Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.26129

Sources and internal cycling of the dissolved Iron in the Indian Ocean

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The present study deals with the distribution dFe concentration along the cruise tracks GI10 in the Arabian Sea and GI09 in the Bay of Bengal, Central Indian Ocean Basin and the southern sector of the Indian Ocean up to 30ºS along with the data available from earlier studies in the Indian Ocean under the GEOTRACES India programme. Notably, dissolved iron concentrations in the Arabian Sea range from 0.02 nM to 3.5 nM, while the Bay of Bengal exhibits slightly higher concentrations, varying from 0.02 nM to 4.6 nM. The distinct biogeochemical processes such as advection from coast to open ocean, atmospheric input, Oxygen Minimum Zone (OMZ) in the Bay of Bengal and Arabian Sea influence dFe contributions. In the Arabian Sea, advection from west coast of India to the open ocean waters serves as a primary source, whereas atmospheric dust input plays a more significant role in the Bay of Bengal due to its higher solubility, particularly in areas affected by eddies and downwelling waters. The two OMZs in the Northern Indian Ocean reveal striking differences in dFe profiles. dFe gets released in low oxygen waters in the Arabian Sea through the remineralization of sinking organic matter, while dFe tends to be scavenged in upper OMZ waters before being released in the Bay of Bengal, potentially influenced by the ballast effect and changes in remineralization dynamics. Significant geological features such as the Carlsberg Ridge, Central Indian Ridge, and Southeast Indian Ridge contribute dFe to deeper waters, often measuring between 2-3 nM, with exceptional concentrations reaching ~20 nM near the Rodrigues Triple Junction. Similarly, the Java-Sumatra Subduction Zone plays a vital role, supplying approximately 2.5 nM of dFe to the deeper water columns. Global warming and increasing sea surface temperature would intensify and expand the OMZs of the Northern Indian Ocean in the near future, resulting in further release of dFe to the water column, hence impacting the surface productivity via upwelling of subsurface waters or eddies formation.