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Serpentinite Mud Volcanism and Exhumation of Forearc- and Lower Plate Material in the Mariana Convergent Margin System (IODP Expedition 366)

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Serpentine seamounts located in the forearc region of a subduction zone represent an excellent natural laboratory for studying the geochemical processes acting along convergent plate margins as well as the forearc structure and the related fault patterns. Active serpentinite mud volcanoes are currently restricted only to the Izu-Bonin-Mariana system, where old (presumably Cretaceous) oceanic lithosphere is subducting in the absence of an accretionary prism.

IODP Expedition 366 recovered cores from three serpentinite mud volcanoes at increasing distances from the Mariana trench (Yinazao, Fantangisña and Asùt Tesoro). Most of the material consists of serpentinite mud containing lithic clasts from the underlying forearc crust and mantle as well as from the subducting Pacific plate. Pelagic sediments and volcanic ash deposits underlying the mud volcanoes were also recovered. Recycled materials from the subducted slab are found at all three mud volcanoes and consist of metavolcanics, metamorphosed pelagic sediments including cherty limestone as well as fault rocks.

Preliminary investigation of lithic clasts from the furthest Asùt Tesoro Seamount revealed metavolcanics as well as serpentinized ultramafics with well-preserved primary mineral assemblages containing olivine, orthopyroxene and spinel.

Recovered clasts from the summit of the adjacent Fantangisña Seamount contain mainly sedimentary rocks of probable Pacific plate provenance. These consist of red cherty limestone breccia, red shale and mud-siltstone transected by a network of carbonate veins. In contrast, recovered material from the flank shows a wider variety including ultramafic rocks with various degrees of serpentinization and matrix composed of mesh and bastite textures, mafic metavolcanics as well as low-grade metasediments (cherty limestones). Interestingly, garnet with andradite composition occurs throughout the matrix of the ultramafics, indicating serpentinization temperatures of at least 225 °C.

Petrological analysis of metabasalt clasts from the flank of Fantangisña shows changes in the mineral composition within the different core intervals. The composition of clinopyroxene varies between aegirine-augite and omphacite, but augite and diopside are also present. The presence of phengite with Si content of up to 3.5 a.p.f.u. as well as the Na-content in pyroxene indicate minimum pressure of 0.7 GPa at ~250 °C. Additionaly, this estimation is supported by the

presence of prehnite, chlorite and pumpellyite.

Furthermore, providing a detailed characterization of the fluids composition and transport would allow the better constraining of the tectonic and metamorphic history as well as the physical properties of the subducting Pacific Plate. Additional data on that will be presented.