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Characterization of the magma storage system of Fogo Volcano, Cape Verde archipelago: insights from fluid inclusions in olivine and clinopyroxene crystals.

FRANCESCO MARIA MARIA LO FORTE[1], VITTORIO ZANON[2], PROF. ALESSANDRO AIUPPA[3] AND SILVIO G. ROTOLO[1,4]

[1]Università degli Studi di Palermo

[2]Centro de Vulcanologia e Avaliação de Riscos Geologicos

[3]University of Palermo, Dipartimento di Scienze della Terra e del Mare

[4]Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Palermo

Presenting Author: francescomarialoforte@gmail.com

The magma storage system of Fogo Volcano, Cape Verde archipelago, was characterized by petrological, geochemical, and fluid inclusion studies.

The analysed samples span the last 120 ky of activity, and include 3 extra-caldera samples (~120 ka, ~60 ka, and ~10 ka) and 12 intra-caldera samples from 8 different eruptions (~ 10 ka, 1664, 1785, 1799, 1852, 1951, 2014-15 and between 15th and 1785). The samples range in composition from clinopyroxene and olivine-rich basalts to basanite-phonolite.

Fluid inclusions hosted in olivine and clinopyroxene crystals consist of pure CO_2 (Tm = -56.6 ± 0.1 °C). Based upon their textural characteristics, we rank them into early and late stage inclusions.

Early-stage inclusions are isolated or in a small cluster, and their texture often shows evidence of partial density re-equilibration. There is no evidence of volume stretching and/or leaking. Late-stage inclusions form trails that heal crystal fractures and have experienced volume stretching and/or leaking.

Inclusions homogenized to a liquid phase in a range of temperatures from 2.8 to 30.8 °C. Density values were recalculated accounting for a 10% H_2O content at the time of trapping. The early presence of water is confirmed by frequent occurrence of Mg-calcite and/or dypingyte in the inclusion cavities, as identified by Raman micro-spectroscopy. Recalculated densities range is 0.561-0.952 g/cm^3 (260-730 MPa) for extra-caldera olivines; while they span 0.543-0.885 g/cm^3 (245-640 MPa) for intra-caldera olivines and 0.543-0.7100 g/cm^3 (250-420 MPa) clinopyroxenes.

The interpretation of barometric data reveals three distinct magma storage zones located at depths of ~24 km, ~14-21 km, and ~10 km. The two deepmost zones are located within mafic cumulates of the lower crust, the shallowest is nearby the seismic Moho.