Rates and regulation of anaerobic ammonium oxidation and denitrification in the Black Sea

Jensen, Marlene M., Marcel M. M. Kuypers, Gaute Lavik, Bo Thamdrup

Limnol. Oceanogr., 53(1), 2008, 23-36 | DOI: 10.4319/lo.2008.53.1.0023

ABSTRACT: We performed incubation experiments with ^{15}N-labeled nitrogen compounds to investigate the vertical distribution of pathways of N_2 production through the suboxic zone of the central Black Sea and the impact of oxygen and sulfide on the anammox process. Anammox rates increased with depth through the upper suboxic zone and reached a maximum of ~11 nmol N_2 L^{-1} d^{-1} at the sharp interface between nitrate and ammonium, below which rates decreased toward the depth of sulfide accumulation. Heterotrophic denitrification was not detected, and therefore anammox was the prevailing sink for fixed nitrogen in the central Black Sea. In incubations with low oxygen concentrations, anammox activity was only partially inhibited, with a decrease in anammox rates to ~70% and 50% of the anoxic level at ~3.5 and ~8 µmol L^{-1} O_2, respectively, and complete inhibition at ~13.5 µmol L^{-1} O_2. Thus, the anammox process is not constrained to anoxic marine waters. This increases the volume of the major open-ocean oxygen-deficient zones, where anammox is potentially active, which has important implications for the contribution of anammox to the marine nitrogen cycle. We observed an inhibitory effect of micromolar sulfide concentrations on anammox activity, indicating that the vertical and likely horizontal distribution of active anammox bacteria is constrained to nonsulfidic water layers, which may explain the absence of the process in sulfidic basins with no suboxic zone.

Article Links

Download Full-text PDF

Return to Table of Contents

Please Note

Articles in L&O appear in PDF format. Open access articles may be freely downloaded by anyone. Other articles are available for download to subscribers only, or may be purchased for $10 per article. All L&O articles are moved into Open Access after three years.