# ABSTRACT

Denitrification, the reduction of nitrate is recognized as the most important process that converts biologically available nitrogen to $N_2$ gas and thereby removes nitrogen from marine ecosystems. In current N-cycle models, 50 to 70% of global denitrification is assumed to take place on the sea floor, particularly in organic rich continental margin sediments. The classical view of the marine N cycle, however, is challenged by recent discoveries of alternative pathways during N mineralization that previously most often have been overlooked. This thesis summarizes on some of the alternative routes during N cycling in marine sediments, including anaerobic ammonium oxidation to $NO_2^-$, $NO_3^-$ and $N_2$ by Mn-oxides (anoxic nitrification), and anaerobic ammonium oxidation coupled to nitrite reduction and subsequent $N_2$ production (anammox). Anoxic nitrification is suggested to occur in marine environments world-wide, though there is only indirect evidence presented. Therefore the importance of anoxic nitrification is the subject for debate. Anammox was found in marine environments only recently (2002) and studies in water column and benthic environments indicate that anammox may be a globally important sink for N. There are estimates that anammox accounts for between 25-50% of total $N_2$ production in the world oceans.

This thesis includes studies on the importance of anoxic nitrification and anammox for N mineralization and the removal of N in coastal marine sediments. There were no clear indications for anoxic nitrification to be a significant reaction in the investigated sediments. Anammox, however, was found at almost all sites visited and the contribution of anammox to total $N_2$ production varied between 0 to 80%. The relative contribution of anammox to total $N_2$ production was found to be related to organic matter mineralization. Significance of anammox to total $N_2$ production showed a negative correlation with sediment reactivity. Absolute rates however, can be stimulated by increased organic matter mineralization rates though it seemed like anammox rates reaches a maximum at intermittent reactivity.

Estimations of anammox rates in intact sediments were tested by using the isotope pairing technique (IPT). The IPT is frequently used for estimating $N_2$ production in intact sediments. The presence of anammox violates critical assumptions in the IPT and a revised stoichiometry was used for calculations of natural $N_2$ production and relative importance of anammox. In this study it was found that to simultaneously measure anammox and denitrification, the IPT should only be used after careful considerations.