STATEMENT OF INTEREST FOR THE GEOTRACES GP17 SECTIONS

Silicon isotopes

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RELEVANCE & RESEARCH GOALS: The GEOTRACES program is revolutionizing our understanding of the processes controlling the distribution of silicon isotopes in the global ocean. A mechanistic understanding these processes is essential for successful application of the $\delta^{30}Si$ proxy to assess the role of diatoms and silicic acid in past shifts in ocean productivity and their implication for climate. The isotopic composition of ventilating water masses plays a critical role in setting the $\delta^{30}Si$ of diatoms placing priority on understanding how the silicon isotopic composition of ventilating waters masses varies in time and space.

Model results predict control through fractionation during silica production in surface waters coupled to the movement of Si by the biological pump and the meridional overturning circulation. The predicted gradient in $\delta^{30}Si(OH)_4$ along the MOC is reflected in data with the deep Arctic containing the heaviest Si followed by the Atlantic and then the south Pacific (Fig. 1).

The Southern Ocean that dominates the cycling of Si in the global ocean and sets the $Si(OH)_4$ content and $\delta^{30}Si(OH)_4$ values of both the deep and intermediate waters delivered to the Pacific, Atlantic and Indian Oceans. Southern Ocean circulation creates a silicic acid trap resulting in high $[Si(OH)_4]$ in bottom waters while iron limitation drives strong $Si(OH)_4$ consumption in surface waters. Current models predict a bimodal isotope response, with light isotopes partitioned into deep waters and heavy isotopes partitioned into mode waters. To date we lack a detailed full-depth section of $\delta^{30}Si(OH)_4$ that traverses the key water masses involved. GP17-OCE will allow these predictions to be tested.

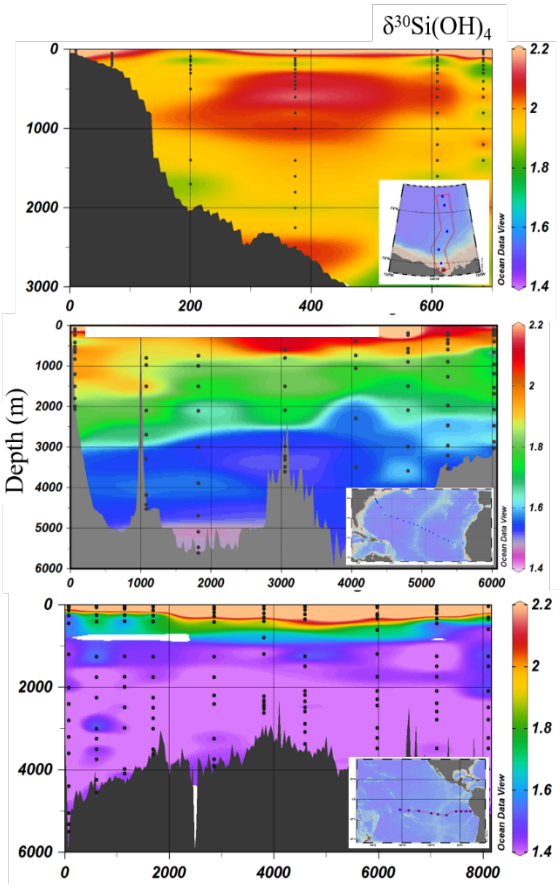

Figure1. Sections of $\delta^{30}Si(OH)_4$ in the Canadian Arctic (upper), North Atlantic (middle) and South Pacific (lower).

GP17-ANT is also of interest as diatoms dominate Antarctic ice edge blooms producing strong isotope signals for examining fractionation. This will allow a field test of recent findings that some Antarctic diatoms manifest atypical ε_{Si} values in culture.

NOTE: Brzezinski will be at sea during the GP17 workshop so he cannot attend; however, Dr. Closset (currently a post doc with Brzezinski) can attend and will be fully prepared to represent our interests (e.g. relevance, science goals, sample requirements) to the group.