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Progressive carbonatite-rock interactions recorded in magmatic cumulates from Santo Antão (Cabo Verde).

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We present analyses on a suite of cumulates hosted in nephelinite from the island of Santo Antão, the northwesternmost island in the Cabo Verde Archipelago. The suite presents large variations in composition and mineralogy. The most MgO-rich sample (28 wt% MgO) is mostly composed of phlogopite, olivine, kaersutite and titanomagnetite. The most MgO-poor sample (5.8 wt% MgO) is dominated by clinopyroxene (cpx), kaersutite, titanomagnetite and haüyne.

Olivines have intermediate forsterite (~ Fo_{84}) a nd Ca (1700-2000 ppm), low Ni (< 600 ppm), and very high Mn (up to 5600 ppm) contents. To our knowledge, such olivine compositions have not been documented in lavas from Santo Antão [1] or elsewhere.

The mineral chemistry of the cumulates shows similarities with inclusions found in ultramafic lamprophyres (UML): the olivine Fo and Ni contents, and the Ti/Al ratios of the cpx and phlogopite fall in the field defined by the Aillik cpx-phlogopite inclusions [2]. UML are interpreted as resulting from the melting of carbonate-phlogopite veins and subsequent interactions with surrounding peridotite [3]. However, the olivine extreme Mn enrichment is not consistent with large amount of residual phlogopite in the source [4].

Alternatively, the evolution of the mineral assemblage is similar to the evolution in reaction domains observed at the contact between ultramafic massif and carbonatite [5]. These domains have been interpreted as resulting from the assimilation of silicate igneous rock by carbonatite magma. Olivine present in these domains are also Mn-rich and Ni-poor, but are characterized by high forsterite content (>Fo_{88}).

We will test and discuss the implications for two models of formation: (A) a mantle model in which the suite represents progressive fractionation of a melt produced by melting of a phlogopite-poor dunite formed during the reaction of the peridotitic mantle with percolating carbonatite. (B) A crustal model in which cumulates are impregnated in situ by a carbonatitic magma, resulting in the progressive dissolution of pyroxene and crystallization of phlogopite + olivine.

[1] Barker et al. (2014), 10.1007/s00410-014-1052-0; [2] Tappe et al. (2006), 10.1093/petrology/egl008; [3] Rooney et al. (2020), 10.1007/s00410-020-01694-0; [4] Förster et al. (2018), 10.1016/j.chemg eo.2017.11.039; [5] Chmyz et al. (2022) 10.1016/j.lithos.2022.106647