A high rank taxonomic classification of the Cenozoic coccolithophores and their Mesozoic roots

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A new higher classification of the Cenozoic (extinct and extant) coccolithophores is presented that incorporates morphostructural information together with molecular data on living forms. It is largely based on the structure of the coccoliths that are secreted during the diploid phase of the coccolithophores, beginning with the basic shape of the elements of the marginal cycle, and continuing with their imbrication (or lack thereof) and the number of, and relationship between, cycles of the margin and central area. An important step taken here is the description and naming of heterococcoliths in terms of morphostructural units, i.e., natural entities whose evolution through time is distinct from the evolution of neighboring units in the same coccolith (for instance the evolution of the calyptra compared to that of the column in sphenoliths). The naming of structural units was introduced by Prins (1971) and Romein (1977), and that practice is systematically extended here to all heterococcoliths. Convergent evolution constitutes a major caveat in coccolithophore taxonomy. It has been circumscribed by careful analysis of morphostructural evolution in appropriate stratophenotypic contexts. Ten taxonomic orders were recognized, all of which were already present in the Mesozoic, although the Order Isochrysidales did not mineralize coccoliths until the early Eocene. Major revisions include the introduction of the Order Biscutales and the Order Pontosphaerales and the emendation of the Order Discoasterales and the Order Zygosdiscales. It is interesting that the number of families, as natural entities within orders, is not correlated with the number of species/genera in them. This is taken as an indication of "morphologic evolvability" within an order, thus reflecting the ability of its species to undergo adaptive evolution.

References

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