Dissolved Trace Metal Concentrations in the Indian Ocean (CLIVAR I5 and I8/I9)

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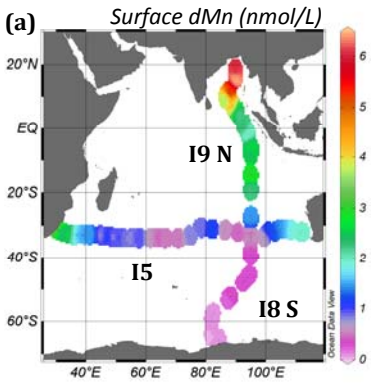
Introduction – High resolution vertical profiles of dissolved bioactive trace metals

More than 1000 discrete seawater samples were analyzed to explore the biogeochemistry of dissolved trace metals in the Indian Ocean. Samples were collected along two CLIVAR oceanographic transects: from the Bay of Bengal to the Antarctic margin (I8S/I9N) and from South Africa to Australia (I5).

Experimental – Automated trace metal extraction and preconcentration, analysis by ICP-MS

Dissolved samples were subsampled into quartz tubes and spiked with a mixture of enriched stable isotope standards (Fe, Cd, Cu, Ni, Zn and Pb) and monoisotope standards (Mn and Co). The samples were UV-irradiated to release the metals from organic ligands, then the metals were extracted from the seawater matrix by passing them over a chelating resin column containing the Nobias Chelate PA-1 resin[1]. The metals were eluted from the column into a small volume of 1.0 M HNO_3 at a preconcentration factor of ~20. Eluted samples were analyzed with calibration standards using the Thermo ELEMENT 2 HR-ICP-MS, housed in the Geochemistry division of the NHMFL. Dissolved trace metal concentrations were plotted against depth to visualize the distributions across the various regimes of the Indian Ocean.

Results and Discussion



Dissolved trace metal concentrations reflect the numerous sources and cycles of trace metals. For example, dissolved Mn (dMn) concentrations are highest along every shelf except the Antarctic margin, resulting from sedimentary input (Fig. 1a). In the Bay of Bengal (~10-20°N; Fig. 1b), surface dMn concentrations are especially high, resulting from an additional input of Mn-enriched freshwater. This freshwater input is less dense than seawater and extends far beyond the coast. Otherwise, dMn concentrations are fairly low in the open ocean, with only a small notable surface enrichment at 70°E to 85°E (Fig. 1c) due to atmospheric deposition of Mn-rich dust.

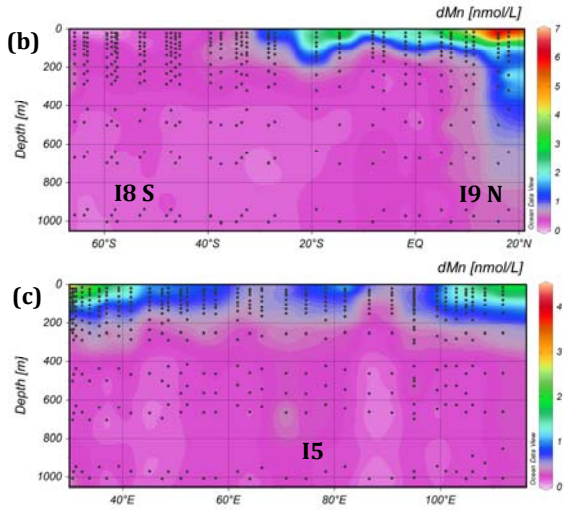


Fig. 1 Surface (a) and vertical profiles of dissolved Mn (dMn) along the CLIVAR I5 east-west (b) and I8S/I9N (c) transects.

Conclusions

The basin-wide surveys of dMn and other trace metals are being shared with collaborators (studying marine particles and aerosols) to compare the relative contributions of atmospheric dust and marine mixing processes to the surface ocean.

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References

[1] Milne, A., *et al*., Analytica Chimica Acta, **665**, 200-207 (2010).