
The suborder Allogromiina includes foraminifers ("allogromiids") in which the test wall is membranaceous or proteinaceous, sometimes with a thin outer veneer of agglutinated particles (Brimniman et al. 1979; Loeblich and Tappan 1987; Rhumbler 1904). Members of this taxon typically have a simple, sack or flask-like test morphology (Loeblich and Tappan 1987). Although widely distributed and sometimes common, allogromiids remain rather poorly known. Of the 2455 living and fossil foraminiferal genera recognised by Loeblich and Tappan (1987), only 56 are members of this taxon. Almost three-quarters (40) of these genera were first described from either European fresh-water or coastal marine sites or from the North Atlantic (Loeblich and Tappan 1987). The remainder originate from the coasts of North and South America and the Pacific Ocean.

This paper presents what we believe to be the first record of allogromiids from Indian coastal waters. Two species, both assigned to the new genus *Vellaria*, are described from the Vellar Estuary on the east coast of India. The foraminiferal fauna of this estuary was investigated by Ramanathan (1970) who recorded almost ninety species, more than 95% of them calcareous and the remainder agglutinated. Foraminifera have also been studied in other brackish water settings around the Indian coast, namely Thana Creek near Bombay (Setty 1982; Setty & Nigam 1984), Vembanned Estuary and Kayankulam Lake, SW India (Antony 1975, 1980; Antony & Kurian 1975), lagoons near Cochin (Seibold & Seibold 1981), and the Pennar, Godavari River and Suddagedda Estuaries in eastern India (Reddy & Rao 1983, 1984; Narappa et al. 1981; Rao & Rao 1975). Allogromiids were not explicitly reported in any of these studies. Antony (1975, 1980) mentions "chitinous" foraminifera but he appears to be referring to forms with agglutinated rather than proteinaceous tests.

Fully marine foraminiferal faunas have been described from the shelf off the west coast (Bhatia & Kumar 1976; Nigam 1984; Sethulekshmi Amma 1958; Setty 1976, 1978; Setty et al. 1979; Setty & Nigam 1980, 1982) and from the shelf and from beach sands along the east coast of India (Anantharaman 1971; Bhalla 1968, 1970; Hansa 1972; Kaladhar et al. 1990). These papers also deal exclusively with calcareous and agglutinated taxa.

MATERIAL AND METHODS
The specimens were collected in the estuary of the River Vellar, Bay of Bengal (11 29'N, 79 46'E; Station J1 of Fernando 1987), at a site where the sediment consisted of fine sand with a maximum silt content of 35.1% (mean particle size 2.25-3.55f). Full details of the sampling area are given by Fernando (1987) and Fernando & Fernado (1988).

The samples were obtained using a corer of 2.8cm internal diameter. This was pushed into the sediment by hand to a depth of 10cm and closed with a rubber stopper before being removed. The sediment was washed through 500mm and 63mm mesh sieves. Material retained on the finer sieve was fixed and stored in 4% formaldehyde. After staining with Rose Bengal, meiofaunal organisms were sorted under a binocular microscope and separated using a fine tipped pipette.

The allogromiids were photographed in alcohol under reflected light using a Wild M400 photomicroscope or were mounted in a drop of glycerol and photographed under an Olympus model BH5 compound photomicroscope. Line drawings were made using a Wild M20 drawing tube. For permanent storage specimens were mounted in glycerine jelly Maybury et al. (1991). This procedure led to some shrinkage and distortion of the test, particularly in *Vellaria* sacculus.

SYSTEMATIC DESCRIPTIONS
Order Foraminiferida Eichwald, 1835
Suborder Allogromiina Loeblich & Tappan, 1961
Family Allogromiidae Rhumbler, 1904
Subfamily Allogromiinae Rhumbler, 1904
*Vellaria* gen. nov.
Generic diagnosis. Test less than 1mm in total length, symmetrically oval with a thin proteinaceous wall, in one species overlain by thin veneer of finely agglutinated particles, in another without agglutinated particles. Apertural end produced into strongly flared, approximately conical or bowl-shaped structure. Cytoplasm finely granular with single large nucleus.

Type species. *Vellaria pellucida* gen. et sp. nov..

Remarks. One of the two species placed in *Vellaria* has a finely agglutinated outer test layer. The presence of a sparse agglutinated coating is not incompatible with a placement in the suborder Allogromiina (Loeblich & Tappan 1987, p.7). However, in view of the importance of wall structure in foraminiferal taxonomy (Loeblich & Tappan 1988), this difference may eventually warrant separation of the two species at the generic level. For the present, they are regarded as congeneric because both possess a flared apertural extension. This feature distinguishes the new genus from *Allogromia* and similar allogromiid genera (Loeblich & Tappan 1987). In some sublittoral *Rhynchogromia* species the apertural end is extended into a short neck (Golemansky 1991) but this is parallel-sided rather than flared.

The apertural region in *Vellaria* resembles that developed in some testate amoebae. The test of *Sudzukiella marina*, a species recently described from sublittoral sands off the French coast (Golemansky, 1991), is produced distally into a short, curved neck which attaches the organism to sand grains. In testate amoebae belonging to the family *Psalmonobiotidae*, a short sucker-like funnel with a flexible periphery surrounds the apertural region (Ogden & Coteaux, 1989; Golemansky, 1990). *Psalmonobiotids* are tiny interstitial organisms which live in the pore waters of coastal sands in many parts of the world (for example, Golemansky, 1974, 1982) and are characteristic of the contact zone between continental fresh water and sea water (Golemansky, 1990). Our organisms differ from psalmonobiotids in their overall test shape, the much less regular shape of the apertural funnel, and the basically proteinaceous nature of the test wall.

They are also larger than either *Sudzukiella* or psalmonobiotid species. However, since it is possible to confuse foraminifera with testate amoebae (Ogden & Coteaux 1989), we are grateful to Dr C.G. Ogden (written communication August 1991) and to Professor V. Golemansky (personal communication, April 1992) for confirmation that our organisms are almost certainly allogromiids.

*Vellaria pellucida* gen. et sp. nov.

(Fig. 1; Pl. 1, figs 1-8)

Derivation of name. Latin pellucidus, transparent; referring to the appearance of the test wall.

Diagnosis. Species of *Vellaria* 140-420mm in length with

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**Explanation of Plate 1**

*Vellaria pellucida* gen. et sp. nov..

Fig. 1. Collection of specimens photographed in alcohol. Scale = 500mm.

Figs 2-8. Specimens photographed in glycerol before mounting in glycerine jelly on slide ZF 4983. Fig. 2 is a detail of fig. 3 and shows the apertural structure with adhering sediment grains. Fig. 7 is a detail of fig. 5 and shows the nucleus. Scales = 100mm (figs 2-6,8) and 50mm (fig.7).
Diagnosis. Species of Vellaria <200mm long with apertural the shape of the test.

Derivation of name. Latin sacculus, a little bag; referring to end produced into conical structure. Test wall basically organic but with 

tortion, the individual specimens can no longer be confidently photographed before mounting. Because of subsequent dis- 

rkcognised on the type slides. The holotype (Fig.2) was drawn 

glycerine jelly which, in most cases, has caused considerable 

shrinkage and distortion of the test. The paratypes (Pl. 2) were 

After 

type locality. Vellar Estuary, near 

Other material studied. 33 specimens.

Description. The test ranges from 117mm to 195mm (mean 158±21mm) in length and 62mm to 166mm (mean 93±12mm) in width; length:height ratio 1.23-2.50 (mean 1.76±0.30). It is basically flask shaped and approximately oval in lateral out- 

line. In detail, the shape is rather variable. Most specimens are 

concavity along one or both sides of the test.

A few specimens are more elongate and approximately cylindrical in shape. In cross section, the test is circular or slightly flattened. The apertural end is produced out into flared, roughly conical structure, 20-40mm (mean 30±3.8mm) long. In one specimen the aperture is attached to a large sand 

The test wall is thin (about 10-15mm), flexible, translucent and milky white in reflected light. It is composed of organic material with a thin but complete outer veneer of finely agglutinated particles. The protoplasm is finely granular. There are usually no large, identifiable inclusions although one specimen contains a diatom frustule.

There is no endosolenial tube. Most specimens contain a single nucleus, 90-120mm diameter, with an optically denser outer region.

Remarks. Vellaria sacculus is smaller than V. pellucida and has a more rounded test outline, a flared apertural structure which arises directly from the test rather than 10 from the end of a short neck, and a distinct, agglutinated outer test layer.

DISCUSSION

Allogromiid foraminifera are common in a wide variety of marine environments ranging from deep-sea trenches (Jumars & Hessler, 1976) to intertidal mudflats (Ellison, 1984).

Although frequently overlooked, allogromiids seem to be particularly common in estuaries and other brackish water environments around the world. Smitten (1956), Brunnmann et al. (1979) and Brunnmann & Zaninetti (1984) described several new species and genera from mangrove swamps and other brackish water sites in SE Africa and Brazil.

According to Zaninetti et al. (1979), allogromiids constituted 6.9-18.5% of foraminifera in different zones of Brazilian mangrove swamps. Nyholm & Olsson (1973) found monothalamous foraminifers, including allogromiids, to be common at three stations in an estuary on the Swedish west coast. One of the two dominant foraminiferal species living on an intertidal mudflat in the estuary of the River Tamar, SW England, was an undescribed allogromiid (Ellison 1984).

Poorly known rhizopod protozoans (e.g. Lieberkuhnia) which resemble allogromiids are also known from fresh water environments (Bovee 1985). Members of the new genus are delicate, easily overlooked organisms which certainly would be destroyed if samples were dried, a procedure often adopted in micropalaeontological investigations. Careful examination of esturine sediments samples may reveal that these and similar delicate allogromiids are of widespread occurrence.

The allogromiids occurred only in the superficial layers of the cores. Even after sieving, many specimens were attached to small sand grains, although by the time they were examined by the senior author, most had become detached. Attachment to sand grains may allow them to retain a position near the sediment-water interface, a potential problem for these very light organisms, even in the very gentle current conditions which prevail in the Vellar Estuary. The algal and bacterial microflora which is often associated with sand grains may

Explanation of Plate 2

Vellaria sacculus gen. et sp. nov.

Fig.1. Collection of specimens photographed under alcohol.

Scale = 500mm.

Figs 2-8. Specimens photographed in glycerol prior to mounting in glycerine jelly on slides ZF 4984 and ZF 4985. Fig. 4 shows a specimen attached to a small sand grain. Fig. 7 shows the nucleus. All scales = 50mm.
A new Allogromiid Genus
also provide a food source for the allogromiids (Anderson & Meadows 1978).

As noted above, the apertural region of Vellaria is similar to that of some testate amoebae, particularly members of the Psammonobiidae. In both cases, the aperture is used to attach the organism, at least temporarily, to sand grains and other hard substrates (Chardez 1984; Golemansky 1990). However, in other respects, the two taxa occupy different ecological niches. Psammonobiids are interstitial protozoans which inhabit the pore waters of sandy coastal sediments whereas Vellaria lives at or near the surface of fine, silty estuarine sands.

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