**Goldschmidt 2000**
**September 3rd–8th, 2000**
**Oxford, UK.**

**Journal of Conference Abstracts**
**Volume 5(2), 411**


# Neogene Pb- and Nd-Isotope Composition of a Mn Nodule from the South Pacific Ocean

**Norbert Frank**[1], **Gary Hemming** (hemming@ldeo.columbia.edu)[2] &
**Steven Goldstein** (steveg@ldeo.columbia.edu)[2]

[1] Heidelberger Akademie der Wissenschaften, INF229, Heidelberg, 69120, Germany
[2] Lamont Doherty Earth Observatory, Columbia University, Palisades, 10964 NY, USA

Pb- and Nd- Isotopes of hydrogenous ferromanganese deposits monitor past ocean circulation, chemistry, and variations of continental weathering through time. We investigated hydrogenous manganese nodule DK143 (42ºS, 148ºW, ~5000m depth) from the South Pacific Ocean to determine the isotopic variability of Pb and Nd since the Miocene (ca. 12Ma). This nodule was chosen because it is located in the western side of the tongue of Antarctic bottom water (AABW) incursion into the deep Pacific today. The nodule has an almost constant growth rate of 4 mm $myr^{-1}$ determined by $10Be_{exc}$ (Segl et al. 1989), consistent with a constant Co-flux (with variability less than 9%). At ~ 6 million years a detrital rich layer, likely a strong nepheloid-derived layer, separates an inner zone of concentric detritus rich layers with Mn/Fe ratios ~ 1.2 from the outer zone of fine laminar layers of more hydrogenous origin having Mn/Fe ~ 1. At ~ 3 million years there is a second major detrital layer. $\varepsilon_{Nd}$ = -7.1 throughout the past 12 million years, which is similar to values obtained from Indian ocean and Circum-Antarctic ferromanganese deposits (Albarede et al. 1997), but more radiogenic than modern Antarctic bottom water having $\varepsilon_{Nd}$ = -8.5 (Jeandel 1993). This constancy is astonishing as the Nd-flux exhibits a two-fold increase between 6 and 3 million years, indicating greater Nd-input, recycling or decreased scavenging in the water column above. Also, Ce/Nd ratios indicate a synchronous two-fold decrease that may be attributed to increased deep water ventilation or a change of circulation. In contrast to the constant $\varepsilon_{Nd}$ values, Pb isotope ratios display a systematic change between 6 and 3 million years. However, the total range of Pb isotope ratios measured in DK143 agrees well with values measured on surface samples of Mn nodules from the Southern Ocean (Abouchami et al. 1995). Prior to 6 million years, Pb isotope ratios of the South Pacific Ocean were separated from the North Pacific. Since then, the South Pacific has successively become more North Pacific like (Figure 1). Mangini et al. (1990) explained the growth history of the nodule assuming that its growth was initiated at 14.5Ma with the expansion of the Antarctic Ice Sheet. This led to an increase in bottom-water circulation and a substantial raising of the CCD in the Pacific. A terminal Miocene event dated at 6.2Ma has been inferred from a $\delta^{13}C$ shift in foraminifera and is presumed to mark a change in the global circulation pattern. This date marks a number of global events, such as the closure of the Panama gateway, the expansion of the West and East Antarctic Ice Sheet, a lowering of sea level, and an increased production of biogenic silica in the Southern Ocean (Mangini et al. 1990, and references therein). An increase in biogenic silica production would probably yield a higher flux of surface-borne Nd and Pb to the deep water in which the nodule bathes. The textural change of the nodule, towards less detrital rich layers beyond 6.2Ma, indicates slower bottom water currents. This could be due to a slow down of AABW production as a result of the expansion of the West and East Antarctic Ice Sheets. Therefore, the influence of Pacific like water would increase, consistent with the change in Pb isotope ratios.

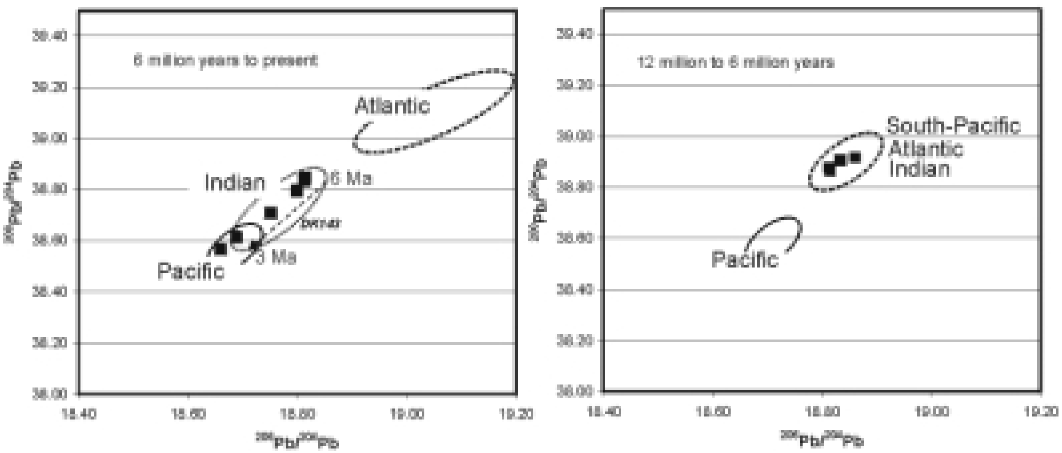


Figure 1: Pb isotope ratios of ferromanganese nodule DK143. Circles reflect Pb isotope ratios measured on ferromanganese crusts from Pacific, Indian Ocean, and Atlantic.

**Journal of Conference Abstracts**
**Volume 5(2), 412**


Segl M, Mangini A, Beer J, Bonai G, Suter M & Woelfli W, *Paleoceanography*, **4**, 511-530, (1989).
Abouchami W & Goldstein S, *Geochim. Cosmochim. Acta*, **53**, 1809-1820, (1995).
Albarede F, *Science*, **277**, 908-918, (1997).
Jeandel C, *Earth Planet. Sci. Lett.*, **117**, 581-591, (1993).
Mangini A, Segl M, Glasby G, Stoffer P & Plueger W, *Mar. Geol.*, **94**, 97-107, (1990).