

Na-Ca Amphibole and Aenigmatite assemblage, evidence of contamination of a mafic magma by volatile elements during sill emplacement.

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Processes and proxies tracking the magma's journey through the Earth's crust (melting source, transport and crystallization of the magma) are relatively well constrained, except at the shallowest levels, where assimilation of volatile-rich sediment may occur. This study, based on samples collected during IODP Expedition 385 in the Guaymas Basin, aims to understand the effects of sediment and fluid assimilation on the magma differentiation. For that, we studied a 76 m mafic sill emplaced at 356 m below the seafloor, intruding water-rich siliceous oozes. The sill has a basaltic texture at the margins to doleritic at the sill center, it has a basaltic composition and contain plagioclase phenocrysts, plagioclase-pyroxene microlites and minor olivines. The sill edges also contain micas. In the core of this sill, layers with a gabbroic texture and high porosity have been described. This textural change is associated with heterogeneity of chemical composition and mineralogical changes. Our geochemical study of major and trace elements, combined with petrological observations, highlight the enrichment of elements such as Na, Hf and Zr in the gabbroic zones. Furthermore, the primary magmatic assemblage was destabilized to form an assemblage of Na-Ca amphiboles, aenigmatite and Na-plagioclase. This secondary mineralogical assemblage indicates contamination by a fluid from the sediments into the sill. Thermodynamic modeling was used to constrain the effect of contamination and volatile elements on magma crystallization.