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ABSTRACT

The Eastern Arabian Shelf (EAS) is analogous to the upwelling systems of global ocean in terms of the organic matter content in sediments and the presence of oxygen minimum zone (OMZ). However, the accumulation of phosphorus in the EAS is low as compared to the upwelling dominated systems. In the present study, the factors influencing the phosphorus accumulation such as OMZ, primary productivity, organic matter enrichment, redox conditions of sediments and different phosphorus reservoirs have been evaluated in the EAS, where each of the concerned factors is a matter of debate.

The present study evaluates the east-ward shift, near-invariance of OMZ across seasons and paths followed by different water masses in the Arabian Sea through the extended optimum multiparameter analysis and multivariate regression of nutrients data, which were retrieved from the World Ocean Atlas-2013. The results suggest that the subtle balance between the flow from marginal Seas (Persian Gulf Water and Red Sea Water) and organic matter remineralization can explain the eastward shift and maintenance of this OMZ of Arabian Sea that is the most intense and third most voluminous in the world ocean.

The preservation of organic matter and phosphorus distribution in the surface sediments of EAS has been explained through rigorous spatial and multivariate analysis of available extensive dataset. The results indicate that the oxygen concentration and sedimentation rate control the preservation of organic matter and phosphorus accumulation, where the latter is also a function of organic matter content in the sediments.

The sediments of EAS have been derived from low to moderately weathered rocks of the adjoining Dharwar craton (Peninsular Gneissic Complex and younger granites), deposited in fully oxic environment, as inferred from the trace metal proxies, the response of which depends on the sedimentation rate and seasonal oxygen flux. Phosphorus in the EAS resides dominantly in the organic fraction that is essentially terrestrially derived and have negligible authigenic fraction.

High sedimentation rate, lack of significant authigenic phosphorus precipitation, dominance of non-reactive detrital fraction of phosphorus and seasonally varying oxygen flux seems responsible for the lack of significant enrichment of phosphorus in the EAS.

Keywords: Eastern Arabian Shelf, OMZ, redox proxies, phosphorus, organic matter