Slab dehydration across the Mariana arc as traced by melt inclusions

Award: 06-46869, 06-46694 (March 2007)

A. Shaw[1], E. Hauri[2]

[1] Woods Hole Oceanographic Institution; [2] Carnegie Institution of Washington;

Volatile, major and trace element data for olivine-hosted melt inclusions from submarine cross chain Izu-Bonin-Mariana volcanoes yield new insights to the dehydration process in a relatively cool subduction regime. Results show that there is a strong decoupling of water and slab fluid tracers such as Ba/La and B contents, beyond the main arc system. As might be anticipated, trace element enrichments generally associated with the subducting slab show a systematic decrease across the arc into the back-arc. However, water contents in cross-chain samples, 230 km above the subducting slab, show similar values to the arc-front samples, implying that water release is a continuous process across the arc. This finding is consistent with experimental results (Schmidt and Poli, 1998)* and melt inclusion studies across the Central American arc (Walker et al, 2003)*. In contrast to H_2O contents, we observe significantly higher CO_2 contents in the cross chain samples as compared to the arc samples, suggesting either enhanced decarbonation at depth, or that the cross chain samples have experienced less degassing. This work has important implications since our observations show that fluid release can be substantial behind the main volcanic front and that a re-evaluation of the common use of slab-fluid tracers is clearly needed.

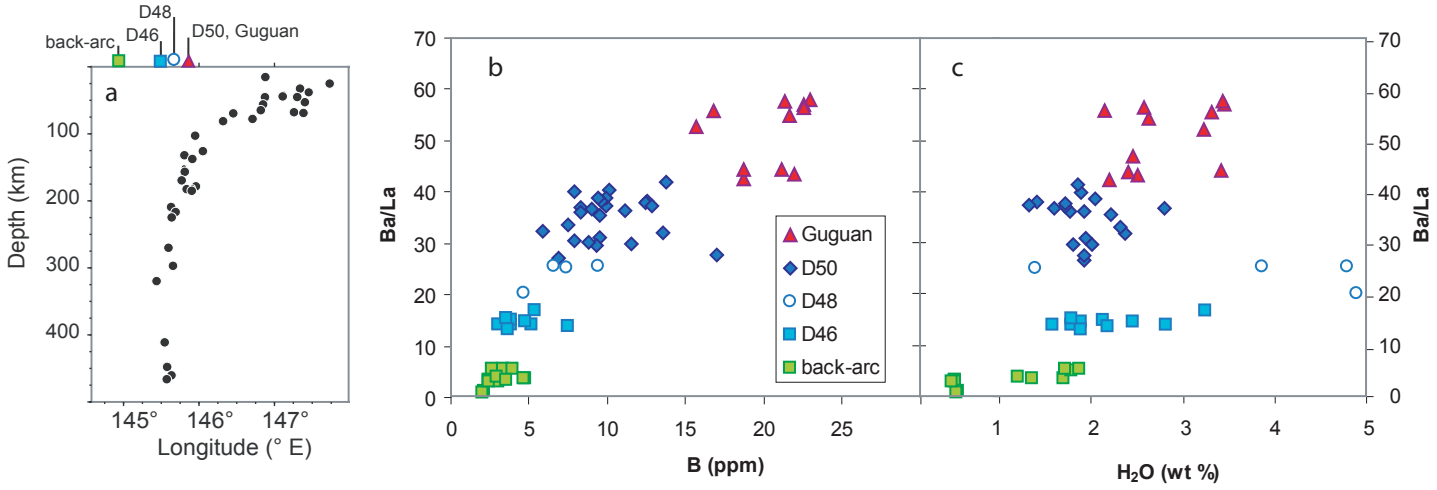

Figure: a) cross-sectional view of the central Mariana subduction system, showing the locations of the Guguan cross chain volcanoes, b) Common fluid proxies such as Ba/La and B measured in Mariana cross-chain melt inclusions show a systematic decrease from the arc (Guguan volcano) to the back-arc, where values are similar to the typical MORB range, c) Water contents of melt inclusions remain relatively high across the arc and are not well correlated with slab fluid proxies

 *References listed in appendix A.