Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.12276

Reversible Scavenging and Particle Veil Transfer of Pb Isotopes into the Deep Pacific Ocean

EDWARD ALLEN BOYLE[1], NATHAN LANNING[2], SHUO JIANG[3] AND JESSICA N. FITZSIMMONS[2]

[1]Massachusetts Institute of Technology
[2]Texas A&M University
[3]East China Normal University

Presenting Author: eaboyle@mit.edu

The US GEOTRACES Pacific Meridional Transect (GP15) proceeded south from Alaska to Tahiti along 162°W. Although there is considerable structure in the Pb isotope composition along this transect, but in general the upper ocean has higher Pb and lower Pb isotopes than the deeper waters, and the northern hemisphere has higher Pb than the southern hemisphere because of stronger anthropogenic inputs. Wu, Rember et al. (2010, GCA 74:4629) attributed this distribution to the time-dependent evolution of surface 206Pb/207Pb from pre-anthropogenic crustal values (~1.20) to lower values caused by anthropogenic Pb emissions from Australian- and Chinese-type Pb, transported to great depths by reversible scavenging on sinking particles. As shown by the particulate data from GP15 by Bishop, Lam, et al. (in press), there are sinking "particle veils" at the equator and north of 35°N caused by high biological production in the near-surface waters. 206Pb/207Pb decreases from 1.160-1.165 in the upper 1000m to ~1.18 at greater depths, but immediately within the equatorial and northern Pacific "particle veils", deep 206Pb/207Pb shows lower values compared to samples from outside of the veils. We propose that the higher capacity for reversible Pb transport in the veils releases sufficient low upper ocean 206Pb/207Pb to overwhelm the effect of lateral isopycnal mixing in the deep Pacific. 208Pb/206Pb and 206Pb/204Pb show similar patterns. In addition to the original crustal source Pb, high 206Pb/207Pb anthropogenic U.S. Pb from the latter half of the 20th century was transported by reversible exchange with sinking particles and the higher values at depth reflect their accumulated release along with that of the original natural crustal Pb. We will present a simple quantitative model of this time-dependent process.