Boron isotopes in hydrothermally altered rocks from the Manus basin

L. E. M. SCHLICHT[1*], S. A. KASEMANN[1], A. MEIXNER[1], W. BACH[1]

[1]University of Bremen, Klagenfurter Straße 2, 28359 Bremen, Germany (*correspondence: lucy.schlicht@uni-bremen.de, kasemann@uni-bremen.de, meixner@uni-bremen.de, wbach@uni-bremen.de)

The mass exchange between oceanic crust and seawater in hydrothermal systems impacts seawater chemistry, the composition of altered crust, and mantle chemistry once the altered crust is getting subducted. Most published studies focus on hydrothermal systems in mid-ocean ridge (MOR) systems. Indeed, about 30 % of the known hydrothermal active fields occur in back-arc basin (BAB) and intra-oceanic arc settings that show significant differences in terms of rock types, alteration processes and greater fluxes of magmatic volatiles than MOR systems.

In this study, we investigated altered rocks from the Manus BAB (ODP Leg 193, Hole 1188) to trace alteration processes of the crust by using boron (B) contents and boron isotopes ($\delta^{11}B$). Yang & Scott [1] suggested that a significant portion of the base metals in BAB systems may be derived from uprising magmatic fluids. The occurrence of bleached, acid-sulfate altered rocks and the composition of vent fluids in the Manus Basin also hint at an influence of magma degassing [2]. In addition, the basement features chlorite-magnetite altered rocks, indicative of alteration by seawater-derived fluids. We examined both bleached and chloritized rocks to determine the sensitivity of B for different sources of fluids (i.e., seawater versus magmatic fluids).

The data show that all altered rocks have lost B to the interacting fluids. The $\delta^{11}B$ values range from 5.0 to 23.2 ‰, and the highest values are found in the chlorite-magnetite altered rocks, indicative of a seawater origin of the alteration fluids. The bleached rocks tend to have high B contents and are isotopically similar to the fresh rock, consistent with a higher proportion of magmatic fluids involved in this alteration type. Mass balance constraints point to that, regardless of the fluid source, the basement must have undergone enrichment in ^{11}B previous to hydrothermal alteration. This enrichment is most likely the result of low-T alteration prior to the establishment of hydrothermal activity.

[1] Yang & Scott (1996) *Nature* **383**, 421-423. [2] Reeves *et al.* (2011) *GCA* **75**, 1088-1123.