

## Nitrous oxide concentrations and isotopes in GP17

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We would like to propose measurements of nitrous oxide concentrations and isotopes on GP17. Our scientific objective is to map the distribution of nitrous oxide ( $\text{N}_2\text{O}$ ) concentrations and isotopes in the South Pacific and Southern Ocean, in order to better understand 1) the fluxes of  $\text{N}_2\text{O}$  to the atmosphere, 2) the oceanic sources of  $\text{N}_2\text{O}$ , and 3) the interactions between trace metals and  $\text{N}_2\text{O}$  production.  $\text{N}_2\text{O}$  is a potent greenhouse gas, and its cycling runs in parallel with that of nitrate and nitrite. Its production and consumption involves metalloenzymes that contain iron and copper, and its distribution in the Atlantic Ocean has been shown to track cobalt. We propose to study  $\text{N}_2\text{O}$  on GP17, which will cross important regions of deep upwelling that may transfer  $\text{N}_2\text{O}$  to the atmosphere, as well as regions of intermediate water subduction which will set the boundary conditions for water parcels we measured on GP15.

We request a single berth on both legs to collect the samples and conduct the concentration measurements at sea (1L). Duplicate samples for  $\text{N}_2\text{O}$  isotopic analyses (1L) will be collected at sea, observing proper gas sampling procedures, and stored for isotopic analysis back on land.  $\text{N}_2\text{O}$  analysis onboard involves stripping the dissolved gas from seawater, and injection of the trapped gas into a GC-ECD. Therefore bench space would be required for a GC and an equivalent amount of space for the seawater handling system. We also require 2 compressed gas cylinders on each leg. Conducting the analyses at sea will increase the accuracy and precision of the measurements which is particularly important for the Southern Ocean as concentrations will be close to saturation and in some instances be under-saturated.

The parameters to be determined are  $\text{N}_2\text{O}$  concentration, as well as  $\text{N}_2\text{O}$  isotopes ( $\delta^{15}\text{N}$  and  $\delta^{18}\text{O}$ ) and isotopomers ( $\delta^{15}\text{N}$ -alpha). Obtaining these data will help constrain nitrous oxide fluxes in a part of the global ocean that is currently weakly resolved. The investigators have previously been involved in intercalibration exercises for nitrous oxide concentrations and stable isotopes, and GP17 will help provide a connection between the  $\text{N}_2\text{O}$  measurements made in GO-SHIP and GEOTRACES programs. In particular, this will extend the  $\text{N}_2\text{O}$  samples collected by Karen Casciotti on GP15 and GP16.