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Early diagenesis in sediments of the subtropical Beibu Gulf, South China Sea: Constraints from trace elements, and stable S and C isotopes

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The Beibu Gulf forms the transition zone between the highly economic and agricultural coastal areas of South China and North Vietnam and the South China Sea. The coastal area is influenced by pronounced natural and anthropogenic forces which may strongly influence matter fluxes to the Beibu basin.
Results from a joint German-Chinese expedition in the Beibu Gulf with R/V FENDOU-5 (September 2009) together with preliminary results from another cruise with R/V SONNE (December 2011) are presented here. Element transformation driven by early diagenetic oxidation of organic matter was investigated by pore water analyses of major and trace elements as well as sulphur and carbon isotope partitioning. Sediments were collected with multi-coring and gravity-coring devices and pore waters were retrieved using rhizons. Additionally, anaerobic incubation experiments were carried out with selected surface sediments.
It was found, that the sediments are relatively low in total organic carbon (TOC) with contents mostly below 1% dwt. Due to the organic matter (OM) mineralization down-core increases of metabolites and isotopically light dissolved inorganic carbon (DIC) are observed. Net sulphate reduction seems to play a minor role, as substantial decreases in dissolved sulphate with corresponding enrichments of the heavier sulphur isotopes are only observed at some sites at greater sediment depths. Enrichments of dissolved Mn and Fe in the shallow pore waters indicate the importance of microbial and/or chemical reduction of metal oxides during OM decomposition.
On-board incubation experiments with sediments showed that the enhanced input of degradable organic material stimulates sulphate reduction and the formation of iron mono-sulphides thus emphasizing the current limitation of element transformations by the abundance of OM and the microbial potential of the Beibu Gulf sediments.
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