GEOTRACES GP17 Statement of Interest

Dissolved Inorganic Carbon – PI Ryan Woosley

I propose measuring the inorganic carbon system (Total Alkalinity/Dissolved Inorganic Carbon/pH) on both legs of the GP17 cruise. The carbon system and TEI cycling are indelibly linked (GEOTRACES Science plan table 1), and one of the overarching goals of GEOTRACES is to understand the links between carbon and TEIs. Measuring both sets of parameters (TEI alongside carbon) on these cruises seems only natural. TEIs play an important role in carbon cycling as micronutrients, but carbon, mainly through pH, influences in turn the distribution and behavior of TEIs[1]. For the GP17-OCE leg, directly evaluating carbon will help explain the distributions of TEIs across the multiple regimes and the influence on pre-formed concentrations (OCE goal 1). As a repeated section it will also help to elucidate decadal and sub-decadal variability of anthropogenic carbon uptake and ocean acidification[2], an NSF priority. The GP17-ANT leg is a highly under-sampled region. The southern ocean is extremely important in the carbon cycle due to deep and intermediate water formation, but is also highly variable and exceedingly sensitive to ocean acidication[3]. Carbon system measurements will help to explain the processes controlling TEI distributions under ice covered and marginal sea ice conditions (ANT Goals 1 and 2), which are poorly understood for both carbon and TEIs. The fluxes of carbon in meltwaters will also help in understanding the fluxes of TEIs in meltwater and the Antarctic Circumpolar Current (ANT Goal 4). Finally, characterizing the carbon content of Circumpolar Deep Water will aid in determining how TEIs are mixed and modified throughout the region (Goal 3). Carbon measurements on the GP17 cruises will provide many complementary measurements essential to addressing both the cruise goals and the overarching GEOTRACES goals. Our past CO_2 measurements on GEOTRACES cruises have proven beneficial to both GEOTRACES and the marine carbon community[4].

1. Millero, F. J., Woosley, R. J., DiTrolio, B. & Waters, J. F. Effect of Ocean Acidification on the Speciation of Metals in Seawater. *Oceanography* **22**, 72–85 (2009).
2. Gruber, N. *et al.* The oceanic sink for anthropogenic CO 2 from 1994 to 2007. *Science.* **363**, 1193–1199 (2019).
3. Gruber, N., Landschützer, P. & Lovenduski, N. S. The Variable Southern Ocean Carbon Sink. *Ann. Rev. Mar. Sci.* **11**, 159–186 (2019).
4. Woosley, R. J. & Millero, F. J. Freshening of the Western Arctic Negates Anthropogenic Carbon Uptake Potential. *Limnol. Oceanogr.*