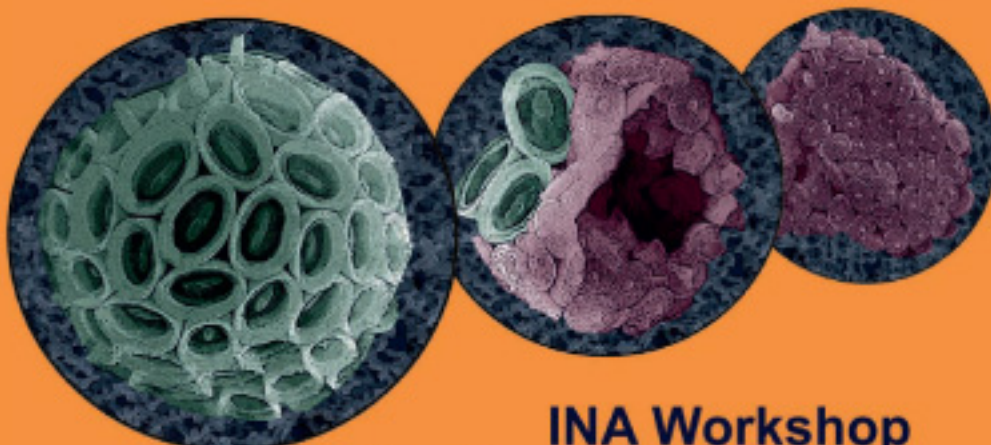


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Verification of the *Coronosphaera mediterranea* – “*Zygosphaera hellenica*” life-cycle association

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Abstract: This is the first documentation of a combination coccosphere from samples collected in the field (North Aegean Sea, NE Mediterranean) between the heterococcolithophore species *Coronosphaera mediterranea* (Lohmann 1902) Gaarder in Gaarder & Heimdal (1977) and the holococcolithophore species “*Zygosphaera hellenica*”. This specimen verifies previous combination coccosphere evidence found in culture and again demonstrates that “*Zygosphaera hellenica*” can be developed from cells of *Coronosphaera mediterranea* in a life-cycle association.

Keywords: living coccolithophores, combination coccosphere

1. Introduction

Coronosphaera mediterranea (Lohmann 1902) has previously been shown to be associated with the holococcolithophore *Calyptrolithina wettsteinii* (Kamptner, 1941; Cros et al., 2000). In addition, a single combination coccosphere of *C. mediterranea* with the holococcolithophore *Calyptrolithophora hasleana* has been observed (Cortes & Bollmann, 2002). Interestingly Geisen et al. (2002) and Houdan et al. (2004) reported “*Zygosphaera hellenica*” as an alternate phase of *Coronosphaera mediterranea* in culture. Geisen et al. (2002) discussed thoroughly this complex, arguing that the heterococcolith phase of *C. mediterranea* consists of three morphologically indistinguishable species. Cros et al. (2000) and Geisen et al. (2002) proposed the use of the informal names *C. mediterranea* HOL *wettsteinii*-type, *C. mediterranea* HOL *hasleana*-type (or *C. mediterranea* HOL *gracillima*-type, in Young et al., 2003) and *C. mediterranea* HOL *hellenica*-

type (see also Malinverno et al., 2008; Young et al., 2014). Later on, Jordan et al. (2004) decided not to synonymize the three species in the lack of further field evidence and given the taxonomic complexity of this association, as *Zygosphaera* has priority over *Coronosphaera*.

In this paper, we present the first description of a combination of the heterococcolithophore species *Coronosphaera mediterranea* and the holococcolithophore species “*Zygosphaera hellenica*” from samples collected in the field.

2. Materials and methods

The *Coronosphaera mediterranea* – “*Zygosphaera hellenica*” combination coccosphere in this study was found in a filtered water sample collected with a rosette system deployment from the north Aegean Sea, during an R/V Aegaeo cruise (sample 2AMT7-10m, March 2014, AegeanMartech project, for location see Dimiza et al.,

this volume; station M4). For each sampling depth, 2 liters of seawater were filtered on Whatman cellulose nitrate filters (47 mm diameter, 0.45 mm pore size), using a vacuum filtration system. Salt was removed by washing the filters with about 2 ml of mineral water. The filters were open dried and stored in plastic Petri dishes. A piece of each filter approximately 8x8 mm² was attached to a copper electron microscope stub using a double-sided adhesive tape and coated with gold. The filter was then examined with a Jeol JSM 6360 Scanning Electron Microscope (University of Athens, Department of Historical Geology and Palaeontology) and is kept in the collections of the Museum of Paleontology and Geology in the University of Athens.

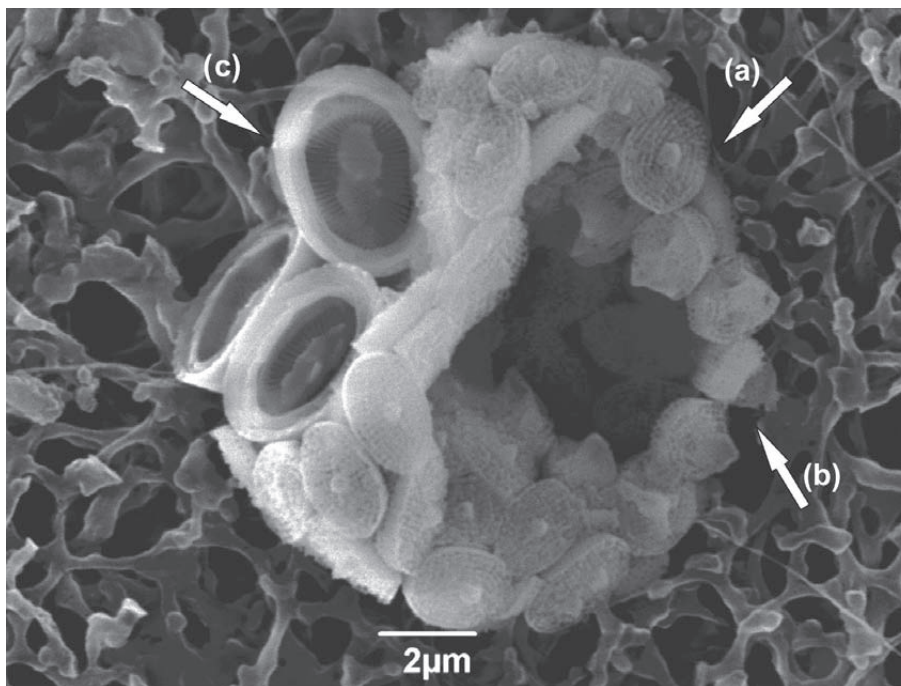


Figure 1. A combination coccosphere consisting of numerous body holococcoliths with characteristic concentric structure of the hexagonal crystallites (a) and circum-flagellar zygoliths (b) of “*Z. hellenica*”, together with three visible body coccoliths (murooliths) of *C. mediterranea* (c) with visible irregular plates in the central area (sample 2AMT7-10m).

Coccolithophore densities (coccospheres/l) were calculated following the methodology of Jordan and Winter (2000).

3. Results and discussion

Coccolithophore communities in the studied sample 2AMT7-10m from the north Aegean Sea, were dominated by *Emiliania huxleyi* (>70% of the coccolithophore assemblage). *Coronosphaera mediterranea* was an extremely minor component (0.3%), whereas “*Zygosphaera hellenica*” was practically absent.

A single combination coccosphere has been recorded, consisted of three body muroliths of *Coronosphaera mediterranea* with a central area composing two irregular flattened plates (see (c) in Fig. 1), and numerous characteristic body holococcoliths with concentric structure and central boss of “*Zygosphaera hellenica*” (see (a) in Fig. 1). Several circum-flagellar coccoliths with the boss elevated into a spine-like structure (zygoliths) are also visible (see (b) in Fig. 1).

Our evidence along with the previous observations, verifies that the heterococcolithophore *Coronosphaera mediterranea* and the holococcolithophores “*Calyptrolithina wettsteinii*”, “*Calyptrolithophora hasleana*” and “*Zygosphaera hellenica*”, all belong to the same species, and therefore a thoroughly revised taxonomy for all the involved taxa has to be formally established.

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