

Top-down or bottom-up control on ocean geochemistry?

BRIAN A HALEY

Oregon State University

Presenting Author: brian.haley@oregonstate.edu

Scavenging and reversible scavenging are thought to control the distribution of many dissolved elements in the ocean's water column, especially the suite of "particle reactive" elements. Because particles - the agents of scavenging/reversible scavenging - predominately input at the surface ocean only to sink, this becomes a "top down" view of ocean elemental cycling. A complementary view is an older idea [1] that ocean chemistry is simply seeking equilibrium with the sediments of the sea floor; essentially a "bottom up" view of ocean geochemistry. While the former idea is in vogue today, there is growing evidence for "boundary exchange" processes occurring on the sea floor. That is, the more comprehensive trace metal datasets now becoming available are indicating significant regional benthic influences on bottom water chemistry.

In this talk, I will focus on the REEs/ ϵ_{Nd} , as ambassadors for "particle reactive" elements, to query the "top down" versus "bottom up" hypotheses. Use of the REEs and ϵ_{Nd} is particularly appropriate to investigate these hypotheses, which must offer a resolution to the "Nd paradox" [2]. Data from the water column, and both marginal and abyssal pore waters will be shown and discussed. I will offer an initial conclusion that water column elemental/isotopic distributions reflect a "bottom up" source, modified by irreversible removal via scavenging onto particles. I offer this "conclusion" as a competing target to steer future observations, and to promote consideration of the implications this conclusion has on interpretation of proxy data in palaeoceanographic studies.

[1] Sillen, L.G. (1967) "The Ocean as a Chemical System" *Science*, v.156, p.1189-1197.

[2] Goldstein, S.L. and Hemming, S.R. (2003) "Long-lived isotopic tracers in oceanography, paleoceanography, and ice-sheet dynamics" In: Holland, H.D., Turekian, K.K. (Eds.), *Treatise on Geochemistry*. Pergamon, Oxford, pp.453-489.