

A Whole Rock Strontium Isotopic Profile Through an Intact Section of Upper Oceanic Crust: ODP Site 1256

Details

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Index	Mid-oceanic ridge processes [8416]
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Abstract

Deep drilling at Site 1256 provides the first complete sampling of intact upper oceanic crust down to gabbros. Hole 1256D currently penetrates 1257 meters into 15 M.yr-old crust formed at the East Pacific Rise ocean crust during an episode of superfast (200 mm/yr) spreading, encountering 810 m of lavas overlying a thin (346 m) sheeted dike complex. A plutonic transition zone comprises the lower 100 m of the hole with two gabbroic bodies intruded into contact metamorphosed dike screens. Strontium isotopes are a sensitive tracer of seawater-basalt hydrothermal exchange because end-member signatures are well established and Sr concentrations in seawater and basalts are similar. Leaching experiments of weakly altered basalts reveal a primary $^{87}\text{Sr}/^{86}\text{Sr}$ of 0.7028. There is only a limited range of Sr-isotopes through out the lava sequences from primary igneous values up to 0.7038, with no systematic trends with depth or morphology. Rare breccias and alteration patches yield more elevated ratios (0.704 to 0.7075). A very wide range of Sr-isotopic ratios (0.703 to 0.706) is displayed at the narrow lava-dike transition (754 to 810 m sub-basement, (msb)) particularly within a thin horizon of silica and pyrite mineralized hyaloclastite breccia, indicating a zone of mixing between downwelling seawater and upwelling hydrothermal fluids. The sheeted dikes of Hole 1256D exhibit greater Sr exchange than the overlying lavas with ratios elevated to between 0.703 and 0.705. The granoblastic diabase, that make up the lower 50 m of the dike section, show a more limited range of Sr-ratios, mostly clustering around

0.7031 to 0.7036. The dike-gabbro boundary is marked by a sharp increase in $^{87}\text{Sr}/^{86}\text{Sr}$ values up to 0.704 reflecting the intense hydrothermal alteration observed. Below this the upper gabbro body yields a limited range of $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of 0.703 to 0.7036. The contact between the dike screen and the lower gabbro body also shows a marked increase in $^{87}\text{Sr}/^{86}\text{Sr}$ to 0.705. Analyses of epidote indicate that the Site 1256 hydrothermal fluids had $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of 0.7052.

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