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TITLE: The influence of environmental variability on the biogeography of coccolithophores and diatoms in the Great Calcite Belt

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ABSTRACT:

Abstract. The Great Calcite Belt (GCB) of the Southern Ocean is a region of elevated summertime upper ocean calcite concentration derived from coccolithophores, despite the region being known for its diatom predominance. The overlap of two major phytoplankton groups, coccolithophores and diatoms, in the dynamic frontal systems characteristic of this region provides an ideal setting to study environmental influences on the distribution of different species within these taxonomic groups. Samples for phytoplankton enumeration were collected from the upper mixed layer (30 m) during two cruises, the first to the South Atlantic sector (January?February 2011; 60° W?15° E and 36?60° S) and the second in the South Indian sector (February?March 2012; 40?120° E and 36?60° S). The species composition of coccolithophores and diatoms was examined using scanning electron microscopy at 27 stations across the Subtropical, Polar, and Subantarctic fronts. The influence of environmental parameters, such as sea surface temperature (SST), salinity, carbonate chemistry (pH, partial pressure of CO2 (pCO2), alkalinity, dissolved inorganic carbon), macronutrients (nitrate + nitrite, phosphate, silicic acid, ammonia), and mixed layer average irradiance, on species composition across the GCB was assessed statistically. Nanophytoplankton (cells 2?20 µm) were the numerically abundant size group of biomineralizing phytoplankton across the GCB, with the coccolithophore Emiliania huxleyi and diatoms Fragilariopsis nana, F. pseudonana, and Pseudo-nitzschia spp. as the most numerically dominant and widely distributed. A combination of SST, macronutrient concentrations, and pCO2 provided the best statistical descriptors of the biogeographic variability in biomineralizing species composition between stations. Emiliania huxleyi occurred in silicic acid-depleted waters between the Subantarctic Front and the Polar Front, a favorable environment for this species after spring diatom blooms remove silicic acid. Multivariate statistics identified a combination of carbonate chemistry and macronutrients, covarying with temperature, as the dominant drivers of biomineralizing nanoplankton in the GCB sector of the Southern Ocean.

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