

Compositional Variability in Serpentinite Solids, IODP Expedition 366: Insights into a Developing Subduction Channel

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Recovered rocks and sediments from IODP Expedition 366 sites include serpentinite muds, serpentinized ultramafic rocks, and altered mafic and sedimentary rocks. In terms of major and compatible trace elements (Mg, Fe, Al, Si; Mn, Ni, Cr), serpentinites from Yinazao, Fantangisna and Asut Tesoru seamounts are similar to those encountered during ODP Legs 195 and 125 (S. Chamorro and Conical Smts.) in reflecting depleted mantle protoliths. However, for elements mobile in Mariana forearc porefluids, the samples are highly variable.

Yinazao summit (Site U1492) samples are high in Ca and Sr, consistent with their enriched (7-10x seawater) porefluids. These samples and fluids are in thermodynamic equilibrium with gypsum, which occurs as an abundant precipitate in several core segments. Asut Tesoru Site U1496 summit samples have elevated Na₂O, consistent with the very high pore fluid Na concentrations (>700mM Na) from this Site.

As seen in past ODP Legs, all Exp. 366 serpentinite muds have elevated CaO and Al₂O₃, consistent with the presence of a mafic/sedimentary component. However, the summit Site muds also show substantial enrichments in elements high in their entrained pore fluids, the compositions of which appear to vary with slab metamorphic conditions (e.g., Hulme et al 2010). The Mariana serpentinite muds thus comprise a developing reservoir of "fertile" hydrated ultramafic materials forming near the slab-mantle interface starting at very shallow (13-19 km) depths, that reflect both the evolving metamorphic state of the downgoing plate, as well as (potentially) its along-strike variability (e.g., Pearce et al 2005).