Coccoliths and Foraminifera in Deep Sea Sediments and their Role in the Calcium Carbonate Budget

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Substantial dissolution of calcite is required to balance carbonate production in the surface ocean and carbonate burial in the deep ocean. Broecker and Clark showed that coccolith and formainiferal calcite, the two dominant forms of open-ocean calcite, are equally abundant in sediments above the calcite saturation horizon. However, most of the seafloor area sits below the saturation horizon, and coccoliths and foraminifera dissolve at different rates. We present size-fractionated measurements of deep ocean calcium carbonate from the Ontong-Java Plateau (W. Eq. Pacific) and the Corner Rise (NW Atlantic). Sieving sediment effectively separates coccoliths (<10 microns) from foraminifera (>63 microns) and their fragments (10-63 microns). Coccoliths and foraminifera exhibit significantly different pattens of preservation as a function of water depth. The mass ratio of coccoliths to foraminifera increases by at least a factor of three as a function of water depth at these sites, reflecting the preferential dissolution of foraminifera. Extrapolating these depth trends to the global seafloor, coccoliths outweigh foraminifera in deep ocean sediments by a factor of 1.8, which is significantly higher than the coccolith:foraminifera production ratio in surface waters. In addition, the preferential dissolution of planktic foraminifera in these cores is related to their Mg/Ca content, such that the Mg/Ca of the entire foraminiferal assemblage decreases as a function of dissolution. These results underscore the complicated mineralogy of biogenic calcite, and suggest that changes in calcite production ecology could produce different seafloor calcite distributions in the geologic past.

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