Si isotopes and small scale processes in olivine hosted melt inclusions

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Melt inclusions are minute melts trapped during crystal growth [e.g., 1]. When trapped in euhedral olivine they are believed to represent the melt in which olivine grew [1], despite some post-entrapment modifications [e.g., 2, 3]. In this study, we analysed olivine hosted melt inclusions (OHMIs) in Mid-Ocean Ridge Basalts (MORBs) from two different locations on the Mid-Atlantic Ridge: FAMOUS and the 14° MAR triple junction (respectively Normal-MORB and Enriched-MORB). Silicon, as oxygen, is a major element in olivines and it diffuses slowly in dry basaltic melt [4]. Both isotope systems (O and Si) do not fractionate during melting [e.g., 5]. The isotopic ranges reported for bulk MORBs are narrow (<0.5‰) [e.g., 6, 7]. Thus, we do not expect δ^{30}Si and δ^{18}O variability in OHMIs. However, previous analyses of δ^{18}O in these OHMIs show up to 2.5‰ variation (8 times the analytical error) in each sample [8]. Any difference or similarity between the δ^{30}Si and δ^{18}O signatures in the OHMIs would give valuable insight on the process responsible for the δ^{18}O variation in the OHMIs.

Silicon isotopes in OHMIs were measured by ion probe. OHMIs from the two samples display similar δ^{30}Si values, ranging from 0.08 ± 0.23‰ to 2.8 ± 0.32‰ for the N-MORB, and from 0.51 ± 0.34‰ to 2.8 ± 0.31‰ for the E-MORB (2se). The variation is larger than the accuracy (~0.4‰). δ^{18}O and δ^{30}Si display a slight positive trend. While the average δ^{18}O value in the OHMIs from the N-MORB sample is similar to the values previoulsy reported for bulk MORBs [6], the average δ^{30}Si is much higher, and similar for both of our samples. Such high values are not representative of any high temperature terrestrial reservoirs. The large δ^{30}Si offset with bulk MORBs and the large variation within the OHMI population thus most likely reflect either a localized or OHMIs-specific process (e.g. boundary layer or local dissolution).

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