Voluminous Melt-rich Magmatic Reservoir Beneath Mayotte Island

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Résumé

The nature of crustal magmatic reservoirs is elusive since they cannot be sampled in situ. The historical view of magma chambers containing the eruptive materials has recently been replaced by a notion of reservoirs being mostly filled by immobile solid materials with minute fraction of mobile melts; the so-called magmatic mush. Eruptions are likely if a significant portion of melt segregates within the mushy reservoirs. This implies that melts and crystals have different magmatic histories, and questions the analogy between plutonic and volcanic rocks. This is however a default model essentially justified by the absence of clear geophysical signatures of melt-rich magma chambers, and by the rare and tentative estimations of the melt fraction in the crustal storages based on geochemical and textural analyses of eruptive products. Here, we provide a clear electrical conductivity imaging of a magmatic reservoir beneath Mayotte island that we interpret with new laboratory measurements on Mayotte's melt conductivity. We provide evidence for a large magmatic reservoir (> 200 km3) containing high melt fraction (25-50%) at 22±2 km bsl. This crystal to liquid ratio matches the reconstructed differentiation paths conducive to phonolitic and phono-tephritic melts that recently erupted at Mayotte and must be still lurking in this reservoir. The development of intra-crustal voluminous melt-rich magma chambers, so far merely predicted in numerical models involving high magma intrusion rates, is thus proven.

Mots-Clés: Reservoir magmatique, stockage magmatique, conductivité électrique

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