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Strontium, Acantharia and Carbon Export,What's the Connection?

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Acantharia are marine protists belonging to Radiolaria, which are found throughout the world in abundance equal to or greater than foraminifera[1]. Despite this, Acantharia have been largely overlooked because their delicate strontium sulphate ($SrSO_4$) skeletons, which dissolve rapidly after death as seawater is undersaturated with respect to $SrSO_4$[2]. While Acantharia have a high sinking rate due to their heavy skeletons and cysts[3], they are not considered to contribute significantly to sinking particle fluxes in the mesopelagic zone and below[4]. However, recent observations in sediment traps at bathypelagic depths at high latitudes show large Acantharian fluxes, indicating their importance to export fluxes[3], [5]. This study measured dissolved strontium concentrations along the WOCE SR3 line (145°E) and at three process stations during the SOLACE voyage, including one in the Subantarctic Zone (SAZ) (47°S, 141°E) and the others further south in the Antarctic Zone (AZ) at 55°S and 58°S. A stronger vertical gradient in Sr concentrations was found in the SAZ and further north, indicating a depletion of surface Sr relative to deep waters of up to 1.4%. There was a noticeable difference in surface Sr concentrations from north to south, with values increasing from 87.3 umol kg^{-1} near Tasmania to 88.5 umol kg^{-1} near Antarctica. Furthermore, Sr was observed to be remineralized at a shallower depth in the AZ than in the SAZ. These findings highlight the crucial role that Acantharia play in marine strontium cycling. Based on the modeled Sr particulate fluxes, it is suggested that the contribution of Acantharia to the total POC flux is varying in the Southern Ocean.

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