Melt migration and interactions in the lower oceanic crust: insights from Atlantis Bank interlayered series at IODP Hole U1473A (Southwest Indian Ridge)

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Layered portions of gabbros were described at slow-spreading environments in at least two different Oceanic Core Complexes (OCC), which are interpreted as exhumed portions of lower crust at the ridge axis. Two ODP-IODP Holes drilled into the Atlantis Bank OCC (SW Indian Ridge) present locally such features, which provide essential insights on melts migration and evolution during accretion. We combined petrographic observations with high-resolution microstructural quantifications (EBSD), whole rock and *in situ* geochemical analyses (major and trace elements) to decipher the different events that lead to the formation of a 1.35 m-long plastically undeformed section sampled at 593 mbsf in IODP Hole U1473A. The layering is defined by grain-size variations in olivine-gabbro series, representative of the other structures found in the Hole; the nature of the layer contacts, together with textures and fabrics indicate their formation by the intrusion of a crystal-bearing magma (fine-grained) into a solidifying mush (coarse-grained). In situ geochemical data highlight a complex interplay between different stages of crystallization and crystal-melt reaction events. At the contacts between the two main lithologies, mineral compositions of the coarse-grained solidifying mush are chemically homogenized by mixing with the intruding crystal-bearing magma. Microstructural observations, together with incompatible elements enrichments indicate that both materials record reactive porous migration of a melt that modified the pre-existing minerals chemistry. This migration is locally channelized in texturally modified fine-grained areas. Altogether, the two identified main processes of melt migration within the slow-spread lower crust by porous or focused flow, trigger significant changes in rock and minerals compositions. Those two key processes should therefore be carefully considered when quantifying the accretion of igenous systems in oceanic settings.