Hf-Nd isotopes of Chile Ridge Basalts, Evidence of Pelagic Sediment in the MORB mantle

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The Chile Ridge (CR) in the southeast Pacific is one of the few places on Earth where an active mid-ocean ridge system is currently subducting under the South American continent. Therefore, CR lavas provide an unprecedented opportunity to understand the interaction between the subduction and ridge processes. Some earlier studies [1, 2, 3, 4] have reported that CR lavas display a wide range of chemical compositions from D-MORB to E-MORB and some carry an unusual "arc like" signature (low Ce/Pb-low Nb/U ratios)- the only example in the global MORB dataset. Some of these compositional variations are explained by incorporating an arc component flowing from the adjacent Andean mantle wedge (CR segment 1) and some are explained by ancient recycled material (CR segment 3) [1, 2]. To better constrain the nature of mantle heterogeneity, here we present new Hf and Nd isotope ratios of the CR lavas covering the full spectrum of trace element variability. The εHf and εNd display a large range (5.5 to 16.9 and -1 to 11.3, respectively) extending from a Pacific mantle to an enriched mantle, consistent with the previously published trace element and Sr-Nd-Pb isotope data. In εHf-εNd plot CR lavas are highly correlated (R^2=0.94, n=19) and extend to unradiogenic values that distinctly plot above the mantle array with a Δ εHf of up to 7. Moreover, the CR lavas array has a slope of 0.88, which is much shallower than that of mantle array (1.59) [5]. To the best of our knowledge this is the first report of any MORB array with such a shallow slope on an εHf-εNd diagram [6]. This suggests that the Hf-Nd isotope variability of the CR lavas is controlled by an unradiogenic Hf-Nd component that distinctly plots above the mantle array. Pelagic sediments carry this geochemical signature with a high Lu/Hf that decouples from the mantle array. Therefore, we suggest that combined Hf-Nd isotopes of CR lavas indicate the presence of pelagic sediment component. Furthermore strong positive correlation between Hf isotope and Ce/Pb-Nb/U-Th/La-Cs/Nb ratios of CR lavas is consistent with the sediment involvement in the CR magmatism.

[1] Klein and Karsten (1995) *Nature*. [2] Karsten et al., (1995) *Lithos*. [3] Sturm et al, (1999) *JGR*. [4] Bach et al., (1996) *EPSL*.[5] Chauvel et al., (2008) *Nature*. [6] Salters et al., (2011) *G-cubed*.