

# **The heteromorphic haploid-diploid life cycle of coccolithophores: Insights into genetic fingerprinting, adaptive morphology, phylogeny, and origin and maintenance of a complex cycle.**

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The coccolithophores may be the most iconic example of an organism with a haplo-diplobiontic life cycle, with a dimorphism so extreme that their exoskeletons were commonly assigned to separate species and genera when first described. A wealth of data has been recorded for the diploid phase of the coccolithophores, with comprehensive syntheses of their biology, ecology and phylogeny. In contrast, knowledge of the more fragile haploid phase has lagged to an extent that prevents a holistic approach to the study of coccolithophores in general.

This study attempts to remedy this chaotic situation. Based on a comprehensive description of the morphology and structure of all described coccoliths and coccospheres secreted during the haploid phase and a comparison between those that are paired with a diploid counterpart and those that are not, an inclusive biologic framework that unites haploid and diploid phases is established.

Implications of this effort are examined, including the leading role of morphostructural analysis in guiding interpretation of molecular phylogeny inferred from environmental databases, the modalities of adaptive morphology in oligotrophic waters, and the origination of a strongly differentiated haplo-diploid life cycle in the earliest coccolithophores. Importantly, the coccolithophores offer a unique opportunity to analyze the differences in phenotypic expressions of the genome of a species during its haploid and diploid phases.

## References:

Aubry, M.-P. 2022. Coccolithophores: The calcifying haploid phase in living species. Biology, Adaptive morphology, Taxonomy. *SEPM Concepts in Sedimentology and Paleontology* **15**: 402 pp.