

Travel support request for the GP17 Planning Workshop  
From: Daniel M. Sigman, Princeton University

I plan to propose nitrate  $\delta^{15}\text{N}$  and  $\delta^{18}\text{O}$  analysis for both expeditions. This work will provide new information on the patterns of circulation and nitrate assimilation in the South Pacific, open Southern Ocean, and coastal Antarctic. It will also provide constraints on parameters important for paleoceanographic N isotope applications that my group and others are pursuing in the eastern Pacific Subantarctic and Antarctic Zones, including near the Drake Passage (Studer et al., 2015; Wang et al., 2017). The coastal Antarctic data may prove particularly useful for ground-truthing future paleoceanographic efforts in the coastal Antarctic Zone, which is believed to be critical region for ventilation of the interior. Data from GP17-ANT may clarify the isotopic consequences of strong lateral gradients in surface nitrate concentration, providing a better test-case for this situation than any other oceanographic setting that I can imagine. The data will be highly complementary with other data sets that have been or are being produced in this and neighboring regions (e.g., GP15 by Casciotti's group, our published and unpublished measurements along CLIVAR occupations of P16S, our unpublished measurements along P06, my thesis work on nitrate isotopes in this region of the Southern Ocean). The P16S line has been measured at lower densities previously (Rafter et al., 2013), and the comparison between occupations will be the first of its kind for the nitrate isotopes. Thus, with the completion of GP17-OCE, we will have adequate data to interpolate the 3-dimensional distribution of nitrate  $\delta^{15}\text{N}$  and  $\delta^{18}\text{O}$  the eastern-to-central South Pacific. Moreover, the eastern South Pacific is characterized by an unusually broad Subantarctic region, with a much weaker role for southward inputs of low-nutrient subtropical water in this region. This provides a unique opportunity to study the interaction of nitrate supply and consumption in this zone of the Southern Ocean.

To improve the paleoceanographic impact of this work, I will discuss with relevant investigators the plans for generation of depth profiles of suspended and sinking (i.e. large) particle  $\delta^{15}\text{N}$ . Such data will be particularly valuable for ground-truthing deep sea coral  $\delta^{15}\text{N}$  in this coral-rich region. A central question is how faithfully suspended particle  $\delta^{15}\text{N}$  reflects the spatial pattern in the  $\delta^{15}\text{N}$  of the nitrate consumed in surface waters, with the benefit of the large dynamic range of conditions provided by this cruise.

Finally, Karen Casciotti will provide me with some material to motivate the possible analysis of the isotopes of nitrous oxide on GP17.