EGU21-2797
https://doi.org/10.5194/egusphere-egu21-2797
EGU General Assembly 2021
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Time-window into the transcrustal plumbing system dynamics of Dominica (Lesser Antilles)

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A transcrustal mush system has been recognized beneath Dominica (Lesser Antilles) with different magma ponding zones that generated a series of pumiceous eruptions from Morne Trois Pitons–Micotrin volcano. Here, the latest, large, pumiceous eruption (Grand Fond - 24 kyrs cal BP) and four, smaller, Plinian eruptions (18-9 kyrs cal BP) are investigated. Pre-eruptive magma dynamics within the mush are unraveled through orthopyroxene phenocrysts by combining a Crystal System Analysis approach (on unzoned and zoned orthopyroxenes) and timescale estimates derived by intracrystalline Fe-Mg interdiffusion modeling. Two magmatic environments are recognized in the mush and have mixed, more or less vigorously, before the successive eruptions. Few interactions between the two magmas began 15-34 years prior to the small Plinian eruptions, but the sustained mixing occurred in the last 2 years. This contrasts with longer timescales (2-80 years) obtained for the larger eruption of Grand Fond with magmas stored deeper. These magma mixing timescales have significant implications for volcanic risk mitigation, with a growing reactivation signal that could be registered at the surface few years prior to the eruptions.