



## The isotopic composition of nitrogen gas in oxygen deficient zones

Allan Devol (1), Bonnie Chang (2), and Wajih Naqvi (3)

(1) University of Washington, Seattle, USA (devol@u.washington.edu), (2) Princeton University, Princeton, USA (bonniec@princeton.edu), (3) National Institute of Oceanography, Goa, India (naqvi@nio.org)

We present the nitrogen isotope composition of nitrogen gas in each of the three major oxygen deficient zones (ODZ) of the world's ocean: the eastern tropical North Pacific (ETNP), the eastern tropical South Pacific (ETSP) and the Arabian Sea (AS). The isotopic composition of nitrogen gas in these areas has been altered by denitrification and related suboxic processes. We also present the isotopic values for stations nearby the oxygen deficient zones that were not influenced by denitrification and related processes. These two sets of data are used to calculate the isotopic composition of the excess nitrogen gas in each major ODZ. Outside the ODZs the  $\delta^{15}\text{N}$  of  $\text{N}_2$  consistently ranged between 0.6 ‰ and 0.8 ‰. However, within each ODZ, a deviation from the air-equilibrated value due to the effects of suboxic  $\text{N}_2$  gas production was apparent. Within each ODZ, isotopic values decreased to a minimum and then returned to more typical values a few hundred meters below the lower boundary of the ODZ. The lowest values were observed in the suboxic waters of the ETNP with values of about 0.11 ‰ coincident with the secondary nitrite maximum. In the ETSP these values were about 0.17 ‰ again coincident to the secondary nitrite maximum. In the AS the values were higher, near 0.23 ‰ but still significantly isotopically depleted in the heavy N isotope. Using the observed values within and outside each oxygen minimum zone, and nitrate deficits due to suboxic processes calculated with an  $\text{N}^*$ -type calculation, the isotopic composition of the  $\text{N}_2$  gas added by denitrification was calculated. Although the exact value differed in the three ODZs, all values were  $> -30$  ‰ which is significantly more depleted than would be expected from fractionation during heterotrophic denitrification. Reasons for this high degree of depletion are discussed.