

Supplementary Materials

Calcination procedures

To remove organic matter from soil materials, Ag crucibles containing aliquots of the samples were placed in a furnace with the following program: 1 hour to reach 250°C, 1 hour at 250°C, 1 hour to reach 450°C, 1 hour at 450°C. This procedure was performed by CEREGE, GET and STAiG while a calcination at 420°C for 3 hours was carried out at WQC Trent for both soil and plant materials. The duration of the 450°C step was extended to 16 hours for the plant material (ERM-CD281) at CEREGE and STAiG with a total calcination duration of 24 hours. A 8 hour calcination at 500°C was performed at GET for the plant reference material.

Sample preparation and Si isotope ratio measurements at CEREGE

Approximately 500 mg of plant material or 10-20 mg of soil material, was weighed into Ag crucibles and combusted overnight (1h to reach 250°C, 1h at 250 °C, 1h to reach 450°C and 1h at 450 °C, plant materials are left for 16h more at 450°C). After cooling about 200 mg of a NaOH powder (Merck, p.a. grade) was added. The capped crucibles were then placed in a muffle furnace at 720°C for 10 min. After fusion, crucibles were removed from the furnace and cooled to room temperature. The outside of the crucibles were rinsed with ultrapure water to remove any contaminant and placed into PFA beakers filled with 50 ml of ultrapure water and then stored in the darkness overnight. During dissolution, three sequences of 20 min of sonication were performed in an ultrasonic bath. Solutions were then quantitatively transferred into 120 ml pre-cleaned PP bottles and acidified with concentrated HNO₃ distilled to reach pH of 2. Silicon purification was achieved by loading approximately 2 ml of solution on columns filled with 2 ml of AG50W-X8 (100–200 mesh in H⁺ form; Bio-Rad, Hercules, CA, USA) cation exchange resin in H⁺ form following the protocol of Georg et al. (2006). Purified samples were collected in 8 ml pre-cleaned PP bottles. The purity and Si yield of the fusion procedure and the column chemistry were checked by ICP-MS with Rh as internal standard. Si blanks of the fusion and column separation procedure are below < 30 ng, which is less than 1 % of the total amount Si processed.

Silicon isotope ratios were measured using a Thermo Scientific Neptune Plus MC-ICP-MS equipped with regular Ni sample and skimmer cones. Samples were injected in the MC-ICP-MS using a 100 μl min⁻¹ PFA nebulizer (OpalMist from Glass Expansion) and the Thermo double pass spray Chamber. Analyses were carried out with a double mass bias correction including first an internal normalization via Mg doping (Mg ICPMS standard solution from VWR) of the samples and second sample-standard bracketing with the Si NBS28 isotopic standard (also normalized internally via Mg doping). For each sample and bracketing standard, a purified sample solution of ca. 2 μg ml⁻¹ Si diluted in 1% v/v HNO₃ doped with Mg was introduced in the MC-ICP-MS. The Mg doping was adjusted to reach a ²⁸Si/²⁴Mg voltage ratio close to 1. Si and Mg isotope ratios were measured in medium mass resolution (RP ~4500) in dynamic mode. These conditions gave typical signals of 8-10 V per 2 μg ml⁻¹ on ²⁸Si and 5-7 V per 2 μg ml⁻¹ on ²⁴Mg. For Si isotopes, intensities at m/z 28, 29 and 30 were measured simultaneously in H3, Axial, L3 faraday cups all equipped with 10¹¹ Ω amplifiers. After a magnet switch (idle time set at 3s), Mg isotopes intensities at m/z 24, 25, 26 were measured on H4, Axial, L4 faraday cups equipped with 10¹¹ Ω amplifiers. Each sample or bracketing standard analysis consisted of 36 cycles of 4.194s integrations per element. Prior to each sample or standard acquisition, a peak centring using the HR peak centring option in the Thermo software was done (typical Δm set at 0.012-0.013). The on-peak background in 1% v/v HNO₃ was repeatedly recorded during the sequence and subtracted from all sample and bracketing standard intensities. Each aliquot was analysed at least three times on different days. The daily reproducibility of the self-bracketed

$\delta^{28}\text{Si}_{\text{NBS}28}$ was typically $< 0.1\text{‰}$ during the course of this study. Quality control of the measurements was provided by secondary reference materials (Diatomite or BHVO-2) regularly inserted in each sample series. The $\delta^{30}\text{Si}$ and $\delta^{29}\text{Si}$ values of the Diatomite ($\delta^{30}\text{Si} = +1.25 \pm 0.10 \text{‰}$; $\delta^{29}\text{Si} = +0.66 \pm 0.07 \text{‰}$; $n = 40$) and BHVO-2 ($\delta^{30}\text{Si} = -0.25 \pm 0.11 \text{‰}$; $\delta^{29}\text{Si} = -0.12 \pm 0.11 \text{‰}$; $n = 14$) agree well with published consensus values (Reynolds et al., 2007; Savage et al., 2014; compiled value in Table S1).

Table S1. Compilation of published BHVO-2 $\delta^{30}\text{Si}_{\text{NBS}28}$ estimates.

BHVO-2					
	$\delta^{30}\text{Si}_{\text{NBS}28} (\text{‰})$	2SD ^a		$\delta^{30}\text{Si}_{\text{NBS}28} (\text{‰})$	2SD ^a
van den Boorn et al., 2006	-0.09	0.31	Geilert et al., 2015	-0.32	0.15
Abraham et al., 2008	-0.29	0.11	Geilert et al., 2015	-0.39	0.21
Fitoussi et al., 2009	-0.32	0.06	Oelze et al., 2015	-0.27	0.17
Savage et al., 2010	-0.27	0.10	Poitrasson and Zambardi, 2015	-0.27	0.07
Steinhoefel et al., 2011	-0.30	0.28	Mavromatis et al., 2016	-0.29	0.17
Steinhoefel et al., 2011	-0.33	0.24	Reddy et al., 2016	-0.26	0.19
Armytage et al., 2011	-0.28	0.14	Reddy et al., 2016	-0.29	0.13
Armytage et al., 2011	-0.34	0.07	Pringle et al., 2016	-0.30	0.12
Armytage et al., 2011	-0.30	0.09	Zheng et al., 2016	-0.21	0.19
Savage et al., 2011	-0.29	0.09	Oelze et al., 2016	-0.30	0.14
Zambardi and Poitrasson, 2011	-0.27	0.08	Ameijeiras-Mariño et al., 2017	-0.30	0.11
Opfergelt et al., 2011a	-0.26	0.09	Steinhoefel et al., 2017	-0.29	0.10
Opfergelt et al., 2011b	-0.26	0.09	Opfergelt et al., 2017	-0.26	0.09
Opfergelt et al., 2012	-0.26	0.09	Chen et al., 2017	-0.28	0.14
Armytage et al., 2012	-0.28	0.14	Yu et al., 2018	-0.29	0.05
Pogge von Strandmann et al., 2012	-0.26	0.09	Trail et al., 2018	-0.30	0.04
Savage et al., 2012	-0.30	0.09	Riotte et al., 2018	-0.27	0.06
Savage et al., 2013a	-0.30	0.04	Yu et al., 2018	-0.30	0.05
Kempl et al., 2013	-0.23	0.20	Wille et al., 2018	-0.23	0.02
Savage et al., 2013b	-0.29	0.05	André et al., 2019	-0.29	0.03
Savage and Moynier, 2013	-0.28	0.09	Deng et al., 2019	-0.27	0.01
Pringle et al., 2013	-0.28	0.12	Wang et al., 2019	-0.32	0.04
Opfergelt et al., 2013	-0.26	0.09	Nantke et al., 2019	-0.30	0.04
Geilert et al., 2014a	-0.27	0.14	Cornelis et al., 2019	-0.29	0.21
Schuessler and von Blanckenburg, 2014	-0.36	0.18	Fernandez et al., 2019	-0.35	0.11
Schuessler and von Blanckenburg, 2014	-0.27	0.11	Chen et al., 2020	-0.22	0.14
Geilert et al., 2014b	-0.27	0.14	Stamm et al., 2020	-0.25	0.16
Oelze et al., 2014	-0.27	0.04	Li et al., 2020	-0.29	0.06
Dauphas et al., 2015	-0.26	0.16	Sikdar and Rai, 2020	-0.27	0.08
Tatzel et al., 2015	-0.30	0.11	Chen et al., 2020	-0.27	0.06
$\delta^{30}\text{Si}_{\text{NBS}28} (\text{‰})$	-0.28				
$U, k=2 (\text{‰})$	0.08				

^a In the published work the uncertainties have been quoted in different ways.

Here ± 2 s.d. has been applied uniformly for consistency.

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Table S2. Averages of analytical replicates of $\delta^{30}\text{Si}_{\text{NBS 28}}$ and $\delta^{29}\text{Si}_{\text{NBS 28}}$, and associated 2 standard deviations, number of analyses per full replicate preparation for each reference material. The table also shows whether the samples were calcinated during the preparation and whether the samples were doped with Mg prior to the isotope analysis by mass spectrometry.

Reference Material	Lab Number	Lab Name	Sample Label	$\delta^{29}\text{Si}_{\text{NBS 28}}$ (‰)	2SD (‰)	$\delta^{30}\text{Si}_{\text{NBS 28}}$ (‰)	2SD (‰)	Number of Analyses	Calcination	Mg Doping
GBW-07401	1	BIG	GBW07401 1	-0.14	0.12	-0.26	0.08	3	N	Y
GBW-07401	1	BIG	GBW07401 2	-0.19	0.11	-0.29	0.12	4	N	Y
GBW-07401	1	BIG	GBW07401 3	-0.16	0.05	-0.27	0.04	3	N	Y
GBW-07401	2	CEREGE	GSS1_4	-0.12	0.07	-0.24	0.08	5	Y	Y
GBW-07401	2	CEREGE	GSS1_5	-0.13	0.05	-0.27	0.14	6	Y	Y
GBW-07401	2	CEREGE	GSS1_6	-0.14	0.08	-0.28	0.09	8	Y	Y
GBW-07401	3	GET	GSS-1	-0.12	0.03	-0.20	0.05	3	Y	Y
GBW-07401	4	GFZ	GBW 07401(A)	-0.15	0.06	-0.28	0.05	3	N	Y
GBW-07401	4	GFZ	GBW 07401(B)	-0.15	0.06	-0.28	0.04	5	N	Y
GBW-07401	4	GFZ	GBW 07401(C)	-0.14	0.06	-0.29	0.08	6	N	Y
GBW-07401	5	IFREMER	GSS-1-1	-0.17	0.12	-0.30	0.21	3	N	Y
GBW-07401	5	IFREMER	GSS-1-2	-0.16	0.08	-0.26	0.17	3	N	Y
GBW-07401	5	IFREMER	GSS-1-3	-0.17	0.08	-0.30	0.26	3	N	Y
GBW-07401	6	STaIG	401 c1	-0.14	0.05	-0.29	0.07	7	Y	N
GBW-07401	6	STaIG	401 c2	-0.14	0.09	-0.28	0.09	6	Y	N
GBW-07401	6	STaIG	401 c3	-0.13	0.05	-0.27	0.05	5	Y	N
GBW-07401	6	STaIG	401 uc	-0.12	0.05	-0.29	0.09	5	N	N
GBW-07401	7	WQC Trent	F3	-0.15	0.05	-0.29	0.09	8	Y	N
GBW-07404	1	BIG	GBW07404 1	-0.40	0.04	-0.78	0.14	3	N	Y
GBW-07404	1	BIG	GBW07404 2	-0.35	0.05	-0.72	0.10	3	N	Y
GBW-07404	1	BIG	GBW07404 3	-0.37	0.07	-0.85	0.03	3	N	Y
GBW-07404	2	CEREGE	GSS4_3	-0.36	0.04	-0.72	0.08	5	Y	Y
GBW-07404	2	CEREGE	GSS4_4	-0.33	0.10	-0.72	0.10	3	Y	Y
GBW-07404	2	CEREGE	GSS4_5	-0.36	0.04	-0.74	0.12	3	Y	Y
GBW-07404	3	GET	GSS-4	-0.27	0.04	-0.67	0.14	3	Y	Y
GBW-07404	4	GFZ	GBW 07404(A)	-0.40	0.04	-0.77	0.07	4	N	Y
GBW-07404	4	GFZ	GBW 07404(B)	-0.37	0.05	-0.71	0.11	6	N	Y
GBW-07404	4	GFZ	GBW 07404(C)	-0.39	0.04	-0.76	0.11	6	N	Y
GBW-07404	5	IFREMER	GSS-4-1	-0.40	0.08	-0.79	0.13	3	N	Y
GBW-07404	5	IFREMER	GSS-4-2	-0.38	0.11	-0.76	0.19	3	N	Y
GBW-07404	5	IFREMER	GSS-4-3	-0.47	0.09	-0.90	0.25	3	N	Y
GBW-07404	6	STaIG	404 c1	-0.38	0.08	-0.73	0.08	8	Y	N
GBW-07404	6	STaIG	404 c2	-0.38	0.06	-0.76	0.12	9	Y	N
GBW-07404	6	STaIG	404 c3	-0.39	0.05	-0.75	0.10	14	Y	N
GBW-07404	7	WQC Trent	F1	-0.39	0.05	-0.75	0.10	7	Y	N
GBW-07407	1	BIG	GBW07404 1	-0.89	0.08	-1.77	0.04	3	N	Y
GBW-07407	1	BIG	GBW07404 2	-0.88	0.05	-1.74	0.07	3	N	Y
GBW-07407	1	BIG	GBW07404 3	-0.90	0.09	-1.82	0.15	4	N	Y
GBW-07407	2	CEREGE	GSS7_1	-0.84	0.07	-1.74	0.06	3	Y	Y
GBW-07407	2	CEREGE	GSS7_2	-0.90	0.16	-1.75	0.22	3	Y	Y
GBW-07407	2	CEREGE	GSS7_3	-0.83	0.11	-1.76	0.20	3	Y	Y
GBW-07407	3	GET	GSS-7	-0.88	0.09	-1.71	0.22	3	Y	Y
GBW-07407	4	GFZ	GBW 07407(A)	-0.95	0.08	-1.85	0.07	6	N	Y
GBW-07407	4	GFZ	GBW 07407(B)	-0.93	0.03	-1.80	0.10	6	N	Y
GBW-07407	4	GFZ	GBW 07407(C)	-0.95	0.05	-1.82	0.03	4	N	Y
GBW-07407	5	IFREMER	GSS-7-1	-1.07	0.11	-2.05	0.26	3	N	Y
GBW-07407	5	IFREMER	GSS-7-2	-1.00	0.01	-1.97	0.11	3	N	Y
GBW-07407	5	IFREMER	GSS-7-3	-0.98	0.06	-1.87	0.12	3	N	Y
GBW-07407	6	STaIG	407 c1	-0.93	0.05	-1.81	0.07	9	Y	N
GBW-07407	6	STaIG	407 c2	-0.92	0.07	-1.80	0.11	3	Y	N
GBW-07407	6	STaIG	407 c3	-0.92	0.08	-1.83	0.12	9	Y	N
GBW-07407	6	STaIG	407 uc	-0.96	0.07	-1.85	0.06	4	N	N
GBW-07407	7	WQC Trent	F2	-0.88	0.05	-1.70	0.10	8	Y	N
TILL-1	1	BIG	TILL 1 575 1	-0.12	0.08	-0.21	0.02	3	N	Y
TILL-1	1	BIG	TILL 1 575 2	-0.06	0.09	-0.18	0.09	5	N	Y
TILL-1	1	BIG	TILL 1 575 3	-0.11	0.09	-0.19	0.03	3	N	Y
TILL-1	2	CEREGE	TILL_1	-0.07	0.05	-0.14	0.13	5	Y	Y
TILL-1	2	CEREGE	TILL_2	-0.08	0.04	-0.19	0.13	6	Y	Y
TILL-1	2	CEREGE	TILL_3	-0.02	0.12	-0.13	0.06	5	Y	Y
TILL-1	4	GFZ	TILL-1, LOT575 (A)	-0.08	0.06	-0.14	0.04	5	N	Y
TILL-1	4	GFZ	TILL-1, LOT575 (C)	-0.06	0.07	-0.15	0.10	3	N	Y
TILL-1	6	STaIG	Till 1 c1	-0.05	0.03	-0.13	0.06	5	Y	N
TILL-1	6	STaIG	Till 1 c2	-0.05	0.04	-0.14	0.06	10	Y	N
TILL-1	6	STaIG	Till 1 c3	-0.08	0.05	-0.12	0.08	5	Y	N
TILL-1	7	WQC Trent	Till-1 LOT 575	-0.03	0.10	-0.06	0.19	8	Y	N
ERM-CD281	2	CEREGE	ERMCD281_4	-0.08	0.03	-0.26	0.10	3	Y	Y
ERM-CD281	2	CEREGE	ERMCD281_5	-0.13	0.11	-0.36	0.10	3	Y	Y
ERM-CD281	2	CEREGE	ERMCD281_6	-0.10	0.09	-0.29	0.05	3	Y	Y
ERM-CD281	3	GET	Rye Grass	-0.17	0.03	-0.28	0.13	3	Y	Y
ERM-CD281	3	GET	Rye Grass 3	-0.06	0.19	-0.18	0.19	3	Y	Y
ERM-CD281	4	GFZ	ERM-CD 281(A)	-0.17	0.04	-0.30	0.14	3	N	Y
ERM-CD281	4	GFZ	ERM-CD 281(B)	-0.16	0.06	-0.30	0.09	4	N	Y
ERM-CD281	4	GFZ	ERM-CD 281(C)	-0.17	0.03	-0.32	0.11	3	N	Y
ERM-CD281	4	GFZ	ERM-CD 281(E+F, 1x col.)	-0.14	0.05	-0.23	0.08	3	N	Y
ERM-CD281	4	GFZ	ERM-CD 281(E+F, 2x col.)	-0.11	0.07	-0.24	0.10	3	N	Y
ERM-CD281	5	IFREMER	Rye Grass-1	-0.20	0.20	-0.31	0.16	3	N	Y
ERM-CD281	7	WQC Trent	ERM-CD281	-0.05	0.11	-0.10	0.21	4	Y	N