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Volatile contents in alkaline magmas from Tenerife, Canary Islands: insights from melt inclusions.

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Effusive and mildly explosive mafic monogenetic volcanism has predominated over felsic eruptions during the historical and recent period (last 2000 years) at Tenerife (Canary Islands). Consequently, this is the most likely volcanic activity expected in the near future and therefore, it is crucial to have a better understanding of the storage conditions, ascent mechanism and degassing paths of this eruption type. For this purpose, the study of olivine-hosted melt inclusions (MI) is a powerful tool for providing direct information on the composition, physicochemical parameters (P, T, Æ'O_2 and volatiles) and evolution during the storage and ascent of these primitive magmas. By combining this information with knowledge on H_2O and CO_2 solubility [1], MI volatile concentrations are then used to calculate minimum entrapment pressures and thus, provide constraints on the structure of the magma plumbing system and degassing patterns. Unfortunately, to date, this information remains poorly constrained for mafic magmas at Tenerife and the Canary Islands in general.

Volatile contents, as well as major and trace element concentrations of MI hosted in olivines from tephra samples of three monogenetic mafic eruptions that occurred along the NE rift system of Tenerife, have been analyzed. MIs are mainly hosted in three dominant olivine populations with high (84-87), medium (80-82) and low (78-80) forsterite contents, although a more primitive group is also identified (Fo 89-91). Overall, melts exhibit remarkably high and variable volatile contents with maximum dissolved concentrations of 2.3 wt.% H_2O, 9435 ppm CO_2, 4810 ppm F, 5510 ppm S and 1388 ppm Cl. The ratios of volatiles to similarly incompatible non-volatile trace elements such CO_2/Nb and H_2O/Ce suggest that MIs have undergone differential degassing, which together with their chemical variability provide evidence for a heterogeneous and volatile-rich mantle source. Entrapment pressure estimates show that primitive magmas rising from 20-25 km depth are storage at two main crustal levels (9-13 km and 6-9 km), followed by dyke injection, ascent and degassing at P <= 200 MPa (6-1.5 km).

[1] Jiménez-Mejías et al. (2021) CR GEOSCI 353, 289-314.