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Supplementary Data for: Discovery of mafic impact melt in the center of the Vredefort Dome; archetype for continental residua of Early Earth cratering?

METHODS

Optical and electron microscopy (secondary and backscatter electron imaging (SE and BSE), energy dispersive spectroscopy (EDS), cathodoluminescence (CL) and electron backscatter diffraction (EBSD)) of petrographic thin sections was carried out, using a Hitachi SU6600 Field Emission Gun-Scanning Electron Microscope (FEG-SEM) at the Western University Zircon and Accessory Phase Laboratory (ZAPLab). Zircon separation for geochronology was conducted at the Jack Satterly Geochronology lab at the University of Toronto using standard procedures. Secondary Ion Mass Spectrometer (SIMS) U-Pb isotopic analysis and Ti-thermometry was conducted at the Stanford/ U.S.G.S. SHRIMP-RG facility according to previously published procedures (Mazdab and Wooden, 2006), and referenced to internal zircon geochronology standard VP-10 (see Bowman et al., 2011). Lu-Hf isotope measurements of zircon were made by LA-MC-ICP-MS at the University of Bristol according to previously published procedures (Hawkesworth and Kemp, 2006; Fisher et al., 2011). The standards used were Plešovice (Sláma et al., 2008) which had an average $^{176}Hf/^{177}Hf$ of 0.282487 ± 0.000023 (n = 20), Mud Tank (Woodhead and Hergt, 2005) with an average of 0.282523 ± 0.000021 (n = 19) and Temora-2 (Woodhead and Hergt, 2005) which had an average of 0.282700 ± 0.000044 (n = 9).

Table DR1: U-Pb Data for V250, V232 and V235

Sample #	207/206 age	2sd error	Conc (%)	204 cts/sec	204 /206	Pb/U: UO/U^{2}	% err	Pb^{204} Corr 207r/206r	% err	Pb^{204} Corr 207r/235r	% err	Pb^{204} Corr 207r/238	% err	Err corr	U (ppm)	Th (ppm)	Th/U
V09_232																	
V09_232_1.1	1993	46	2	0.06	8.5E-5	.02779	1.1	.1225	1.3	5.99	1.7	.3547	1.1	.653	37	17	0.49
V09_232_2.1	1984	56	0	0.07	1.3E-4	.02828	1.3	.1219	1.6	6.06	2.1	.3606	1.3	.637	27	10	0.38
V09_232_3.1	2000	40	0	0.05	5.0E-5	.02845	1.0	.1230	1.1	6.16	1.5	.3632	1.0	.670	53	27	0.53
V09_232_4.1	2013	40	0	-0.07	-7.1E-5	.02874	1.0	.1239	1.1	6.28	1.5	.3676	1.0	.649	51	26	0.52
V09_232_5.1	1995	60	1	0.05	1.0E-4	.02822	1.3	.1227	1.7	6.09	2.1	.3600	1.3	.621	33	11	0.35
V09_232_ 7.1	2035	44	2	0.06	8.1E-5	.02830	1.1	.1255	1.3	6.25	1.7	.3611	1.1	.661	48	38	0.82
V09_232_8.1	2003	36	1	-0.13	-9.3E-5	.02807	0.8	.1232	1.0	6.10	1.3	.3591	0.8	.633	81	41	0.51
V09_235																	
V09_235_1.1	1994	30	-1	0.10	5.5E-5	.02888	0.7	.1225	0.9	6.23	1.1	.3687	0.7	.630	111	49	0.46
V09_235_2.1	2015	28	1	0.07	3.8E-5	.02839	0.7	.1240	0.8	6.20	1.1	.3625	0.7	.666	106	48	0.46
V09_235_3.1	2089	74	3	-0.21	-3.6E-4	.02885	1.4	.1293	2.1	6.61	2.6	.3706	1.5	.570	34	14	0.42
V09_235_4.1	2025	34	4	0.03	2.5E-5	.02747	0.9	.1248	1.0	6.04	1.3	.3509	0.9	.655	90	54	0.62
V09_235_5.1	2018	52	8	0.04	7.2E-5	.02628	1.2	.1243	1.4	5.75	1.9	.3355	1.2	.643	48	21	0.45
V09_235_6.1	2003	32	2	0.06	4.1E-5	.02787	0.8	.1232	0.9	6.04	1.2	.3558	0.8	.655	106	62	0.61
V09_235_7.1	2015	26	3	0.00	---	.02783	0.7	.1240	0.7	6.08	1.0	.3556	0.7	.681	140	81	0.60
V09_235_8.1	2015	30	3	0.09	5.6E-5	.02773	0.7	.1240	0.8	6.05	1.1	.3541	0.7	.653	117	46	0.40
V09_235_9.1	2005	40	8	0.08	8.3E-5	.02628	0.9	.1234	1.1	5.70	1.5	.3353	0.9	.636	93	54	0.60
V09_250																	
V09_250_1.1	2009	48	2	0.06	7.1E-5	.02802	1.0	.1236	1.4	6.10	1.7	.3576	1.0	.613	50	17	0.36
V09_250_4.1	2030	50	1	0.00	---	.02864	1.3	.1251	1.4	6.31	1.9	3659	1.3	.691	29	7	0.24
V09_250_5.1	2016	38	1	0.00	---	0.2843	1.0	.1241	1.1	6.22	1.5	.3633	1.0	.685	59	17	0.30

Table DR2: Ti-in-zircon data

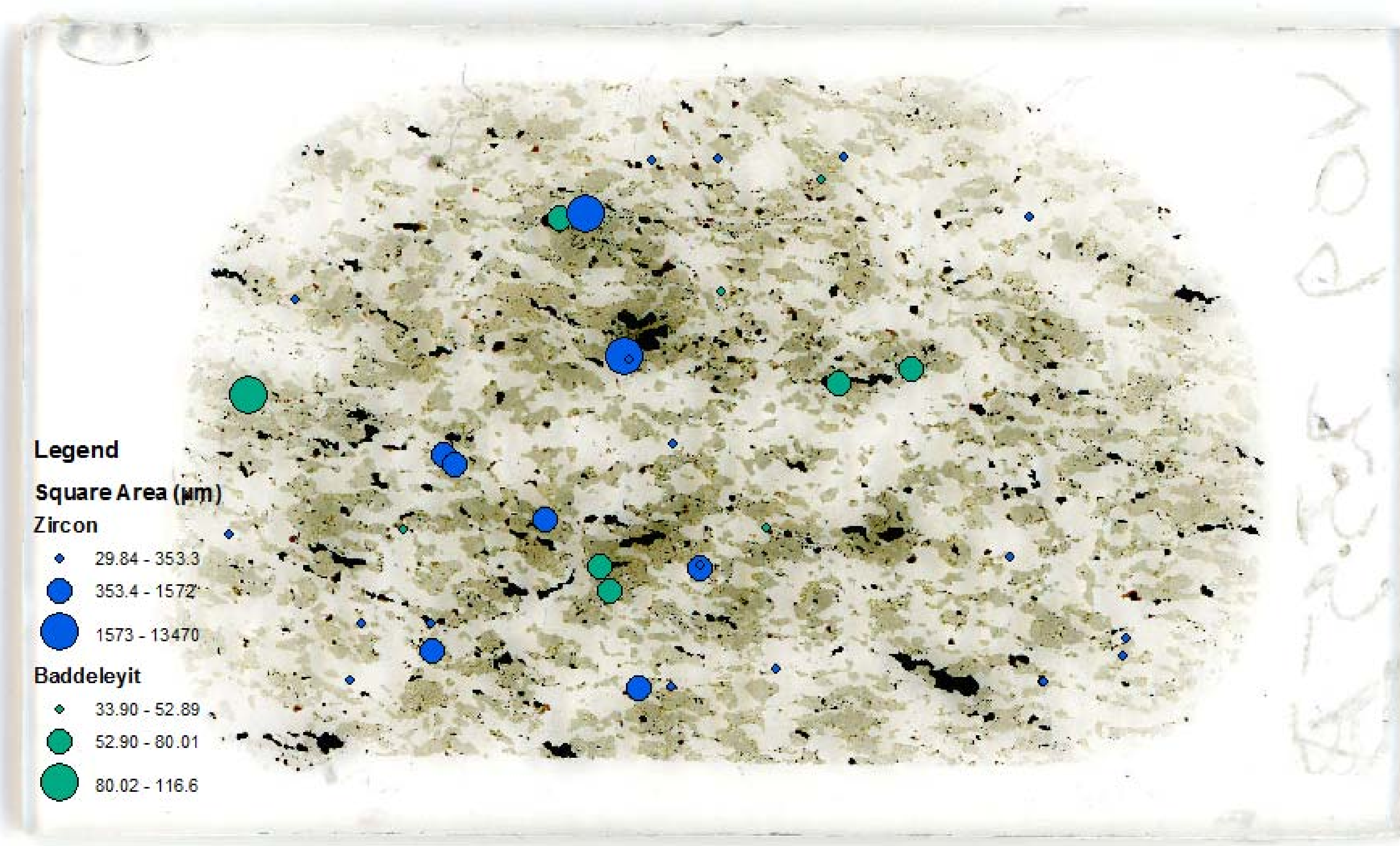
Sample	Ti 48(ppm)	Ti 49(ppm)	T (˚C)
V09-232-1.3TE	19.1	19.2	833
V09-232-2.2TE	30.1	30.3	883
V09-232-2.3TE	22.7	22.9	852
V09-232-3.2TE	27.1	27.8	873
V09-232-3.3TE	17.8	19.0	832
V09-232-4.2TE	32.5	32.2	890
V09-232-5.2TE	24.0	23.9	857
V09-232-5.3TE	13.2	13.2	795
V09-232-6.2TE	38.4	38.2	910
V09-232-6.3TE	30.8	31.9	889
V09-232-7.2TE	29.4	27.8	874
V09-232-7.3TE	18.2	17.5	824
V09-232-8.2TE	15.2	14.4	804
V09-232-9.4TE	31.5	31.2	887
V09-232-9.5TE	30.5	30.8	885
V09-232-9.6TE	32.7	34.0	897
V09-235-1.2TE	18.6	18.9	832
V09-235-2.2TE	15.8	15.6	812
V09-235-3.2TE	44.9	44.1	928
V09-235-4.2TE	18.7	18.3	828
V09-235-5.2TE	26.8	27.2	871
V09-235-6.2TE	22.7	21.9	847
V09-235-7.2TE	19.0	19.0	832
V09-235-8.2TE	18.0	17.5	824
V09-235-9.2TE	20.8	20.9	842
V09-235-9.3TE	29.4	29.6	880
V09-235-10.2TE	18.0	17.5	824
V09-250-1.2TE	22.7	22.3	849
V09-250-2.2TE	19.1	19.9	837
V09-250-3.2TE	45.0	42.9	924
V09-250-4.2TE	18.3	17.9	826
V09-250-5.2TE	23.4	22.5	850
V09-250-6.2TE	27.1	26.3	867
V09-250-6.3TE	24.0	24.2	858

Table DR3: Lu-Hf data

Name	Age Ma ±1σ	$^{176}Lu/^{177}Hf$	$^{176}Yb/^{177}Hf$	$^{176}Hf/^{177}Hf$	±1σ	ε_{HfT} ±2σ	T(DM)[c] Ma
V250- Z1	2020	0.000595	0.025532	0.281345	0.000017	-5.3 1.2	2993
V250- Z2	2020	0.000858	0.032652	0.281435	0.000019	-2.1 1.3	2791
V250- Z6	2020	0.000549	0.023084	0.281407	0.000014	-3.1 1.0	2853
V250- Z9	2020	0.000439	0.017480	0.281426	0.000011	-2.4 0.8	2811
V250- Z10	2020	0.000556	0.023501	0.281454	0.000016	-1.4 1.1	2748
V250- Z11	2020	0.000389	0.015887	0.281443	0.000012	-1.8 0.9	2772
V250- Z12	2700	0.001548	0.064351	0.281060	0.000015	0.4 1.1	3166
V250- Z13	3200	0.001188	0.048438	0.281036	0.000013	11.4 1.0	2855
V235- Z15	2020	0.000689	0.027850	0.281296	0.000011	-7.0 0.8	3104
V235- Z16	2020	0.000560	0.022015	0.281290	0.000015	-7.2 1.0	3116
V235- Z20	2020	0.000398	0.015387	0.281342	0.000020	-5.4 1.4	3000
V235- Z21	2020	0.000445	0.016924	0.281317	0.000016	-6.3 1.2	3057
V235- Z25	2020	0.000281	0.010548	0.281292	0.000015	-7.2 1.1	3112
V235- Z26	2020	0.000652	0.024328	0.281329	0.000013	-5.8 0.9	3028
V235- Z27	2020	0.000529	0.020668	0.281286	0.000015	-7.4 1.0	3126
V235- Z30	2020	0.000418	0.016673	0.281272	0.000020	-7.9 1.4	3158

[c] Stands for crustal source.

Figure DR1: MicroGIS of thin section V235 with distribution of zircons and baddeleyites, grain size is indicated by spot size.



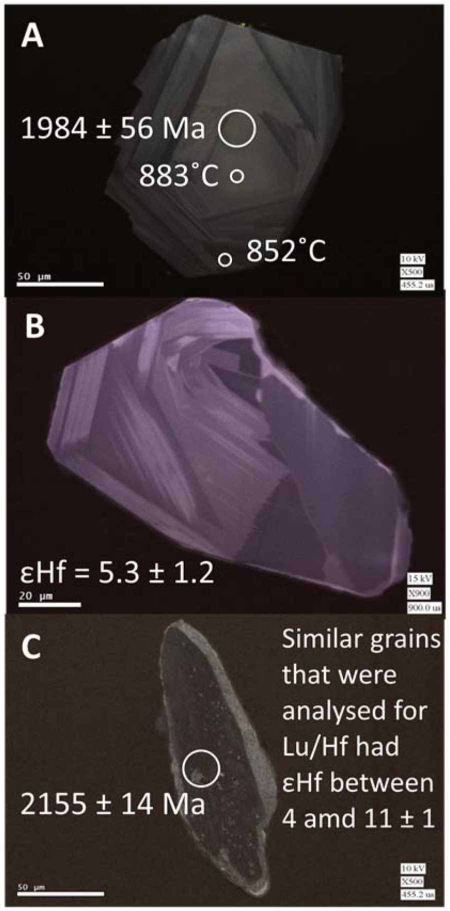


Fig. 2: CL images of zircons from the gabbronorite body, polished to mid-plane and imaged by FEG-SEM.: (A) CL image of unshocked, igneous grain with typical oscillatory planar growth banding and sector zoning are from sample V232 at Site 2. Note the clearly different CL zoning patterns in the shocked and unshocked grains. This grain has a U-pb age of 1984 ± 56 Ma and has a core temperature of 883˚C and a rim temperature of 852˚C. (B) CL image of an unshocked, igneous grain from V250 that was analysed for Lu/Hf and has a εHf value of -5.3 ± 1.2. (C) CL image illustrates a shocked and recrystallized xenocrystic grain from sample V250 from site 1, this grain has a U-Pb age of 2155 ± 14 Ma. Similar grains from this sample were analysed for Lu/Hf ratios and have εHf values between 4 and 11 ± 1.

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