



Anaerobic ammonium oxidation in the Peruvian oxygen minimum zone

Hamersley, M. Robert, Gaute Lavik, Dagmar Woebken, Jayne E. Rattray, Phyllis Lam, Ellen C. Hopmans, Jaap S. Sinninghe Damsté, Siegfried Krüger, Michelle Graco, Dimtri Gutiérrez, Marcel M. M. Kuypers

Limnol. Oceanogr., 52(3), 2007, 923-933 | DOI: 10.4319/lo.2007.52.3.0923

ABSTRACT: We investigated the microbial pathways of nitrogen (N) loss in an April 2005 transect through the Peruvian oxygen minimum zone (OMZ) at 12° S latitude using short anaerobic incubations with ¹⁵N-labeled substrates and molecular-ecological and lipid-biomarker studies. In incubations with ¹⁵NH₄⁺, immediate production of ¹⁴N¹⁵N₂, but not ¹⁵N¹⁵N₂, indicated that N₂ was produced by the pairing of labeled ¹⁵NH₄⁺ with in situ ¹⁴NO₂⁻ via anaerobic ammonium oxidation (anammox). Supporting this finding, we also found anammox-related 16S ribosomal ribonucleic acid gene sequences similar to those previously known from other marine water columns in which anammox activity was measured. We identified and enumerated anammox bacteria via fluorescence in situ hybridization and quantitative polymerase chain reaction and found ladderane membrane lipids specific to anammox bacteria wherever anammox activity was measured by our isotope tracer method. However, in incubations with ¹⁵NO₃⁻ or ¹⁵NO₂⁻, in which denitrification would have been expected to produce ¹⁵N¹⁵N₂ by pairing of oxidized ¹⁵N ions, ¹⁵N¹⁵N₂ production was not detected before 24 h, showing that denitrification of fixed N to N₂ was not taking place in our samples. At the time and locality of our study, anammox, rather than denitrification, was responsible for N₂ production in the Peruvian OMZ waters.

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