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Study of the coarse fraction components of deep-sea sediments from the Indian Ocean and its effect on the bulk sediment composition.

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Abstract:

In this study, an attempt has been made to understand the effect of coarse fraction (CF, >63µ) components in the siliceous sediment of the Central Indian Basin (CIB), Indian Ocean. Surface sediment samples were collected from twenty locations within 11° to 13°S latitude and 75° to 76°E longitude, at an average water depth of more than 5400m. The CF contents of the studied samples constituted 10% of the bulk sediment. In the rest 90% size fraction, silt comprised the major part (75%) and clay comprised the rest (25%). Hence, these sediments can be classified as clayey silt in nature. Majority of the CF were composed of radiolarian tests (>90%), glass shards (5 to 8%), micronodules (1 to 3%) and mineral and rock fragments (~1%). Careful observation revealed that the glass shards were mostly transparent and angular without any abrasion, indicating that they were mostly fresh in nature and possibly of nearby source. The micronodules were botryoidal in habit and some of them were seen to be attached with the radiolarian tests. Palagonite crystals were abundant with few plagioclase, quartz, clay particles and rock fragments.

Geochemical investigation of the bulk sediments revealed their extreme low values of total carbon contents (0.4% on average) and a distinct positive cerium-anomaly, indicating that these sediments were deposited under oxic bottom water condition. Silicon (Si) was more in the bulk sediments than their sieved counterparts and biogenic silica was more than 50% on an average of the total silica content of these samples. This suggests that, the source of Si was mainly from radiolarian tests, glass shards and rock fragments. However, iron (Fe) and manganese (Mn) did not show any trend of decreasing concentration after the removal of the CF (including micronodules). This indicates that Fe and Mn also resided in the finer fraction of the sediments either by diagenetic enrichment (through sediment pore water) or by authigenic precipitation (from the water column). Both these elements (Fe and Mn) were very well correlated with Ni (r = 0.48, 0.79 resp.), Cu(r = 0.47, 0.79 resp.), Co (r = 0.59, 0.75 resp.), V(r = 0.61, 0.51 resp.), Sr (r = 0.68, 0.54 resp.), Y (r = 0.73, 0.67 resp.) and ∑REEs (r = 0.64, 0.62 resp.) in the bulk sediments but not in the sieved sediments. This indicates that the major part of the above mentioned elements were hosted in the micronodules. There is a general trend of middle to heavy Rare Earth Element (REE) enrichment pattern in both bulk and sieved sediments, but in case of bulk sediment, the concentrations of REEs were much higher. Thus, although the CF content of the studied samples constitutes a minor portion of the bulk sediment, still it plays an important role in trace metal and REE incorporation into the bulk sediment.