The Development of a Subduction Channel Serpentinite Reservoir: Insights from IODP Expedition 366 Recovered Solids and Fluids

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Geochemical exchanges between the downgoing plate and mantle wedge start in the earliest stages of subduction. IODP Expedition 366 recovered fluids and solids from three additonal serpentinite seamounts in the Mariana forearc, expanding our sampling of these unique, subduction channel-derived materials in terms of distance to trench and inferred depth to slab [1].

Porefluids recovered from the five sampled Mariana forearc seamounts (Yinazao (13 km depth-to-slab), Fantangisna (15 km), Asut Tesoru (18), S. Chamorro (18) and Conical (19)) show marked changes with slab depth. Shallow seamount fluids have very low B, K, Rb and Cs contents and high Sr and Ca. Deeper seamounts show 100-1000 fold enrichments in heavy alkali metals and B, with dramatic decreases in Sr and Ca. These depth-related changes correlate with clay breakdown and carbonate dissolution in the downgoing plate at inferred slab T°≥200°C [2].

Associated serpentinite solids (muds and entrained clasts) do not record the abrupt concentration changes seen in the porefluids. B, Cs, and As show gradual increases from shallow to deep seamounts, and other elements show variations that contrast with patterns in the fluids. (e.g., lower/less variable Rb and Sb in deeper seamounts). Differences between the serpentinites and their porefuids reflect the varied serpentine/fluid D's of the mobile elements, as well as changes in these $D^{serp/fluid}$ values with temperature (e.g., B, Li). What develops is a subduction channel reservoir with a distinct inventory of mobile trace elements related primarily to serpentine/fluid equilibria, and only secondarily to fluid/rock exchanges on the slab.

[1] Oakley, 2008; [2] Hulme et al, GCubed, 2010.