



Supplementary Figure A. Comparison of  $\delta^{18}\text{O}$  values obtained by SIMS and by laser fluorination for matrix glasses from the Askja volcanic system. Coloured, open symbols are SIMS data that have been corrected for matrix effects according to a linear regression between instrumental mass fractionation and  $\text{SiO}_2$  (see main text for details). The error bars of  $\pm 0.35\text{‰}$  represent the average total uncertainty on the SIMS measurements based on repeat measurements of standards. Solid black symbols are laser fluorination data, and the symbols are larger than the average error of  $\pm 0.05\text{‰}$ . The low uncertainty of the laser fluorination measurements means that these analyses can provide an external test of the SIMS analyses and data reduction procedure.

For some samples, the SIMS analyses produce average  $\delta^{18}\text{O}$  values that are somewhat higher than the laser fluorination data. The only example where this difference is larger than the combined error of the two methods is Nýjahraun, for which the difference between the average SIMS  $\delta^{18}\text{O}$  and the average laser fluorination  $\delta^{18}\text{O}$  is  $0.48\text{‰}$ . However, it should be noted that this difference is based on average values from a small dataset, and some individual analyses are identical within analytical error. SIMS analyses of the NE tuff cone are also higher, on average, than the laser fluorination data, but for this eruption there is wide variability present in the SIMS data, and the laser fluorination analyses are identical to one of the SIMS measurements. This may simply be an artefact of a small dataset, but could also be indicative of micro-scale  $\delta^{18}\text{O}$  variations in glassy fragments from the NE tuff cone that cannot be resolved by bulk analyses. SIMS analyses of glass samples from an eruption in c. 1910 reproduce the laser fluorination data to within  $0.05\text{‰}$ , i.e. for this eruption, the data from the two methods are identical.

For all the eruptions studied, one or more of the laser fluorination analyses are reproduced by the SIMS data within the combined analytical uncertainty of the two methods. We are therefore confident that our SIMS analytical technique and data reduction procedure is able to produce accurate and reliable determinations of  $\delta^{18}\text{O}$  in basaltic glasses.