Supplement to "The Li isotope response to mountain uplift".

Philip A.E. Pogge von Strandmann and Gideon M. Henderson

Contains: Method description, data table (Table S1), sample location map (Figure S1).

Major- and trace-element concentrations were determined by analysis on an Element 2 ICP-MS at Oxford, calibrated against multi-element standards made from pure single-element solutions, and accuracy was assessed by analysis of the international river-water standard SLRS-5 (Heimburger et al., 2013), with certified and suggested values within error of our analyses (Table S1).

For isotope analysis, sufficient sample was evaporated to obtain 20ng Li. Samples were then chemically purified with a 2-step cation exchange process with AG50W X-12 (200-400 mesh) resin, using 0.2M HCl as an eluent (Pogge von Strandmann et al., 2011). The first column contains 2.4ml dry volume of resin, and the 2^{nd} column 0.5ml. Column yields (given that Li isotopes fractionate on the column) were assessed by collecting splits of the solution before and after the collected bracket for Li, which were then analysed for Li content. Results shows that <0.1% of Li was present in these splits.

Isotopic analyses were performed on a Nu Instruments HR MC-ICP-MS at Oxford, by sample-standard bracketing with the NIST L-SVEC standard, where sample intensity was diluted to within $\pm 10\%$ of that of the standard. Analyses consisted of three separate repeats of 10 ratios (10 s total integration time), giving a total integration time of 300 s/sample during each analytical session. At an uptake rate of 75 µl/min, the sensitivity for a 20 ng/ml solution is ~18 pA of ⁷Li. Background

instrumental Li intensity, typically ~0.01pA, was subtracted from each measurement. Precision and accuracy was assessed by multiple analyses of N. Atlantic seawater, given the lack of a calibrated river-water standard. The long-term value and reproducibility is $31.2 \pm 0.6\%$ (2 s.d. n=46). The total procedural blank for Li isotopes is effectively undetectable (<0.005 ng Li) (Pogge von Strandmann et al.,

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	River	Latitude	Longitude	Uplift rate	Rainfall	Li	Na	Mg	Al	Si	Κ	Ca	$(^{234}U/^{238}U)$	δ ⁷ Li	2sd
				mm/yr	mm/yr	nmol/l	Mmol/l	mmol/l	mmol/l	mmol/l	mmol/l	mmol/l			
East															
CL1	Clarence	S 42° 12' 53.6	E 172° 44' 28.5	2.3	1280	167	31.4	1.76	13.2	16.5	3.19	148	2.577	22.0	0.1
CL2	Clarence	S 42° 19' 32.7	E 172° 46' 14.4	2.1	1194	85.5	20.2	7.28	11.9	10.6	4.45	243	2.774	28.3	0.5
CL3	Clarence	S 42° 25' 24.5	E 172° 47' 44.6	2.1	1136	35.3	19.0	5.71	4.10	9.91	4.22	208	2.548	34.7	0.3
CL4	Clarence	S 42° 24' 00.1	E 172° 57' 36.7	2.2	1114	44.6	23.9	12.7	13.6	8.13	7.96	404	2.519	26.2	0.6
CL6	Clarence mouth	S 42° 09' 51.3	E 173° 54' 42.7	3.7	938	290	35.3	12.2	4.09	11.3	7.55	212	2.861	22.6	0.1
WT2	Waitaki	S 44° 43' 55.5	E 170° 28' 42.0	1.5	2378	66.9	11.2	3.21	1.37	6.08	2.23	150	1.316	24.9	0.5
WT3	Waitaki	S 44° 55' 38.5	E 171° 06' 04.4	1.2	2014	83.6	11.6	4.16	3.50	5.56	3.06	196	1.297	25.9	0.3
WT1	Waitaki	S 44° 28' 19.4	E 169° 59' 15.5	0.6	1317	50.2	26.7	10.2	7.91	10.5	10.0	285	1.500	30.7	0.1
RAK	Rakaia	S 43° 45' 09.2	E 172° 01' 49.8	2.1	3320	115	14.9	10.8	11.4	8.31	3.70	351	1.411	27.2	0.5
WAR	Wairau	S 41° 26' 39.3	E 173° 58' 02.3	1.8	1129	225	23.8	9.17	3.9	12.0	2.95	206	1.946	22.3	0.5
CU	Clutha	S 45° 49' 34.4	E 169° 31' 52.3	1.1	1556	59.7							1.081	26.3	0.7
West															
TR1	Taramakau	S 42° 37' 58.1	E 171° 11' 59.7	5.2	5283	136	47.7	15.6	15.5	9.14	20.1	412	1.092	24.5	0.4
POE	Poerua	S 43° 09' 39.6	E 170° 30' 17.2	7.4	6300	386	10.6	5.66	4.91	9.28	9.54	206	1.232	13.2	0.4
HS2	Haast	S 44° 00' 56.8	E 169° 23' 01.7	4.3	8924	44.6	15.5	6.07	4.03	4.45	5.63	210	1.171	23.6	0.3
HS1	Haast	S 43° 56' 11.5	E 169° 07' 43.7	4.8	10063	124	28.1	8.93	4.01	5.38	13.3	216	1.185	18.7	0.5
WHT	Whataroa	S 43° 17' 20.5	E 170° 24' 13.5	7.4	9277	539	33.7	4.00	19.6	21.6	6.64	153	1.158	7.6	0.6
Hanmer S	prings	S 42° 32'	E 172° 49'			121000							1.416	5.8	0.4
SLRS-5						7.3	235	104	1.90	66.8	22.1	255			
Seawater	(n = 46)													31.3	0.6
Scawalei	(n = 40)													51.5	

Table S1. Element concentrations and isotope ratios for the New Zealand samples.

Location, uplift, rainfall and U isotope ratios are from Robinson et al., 2004.



Figure S1. Location map of South Island, New Zealand.

- Heimburger, A., Tharaud, M., Monna, F., Losno, R., Desboeufs, K., and Nguyen, E. B., 2013, SLRS-5 Elemental Concentrations of Thirty-Three Uncertified Elements Deduced from SLRS-5/SLRS-4 Ratios: Geostandards and Geoanalytical Research, v. 37, no. 1, p. 77-85.
- Pogge von Strandmann, P. A. E., Elliott, T., Marschall, H. R., Coath, C., Lai, Y. J., Jeffcoate, A. B., and Ionov, D. A., 2011, Variations of Li and Mg isotope ratios in bulk chondrites and mantle xenoliths: Geochimica Et Cosmochimica Acta, v. 75, p. 5247–5268.
- Pogge von Strandmann, P. A. E., Jenkyns, H. C., and Woodfine, R. G., 2013, Lithium isotope evidence for enhanced weathering during Oceanic Anoxic Event 2: Nature Geoscience, v. 6, p. 668–672.