

Advances in the Measurement of $\delta^{13}\text{C}$ in Silicate Glass by Secondary Ion Mass Spectrometry (SIMS)

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Secondary Ion Mass Spectrometry (SIMS) has been used for decades to analyze volatile isotopes in silicate melts. However, the analysis of carbon stable isotopes ($\delta^{13}\text{C}$) in silicate glasses has been particularly challenging, with few previous attempts yielding high uncertainties. To address this challenge, we characterized and calibrated 31 basaltic and basaltic reference glasses spanning a wide range of CO_2 concentrations and $\delta^{13}\text{C}$ values. Tested with large-geometry SIMS at two different facilities, we achieved precision better than $\pm 1.1\text{‰}$ ($\pm 1\sigma$, both internal and external) for CO_2 concentrations above 1800 ppm using a primary beam intensity of less than 5 nA, resulting in a spot size of 10-20 μm , allowing precise analysis of $\delta^{13}\text{C}$ in mineral-hosted melt inclusions. This advance opens new avenues for the study of carbon sources in mafic melts and the $\delta^{13}\text{C}$ signature of the upper mantle.