Particulate Trace Element Cycling in a Diatom Bloom at Station ALOHA

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Introduction

Marine suspended particulate matter (SPM) samples from the central North Pacific (Station ALOHA) were collected during the July-September 2012 HOE-DYLAN cruises and analyzed for a suite of trace (e.g., Fe, Mn, Cu, V) and major (e.g., Al, P) elements. Evidence for atmospheric deposition and biological cycling was examined using daily surface samples and four vertical profiles through 250 m. Using this information, we calculated the residence times of particulate Fe (pFe) with literature flux values.

Experimental Design

Samples were digested using a modified version of the Ho et al. 2011[1] methodology. To do a complete digestion, the samples were microwaved in specialized vessels containing a solution of H_2O_2, HNO_3 and HF; gently heated to dryness; and then redissolved in 2% HNO_3. The samples were then quantified using the Thermo ELEMENT 2 HR-ICP-MS in the Geochemistry division. Rh and In were added to monitor for digestion recoveries and instrumental drift, respectively.

Results and Discussion

The low concentrations of lithogenic tracer elements confirmed that atmospheric dust inputs were scarce. Therefore, the pFe cycling (Figs.1 and 2) is most likely due to phytoplankton uptake. Rapid changes in SPM Fe match phytoplankton lifetimes (days). Depth-integrated Fe concentrations (upper 150 m; Fig. 3) showed a decrease in pFe on August 13 that was not balanced by an increase in dissolved Fe (dFe), indicating either the vertical or lateral transport of pFe from the surface waters of our region of study[2].

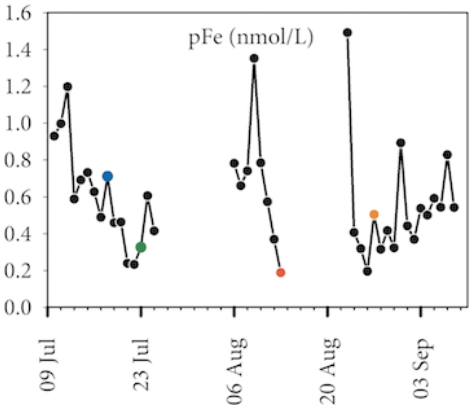

Fig.1 Surface pFe concentrations over the two-month study in the central North Pacific.

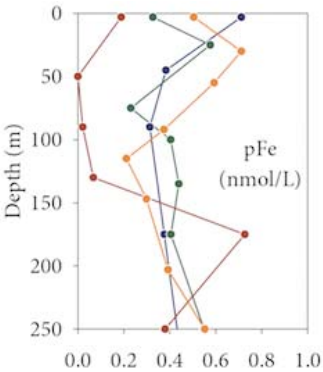

Fig.2 Vertical profiles of pFe showing changes in distributions and total inventories.

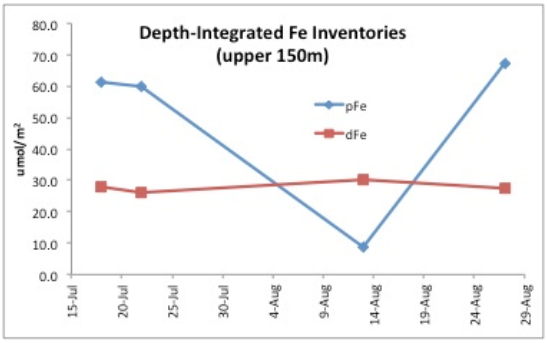

Fig.3 Inventories of pFe and dFe show that vertical and horizontal transport can overwhelm internal transformations.

Conclusions

The quantitative data was shared with other collaborators and has been submitted for publication (under review). The pFe is helping reveal Fe biogeochemical cycling through physical transformations (particulate, colloidal, and soluble forms)[2]. By combining our pFe data with Th isotopes, the scavenging and removal of Fe were used to estimate an Fe residence time of 6-12 months in the surface ocean[3].

Acknowledgements

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References

[1] Ho, T.-Y., *et al.*, Limnology and Oceanography, **56(4)**, 1225–1243 (2011).
[2] Fitzsimmons, J., *et al.*, Geochimica et Cosmochimica Acta, *submitted.*
[3] Hayes, C., *et al.*, Geochimica et Cosmochimica Acta, *submitted.*