Enhanced carbon-sulfur cycling in the sediments of Arabian Sea oxygen minimum zone center

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Fuelled by the high flux of labile organic matter within marine oxygen minimum zones (OMZs), microbial processes can remarkably influence the *in situ* sediment chemistry. Biogeochemistry of OMZ sediments have crucial bearings on the benthic biota, gas and metal fluxes across the sediment-water interface, and carbon-sulfur sequestration. In view of the gradual expansion of global OMZs, a comprehensive investigation of their sediment biogeochemistry is imperative for better modelling of potential perturbations in the water-columns, as well as the benthos. Here we couple pore-fluid chemistry and comprehensive microbial-diversity data to reveal the sedimentary carbon-sulfur cycle across a transect covering the entire thickness of eastern Arabian Sea OMZ, off the west coast of India. Total organic carbon content in the investigated cores vary from 0.32 to 5.0 (wt %). Remarkable intensification of aerial sulfate reduction rate ($J_{SO4}{}^{2-}$) around the OMZ centre, coupled with shallowing of sulfate methane transition zone and hydrogen sulfide and ammonium build–up, indicated enhanced sedimentary sulfate reduction driven by organic matter breakdown as well as anaerobic oxidation of methane. $J_{SO4}{}^{2-}$ calculated for the individual cores from their sulfate concentration profiles were found to range between 0.0008 and 0.0113 mmol cm^{-2} yr^{-1} with a maxima in cores within 500-700 m of water depths. Through the integration of the geochemical and microbial-diversity data we illuminate a potential sensitivity of the carbon-sulfur biogeochemistry of OMZ sediments towards the dissolved oxygen level of bottom-waters and the lability of available organic matters.