Denitrification in OMZs - why is it always so low?

CAROLIN R. LOESCHER[1], HERMANN W. BANGE[2]

[1]University of Southern Denmark, Campusvej 55, 5230 Odense M, DK

[2]Helmholtz Center for Ocean Research-GEOMAR, Düsternbrookerweg 20, 24105 Kiel, DE

During denitrification, the four-step reduction of nitrate to molecular nitrogen (N_2), oxygen (O_2) sensitivity increases with every step. This is mostly due to different sensitivity levels of the genetic regulation and the enzymes involved in denitrification to O_2. In addition, not all microbes are able to perform all steps of denitrification. Some microbes indeed lack the genetic apparatus to perform the last step of denitrification, the reduction of the stron greenhouse gas N_2O to N_2.

In the OMZ off Peru, we observed that genes coding for the last enzyme in denitrification, the N_2O reductase (Nos), are hardly detectable in our metagenomes. Identifyable *nosZ* genes were mainly identified non-functiona, related to clades such as Ignavibacteria and archaea, which are supposedly not actively denitrifiying.

However, a broad diversity of bacteria and archaea capable of producing N_2O was detected in those waters. This may explain the massive production of N_2O in the Peruvian OMZ. However, at the same time it explains why denitrifiers are abundant, but no denitrification rates in terms of N_2 production were below the detection limit. The only exception, both with respect to functional *nosZ* abundance and denitrification rate detection has been observed in the presence of hydrogen sulfide. Thus, the intensity of the OMZ directly impacts on switch between N_2O production and nitrogen loss.