Geophysical Research Abstracts, Vol. 7, 05801, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05801

Evolution of iron along the conveyor belt: North Atlantic to North Pacific

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We have obtained four new full water-column profiles of iron in the ocean from regions where no data was previously available: in the western North Atlantic (10degN 45degW and 24.5degS 37degW), and in the central North Pacific (26degN 175degW and 30degN 140degW). Together with other profiles in the literature, we now can describe the large-scale deepwater $>$2500 m) distribution of Fe with some confidence. In the North Atlantic, deepwater Fe is $\sim$0.7 nmol/kg; by the time NADW has traveled to 24.5degS in the western Atlantic, Fe has decreased to $\sim$0.5 nmol/kg. The salinity and micronutrients of this South Atlantic NADW are the same as at the northern sites, so we attribute the Fe decrease to scavenging onto falling particles as the water travels south. Using Broecker's C14 estimates for the transit time between these sites, we estimate a deepwater scavenging residence time of 270 +/- 140 years. Most of the decrease occurs in the 0.02-0.4 um colloidal fraction. By the time deepwater has reached the north Pacific, Fe has decreased slightly from the South Atlantic levels; three stations (two at HOT-ALOHA near Hawaii and the other further to the northeast) show deepwater Fe levels of 0.45 +/- 0.05 nmol/kg; 75% of this Fe is in the soluble $<$0.02 um fraction. These deepwater data help put to rest the notion that "dissolved" ($<$0.4 um) deepwater Fe is fixed at $\sim$0.6 nmol/kg, but raises the question of whether deepwater "soluble" ($<$0.02 um) iron is fixed at $\sim$0.4 nmol/kg, with most deepwater Fe reactivity confined to the colloidal fraction.