Geophysical Research Abstracts
Vol. 14, EGU2012-8559, 2012
EGU General Assembly 2012

Sedimentary denitrification: Isotope fractionation and its impact on water column nitrate isotopes

K Dähnke (2,1) and B Thamdrup (2)

(1) present address: Helmholtz Zentrum Geesthacht, Geesthacht, Germany (kirstin.daehnke@hzg.de), (2) University of Southern Denmark, Nordic Center for Earth Evolution, Odense, Denmark

The global marine nitrogen cycle is constrained by one major source and two processes that act as nitrogen sinks: nitrogen fixation on the one side and denitrification or anammox on the other. These processes with their respective isotope effecst set the marine nitrate 15N-isotope value to a relatively constant average of 5 per mil. This value can be used to better assess the magnitude of these source and sink terms, but the underlying assumption at present is that sedimentary denitrification, a process responsible for approximately one third of global nitrogen removal, has little to no isotope effect on the water column.
We tested this hypothesis in sediment incubations, measuring net denitrification and nitrogen and oxygen stable isotope fractionation in surface sediments from the coastal Baltic Sea (Boknis Eck, Northern Germany).
We found tremendously high denitrification rates, and regardless of current paradigms assuming little fractionation during sediment denitrification, we measured fractionation factors of 19 per mil for nitrogen and 11 per mil for oxygen in nitrate. These results potentially challenge the current view of fractionation during sedimentary denitrification and imply that nitrogen budget calculation may need to consider this variability. Furthermore, the ratio of fractionation factors for nitrogen and oxygen is distinct from the 1 : 1 ratio otherwise found in marine systems, and suggests that isotope kinetics of sedimentary denitrification might be entirely different from water column denitrification.

Acknowledgements: This work was funded by the German Research Foundation (DFG) and in parts by the Danish National Research Foundation.