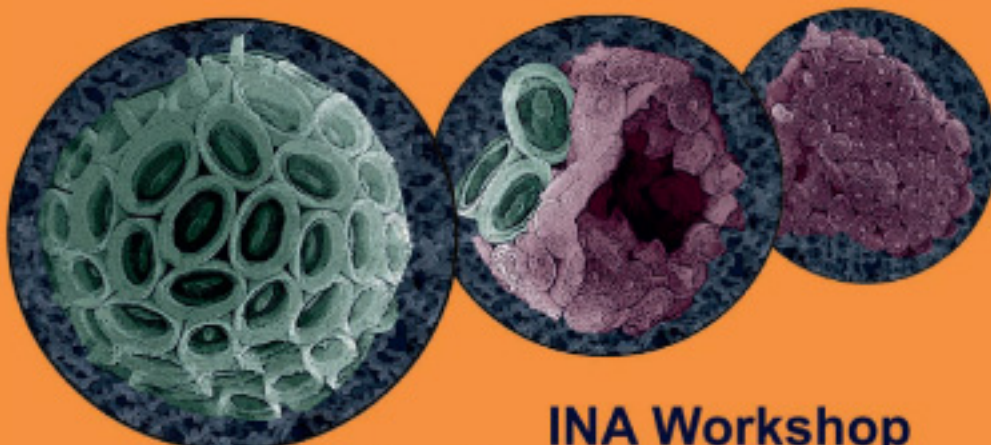


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***Anthosphaera origami* sp. nov. , a planktonic coccolithophore with characteristic paper-boat-shaped structures.**

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Abstract: The holococcolithophore *Anthosphaera origami* sp. nov., which has very characteristic dimorphic coccospheres, is described on the basis of Scanning Electronic Microscopy (SEM) observations. The body coccoliths are calyptroliths with distal structures that resemble origami paper boats and, in apical position, there are fragarioliths which present delicate fanciful ornamentation.

1. Introduction

Coccolithophores with dimorphic holococcolith-bearing coccospheres, with fragarioliths in apical position and calyptroliths as body coccoliths are considered as belonging to the genus *Anthosphaera* Kamptner 1937; emend. Kleijne 1991 (Kleijne, 1991; Jordan *et al.*, 2004).

Several undescribed specimens showing very distinctive apical fragarioliths and body calyptroliths have been reported from SEM observations of Northwestern Mediterranean (Cros, 2001; Cros and Fortuño, 2002; Cros, 2004) and Atlantic water samples (Bérard-Therriault *et al.*, 1999; McGrane, 2007). These coccospheres present circum-flagellar coccoliths with delicate fanciful ornamentation and body calyptroliths with distal structures resembling origami paper boats. **In the present study, the specimens are formally described as a new species.**

2. Materials and methods

The specimens studied were collected from the Northwestern Mediterranean aboard the R/V “García del Cid”, at the Cruise Fronts-95 station 23D (40°40.3 N 2°52.0 E) on 22nd June 1995 at 50 and 40 m depth (Cros, 2001) and at the Cruise Hivern-99 station 30 (41.33° N 2.25° E) on 26th February 1999 at 5 m depth (Pascual *et al.*, 2002; Moran and Estrada, 2005); and from Northeast Atlantic, in Irish shelf waters station 3602 (55°40.01 N 7°46.00 W) from the R/V Celtic Voyager on 28th July 2002 at 1m depth (Raine and McGrane, 2002).

The samples were filtered directly onto polycarbonate filters of 0.8 μm pore-size following the methodology outlined in Cros (2001). Scanning electron microscopy work was realized on a filter or section of filter mounted on a aluminium stub, the sides of which were painted with silver colloidal suspension, and coated with a film of gold or gold/palladium to avoid electric charges. The examination and micrographs of the specimens have been realized with a Hitachi S-570 SEM in the case of Mediterranean samples and with a Hitachi S-4700 cold field emission SEM in the case of Atlantic specimens.

3. Observations and discussion

***Anthosphaera origami* Cros et McGrane sp. nov.**

Plate 1. Figures 1 - 4

Daktylethra aff. *D. pirus* (Kamptner) Bérard-Therriault *et al.*, 1999, p. 271, pl. 132, fig. a.

Anthosphaera sp. type A (very ornamented; sp. nov. *origami* ?), Cros 2001, p. 81, pl. 57, figs 1-2.

Anthosphaera sp. type A (*origami* art), Cros and Fortuño, 2002, p. 60, fig. 88A

Anthosphaera origami sp. nov. (*nomen nudum*), Cros, 2004, p. 26, fig. 1.

Anthosphaera origami sp. nov. McGrane, 2007 (unpublished PhD thesis so not an effective publication, ICN Art 29), p. 243, pl. 25, fig. 1-6

Diagnosis: Coccosphere dimorphic, bearing holococcoliths; the circumflagellar coccoliths are fragarioliths. They consist of a proximal rim surmounted by an ornamented blade, which ends, distally, in spines-like rows of crystallites. The body coccoliths present a proximal flat rim, a ring of large perforations separating radial rows of crystallites, and a concave distal top with a flange and a central distally pointed triangle.

Holotype: Negative 137410 (Plate 1, Figure 1), deposited at ICM (CSIC) Barcelona, Spain.

Type locality: Western Mediterranean Sea (40°40.3 N 2°52.0 E), depth 50m, 22 June 1995 (Cruise Fronts-95, Station 23D).

Etymology: “*origami*”, suggested by Dr. Margalef, referring to the top body coccolith structures resembling origami paper boats.

Number of specimens studied: 6

Description: The coccosphere consists of 5 to 8 circum flagellar fragarioliths and 40 to 70 body calyptroliths (Pl.1 Figs. 1 – 4).

The fragarioliths have an elliptical baseplate with a proximal rim one crystallite thick and two to three crystallites wide that supports the ornamented blade which appears to be sustained by buttress-like structures of rows of crystallites; the blade ends, distally, in a pointed triangle and six spine-like rows of crystallites, three on each side of the central triangle.

The body coccoliths are calyptroliths with a flat, one

Plate 1

Anthosphaera origami Cros et McGrane sp. nov. Scale bars = 1 μ m

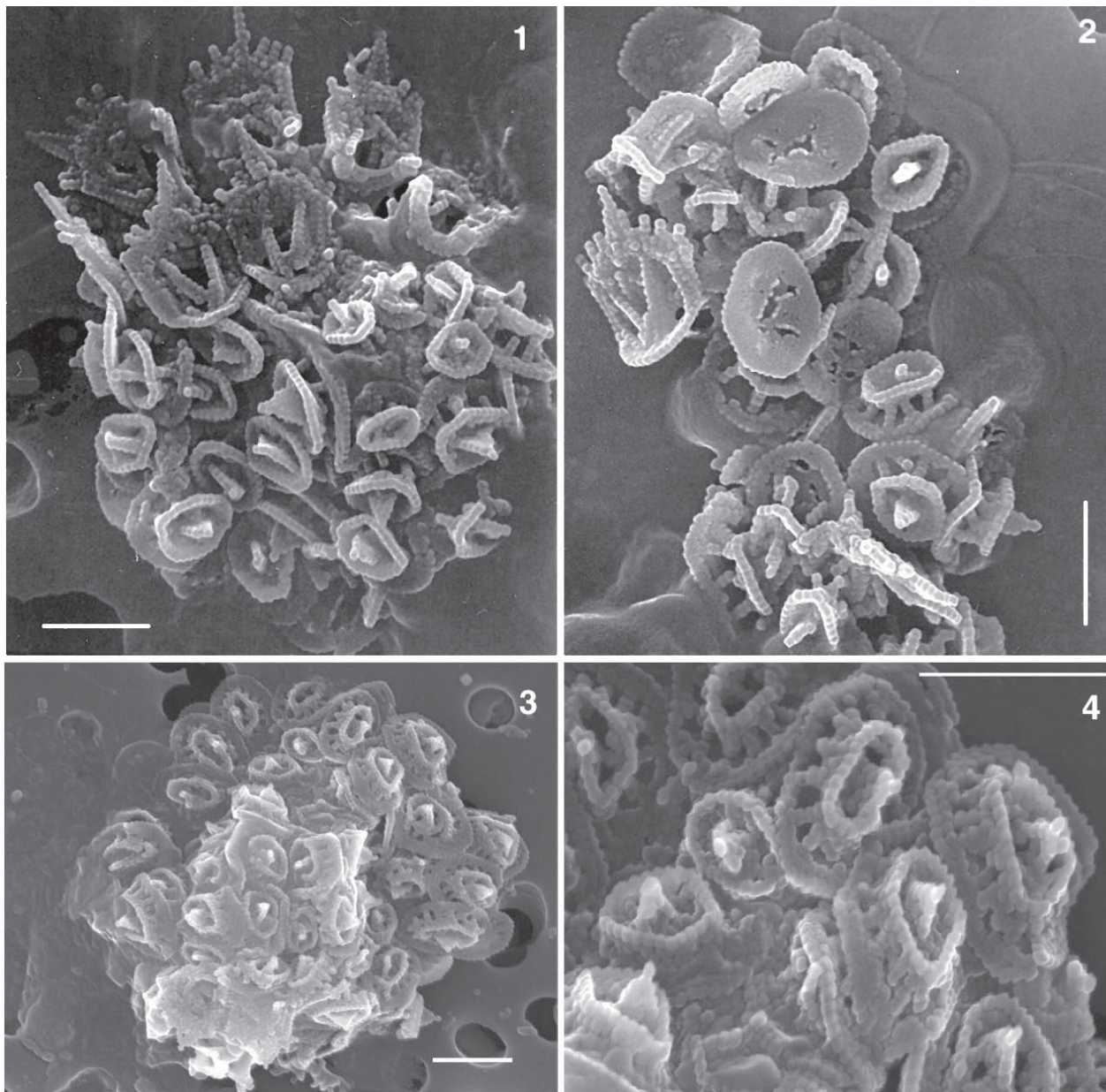


Fig. 1: Holotype; dimorphic coccosphere with very ornamented apical fragarioliths and body coccoliths with top structures that resemble origami paper boats. NW Mediterranean, Lat. 40°40.3 N, Long. 2°52.0 E, at 50m depth.

Fig. 2: Detail showing a fragariolith (centre left) with rows of crystallites forming 'spines' along the distal part of the blade, the central one being the longest. Several ornamented calyptrolith-like body coccoliths are figured, some in proximal view, showing a tear in the central part of the base plate, and others in distal and lateral view, showing a basal ring and columns of crystallites supporting the concave distal top with the pointed triangle-like central structure. NW Mediterranean, Lat. 40°40.3 N, Long. 2°52.0 E, at 50m depth.

Fig. 3: Coccosphere showing well formed body calyptroliths and several collapsed fragarioliths (centre bottom). NE Atlantic, Lat. 55°40.01 N; Long. 7°46.00 W, at 1m depth.

Fig. 4: Detail of fig. 3 showing the distal part of body calyptroliths. Notice the columns of three crystallites high supporting the distal structure.

crystallite thick, elliptical rim two to three crystallites wide connected to a narrower distal structure by up to 10 robust rows of ca. 3 crystallites separated by large spaces; these rows appear to act as columns supporting the paper boat like distal structure; this distal structure consists of a concave top with a distal flange and a sail-like, central pointed triangle-shaped protrusion running parallel to the long axis.

Dimensions: coccosphere ca. 5 μm ; body coccolith length 1.0 – 1.4 μm ; body coccolith width ca. 0.8 μm ; body coccolith height ca. 0.8 μm ; circum-flagellar coccolith (long axis) ca. 1 μm ; circum-flagellar coccolith height ca. 1-2 μm .

Taxonomic notes

Anthosphaera origami sp. nov. is included in *Anthosphaera* because it is a dimorphic holococcolithophore, with circum-flagellar fragarioliths and cap-shaped, calyptrolith-like, body holococcoliths.

The new species differs from the other *Anthosphaera* species mainly in possessing a concave instead of a rounded dome-shaped distal top. Moreover it presents an unusual profusion of adornments and column-like supports built from crystallite rows, which are otherwise only present, in a very restrictive way, in *Anthosphaera periperforata* Kleijne 1991.

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References

- Bérard-Therriault, L., Poulin, M. and Bossé, L., 1999. *Guide d'identification du phytoplancton marin de l'estuaire et du golfe du Saint-Laurent incluant également certains protozoaires*. Ottawa, Conseil national de recherches du Canada, pp. 387.
- Cros, L., 2001. *Planktonic coccolithophores of the NW Mediterranean*. Ph.D. Thesis. Universitat de Barcelona, Barcelona, pp. 389 (Published by Publicacions Universitat de Barcelona in 2002)
- Cros, L. and Fortuño, J.-M., 2002. Atlas of Northwestern Mediterranean Coccolithophores. *Scientia Marina* **66** (Suppl. 1): pp. 7-182.
- Cros, L., 2004. A planktonic coccolithophore with characteristic origami-shaped holococcoliths. *Journal of Nannoplankton Research* (INA 10 Lisbon 2004 Abstracts), **26** (2), p. 26.
- Jordan, R.W., Cros, L., Young, J.R., 2004. A revised classification scheme for living haptophytes. *Micropaleontology*, **50**, supplement no. 1: 55-79, appendices 1-4.
- Kamptner, E., 1937. Neue und bemerkenswerte Coccolithineen aus dem Mittelmeer. *Archiv für Protistenkunde*, **89**: 279-316.
- Kleijne, A., 1991. Holococcolithophorids from the Indian Ocean, Red Sea, Mediterranean Sea and North Atlantic Ocean. *Marine Micropaleontology*, **17**: 1-76.
- McGrane, P.B., 2007. *Extant coccolithophores in Irish Shelf Waters of the Northeast Atlantic*. PhD Thesis. National University of Ireland. Galway, pp. 380.
- Moran, X.A.G., Estrada, M. 2005. Winter pelagic photosynthesis in the NW Mediterranean. *Deep-Sea Research I*, **52**: 1806-1822.
- Pascual, A., Nardelli, B.B., Larnicol, G., Emelianov, M., Gomis, D., 2002. A case of an intense anticyclonic eddy in the Balearic Sea (western Mediterranean). *Journal of Geophysical Research*, **107** (C11): 1-14.
- Raine, R and McGrane, P., 2002. CV3600 *Coccolithophore Biodiversity Survey Cruise Report 2002*. Unpubl. pp 34.