Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.33920

Controls on dissolved Copper distribution in the Indian Ocean and its implications

NIRMALYA MALLA[1] AND SUNIL KUMAR SINGH[2]

[1]CSIR- National Institute of Oceanography
[2]CSIR-National Institute of Oceanography

The present study investigates the basin-scale distribution of dissolved copper (dCu), a key micronutrient for marine phytoplankton, across the Indian Ocean. Observations span the Arabian Sea, Bay of Bengal (BoB), Eastern Equatorial Indian Ocean (EIO), Southern Indian Ocean (SIO; to 30°S), and the Central Indian Ocean Basin (CIOB) along two GEOTRACES cruise transects (GI10 and GI09). Elevated dCu concentrations in the coastal waters of the northern Indian Ocean are primarily attributed to continental and margin-derived inputs, including riverine discharge, atmospheric dust deposition, shelf sediment release, and submarine groundwater discharge (SGD). In contrast to several other trace metals, hydrothermal activity does not represent a major dCu source; however, enhanced dCu levels in deep waters are linked to inputs from the Java–Sumatra subduction zone and benthic input from polymetallic nodule–rich sediments in the CIOB. Vertical dCu distributions exhibit a near-linear increase with depth, reflecting the dominance of reversible scavenging and benthic sources in subsurface and deep waters, in contrast to the nutrient-type profiles characteristic of Ni and Cd. Anthropogenic activities associated with rapid industrialization contribute additional dCu to coastal regions, with potential implications for phytoplankton physiology and community structure. In particular, increased anthropogenic dust deposition over the BoB may elevate surface dCu concentrations, raising the risk of copper toxicity and altering ecosystem dynamics. Overall, this study highlights the combined influence of natural and anthropogenic processes in regulating dCu distribution and underscores its biogeochemical and ecological significance in the Indian Ocean.