A comparison of iron redox cycling in the world's major oxygen minimum zones

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Our group has studied Fe redox cycling in the world's three oxygen minimum zones (OMZs) since 2004 on ten cruises. Three expeditions were in the Arabian Sea, including the Japanese GEOTRACES section. Three cruises were in the SE Tropical Pacific (Peruvian) OMZ, including the US GEOTRACES section. More recently, we have focused on the large OMZ in the NE Tropical Pacific off southern Mexico, whichh is probably the most understudied of the three major OMZs on three cruises, with a fouth ongoing at the time of writing. We have also studied Fe redox cycling in the Costa Rica Dome, which is distinct from the Mexican OMZ. Common features of these sytems include strong maxima in Fe(II) coincident with the secondary nitrite maxima and a maximum in particles. Fe(II) constitutes up to 50% of the total dissolved Fe. Recent analytical refinements suggest that Fe(II) maxima are much sharper than we have observed before. There are also some important differences amongst OMZs. In the Arabian Sea, Fe(II) maxima are associated with sharp maxima in total dissolved Fe, but these features are less pronounced elsewhere. This almost certainly reflects high rates of biological uptake and regeneration in the Arabian Sea relative to the other regimes, as well as seasonal forcing of aeolian inputs. In the NE tropical Pacific, double maxima are prevalent, reflecting complex lateral processes. Comparisons with iodine redox chemistry and distributions shows that a large fraction of Fe(II) may be derived from the shelf slope break. This may contribute to the intriguing observation that Fe(II) maxima are centered around the 26.5 potential density anomaly in both the NE and SE Tropical Pacific. But benthic sources must be secondary in the Costa Rica Upwelling Dome, an isolated offshore feature.