Characterizing fluid-rock interaction in the lower gabbros from Hess Deep

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The Integrated Ocean Drilling Program (IODP) Expedition 345 sampled lower crustal primitive gabbroic rocks that formed at the fast-spreading East Pacific Rise (EPR) exposed at the Hess Deep Rift. The metamorphic assemblages in the rocks recovered at Site U1415 record the cooling of primitive gabbroic lithologies from magmatic (>1000°C) to zeolite facies conditions (<200°C) associated with EPR spreading, Cocos-Nazca rifting and seafloor weathering. Alteration is dominantly low-grade greenschist (<400°C) and subgreenschist facies (<200°C) alteration of olivine to talc, serpentine, or clay, and commonly accompanied by prehnite microveins. Alteration intensity varies with igneous lithology, in particular, the modal abundance of olivine, as well as proximity to zones of cataclasis. We have investigated the extent of isotopic exchange associated with hydrothermal interaction and present a record of variations in O and Sr isotopic compositions in altered rocks from the lower plutonic crust at Hess Deep. The $^{87}Sr/^{86}Sr$ isotopic compositions of olivine gabbros (Mg# 0.81-0.89) range from 0.702536-0.703364 (±0.000008). Higher $^{87}Sr/^{86}Sr$ ratios are strongly correlated with percentage of hydrous minerals, and are higher in samples with a greater modal abundance of olivine. These rocks have somewhat higher $^{87}Sr/^{86}Sr$ ratios than upper plutonic rocks from the Northern Escarpment at Hess Deep (Kirchner and Gillis, 2012), although their percentage of hydrous phases is apparently similar.