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A new acaremyid rodent (Caviomorpha, Octodontoidea) from Scarritt Pocket, Deseadan (late Oligocene) of Patagonia (Argentina)

MARÍA G. VUCETICH,<sup>\*1</sup> MARÍA E. PÉREZ,<sup>2</sup> MARTÍN R. CIANCIO,<sup>1</sup> ALFREDO A. CARLINI,<sup>1</sup> RICHARD, H. MADDEN,<sup>3</sup> and MATTHEW J. KOHN<sup>4</sup>

<sup>1</sup>CONICET, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata. Paseo del Bosque s/n, B1900FWA La Plata, Argentina, vucetich@fcnym.unlp.edu.ar;

<sup>2</sup>CONICET, Museo Paleontológico "Egidio Feruglio", Avenida Fontana 140, U9100GYO, Trelew, Chubut, Argentina;

<sup>3</sup>Department of Organismal Biology and Anatomy, University of Chicago, 1027 East 57th Street Chicago IL 60637-1508, U.S.A.;

<sup>4</sup>Department of Geosciences, Boise State University, Boise, ID 83725, U.S.A.

## ANALYTICAL METHODS

Zircon was separated using standard techniques, mounted in epoxy, polished until the centers of the grains were exposed, and imaged with cathodoluminescence (CL). U-Pb isotope systematics and trace element compositions were analyzed by laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS) using a ThermoElectron X-Series II quadrupole ICPMS and New Wave Research UP-213 Nd:YAG UV (213 nm) laser ablation system. Analysis spots were placed in homogenous CL domains and not on visible cracks or inclusions. In-house analytical protocols, standard materials, and data reduction software were used for acquisition and calibration of U-Pb dates and a suite of high field strength elements (HFSE) and rare earth elements (REE) using the high sensitivity and unique properties of the interface (Xs cones), extraction lens, and quadrupole analyzer of the X-Series II. Zircon was ablated with a laser spot of 30  $\mu\text{m}$  wide using fluence and pulse rates of 5 J/cm<sup>2</sup> and 10 Hz, respectively, during a 60 second analysis (15 sec gas blank, 45 sec ablation) that excavated a pit ~25  $\mu\text{m}$  deep. Ablated material was carried by a 1.2 L/min He gas stream to the nebulizer flow of the plasma. Dwell times were 5 ms for Si and Zr; 100 ms for <sup>49</sup>Ti and <sup>207</sup>Pb, 40 ms for <sup>238</sup>U, <sup>232</sup>Th, <sup>202</sup>Hg, <sup>204</sup>Pb, <sup>206</sup>Pb and <sup>208</sup>Pb isotopes; and 10 ms all other HFSE and REE. Background count rates for each analyte were obtained prior to each spot analysis and subtracted from the raw count rate for each analyte. Temperature was calculated from the Ti-in-zircon thermometer (Watson et al. 2006). Because we have no constraints on the activity of TiO<sub>2</sub> in the magma, an average value in crustal rocks of 0.6 was used.

For U-Pb dates, instrumental fractionation of the background-subtracted ratios was corrected and dates were calibrated with respect to interspersed measurements of the Plesovice zircon standard (Slama et al. 2008). Two analyses of Plesovice were done for every 10 analyses of unknown zircon. Signals at mass 204 were indistinguishable from zero following subtraction of mercury backgrounds measured during the gas blank (<1000 cps <sup>202</sup>Hg), and thus dates are reported without common Pb correction. Radiogenic isotope ratio and age error propagation for each analysis includes uncertainty contributions from counting statistics and background subtraction. For concentration calculations, background-subtracted count rates for each analyte were internally normalized to <sup>29</sup>Si and calibrated with respect to NIST SRM-610 and -612 glasses as the primary standards.

Age interpretations are based <sup>206</sup>Pb/<sup>238</sup>U dates. Analyses that intersected inclusions during ablation are not included in plots or interpretations of zircon chemistry, but they are used for age interpretation because the inclusions appear to have no U or Pb. These analyses were identified by time-resolved data that show large fluctuations in Ti or P, showing that accessory mineral inclusions likely are ilmenite, rutile, titanite, apatite, or xenotime. Errors on the dates from individual LA-ICPMS analyses are given at 2 $\sigma$  and do not include the standard calibration uncertainty. A weighted mean <sup>206</sup>Pb/<sup>238</sup>U date is calculated using Isoplot 3.0 (Ludwig 2003). The error is given at the 95% confidence interval and includes the standard calibration uncertainty of 0.88% (2 $\sigma$ ).

Two zircon standards were measured as unknowns to assess accuracy, interspersed as groups of two analyses for every 20 unknown analyses. AUSZ2 zircon (38.9 Ma from unpublished chemical abrasion thermal ionization mass spectrometry (CA-TIMS) data, Boise State University) yielded a weighted mean <sup>206</sup>Pb/<sup>238</sup>U date of  $38.5 \pm 0.7$  (MSWD=1.8, n=10). R33 zircon (419 Ma from unpublished chemical abrasion thermal ionization mass spectrometry (CA-TIMS) data, Boise State University) yielded a weighted mean <sup>206</sup>Pb/<sup>238</sup>U date of  $415 \pm 10$  (MSWD=1.7, n=6). Errors include the standard calibration uncertainty of 0.88% (2 $\sigma$ ).

## U-PB GEOCHRONOLOGY RESULTS

Twenty-one spots from SCARTF yielded a weighted mean  $^{206}\text{Pb}/^{238}\text{U}$  date of  $27.17 \pm 0.54$  Ma (MSWD = 1.3).

FIGURE S1. Cathodoluminescence images of zircons from Scarritt Pocket Tuff (SCARTF) showing analytical spots. Data in Supplementary Table 1S.

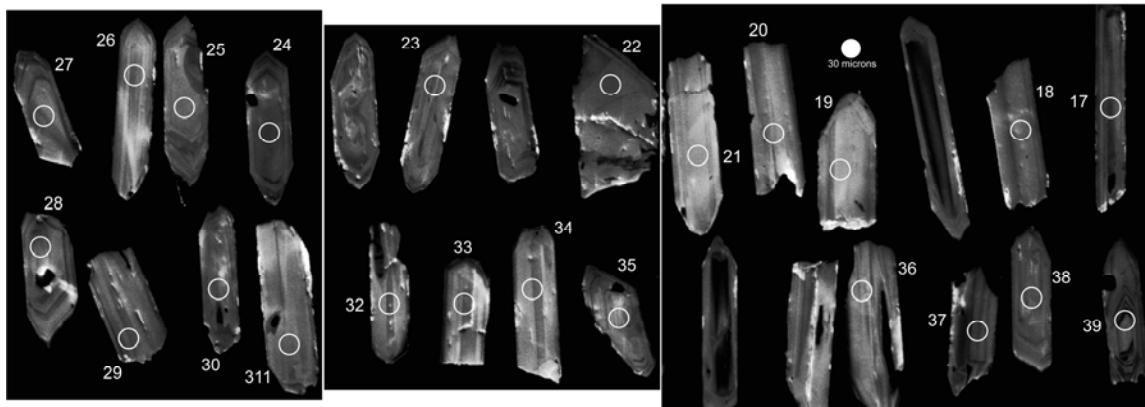
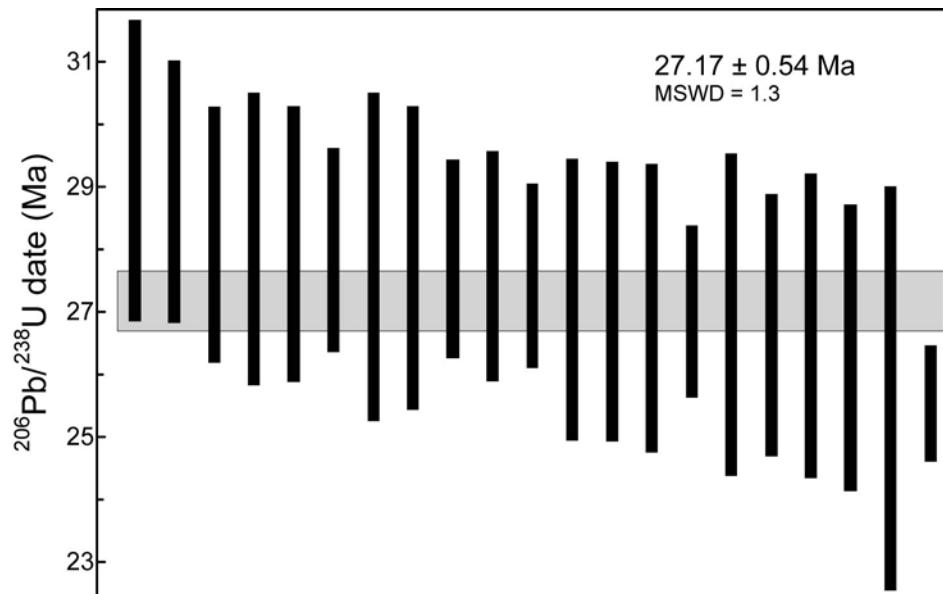


FIGURE S2.  $^{206}\text{Pb}/^{238}\text{U}$  dates for LA-ICP-MS spot analyses of zircon from Scarritt Pocket Tuff, rank-ordered according to apparent age. Each bar is an individual analysis and the sizes of vertical bars are  $\pm 2\sigma$ . Gray band shows mean age  $\pm 2\text{s.e.}$



#### LITERATURE CITED

- Ludwig, K.R. 2003. Isoplot 3.00: A geochronological toolkit for Microsoft Excel. Berkeley Geochronology Center Special Publications. 4.
- Slama, J., J. Kosler, D. J. Condon, J. L. Crowley, A. Gerdes, J. M. Hanchar, M. S. A. Horstwood, G. A. Morris, L. Nasdala, N. Norberg, U. Schaltegger, B. Schoene, M. N. Tubrett, and M. J. Whitehouse. 2008. Plesovice zircon - A new natural reference material for U-Pb and Hf isotopic microanalysis. *Chemical Geology*. 151: 1-35.
- Watson, E. B., D. A. Wark, and J. B. Thomas. 2006. Crystallization thermometers for zircon and rutile. *Contributions to Mineralogy and Petrology*. 151: 413-433.

TABLE S1. U-Pb geochronologic analyses and trace element concentrations of Scarritt Pocket Tuff zircons.

Analysis	U ppm	Th ppm	Pb* ppm	Th/U	$\frac{^{206}\text{Pb}}{^{204}\text{Pb}}$	$\frac{^{208}\text{Pb}^*}{^{232}\text{Th}}$	$\pm 2\sigma$ (%)	$\frac{^{206}\text{Pb}^*}{^{207}\text{Pb}^*}$	$\pm 2\sigma$ (%)	$\frac{^{207}\text{Pb}^*}{^{235}\text{U}^*}$	$\pm 2\sigma$ (%)
SCARTF 27	55.5	36.7	0.26	0.66	231.1	0.0023	21.7	8.9	116.5	0.0696	116.8
SCARTF 31	57.7	59.1	-1.26	1.02	18.6	0.0013	15.9	7.7	168.4	0.0784	168.6
SCARTF 22	32.9	32.1	-0.90	0.98	15.5	0.0024	24.4	20.5	79.2	0.0295	79.6
SCARTF 29	50.0	54.2	-2.50	1.08	8.4	0.0020	16.5	15.3	44.4	0.0394	45.1
SCARTF 33	54.1	56.5	-0.48	1.04	28.7	0.0018	15.7	17.8	59.2	0.0336	59.5
SCARTF 26	53.0	45.4	-1.33	0.86	17.6	0.0021	13.5	27.1	92.8	0.0221	93.3
SCARTF 23	46.4	37.3	-2.91	0.80	8.5	0.0021	17.1	8.0	87.6	0.0748	88.1
SCARTF 30	195.2	409.4	0.76	2.10	92.7	0.0016	9.7	23.6	20.6	0.0253	21.4
SCARTF 19	35.8	38.2	-2.37	1.07	8.2	0.0015	24.8	11.5	19.7	0.0515	20.8
SCARTF 36	39.0	31.5	-0.81	0.81	50.8	0.0020	26.7	20.7	76.5	0.0282	76.9
SCARTF 38	49.6	45.9	-1.20	0.92	16.8	0.0013	23.1	24.7	40.1	0.0234	41.0
SCARTF 39	352.2	267.1	0.91	0.76	122.7	0.0014	10.7	23.2	14.8	0.0250	15.7
SCARTF 34	38.1	37.2	-0.42	0.98	22.9	0.0015	27.5	67.3	63.2	0.0086	63.9
SCARTF 28	46.9	30.1	-1.62	0.64	13.5	0.0021	22.7	20.9	58.0	0.0274	58.7
SCARTF 32	51.1	64.0	-2.22	1.25	9.1	0.0020	21.7	15.0	112.5	0.0378	112.9
SCARTF 25	20.4	13.5	-1.57	0.66	6.5	0.0031	30.4	-13.8	99.4	-0.0399	100.2
contains Ti-bearing inclusion											
SCARTF 20	68.5	85.5	-3.14	1.25	12.0	0.0026	25.5	12.6	25.5	0.0497	26.8
SCARTF 21	72.6	86.2	-2.39	1.19	13.3	0.0015	16.7	15.9	29.5	0.0371	29.9
SCARTF 24	64.7	45.5	-0.42	0.70	40.7	0.0018	20.5	13.2	121.6	0.0441	121.9
contains P-bearing inclusion											
SCARTF 35	122.6	108.2	0.56	0.88	296.2	0.0015	16.0	19.8	32.0	0.0290	33.0
SCARTF 37	270.7	399.9	1.05	1.48	148.4	0.0013	8.1	24.3	20.9	0.0225	21.3

TABLE S1. (Continued)

Analysis	U ppm	Th ppm	Pb* ppm	Th/U	$\frac{^{206}\text{Pb}}{^{204}\text{Pb}}$	$\frac{^{208}\text{Pb}^*}{^{232}\text{Th}}$	$\pm 2\sigma$ (%)	$\frac{^{206}\text{Pb}^*}{^{207}\text{Pb}^*}$	$\pm 2\sigma$ (%)	$\frac{^{207}\text{Pb}^*}{^{235}\text{U}^*}$	$\pm 2\sigma$ (%)
<b>Secondary reference materials</b>											
AUS Z2 120	179.7	90.3	0.06	0.50	107.3	0.0025	12.9	21.3	10.6	0.0374	11.1
AUS Z2 121	180.0	92.0	0.17	0.51	124.8	0.0021	10.3	21.3	14.0	0.0389	14.5
AUS Z2 122	179.9	87.7	0.54	0.49	139.3	0.0023	11.7	19.0	9.7	0.0440	10.4
AUS Z2 123	179.1	86.8	0.27	0.48	116.1	0.0021	10.9	20.6	14.5	0.0381	15.2
AUS Z2 124	180.7	90.1	0.46	0.50	102.5	0.0020	9.6	21.6	12.5	0.0394	13.1
AUS Z2 125	181.5	91.4	-0.20	0.50	60.2	0.0024	16.1	18.2	14.0	0.0463	14.4
AUS Z2 126	200.0	101.8	0.54	0.51	67.3	0.0018	8.4	21.9	10.3	0.0376	10.7
AUS Z2 127	203.6	104.0	0.40	0.51	53.9	0.0022	8.9	19.6	8.1	0.0422	9.0
AUS Z2 128	202.2	103.4	0.97	0.51	91.3	0.0023	10.0	19.6	10.5	0.0423	11.2
AUS Z2 129	202.5	104.0	1.06	0.51	136.8	0.0020	6.9	22.2	9.5	0.0379	10.2
R33 130	104.1	99.3	6.21	0.95	251.3	0.0180	4.9	17.1	3.8	0.5312	5.3
R33 131	150.1	138.6	9.15	0.92	232.0	0.0187	3.8	18.1	2.9	0.5164	4.0
R33 132	114.0	101.4	6.78	0.89	547.5	0.0197	3.6	18.5	4.5	0.5103	5.9
R33 133	115.4	103.4	6.61	0.90	484.5	0.0195	3.8	17.6	3.3	0.5203	4.5
R33 134	113.2	100.2	5.53	0.89	4338.8	0.0196	3.7	17.9	2.9	0.5047	4.3
R33 135	108.7	96.8	5.38	0.89	632.2	0.0190	3.3	17.6	4.3	0.5037	5.9

TABLE S1. (Continued)

Analysis	$\frac{^{206}\text{Pb}^*}{^{238}\text{U}}$	$\pm 2\sigma$	error	$\frac{^{238}\text{U}}{^{206}\text{Pb}^*}$	$\pm 2\sigma$	$\frac{^{207}\text{Pb}^*}{^{206}\text{Pb}^*}$	$\pm 2\sigma$	error
SCARTF 27	0.00450	7.3	0.06	222	7.3	0.1124	116.5	0.00
SCARTF 31	0.00439	7.3	0.04	228	7.3	0.1295	168.4	0.00
SCARTF 22	0.00438	8.3	0.10	228	8.3	0.0489	79.2	0.00
SCARTF 29	0.00437	7.9	0.17	229	7.9	0.0655	44.4	0.00
SCARTF 33	0.00435	5.9	0.10	230	5.9	0.0561	59.2	0.00
SCARTF 26	0.00433	9.5	0.10	231	9.5	0.0369	92.8	0.00
SCARTF 23	0.00433	8.7	0.10	231	8.7	0.1253	87.6	0.00
SCARTF 30	0.00433	5.7	0.27	231	5.7	0.0424	20.6	0.00
SCARTF 19	0.00431	6.7	0.32	232	6.7	0.0866	19.7	0.00
SCARTF 36	0.00423	8.3	0.11	237	8.3	0.0484	76.5	0.00
SCARTF 38	0.00421	8.6	0.21	238	8.6	0.0404	40.1	0.00
SCARTF 39	0.00420	5.1	0.33	238	5.1	0.0432	14.8	0.00
SCARTF 34	0.00419	9.6	0.15	239	9.6	0.0149	63.2	0.00
SCARTF 28	0.00416	9.1	0.16	240	9.1	0.0478	58.0	0.00
SCARTF 32	0.00411	8.7	0.08	244	8.7	0.0667	112.5	0.00
SCARTF 25	0.00400	12.6	0.13	250	12.6	-0.0723	99.4	0.00
contains Ti-bearing inclusion								
SCARTF 20	0.00455	8.3	0.31	220	8.3	0.0793	25.5	0.00
SCARTF 21	0.00429	5.4	0.18	233	5.4	0.0629	29.5	0.00
SCARTF 24	0.00422	8.3	0.07	237	8.3	0.0758	121.6	0.00
contains P-bearing inclusion								
SCARTF 35	0.00416	7.9	0.24	240	7.9	0.0505	32.0	0.00
SCARTF 37	0.00397	3.6	0.17	252	3.6	0.0411	20.9	0.00

TABLE S1. (Continued)

Analysis	$\frac{^{206}\text{Pb}^*}{^{238}\text{U}}$	$\pm 2s$	error	$\frac{^{238}\text{U}}{^{206}\text{Pb}^*}$	$\pm 2s$	$\frac{^{207}\text{Pb}^*}{^{206}\text{Pb}^*}$	$\pm 2s$	error
<b>Secondary reference materials</b>								
AUS Z2 120	0.00577	3.2	0.29	173	3.2	0.0470	10.6	0.00
AUS Z2 121	0.00601	3.6	0.25	166	3.6	0.0469	14.0	0.00
AUS Z2 122	0.00604	3.7	0.36	165	3.7	0.0528	9.7	0.00
AUS Z2 123	0.00570	4.4	0.29	176	4.4	0.0485	14.5	0.00
AUS Z2 124	0.00616	3.7	0.29	162	3.7	0.0464	12.5	0.00
AUS Z2 125	0.00610	3.6	0.25	164	3.6	0.0551	14.0	0.00
AUS Z2 126	0.00598	3.0	0.28	167	3.0	0.0456	10.3	0.00
AUS Z2 127	0.00598	3.8	0.42	167	3.8	0.0511	8.1	0.00
AUS Z2 128	0.00603	3.9	0.34	166	3.9	0.0509	10.5	0.00
AUS Z2 129	0.00610	3.6	0.35	164	3.6	0.0450	9.5	0.00
R33 130	0.06574	3.7	0.70	15	3.7	0.0586	3.8	0.00
R33 131	0.06785	2.7	0.68	15	2.7	0.0552	2.9	0.00
R33 132	0.06865	3.9	0.66	15	3.9	0.0539	4.5	0.00
R33 133	0.06659	3.1	0.69	15	3.1	0.0567	3.3	0.00
R33 134	0.06567	3.1	0.74	15	3.1	0.0557	2.9	0.00
R33 135	0.06425	4.1	0.69	16	4.1	0.0569	4.3	0.00

TABLE S1. (Continued)

Analysis		$\frac{^{207}\text{Pb}^*}{^{206}\text{Pb}^*}$	$\pm 2\sigma$	$\frac{^{207}\text{Pb}^*}{^{235}\text{U}}$	$\pm 2\sigma$	$\frac{^{206}\text{Pb}^*}{^{238}\text{U}^*}$	$\pm 2\sigma$	P	Ti	Y	Zr (wt%)	Nb	Hf	Ta	Ti-in-zircon T(°C)	
SCARTF 27			68	77	28.9	2.1	266		3.3	831		56.1	0.56	9653	0.30	670
SCARTF 31	2091	2961	77	124	28.2	2.0	318		9.7	2014		57.5	0.76	7733	0.36	764
SCARTF 22	141	1860	30	23	28.2	2.3	273		11.3	1276		57.8	0.73	8244	0.27	780
SCARTF 29	789	931	39	17	28.1	2.2	268		9.3	2066		56.8	0.70	8086	0.34	760
SCARTF 33	456	1314	34	20	28.0	1.6	287		12.3	2150		57.9	1.02	7731	0.62	788
SCARTF 26	-563	2503	22	20	27.9	2.6	370		8.3	1295		55.4	0.90	7430	0.44	749
SCARTF 23	2033	1551	73	62	27.9	2.4	244		4.3	975		56.3	0.82	8717	0.40	691
SCARTF 30	-204	517	25	5	27.8	1.6	589		9.7	2929		55.8	1.70	7599	0.34	764
SCARTF 19	1352	380	51	10	27.7	1.8	242		9.6	1576		58.5	0.58	8811	0.35	763
SCARTF 36	117	1803	28	21	27.2	2.3	261		6.8	1068		56.3	0.45	8328	0.23	731
SCARTF 38	-325	1029	24	10	27.1	2.3	291		5.1	949		63.3	0.70	10361	0.34	705
SCARTF 39	-158	369	25	4	27.0	1.4	860		7.4	3896		64.0	8.62	11800	2.52	738
SCARTF 34	-4222	4156	9	6	26.9	2.6	224		8.2	1237		57.2	0.63	7579	0.28	749
SCARTF 28	91	1374	27	16	26.8	2.4	229		7.1	752		56.1	1.14	8540	0.57	735
SCARTF 32	829	2347	38	42	26.4	2.3	279		8.7	2083		56.9	0.88	8139	0.34	753
SCARTF 25	0		-41	-42	25.8	3.2	155		4.1	348		56.1	0.19	8264	0.14	687
contains Ti-bearing inclusion																
SCARTF 20	1179	504	49	13	29.3	2.4	346		28.2	2454		56.4	1.22	7594	0.58	880
SCARTF 21	703	627	37	11	27.6	1.5	317		53.8	2513		60.4	1.43	8127	0.61	963
SCARTF 24	1089	2437	44	52	27.2	2.2	294	3056.4	744			57.9	2.35	8393	0.26	1982

TABLE S1. (Continued)

Analysis	$\frac{^{207}\text{Pb}^*}{^{206}\text{Pb}^*}$	$\pm 2s$ (Ma)	$\frac{^{207}\text{Pb}^*}{^{235}\text{U}}$	$\pm 2s$ (Ma)	$\frac{^{206}\text{Pb}^*}{^{238}\text{U}^*}$	$\pm 2s$ (Ma)	P ppm	Ti ppm	Y ppm	Zr wt%	Nb ppm	Hf ppm	Ta ppm	Ti-in-zircon T(°C)
contains P-bearing inclusion														
SCARTF 35	217	741	29	9	26.8	2.1	576	6.8	1709	56.5	2.32	9434	0.94	731
SCARTF 37	-282	533	23	5	25.5	0.9	759	11.8	4474	59.5	2.37	7267	0.62	784
Secondary reference materials														
AUS Z2 120	51	253	37	4	37.1	1.2	110	2.3	951	61.1	4.15	4607	2.25	640
AUS Z2 121	42	335	39	6	38.7	1.4	111	2.6	971	60.9	4.26	4595	2.27	649
AUS Z2 122	319	221	44	4	38.8	1.4	105	1.8	937	62.6	3.85	4689	2.09	622
AUS Z2 123	122	343	38	6	36.6	1.6	101	2.7	914	60.2	3.66	4592	2.00	652
AUS Z2 124	18	301	39	5	39.6	1.5	102	2.7	932	61.9	4.03	4845	2.16	652
AUS Z2 125	414	312	46	6	39.2	1.4	111	2.4	943	61.5	3.88	4854	2.08	645
AUS Z2 126	-25	249	37	4	38.4	1.1	125	3.0	1011	61.5	4.56	4750	2.49	661
AUS Z2 127	248	187	42	4	38.4	1.5	95	1.3	1031	61.6	4.82	4768	2.42	602
AUS Z2 128	238	243	42	5	38.7	1.5	121	2.0	1031	61.4	4.39	4752	2.19	630
AUS Z2 129	-57	232	38	4	39.2	1.4	122	2.1	1043	61.6	4.55	4786	2.39	634
R33 130	552	83	433	19	410	15	138	6.7	1749	68.3	0.15	11513	0.20	729
R33 131	420	65	423	14	423	11	139	5.5	1695	66.7	0.05	11101	0.20	712
R33 132	367	100	419	20	428	16	151	6.2	1646	65.6	0.15	11097	0.19	723
R33 133	479	72	425	16	416	12	166	6.8	1771	67.0	0.24	11211	0.16	731
R33 134	442	64	415	14	410	12	159	6.9	1727	65.7	0.12	11168	0.14	732
R33 135	486	94	414	20	401	16	146	6.8	1686	66.1	0.22	11037	0.20	731

TABLE S1. (Continued)

Analysis	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm
SCARTF 27		5.9	0.02	1.2	3.8	1.1	18	6.8	79	29	132	36	444
SCARTF 31		11.0	0.20	4.6	11.9	3.3	63	22.5	240	81	317	75	835
SCARTF 22	0.0005	6.9	0.10	3.2	7.4	1.7	36	13.9	145	48	199	46	548
SCARTF 29	0.0122	8.8	0.19	4.1	11.6	2.7	60	21.4	239	81	320	77	823
SCARTF 33		10.1	0.15	4.2	10.7	2.2	58	20.4	240	82	332	83	877
SCARTF 26	0.0495	7.5	0.10	2.2	5.8	1.8	30	11.0	133	48	201	54	632
SCARTF 23		6.1	0.14	2.5	5.8	2.4	26	8.6	103	35	148	39	491
SCARTF 30	0.0474	15.8	0.37	9.1	25.5	9.2	114	34.2	341	104	406	97	1084
SCARTF 19	0.0132	7.4	0.12	2.8	8.7	2.5	47	16.8	188	62	245	60	642
SCARTF 36		5.3	0.08	1.4	4.9	1.2	29	9.5	118	40	168	43	514
SCARTF 38	0.0006	6.1	0.11	1.7	4.1	1.2	25	8.7	102	36	145	39	456
SCARTF 39	0.0152	23.1	0.08	2.1	10.3	2.9	75	31.8	407	148	611	153	1752
SCARTF 34		6.7	0.12	3.5	8.1	2.3	35	11.4	131	47	184	47	565
SCARTF 28	0.0357	6.0	0.04	0.7	1.7	0.7	13	5.3	71	27	126	34	430
SCARTF 32		11.0	0.22	4.0	11.4	2.8	68	22.4	249	79	318	74	794
SCARTF 25		2.1	0.01	0.4	1.2	0.7	8	2.7	33	13	58	16	213
contains Ti-bearing inclusion													
SCARTF 20	0.3369	14.0	0.31	4.3	12.2	2.9	72	23.5	266	91	370	91	973
SCARTF 21	0.0011	12.7	0.17	3.7	11.1	2.9	62	22.4	275	95	382	92	1004
SCARTF 24	0.0231	4.5	0.06	0.9	3.0	1.3	19	5.9	74	27	117	32	425
contains P-bearing inclusion													
SCARTF 35	0.7022	12.3	0.31	3.5	6.0	1.9	36	14.3	181	64	271	70	839
SCARTF 37		22.9	0.31	6.9	21.1	11.0	113	36.9	429	155	632	153	1734

TABLE S1. (Continued)

Analysis	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm
<b>Secondary reference materials</b>													
AUS Z2 120	0.0059	2.6	0.22	4.2	6.7	4.8	27	10.2	114	38	154	40	441
AUS Z2 121	0.0103	2.7	0.21	4.1	7.5	5.0	27	9.8	119	38	156	39	446
AUS Z2 122		2.7	0.26	3.8	7.1	5.1	26	9.8	114	37	152	39	438
AUS Z2 123	0.0308	2.5	0.18	3.2	7.0	4.9	26	9.4	111	36	150	38	430
AUS Z2 124	0.0301	2.8	0.26	3.7	6.9	4.8	26	9.9	117	37	151	41	454
AUS Z2 125	0.0004	2.6	0.24	3.3	7.3	5.3	25	10.1	118	40	152	40	442
AUS Z2 126	0.0229	3.0	0.27	4.3	7.6	5.6	30	11.1	130	40	168	42	487
AUS Z2 127		3.0	0.24	4.5	7.1	5.8	31	11.4	132	41	173	44	491
AUS Z2 128		3.0	0.27	4.4	8.3	5.7	29	11.3	125	42	165	43	472
AUS Z2 129	0.0147	3.0	0.29	4.3	6.8	5.8	29	11.3	130	42	168	44	490
R33 130	0.0173	3.9	0.06	2.1	7.0	1.5	37	14.1	172	63	274	70	771
R33 131		4.2	0.10	1.8	5.4	1.4	30	11.8	155	57	263	69	794
R33 132		3.9	0.05	1.6	5.1	1.3	31	12.8	161	59	259	70	765
R33 133		4.0	0.10	2.6	6.6	1.5	38	13.9	172	64	279	73	818
R33 134	0.0056	4.0	0.07	2.2	6.2	1.5	35	13.6	169	64	281	72	798
R33 135	0.0330	3.7	0.06	2.1	6.4	1.5	35	12.8	163	61	270	69	780