

1 **Table S1: Sample-measurement details**

Sample number	TUCNL	AMS ID	Quartz (g)	Carbon yield (μg)	Carbon-yield uncertainty (μg)	Diluted carbon (μg)	$^{14}\text{C}/^{13}\text{C}$	$^{14}\text{C}/^{13}\text{C}$ uncertainty	$\delta^{13}\text{C}$ (per mille)	$^{14}\text{C}/\text{C}_{\text{total}}$	$^{14}\text{C}/\text{C}_{\text{total}}$ uncertainty
GR01	761	OS-163393	.6034	3.4	0.04	115.3	1.98E-12	5.83E-14	-2.69	1.90E-14	5.59E-16
GR03	762	OS-163394	5.01112	21.1	0.3	115	2.33E-12	2.77E-13	-4.17	2.53E-13	3.01E-15
GR04	763	OS-163397	5.3835	66	0.8	116.6	4.65E-11	2.04E-13	-5.04	5.08E-13	2.24E-15
GR06	764	OS-163398	5.186	35	0.4	115.6	5.17E-11	2.04E-13	-5.56	5.65E-13	2.24E-15
GR07	723	OS-161685	1.1181	7.4	0.1	113.6	1.56E-11	7.29E-14	-4.58	1.68E-13	7.89E-16
GR12(BR)	724	OS-161686	2.4832	10.1	0.1	115	5.64E-12	4.37E-14	-4.28	5.91E-14	4.59E-16
GR13	765	OS-167939	5.2367	23.6	0.3	114.4	1.44E-11	1.02E-13	-3.92	1.55E-13	1.10E-15
GR15(BR)	735	OS-162192	5.0494	35.5	0.5	116	2.32E-12	5.83E-14	-6.00	2.27E-14	5.71E-16
GR18	725	OS-161687	5.1754	25	0.3	115.7	4.56E-11	1.75E-13	-4.60	4.98E-13	1.92E-15
GR21(BR)	741	OS-162198	5.2501	41.2	0.5	116	6.51E-11	3.06E-13	-4.88	7.12E-13	3.36E-15

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3 **Table of sample-measurement details. All sample concentrations corrected by subtracting a $0.58 \pm 0.31 \times 10^4$ atom blank. Where the 1σ [^{14}C] uncertainty and 6% [^{14}C] uncertainty differ, the larger uncertainty value is used. “Internal” ^{14}C -age uncertainty includes only instrumental uncertainty. “External” ^{14}C -age uncertainty includes both instrumental and production-rate uncertainties. All Al and Be data from Lilly (2008; PhD thesis) and Lilly *et al.* (2010).**

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12 **Table S1: Sample-measurement details (continued)**

Blank-corrected total $^{14}\text{C}^*$ (10^4 atoms)	Blank-corrected total- ^{14}C uncertainty (10^3 atoms)	^{14}C (10^5 atoms/g)	1σ ^{14}C uncertainty (10^3 atoms/g)	6% ^{14}C uncertainty (10^3 atoms/g)	^{14}C Age (ka)	Internal ^{14}C -age uncertainty (ka)	External ^{14}C -age uncertainty (ka)	Effective-blank proportion of total ^{14}C (%)	$^{10}\text{Be}/^9\text{Be}$ ratio (10^{-15})	$^{10}\text{Be}/^9\text{Be}$ -ratio uncertainty (%)
5.2	4.70	0.86	7.79	5.16	1.006	0.097	0.098	52.8	$1,585 \pm 64$	4
140.0	25.69	2.8	5.13	16.8	3.983	0.308	0.32	4.0	16,303	0.9
291.3	40.35	5.41	7.5	32.46	11.004	1.387	1.442	2.0	$12,062 \pm 142$	1.2
321.5	43.98	6.2	8.48	37.2	14.615	2.425	2.521	1.8	$2,812 \pm 50$	1.8
90.0	13.44	8.05	12.02	48.3	Saturated	N/A	N/A	6.1	$25,652 \pm 348$	1.4
28.3	5.98	1.14	2.41	6.84	1.371	0.09	0.093	17.1	$7,650 \pm 100$	1.3
83.2	13.39	1.59	2.56	9.54	1.989	0.135	0.141	6.6	$1,681 \pm 22$	1.3
7.4	4.85	0.15	0.96	0.9	0.019	0.013	0.013	44.0	$8,746 \pm 127$	1.4
282.9	38.74	5.47	7.48	32.82	11.6	1.53	1.59	2.1	$9,037 \pm 85$	0.9
408.5	56.63	7.78	10.79	46.68	Saturated	N/A	N/A	1.4	$21,477 \pm 250$	1.2

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14 **Table of sample-measurement details (continued).**

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21 **Table S1: Sample-measurement details (continued)**

$[^{10}\text{Be}]$ (10^6 atoms [g quartz] $^{-1}$)	$[^{10}\text{Be}]$ uncertainty (%)	$^{26}\text{Al}/^{27}\text{Al}$ ratio (10^{-15})	$^{26}\text{Al}/^{27}\text{Al}$ - ratio uncertainty (%)	$[^{26}\text{Al}]$ (10^6 atoms [g quartz] $^{-1}$)	$[^{26}\text{Al}]$ uncertain ty (%)
1.53 ± 0.07	4.5	$2,060 \pm 84$	4.1	7.2 ± 1.5	2.0
7.44 ± 0.16	2.2	$21,317 \pm 382$	1.8	49.8 ± 3.1	6.3
9.45 ± 0.22	2.3	$35,266 \pm 431$	1.2	50 ± 10	2.0
3.15 ± 0.08	2.7	$7,824 \pm 199$	2.5	15.4 ± 3.1	2.0
17.8 ± 0.4	2.4	$51,037 \pm 593$	1.2	96 ± 19	2.0
8.49 ± 0.20	2.4	$24,625 \pm 496$	2	39.5 ± 1.8	4.5
1.53 ± 0.04	2.4	$5,520 \pm 267$	4.8	10.1 ± 0.6	6.3
11.5 ± 0.3	2.5	$30,658 \pm 401$	1.3	54.0 ± 2.3	4.2
5.58 ± 0.12	2.2	$13,500 \pm 398$	3	57.8 ± 1.4	5.0
22.6 ± 0.5	2.3	$47,386 \pm 561$	1.2	107 ± 4	4.2

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23 **Table of sample-measurement details (continued).**24 **References**

25 Lilly, K.: Three million years of East Antarctic ice sheet history from in situ cosmogenic nuclides in the Lambert-Amery Basin, 2008. 2008.

26 Lilly, K., Fink, D., Fabel, D., and Lambeck, K.: Pleistocene dynamics of the interior East Antarctic ice sheet, *Geology*, 38, 703-706, 2010.