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Formation and evolution of a magma reservoir at a slow-spreading center (Atlantis Bank, Southwest Indian Ridge)

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The heterogeneous presence of ephemeral magmatic systems below the ridge axis and their complexity mostly account for the heterogeneous character of the oceanic crust accreted at (ultra) slow-spreading ridges. In order to better understand the magmatic processes involved in slow-spreading lower oceanic crust formation, we studied a drilled section of an oceanic core complex (OCC) interpreted as an exhumed portion of lower crust close to the ridge axis. We focused on ODP Hole 735B which presents the most primitive lithologies sampled at Atlantis Bank OCC (Southwest Indian Ridge) in a ~250 m thick section previously interpreted as a single crustal intrusion.

We combined detailed structural and petrographic data with whole-rock and *in situ* mineral analyses to determine the processes of emplacement and differentiation of melts within this section. The lower half of the unit is comprised of alternating troctolites and olivine gabbros showing intrusive contacts, and both magmatic and crystal-plastic fabrics. Such features are lacking in the upper half, rather uniform, gabbroic sequence. Whole-rock compositions highlight the cumulative character of both lower and upper units, and a great compositional variability in the lower sequence, whereas the upper sequence is rather homogeneous and differentiates up-section. *In situ* analyses of mineral phases document magma emplacement processes and provide evidence for ubiquitous reactive porous flow during differentiation. Comparison between both units' geochemistry also led us to strongly favor a model of formation of the reservoir that genetically links melts from the lower and the upper unit.

We show that the whole section, and related geochemical units, likely constitutes a single magmatic reservoir, in which the lower unit formed by emplacement of primitive sills related to the continuous recharge of primitive melts. Recharge led to partial assimilation of the crystallizing primitive mush, and related hybridization with interstitial melts. Hybrid melts were progressively collected in the overlying mushy part of the reservoir (upper unit), whereas the sills' residual melt differentiated by reactive porous flow processes under a predominantly crystallization regime.

Similarly, hybrid melts' evolution in the upper unit was governed by upward reactive porous flow and progressive differentiation and accumulation of evolved melts at the top of the reservoir. Our results provide the first integrated model for magma reservoir formation in the lower slow-spreading oceanic crust, and have potential implications regarding the lower crust structure and the composition of MORBs.