Variability of As and other fluid-mobile trace elements (FME) in Mariana forearc serpentinites and entrained crustal rocks

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In the Mariana subduction system, active serpentinite mud volcanoes are associated with the subduction of the Pacific plate beneath the Philippine Sea plate in a non-accretionary convergent plate margin. We are examining the systematics of As and other fluid-mobile trace elements (FME: Cs, Rb, Sr, Pb, Sb, Tl, Mo) in serpentinized ultramafic clasts, serpentine muds, and entrained crustal rocks recovered during IODP Expedition 366 and previous ODP Legs (125, 195) to constrain the role of slab-derived fluids to gauge P-T° conditions at which fluids are mobilized.

The three different seamount summit sites examined show marked mobile element abundance differences, with Yinazao and Fantangisña serpentinites generally showing lower As, Cs, Sb, and Rb, and higher Sr and Pb contents than those from Asùt Tesoru. Tl levels were similar at all sites sampled. With respect to differences in FME concentrations between clasts and muds, variability was pronounced. Clasts generally contained higher concentrations of As, Sb, and Tl, than muds regardless of depth to slab. Cs concentrations were higher in muds in samples collected from Yinazao and Fantangisña, while lower in samples from Asùt Tesoru and South Chamorro. Entrained mafic clasts are as high or higher in FME than the serpentinites, perhaps pointing to greater affinities for many of these elements during fluid-rock exchange.

Asùt Tesoru serpentinites are similar in As, Cs, Sb, Pb, Sr, and Rb abundances to those from S. Chamorro and Conical seamounts, which also reflect greater depths-to-slab (18 and 19 km, respectively). The patterns of serpentinite FME abundances from seamount to seamount mimic to a great degree the dichotomy in cation abundances observed in their associated porefluids, where B and K are markedly lower, and Sr and Ca are markedly higher in Yinazao summit fluids than at the summits of Asùt Tesoru, S. Chamorro, or Conical. These abrupt changes in serpentinite and fluid compositions likely reflect the initiation of carbonate and clay breakdown reactions on the downgoing plate in the earliest stages of subduction metamorphism.