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What can we learn from the heavy iron isotope signatures of aerosols in the equatorial Pacific?

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Dissolution of atmospheric aerosols is one of the main sources of bioavailable Fe to the surface ocean. Data for this source in the central and western equatorial Pacific have not been available. Aerosols were sampled in this region during the EUCFe cruise (August – October 2006, R/V Kilo Moana, Chief Scientist J. W. Murray) along the equatorial Pacific from 140°W to 145°E and along the coast of Papua New Guinea. Ten samples were collected, covering the entire cruise track from Hawaii, to the central equatorial Pacific, then to Papua New Guinea and back to Hawaii.

Samples were collected with a small volume collector equipped with 1µm pore size acid-cleaned PTFE filters (following protocols from Central Washington University, USA). Fe concentrations and isotopes were determined, after total particle digestion (HCl, HNO3, HF) and ion exchange purification, with a Neptune MC-ICPMS in LEGOS, France [1].

All samples, except the southeasternmost one, were enriched in heavy Fe isotopes relative to average crust, with an average signature of δ^{56}Fe=0.31‰ ± 0.2 (2 standard deviations, N=9). Combining information from HYSPLIT air mass back trajectories and particle size classes, we explore the possibility that this is a direct reflection of source signatures, including anthropogenic ones [2]. However, using experimental isotope fractionation data [3] and a Rayleigh distillation model, we suggest that isotopic fractionation of Fe during dissolution processes in clouds may be a more realistic explanation of slightly heavy δ^{56}Fe values. This allows estimation of the proportions of Fe that have been dissolved during aerosol transport.

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