Altabet Statement of Interest for the Alaska to Tahiti GEOTRACES Section

The Alaska to Tahiti Pacific section will cross a number of distinct biogeochemical regimes that vary widely in biogeochemical and nutrient characteristics. These include the HNLC regions of the Subarctic and Equatorial Pacific and the oligotrophic Subtropical/Tropical North and South Pacific. Within the tropical portions of the transect are, at intermediate depth, the westward extensions of the of the Pacific Oxygen Deficient Zones as seen in local nitrogen deficit signals of moderate intensity (Fig. 1). A greater N deficit is assumed where the nitrate anomaly relative to PO_4^{-3}, N', is most negative. These are important regions to study with respect to the transport and spreading of the biogeochemical signals of N-loss in the ODZ's. In contrast the more positive N' in the subtropical N. Pacific above 500 m may be the result of N_2 fixation. These processes leave contrasting imprints on the isotopic composition of NO_3^-, a core GEOTRACES parameter which is used to study both modern and past changes in ocean nitrogen cycling from local to global scales.

My group's efforts would be in collaboration with and support of Casciotti and Sigman's project that includes measurement of $\delta^{15}N_{NO3}$. This is a routine analysis for us and, subject to future discussion with Casciotti, my group would be involved in further cross-calibration and comparison of this parameter between our laboratories. However, the main and singular contribution from our group would be N_2/Ar gas measurements to determine N_2 resulting from fixed N-loss processes, which we have carried out previously as part of our NSF-supported Pacific and Arctic GEOTRACES projects. In our laboratory, this measurement is also accompanied by $\delta^{15}N_{N2}$, and $\delta^{18}O_{O2}$ analyses.

The N_2/Ar and $\delta^{15}N_{N2}$ measurements are linked to nitrogen isotope budgets and the mass balance of N in and around ODZ's. N deficits produced by denitrification and/or anammox and apparent isotopic composition can be compared against the concentration and $\delta^{15}N$ of dissolved N_2 gas to better understand N loss pathways. This approach has proven successful in out prior Pacific GEOTRACES project with Casciotti. Well outside of ODZ's, apparent excess N_2 derived from N_2/Ar measurements have been interpreted as reflecting mainly non-equilibrium air-sea gas exchange processes in water mass formation regions. However, a new modeling study (Shigemitsu et al., GBC 2016) suggests that these signals reflect widely-distributed benthic N-loss which constitutes >50% of the global ocean total and that N_2/Ar data thereby are a "powerful constraint" on understanding overall oceanic N-loss. The Alaska-Tahiti section will be an important opportunity to test these model results with an intensive and extensive N_2/Ar dataset.

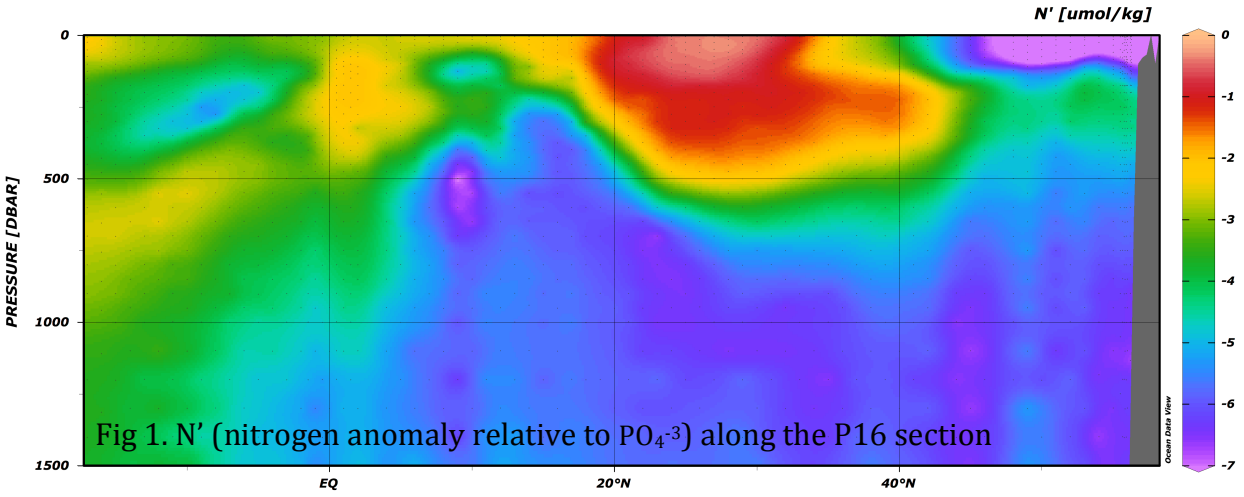

Fig 1. N' (nitrogen anomaly relative to PO_4^{-3}) along the P16 section