Sulfur –Iron-Carbon systematics in marine sediments: A study off Mahanadi Basin, Bay of Bengal

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Marine geochemical cycles of carbon, sulfur and iron are highly integrated. Microbial sulfate reduction, sulfide oxidation, organic matter degradation and sulfurization of iron and organic matter control the S-Fe-C geochemical cycles. In order to study the S, Fe and C relationship, a sediment core (MD161-19) was recovered from the Mahanadi offshore basin. The 39 m long core was recovered on-board ORV *Marion Dufresne* at a water depth of 1480 m (Lat: 85º 41.1669E; Long: 18º 59.1020N). The pore-water sulfate concentration profile shows quasi-linear trend with a gradient of 1.61 mM/m. The sulfate methane transition zone (SMTZ) lies within 1500-1900 cmbsf. The total alkalinity increases steadily down-core and reaches a maximum of 22 mM in the SMTZ and subsequently decreases. Total organic carbon content ranges from 0.19 to 2.14 wt%. Chromium reducible sulfur (CRS-pyrite) was extracted from the sediments using boiling 1M $CrCl_2$ (in 6N HCl) in an oxygen free reaction vessel with continuous nitrogen flow. H_2S produced by reduction of sulfide is trapped as CdS in a cadmium nitrate solution and subsequently re-precipitated as Ag_2S by adding $AgNO_3$. A total of 249 samples were analysed for CRS concentrations and sulfur isotope ratios. The CRS content varies from 0.002 to 0.64 wt.% and shows multiple zones of high enrichment. Highly reactive iron (Fe_{HR}) content varies from 0.46 to 3.65 wt.%. A moderate positive correlation exists between CRS & Fe_{HR} wt.% exhibiting partial role of reactive iron in controlling the formation of pyrite in sediment. Remarkable ^{34}S depletions in CRS (down to $\delta^{34}S_{CRS}$ -49‰ VCDT) possibly indicate sulfate reduction and disproportionation of sulfur intermediates like S^0 and $S_2O_3^{2-}$ at the sediment-water interface. The ^{34}S enrichment spikes superimposing the overall ^{34}S depleted background is associated with high CRS concentrations suggesting possible influence of sulfate methane transition processes.