Blooming Coccolithophores

R. E. M. RICKABY[1] H. STOLL[2], J. HENDERIKS[3], S. SHAW[4] AND H. ELDERFIELD[5]

[1] Department of Earth Sciences, Oxford University, Parks Road, Oxford OX1 3PR; rosr@earth.ox.ac.uk
[2] Williams College Department of Geosciences, Clark Hall, 947 Main Street, Williamstown, MA 01267; hstoll@williams.edu
[3] Department of Geology and Geochemistry, Stockhom University, SE-106 91 Stockhom, Sweden; jorijntje.henderiks@geo.su.se
[4] School of Earth and Environment, University of Leeds, Leeds LS2 9JT; s.shaw@see.leeds.ac.uk
[5] Department of Earth Sciences, University of Cambridge, Cambridge CB2 3EQ; he101@esc.cam.ac.uk

Coccolithophores play a critical role in the balance between the chemistry of the atmosphere, ocean and sediments. Over geological time, amongst the population of coccolithophore species present, particular bloom forming species have risen to dominance. Every species of coccolithophore inititates the growth of calcite liths with a protococcolith ring consisting of calcite crystals with alternating vertically or radially oriented c-axes, the V/R model [1]. But the modern bloom species, *Emiliania huxleyi*, appears to exploit the faster propagation of radial calcite crystals which grow largely with obtuse kink sites parallel to the c-axis [2] to produce liths consisting almost entirely of radial calcite. Cations larger than calcium are preferentially incorporated into the less spatially restricted obtuse kink sites of calcite with a radially oriented c-axis, and cations smaller than calcium are preferentially incorporated into the acute sites of calcite with a vertically oriented c-axis. We hypothesise that the different orientations of crystal growth may also have implications for the stable isotopic composition of the calcite liths. Sediment records from the global ocean reveal an inverse relationship between coccolith fraction Mg/Ca and Sr/Ca during the last 1 Myrs with a strong resonance of bloom species production at 100 and 400 kyr periods at times of low eccentricity. We propose that these trace metal and isotopic records demonstrate a relationship between orbital eccentricity and the production of bloom species growing radial calcite liths in the Pleistocene ocean [3], perhaps as a result of the inverse relationship between growing season length and insolation under conditions of high eccentricity. We shall explore, with a geological perspective, the complex interplay between atmospheric chemistry, ocean saturation and the evolution of coccolithophores and their geochemistry.

References

[1] Young J. R., J. M. Didymus, P. R. Brown, B. Prius and S. Mann (1992) *Nature* **356,** 516-518.
[2] Paquette, J., and R. J. Reeder (1995) *GCA* **59,** 735-749.
[3] Rickaby R. E. M., Bard E., et al., submitted to EPSL.