

New perspectives on the Cenozoic history of the Syracosphaerales

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The Order Syracosphaerales includes the two most diverse modern coccolithophore families, the Syracosphaeraceae and Rhabdosphaeraceae, and forms approximately half of modern heterococcolithophore biodiversity. An understanding of its evolutionary history has, however, been hampered by the relatively poor fossil record of the often small and fragile coccoliths produced by these taxa, and by some dubious assignments of taxa to the modern genera. Recently acquired palaeontological data from locations with exquisite nannofossil preservation (Tanzania, New Zealand, US Gulf Coast and Para-Tethys) provide new morphological and taxonomic data, constraints on origination times for major extant genera, and an outline of long-term patterns of diversity through the Cenozoic.

The pattern of Rhabdosphaeraceae diversification in the early Eocene, with peak diversities in the middle Eocene, before a long-term decline through the late Eocene and early Oligocene, is supported, but new, deep-time occurrences of the extant genera *Acanthoica* (late Paleocene), *Rhabdosphaera* (middle Eocene) and *Algirosphaera* (late Eocene) are documented for the first time, together with exceptional morphological and species diversities in the Eocene genus *Blackites*.

The Syracosphaeraceae are present in the fossil record by at least the late Paleocene, but remain at relatively low (preserved) diversities and with conservative morphologies through the Eocene, Oligocene and Miocene in contrast to their high diversity in the modern oceans. Available molecular genetic data indicate a late Mesozoic divergence time for the Syracosphaeraceae, and the relationship between the Cenozoic families and the Mesozoic to modern Calciosoleniaceae will be discussed.