DNRA dominates NO_3^- reduction in persistantly anoxic Saanich Inlet

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Modern oceans contain large volumes of anoxic water that are currently expanding due to anthropogenic activities. Similarly, the Archean and Proterozoic oceans were almost entirely anoxic. High rates of anaerobic N-metabolisms characterize these anoxic waters, resulting in intense cycling of N through microbial metabolisms. This can either lead to N-loss or N-retention, depending on the partitioning of N-reduction across denitrification, anammox, and dissimilatory NO^-_3 reduction to NH^+_4 (DNRA). While substrate supply rates are a first order control on the rates of N-reduction, the controls on partitioning across the different pathways remain uncertain and this confounds efforts to predict the response of the marine N-cycle to deoxygenation. Here we show that DNRA dominates N-reduction on an annual basis in Saanich Inlet, a persistently anoxic fjord that serves as an analogue for anaerobic marine microbial metabolisms. Rates of DNRA varied between 10^{-5} to 1.4 mol N m^{-2} d^{-1} and constituted up to 99% of total NO_3^- reduction. While anammox and denitrification play an important role throughout most of the year, high rates of DNRA develop following introduction of new oxidants and substrates to the anoxic deep-waters during renewal events. Although often overlooked, DNRA appears to be more important than previously thought, and, with changing oxygen dynamics in the ocean, DNRA could have a large effect on the oceanic nutrient status, possibly promoting euxinia through enhanced N-retention and increased primary production.