

# SUPPLEMENTARY MATERIALS

Table S1. Instrumentations and operational conditions of LA-ICP-MS

1. ICP-Mass spectrometer	
Instrument	iCAP Qc (Thermo Fisher Scientific, Massachusetts, USA)
ICP RF incident power	1550 W
Plasma gas flow rate	14.0 L min <sup>-1</sup>
Auxiliary gas	0.8 L min <sup>-1</sup>
He flow rate	0.60 L min <sup>-1</sup>
Ar makeup flow rate	1.05 L min <sup>-1</sup>
Monitored isotope	<sup>7</sup> Li, <sup>9</sup> Be, <sup>10</sup> B, <sup>11</sup> B, <sup>24</sup> Mg, <sup>29</sup> Si, <sup>43</sup> Ca
Date acquisition mode	Time resolved analysis (TRA)
Dwell time	0.01 s
Detector	EM (Pulse counting)
2. Laser ablation system	
Instrument	CyberProbe UV
Laser	Ti:S femtosecond laser
Pulse duration	227 fs
Wavelength	260 nm (THG)
Objective lens	f-theta lens (f=100mm)
Repetition rate	50, 100, 250 Hz
Fluence	6.5 ~ 9.8 J s <sup>-1</sup>
Ablation pit size	20 ~ 30 μm
Stabilizer	Baffle type (Tunheng and Hirata, 2004)
3. Standardization	
Calibration standard	Glass standard reference material (NIST SRM610)
Secondary standard	Glass standard reference material (NIST SRM612 and BCR-2G)

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Table S2. Ion intensity ratios measured with the NanoSIMS and the calculated Relative Sensitivity Factors

Sample	Åk#	${}^9\text{Be}/{}^{30}\text{Si}$ (atomic ratio) *2	${}^9\text{Be}^{+30}\text{Si}^{+}$ (ion intensity ratio) *3	${}^9\text{Be}/{}^{30}\text{Si}$ RSF *1	${}^{11}\text{B}/{}^{30}\text{Si}$ (atomic ratio) *2	${}^{11}\text{B}^{+30}\text{Si}^{+}$ (ion intensity ratio) *3	${}^{11}\text{B}/{}^{30}\text{Si}$ RSF *1
20-1B	25	0.698 ± 0.041	0.764 ± 0.033	1.096 ± 0.080	0.0404 ± 0.0024	0.0227 ± 0.0013	0.562 ± 0.045
30-1B	24	0.661 ± 0.087	0.703 ± 0.094	1.063 ± 0.199	0.0284 ± 0.0042	0.0161 ± 0.0022	0.565 ± 0.114
60-1A	25	1.656 ± 0.157	1.736 ± 0.066	1.048 ± 0.107	0.0344 ± 0.0049	0.0168 ± 0.0003	0.489 ± 0.071
50-1C	43	0.980 ± 0.070	0.998 ± 0.051	1.019 ± 0.089	0.0243 ± 0.0043	0.0131 ± 0.0013	0.539 ± 0.110
70-2A	63	1.142 ± 0.070	1.216 ± 0.046	1.065 ± 0.077	0.0203 ± 0.0020	0.0110 ± 0.0014	0.541 ± 0.089
<i>weighted mean</i>							
NIST 610		0.148	0.138 ± 0.005	0.929 ± 0.035	0.0727	0.0364 ± 0.0006	0.500 ± 0.009

Note: \*1 relative sensitivity factor:  $({}^9\text{Be}^{+} \text{ (or } {}^{11}\text{B}^{+})/{}^{30}\text{Si}^{+})_{\text{NanoSIMS}}/({}^9\text{Be} \text{ (or } {}^{11}\text{B})/{}^{30}\text{Si})_{\text{atomic}}$ . Errors are 2  $\sigma$ . Note that RSFs are not absolute values because relative sensitivities between the EMs used for Be and Si (B and Si) were not checked. \*2 calculated from  $\text{SiO}_2$ , Be, and B concentrations in Table 1 assuming terrestrial isotopic ratios. Errors are 2  $\sigma$ . \*3 Errors are 2 Standard Deviation (2SD).

59 **Supplemental Figure captions**

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61 Fig. S1 (a)  ${}^9\text{Be}^+/{}^{30}\text{Si}^+$  ratios as a function of Be/Si atomic ratios determined for five synthetic  
62 melilitic glasses. (b)  ${}^{11}\text{B}^+ / {}^{30}\text{Si}^+$  ratios as a function of B/Si atomic ratios determined for five  
63 synthetic melilitic glasses. Note that RSFs are not absolute values because sensitivity  
64 differences between EMs for  ${}^9\text{Be}^+$  (or  ${}^{11}\text{B}^+$ ) and  ${}^{30}\text{Si}^+$  were not corrected. Error bars are 2 SD  
65 that were evaluated from repeated measurements of individual glasses. The slopes define  
66 weighted mean values of relative sensitivities of five glasses.

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88 Fig. S1

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