

## Morphological similarities linking fossil species *E. macellus* to the extant coccolithophorids *Gaarderia* and *Umbellosphaera*: Significant implications for the function of coccoliths

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The coccolithophorids are a group of phytoplankton that secretes a carbonate shell called a coccosphere. The latter comprised interlocking mineralized scales called coccoliths. In the extant coccolithophorids, there are, in general, little morphologic differences among coccoliths on individual coccospheres. Two notable exceptions are the spirothecate coccospheres of *Gaarderia* and *Umbellosphaera*. In them, the larger, external coccoliths have a broad marginal cycle and a narrow central cycle; the smaller, inner coccoliths are structurally opposite. Around the spirothecate, there is a gradual modification of the morphology as size increases. Thus size variations of sedimented coccoliths of these genera are not simply indicative of species differences, but reflect the composition of coccospheres.

The coccoliths of one fossil species, *Ellipsolithus macellus*, show a large morphologic variability. The coccoliths of *E. macellus* are very delicate, and no intact coccosphere has been recovered. It is possible that this variability reflects the co-existence of several species under one paleontological name. But it is also possible that it reflects the original composition of the coccosphere, with coccoliths of different shapes and sizes forming a spirothecate coccosphere, analogous to that of *Gaarderia* and *Umbellosphaera*. Although of different basic structures, the morphology of the coccoliths of *E. macellus* are strongly reminiscent of those of *Gaarderia* and *Umbellosphaera* spp.

I have conducted a quantitative analysis on over 400 specimens of *E. macellus* from the lower Paleocene of Egypt, measuring and analyzing variations in the dimensions of coccoliths. I have done the same with published figures of *Gaarderia* and *Umbellosphaera*. The preliminary conclusions of this work are that the coccosphere of *E. macellus* may well have been spirothecate. The function of the coccoliths is still unknown, although several ideas have been offered, including protection, flotation, and/or the regulation of light (Young, 1994). A new function for several of the specialized coccolith groups, including *Gaarderia* and *Umbellosphaera*, has been proposed: these coccoliths may be highly specialized for food collection, which would possibly suggest mixotrophy among at least some extant coccolithophorids (Aubry, in press). If this is the case, morphologic variation in *E. macellus* may be indicative of mixotrophic physiology.

Young, J. 1994. Function of coccoliths. In: A. Winter, A. & W.G. Siesser (Eds). *Coccolithophores*. Cambridge University Press, Cambridge: 63-82.

### References

Aubry, M.-P. In press. A Sea of Lilliputians. *Palaeogeography, Palaeoclimatology, Palaeoecology*.