Decastroia razini n. gen. n. sp. – A new alveolinacean (foraminifera) from the Cenomanian of Socotra Island (Yemen)

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ABSTRACT

The architecture of a new alveolinacean, Decastroia razini, from the Cenomanian shallow-water sediments of Socotra Island is described. The shape of the new genus is globular to slightly elongated. The internal structure is characterised by septula and floors that individualise two rows of superposed tubular chamberlets, an upper row of large, cortical chamberlets and a lower row of small, medullar ones. The chamberlets of the same chamber are communicated by preseptal passage.

INTRODUCTION

During mapping of the northwestern region of Socotra Island, under the projects “YOCMAL” and “EUROMARGINS 2007”, numerous specimens of a porcelaneous larger foraminifer belonging to the Alveolinacea were collected. A detailed study of its architectural characteristics has revealed differences between Socotra’s specimens and other Cenomanian genera (see Reichel, 1933, 1937, 1941, 1947; Colalongo, 1963). More details about these genera and their species are given in Schroeder and Neumann (1985) and Calonge et al. (2002). The aim of this paper is to describe this new taxon from Socotra, and to discuss its relationship with the previously published alveolinacean genera and species. The paper is based on three carbonate samples, from which 30 thin sections were prepared. The new foraminifer has been described using more than 200 random sections including axial, equatorial, oblique and tangential sections, which enabled the construction of a three dimensional model.

GEOLOGICAL SETTING

Socotra Island (Republic of Yemen) is located 350 km to the southeast of the Yemeni mainland in the Arabian Sea, at the eastern end of the Gulf of Aden opposite the Horn of Africa (Figure 1). Before the Gulf of Aden rift began in Oligocene time (Lepvrier et al., 2002), Socotra was located adjacent to the Dhofar area in South Oman. Consequently, both areas underwent a similar geological evolution, and the major unconformities within the sedimentary successes are considered equivalent (Samuel et al., 1997).

In Dhofar, the sediments containing alveolinaceans belong to the Dhalqut Formation, which consists of a thick series (200–800 m) of argillaceous marls, marly limestones and limestones with rudists, echinoids and larger foraminifera. Roger et al. (1989, 1994) reported that alveolinaceans occur in two successive intervals: (1) upper part of the Umbaraaf Member in which alveolinaceans, Ovalveolina crassa De Castro and Simplalveolina simplex Reichel, appear together with orbitolines, Orbitolina (Mesorbitolina) aperta (Erman) and O. (Conicorbitolina) conica (D’Archiac); (2) in the Khadrafi and Sarfait members there are no orbitolines and only Praealveolina cretacea Reichel is cited. The ages suggested by these authors for the two intervals are Early and Mid-Late Cenomanian, respectively.

The only sample from Oman containing alveolinaceans for our analysis was collected in the upper part of the Dhalqut Formation during a fieldtrip to the Dhofar area. It shows abundant sections of Cisalveolina fraasi (Gümbel, 1872) associated with agglutinated foraminifera, trocholines, dasycladacean algae and rudist fragments, but no section of Decastroia or Praealveolina has been identified. It is recommended, therefore, that accurate sampling in the Dhofar area should be carried out to confirm the absence or presence of the new genus in this area, and if it occurs, the biostratigraphical relationship with Cisalveolina and Praealveolina species. The Dalqhut Formation of Dhofar is at least partially equivalent to the Natih and Mishrif formations (see Roger et al., 1994), which have been widely studied due to their regional importance as oil reservoirs.
A form with a shell-architecture close to Decastroia was figured by Simmons and Hart (1987) under the name of Praealveolina tenuis Reichel (see their Plate 10.1, fig. 2). According to them this form occurs in the upper parts of the Natih Formation of Mid to Late Cenomanian age.

In the studied area of Socotra Island, the sediments attributed to the Dhalqut Formation are regionally constrained by two unconformities (Figures 2 and 3): at the base an unconformity separates the Dhalqut Formation from the Proterozoic granitic basement, and at the top, the Cenomanian sediments are unconformably overlain by Tertiary deposits of Thanetian age. They consist of about 100 m of...
mainly siliciclastic deposits that intercalate in the upper part with limestone beds containing rudist fragments and some larger foraminifera (Figure 4). Samples containing the new taxon are located in beds about 40 m below the Tertiary sediments in Jabal Kadarma, in the “Mudstones/Wackestones with porcellaneous foraminifers” interval (Figure 3).

**SYSTEMATIC DESCRIPTION**

**Decastroia** new genus

**Derivation of Name:** In honour of Piero de Castro who studied Cenomanian alveolinaceans.

**Type Species:** *Decastroia razini* n. sp.

**Diagnosis:** Globular or subglobular to elongated shells with porcelaneous walls. The successive chambers are planispirally and involutedly coiled. The apertural face is covered by two superposed rows of apertures extending from pole-to-pole. The apertures of the upper row have a large diameter, while those located in the lower row have a small diameter (Figure 5). The apertural axes are aligned in subsequent chambers.

![Figure 3: Cenomanian stratigraphy of Jabal Kadarma area. Samples containing *Decastroia razini* n. gen. n. sp. were collected from the “Mudstones/Wackestones with porcellaneous foraminifers” interval.](image)

![Figure 4: Microfacies containing (a) *Decastroia razini* n. gen. n. sp., (b) *Rotorbinella mesogeensis* and (c) *Trocholina* sp.](image)
Chamber lumina are subdivided into two rows of tubular chamberlets by means of septula and floors following the typical pattern of the alveolinaceans (Hamaoui, 1984; Vicedo et al., 2009). The chamberlets of the upper, peripheral row (cortical chamberlets) are large, while those of the lower row (medullar chamberlets) are much smaller. The two rows of chamberlets remain constant in both equatorial and polar regions, for the entire ontogeny. Sporadically, further pole-ward additional rows of medullar chamberlets may appear. Septula are aligned from one chamber to the next and they are interrupted by the preseptal passage. All chamberlets of the same chamber are connected by the preseptal space, which is wider in the upper part of the chamber (level of the peripheral, cortical chamberlets).

**Differential Diagnosis:** *Decastroia* differs from *Cisalveolina* Reichel, 1941 (type species: *C. fallax* Reichel, 1941) because this genus has a single, slit-like aperture extending from pole-to-pole, one row of chamberlets, septula alternating from one chamber to the next, and pre- and post-septal passages. *Ovalveolina* Reichel, 1937 (type species: *O. ovum* d’Orbigny, 1850) resembles *Decastroia* in having continuous septula, but the former shows only one row of chamberlets. *Multispirina* Reichel, 1947 (type species *M. iraniensis* Reichel, 1947) differs from the other genera by having a typical multiple spire.

The genus *Praealveolina* Reichel, 1933 (type species: *P. cretacea* d’Archiac, 1835) has been defined by continuously arranged septula, a single preseptal passage running parallel to the septum and supplementary chamberlets appearing below the main chamberlets in the polar regions. These...
A new alveolinacean, Cenomanian, Yemen

Figure 6: See facing page for figure caption.
characteristics make this genus similar to *Decastroia*. Nevertheless, comparative studies carried out with material from the type locality (Île Madame, southwest France) reveals that the supplementary chamberlets of *P. cretacea* appear less regularly in the equatorial region of the shell than in *Decastroia*. Otherwise, the genus *Sellialveolina* Colalongo, 1963 (type species: *S. viallii* Colalongo) differs from *Decastroia* in terms of its axially compressed morphology and the presence of several rows of medullar chamberlets developed in the central part of the chambers. Moreover, the preseptal space in *Sellialveolina* shows a regular wideness (Vicedo et al., 2011).

*Decastroia razini* n. sp. (Figures 6 to 8)

**Derivation of Name:** In honour of Philippe Razin who studied the geology of Socotra Island.

**Holotype:** PUAB-82016 (Figure 6.9). Deposited in the micropaleontological collection of Departament de Geologia, Universitat Autònoma de Barcelona, Spain.

**Paratypes:** PUAB-82017 (Figure 6.10) and PUAB-82018 (Figure 7.4).

**Type Locality:** Jabal Kadarma, Socotra Island (Figures 1 and 2).

**Type Level:** Cenomanian.

**Associated Fauna:** *Rotorbinella mesogeensis* (Tronchetti) and *Trocholina* sp.

**Diagnosis:** Globular or subglobular to slightly elongated, non-dimorphic morphotype. The maximum axial diameter is about 2.4 mm. The megalospheric generation starts with a proloculus of 120–220 µm followed by a flexostyle of about half a whorl. Chambers following the flexostyle are planispirally arranged, 7–9 whorls compose an adult shell. Cortical chamberlets appear in the first whorl, while medullar ones appear in the third to fourth whorl. In the axial section the shape of the former has a circular to subrectangular outline, while the latter always have a circular morphology. The number of cortical chamberlets (counted in a quarter of an axial section) in the fourth whorl varies from 9 to 12.

Specimens of the microspheric generation, less abundant than those of the megalospheric generation, start with a small, poorly preserved glomerulus. The adult specimens reach a maximum axial diameter of around 2.5 mm with 15–16 planispiral whorls. Cortical chamberlets appear in the first to second whorl. Medullar chamberlets appear in the seventh to eighth whorl (Figure 9).

**Occurrence:** at present, all the studied specimens are from Jabal Kadarma. Nevertheless, sections similar to *Decastroia* have also been recognized in the sediments from the Cenomanian of the Natih Formation (Oman Mountains, northern Oman; personal communication, Esmeralda Caus). Moreover, some pictures referred to the genera *Praealveolina* or *Pseudedomia* in regional studies (e.g. Simmons and Hart, 1987; Smith et al., 1990) should be probably placed in the new genus. Most of these figures are not centred sections, and the details about their architecture cannot be properly observed. Further studies in the Cenomanian sediments of the Middle East are needed to constrain its stratigraphical position.

**Figure 7** (facing page): *Decastroia razini* new genus new species from the Cenomanian of Socotra Island, Yemen (x 50).  
1 and 2 Oblique off-centered sections.  
3 Detail of inner whorl of an adult specimen. Cut slightly obliquely to the axial plane. The three chambers of the inner whorl have been cut in parallel to the sense of growth. Note continuous arrangement of septula in these three successive chambers.  
4 Off-centered section parallel to axial plane of an axially elongated specimen. Note the third row of chamberlets appearing in the polar region.  
5 and 6 Off-centered sections parallel to axial plane. Partially dissolved tests. Abbreviations: cch = cortical chamberlet; flo = floor; mch = medullar chamberlet; prp = preseptal space; sl = septulum.
Figure 7: See facing page for figure caption.
Figure 8: Decastroia razini new genus new species from the Cenomanian of Socotra Island, Yemen (x 50).
(1) Oblique off-centered section.
(2) Off-centered section parallel to axial plane. Note the difference in size between cortical and medullar chamberlets.
(3) Fragmented, off-centered section. Note septula aligned from one chamber to the next in the inner whorl.
See facing page for continuation.
CONCLUSIONS

The new alveolinacean *Decastroia razini* n. gen, n. sp. shows: (1) Globular to slightly elongated shells with two rows of superposed apertures of large and small diameter, respectively. (2) Septula and floors subdivide the chamber lumina into two rows of tubular chamberlets: an upper, peripheral row with large cortical chamberlets and a lower one with small medullar chamberlets. (3) The septula are aligned from one chamber to the next, and near the septum they are interrupted by the preseptal passage. According to the characteristics described above, the new genus has intermediate characteristics between *Praealveolina* and *Sellialveolina*.

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Figure 8 (continued): (4 and 5) Oblique off-centered section close to equatorial plane.  
(6) Oblique off-centered section.  
(7) Tangential section.  
(8) Fragmented, off-centered section. Note septula aligned from one chamber to the next.  
Abbreviations: a = aperture; cch = cortical chamberlet; mch = medullar chamberlet; prp = preseptal space; s = septum; sl = septulum.
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