Geophysical Research Abstracts
Vol. 13, EGU2011-3550, 2011
EGU General Assembly 2011

Tracer studies on organic matter cycling by benthic fauna across the Arabian Sea (Indian margin) oxygen minimum zone

Carol White and Clare Woulds
University of Leeds, Faculty of Environment, Leeds, United Kingdom (gycmw@leeds.ac.uk)

Organic matter cycling in marine sediments is of major global significance, acting as the principal driver for many seafloor processes. While oxygen availability, sedimentation rates, mineral surface interaction and organic matter supply are known key factors in organic matter burial and preservation, the potentially critical role of benthic faunal communities (through burrowing, ventilation, digestion and metabolic activity) remains poorly characterized or quantified. Previous carbon and nitrogen isotope tracing experiments suggest oxygen and organic matter availability control benthic carbon processes but it is unclear which of these controls is dominant, or whether that dominance varies between contrasting sites.

The Arabian Sea is characterized by an extensive oxygen minimum zone, typically at 150-1000 m water depth, creating a broad belt of hypoxic sediments sustained by monsoon-driven upwelling and productivity, and restricted intermediate water ventilation. Thus, Arabian Sea margins provide outstanding natural laboratories for biogeochemical studies as they display large ranges in biological communities, organic matter fluxes and sedimentary redox conditions.

Isotope tracing experiments were conducted on sediment cores recovered from depths of 500 m, 800 m and 1140 m on the Indian margin of the Arabian Sea, where oxygen concentrations ranged from 0.2 to 20 μM. A constant dose (650 mg C m^{-2}) of ^{13}C- and ^{15}N-labelled organic matter was added to cores as either algal detritus or lysine sorbed onto montmorillonite. Following incubation for 2 or 7 days, in water baths at ambient seafloor temperatures and oxygen concentrations, core top water was time-series sampled for δ^{13} dissolved inorganic carbon (DIC) analysis and fauna were picked from sediments for ^{13}C and ^{15}N analysis. Parallel experiments were conducted at deliberately manipulated oxygen concentrations to simulate realistic potential fluctuations in Arabian Sea oxygen availability.

We quantify the role of benthic fauna in the short-term processing of sedimentary organic matter, and how this changes in response to manipulated oxygen levels and organic matter quality. Generated carbon budgets are modeled and evaluated against previous experiments, in order to characterize biological organic matter processing on a global scale. The sites are classified using previously developed biological carbon-processing patterns categories. Our results will be used to test the hypothesis that oxygen exerts a threshold-type effect over biological carbon-processing patterns.