

Figure S7: Microanalysis of melt inclusions: Preparation and Data processing

Carbon and water in double-faced polished glass inclusions were analyzed by transmission IR spectroscopy using a Hyperion 1000/2000 microscope (Bruker), equipped with a Tensor 27 IR source (Bruker), an MCT detector cooled with N₂ and a MIR glass beam splitter (*Laboratorio de Fluidos Corticales*, Gilles Levresse, UNAM, Juriquilla).

Volatile's concentration was calculated according to the Beer–Lambert Law $C = MA / p d \epsilon$:

M is the molar mass (g/mol);

A is the absorbance of the band of interest;

p is the room temperature density of the glass (g/L);

d is the thickness of the glass inclusion (cm⁻¹);

ε is the molar absorption coefficient (absorptivity (L / mol · cm).

Preparation: Olivine were handpicked, prepared on Crystal-Bond™ resin, and then polished on two sides to allow intersection of glass inclusions. The doubly polished sample was separated from the resin and kept in capsules for Fourier Transform Infrared (FTIR) analyses.

Thickness determination: The wafer thickness was first roughly estimated by using the micrometers for digital displacement gauges difference (5 μm error). After the separation of the crystal for FTIR analysis the thickness value was re-estimated by measuring the vertical displacement between the focused surfaces of the wafer [1]. The thickness represents the difference between the observed focal distance from the surface of the crystal and the NaCl plate background placed on the Hyperion 1000/2000 microscope stage (5-10 μm error). Due to direct thickness measurement errors [1], samples with clean IR reflective signal were used for comparison, considering the interference fringes method from [2]. Intercomparison of different methods is also showed in [3], for which we carefully evaluated at each inclusion (also explained [1,2]). The wafer thickness values denote the overall thickness of the area analyzed [2].

The thicknesses determined by this method agree to within average 7 μm (% error of 30.7 on water contents). The wafer thickness chosen for the Beer–Lambert law required us to respect three conditions. The decision on the thickness method is mentioned in Table S5 from the Supplementary Materials.

- (1) Minimum limit is 17 μm according to reference works of [2,3].
- (2) Wafer thickness could not exceed the inclusion spherical or ellipsoidal (larger axis) dimensions for depth of FTIR signal.

- (3) If the IR signal is affected by olivine signal, a correction factor is applied. Standard signals were measured on olivine host for absorbance. If crossed Nichols did show doubly intersected inclusion, the wafer thickness correction with absorbance were applied on those data [2].

Density: The density at room temperature and pressure was calculated for each glass inclusion by using the methods from method of Ochs and Lange (1999) [4]. The EMP data (Table 3) were used for estimating the density reported in this work (Table S7). The standard deviation on density represents variation in oxide content for the series HLN2A6 and HLN2A9,, respectively, 0.065 and 0.045 64 g/cm³. The % error for using density in the Beer–Lambert equation induced a variation at the series HLN2A6 and HLN2A9,, respectively, 2.525 and 1.771 % error.

Water contents: Water is dissolved as molecular water (H₂O_{mol}) and hydroxyl groups (OH⁻) in the glass. For the case of the reported H₂O species, M is settled to 18.015 (g/mol). The absorbance signals from the present samples did not register clear H₂O_{mol} peak. Neither was it detected as the stretching plus bending mode at 5200 cm⁻¹, but the symmetrical bending mode is observed at 1635 cm⁻¹. The OH⁻ peak was clearly detected [5, 6]. For the aim of this study, the water concentrations were obtained by measuring the total H₂O peak at 3550 cm⁻¹, which corresponds to the fundamental OH⁻ stretching vibration [6,7]. The peak heights were measured graphically with the OPUS software. The absorption coefficient ϵ was 63 ± 3 L/mol · cm (P. Dobson et al., unpublished data, cited by [8]; also available in [9]).

CO₂ contents: Carbon is dissolved in the glass as CO_{2mol} [10] or can be present as carbonate ions (CO₃²⁻) depending on the melt composition [11,12]. For our samples, the carbon dioxide concentration was determined in glass inclusions by measuring the double peak of CO₃²⁻ at 1515 and 1435 cm⁻¹ with a background subtraction procedure applied in [13] (i.e., [14]). It consists of fitting the sample spectrum with a straight line, a devolatilized basaltic glass spectrum, a pure 1630 cm⁻¹ band for molecular H₂O and a pure carbonate doublet (unpublished spreadsheet provided by S. Newman). Results are accepted in our investigation according to three conditions (Table S5, S6):

- (1) The double peak is clear and without too much noise before and after spectrum correction.
- (2) The calculation gives a correlation coefficient $r^2 > 0.8$.
- (3) A maximum exactitude that allows (1 σ) average error of the sample collection in the reproducibility. In this case, the average is a 35% error (Table S5, S6).

The double peak of CO₃²⁻ was detected in n = 17 samples with average 1 σ in CO₃²⁻ is ± 175 ppm and average percent error 35.7 %. Only 5 of those samples are successfully corrected for the doublet anomaly (according to method used in [13]).

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