

A high-resolution depth profile of coccolithophores from oligotrophic waters in the North Atlantic Gyre (part 2)

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We report abundances and vertical distribution of coccolithophore species from samples retrieved on 28 January 2015 by the RV *Meteor* during cruise M113/2 at station #39 located at 31.46°N, 44.44°W in the North Atlantic Gyre. This location is representative of oligotrophic regions of oceans with a deep chlorophyll *a* maximum at 120 m. Oligotrophic regions account for 70% of the photosynthetic volume of the oceans. We seek to understand not only the biogeographic distribution of coccolithophores but also their contribution in this region to the biogeochemical cycling of carbon. Our results so far include:

1. Whenever possible, at least 300 specimens at 24 depths, from 5 m to 400 m, were evaluated with a scanning electron microscope (SEM) to determine community composition. We counted and digitally imaged over 5000 coccolithophore specimens. Each was placed and catalogued in the interactive database Nannotax.
2. Living coccolithophores were detected in the water column down to 250 m and possibly to 300 m, as determined by abundance patterns.
3. We estimate that $>4.5 \times 10^7$ living coccolithophores were in the samples retrieved from the water column that we studied. The highest abundances, $>4.2 \times 10^4$, occurred at 50 m during the winter/spring mixing season.
4. We identified 158 species from mostly phytoplankton groups but also some zooplankton. Of these species, 123 were identified as coccolithophores, including possibly a few undescribed species. Total species diversity is very high compared to about 280 known oceanic coccolithophore species. About 30 species are represented by a single sample, suggesting we might find more species by searching the filters further.
5. The assemblage is typical of the North Atlantic Gyre (excluding the Sargasso Sea community), which can be characterized by depth zones (surface layer, mixed/deep chlorophyll maximum, and shadow community). Having clearly characterized assemblages allows comparison with other vertical transects.
6. The mixed layer is remarkably homogeneous during the winter/spring season, both in terms of composition and coccolithophore morphology. There is no obvious change in morphology with depth, even for *Emiliania huxleyi* or *Umbellosphaera* spp., contrary to findings in the western Sargasso Sea.
7. Low numbers of holococcolithophores and high levels of *E. huxleyi* possibly reflect a mildly oligotrophic environment due to mixing that occurred during sampling.
8. The Syracosphaeraceae are especially well represented, whereas the Papposphaeraceae are the major missing group.
9. Despite making >5000 coccosphere images, we found no combination coccospheres.
10. Only about 10 specimens are assigned to undescribed taxa, thus >99.5% can be reliably identified.
11. This large set of images was collected without any selection, which means they could be used to acquire good quality data on variations in coccolith size, coccosphere size, and liths per sphere.