A new morphometric approach to coccolith morphometry: reassessing *Coccolithus pelagicus s.l.* data from the Holocene

Gonçalo A. Prista

Universidade de Lisboa, Instituto Dom Luiz, Faculdade de Ciências, 1749-016 Lisboa, Portugal; Sociedade de História Natural, Torres Vedras, Portugal; gaprista@fc.ul.pt

Áurea Narciso

CIIMAR-Madeira and OOM - Oceanic Observatory of Madeira, Edifício Madeira Tecnopolo, 9020-105 Funchal, Madeira, Portugal; aurea.narciso@ciimarmadeira.org

Mário A. Cachão

Universidade de Lisboa, Instituto Dom Luiz, Faculdade de Ciências, 1749-016 Lisboa, Portugal; Sociedade de História Natural, Torres Vedras, Portugal; mcachao@fc.ul.pt

The measurement of coccolith morphological parameters (coccolith morphometry) is based on the fact that heterococcoliths are produced intracellularly, and their final proportions are set prior to being extruded (e.g., Westbroek *et al*., 1984). Thus, their dimensions may be considered as an intrinsic property of a particular species or ecophenotype. This method has already been used to address questions of taxonomy, biostratigraphy, and paleoecology for several calcareous nannofossils (e.g., Samtleben 1980; Young 1990; Baumann 1995; Narciso *et al*., 2006).

Morphological plasticity corresponds to changes in morphology that are ecologically significant under two conditions: (1) must impact fitness to certain environmental conditions and (2) must differ across environmental conditions for some ecological reason (Travis, 1994). Thus, a species such as *Coccolithus pelagicus s.l.* may have different morphotypes (e.g., different coccolith sizes) in response to different (paleo)environmental conditions. In fact, the work of Parente *et al*. (2004) and Narciso *et al*. (2006) confirmed previous assumptions (e.g., Cachão & Moita, 2000) that different morphotypes exist in different environments. Micropaleontologists have proposed that phenotypic variations have genotypic counterparts, and genetic studies have now separated these morphotypes into two different species (Sáez *et al*., 2003) that probably evolved due to the physical separation of the morphotypes/subspecies: *C. pelagicus* ssp. *pelagicus* (smaller – subpolar waters) and *C. pelagicus* ssp. *braarudii*, (intermediate – upwelling regions). A third morphotype/subspecies, *C. pelagicus* ssp. *azurinos*, was defined from surface sediments (Parente *et al*., 2004) but has not been found since then in the water column off the Azores.

In this work, a new statistical approach to coccolithophore morphometry is presented that is based on theoretical models and previous size data sets for *C. pelagicus s.l.* Additional paleoenvironmental and paleoecological information are expected to be obtained from measurements with of 0.μm resolution.

The new method brings greater accuracy to the definition of morphotype size limits and suggests new behavior patterns for the intermediate morphotype, *C. pelagicus braarudii*, which responds to nutrient availability and upwelling systems.

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