

201702: porphyritic rhyolite, Kathleen Range

(Wankari Volcanics, Tjauwata Group, Bentley Supergroup, Musgrave Province)

Location and sampling

SCOTT (SG 52-6), DEERING (4647)
MGA Zone 52, 478743E 7227730N

Sampled on 15 July 2013

This sample was collected from an outcrop south of the Kathleen Range, which is west of the Petermann Ranges. The locality is about 16.2 km southeast of Warrupura community, 13.6 km west-northwest of Mount Deering, and 12.5 km east of the Great Central Road at Giles Creek.

Tectonic unit/relations

The unit sampled is a rhyolite assigned to the Wankari Volcanics of the Tjauwata Group. The c. 1051 to 1039 Ma Wankari Volcanics consists of felsic and mafic metavolcanic rocks with minor psammitic interlayers. The Tjauwata Group is a late-stage component of the Bentley Supergroup and in this area overlies granite and gneiss of the 1220–1150 Ma Pitjantjatjara Supersuite (Edgoose et al., 2004; Smithies et al., 2010). The Bentley Supergroup comprises a thick volcano-sedimentary succession deposited during the 1085–1040 Ma Giles Event (Smithies et al., 2009). A rhyolite of the Tjauwata Group, collected about 8.3 km to the north, yielded an igneous crystallization age of 1041 ± 6 Ma (GSWA 201708, Lu et al., 2017).

Petrographic description

The sample is a fine- to medium-grained, foliated to schistose, porphyritic rhyolite, consisting of about 60% quartz–feldspar groundmass, 20% K-feldspar, 5% plagioclase, 10% opaque minerals, 3% muscovite and biotite, and 2% epidote. The groundmass is cryptocrystalline to microcrystalline, and contains phenocrysts of K-feldspar (perthite) and plagioclase (oligoclase, An₂₅). The phenocrysts are partly sheared, up to 1 mm in size, corroded, and recrystallized. Muscovite, biotite, and cryptocrystalline opaque minerals are aligned with the foliation. Epidote is fine grained and subhedral.

Zircon morphology

Zircons isolated from this sample are colourless, and mainly euhedral. The crystals are up to 500 µm long,

and equant to elongate, with aspect ratios up to 5:1. In cathodoluminescence (CL) images, concentric zoning is ubiquitous. Many crystals contain inclusions and some crystals contain partially resorbed centres. A CL image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed on 14–15 August 2014, using SHRIMP-B. Thirteen analyses of the BR266 standard were obtained during the session, of which 12 analyses indicated an external spot-to-spot (reproducibility) uncertainty of 0.50% (1σ), and a $^{238}\text{U}/^{206}\text{Pb}^*$ calibration uncertainty of 0.15% (1σ). Calibration uncertainties are included in the errors of $^{238}\text{U}/^{206}\text{Pb}^*$ ratios and dates listed in Table 1. Common-Pb corrections were applied to all analyses using contemporaneous isotopic compositions determined according to the model of Stacey and Kramers (1975).

Results

Seventeen analyses were obtained from 16 zircons. Results are listed in Table 1, and shown in a concordia diagram (Fig. 2).

Interpretation

The analyses are concordant to strongly discordant (Fig. 2). The analyses yield $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ dates that correlate with their common-Pb contents (f_{204}), indicating that corrections using ^{204}Pb are inaccurate for some or all of these analyses. The date for this sample is therefore determined from the intersection with the concordia curve of a regression through uncorrected data (Fig. 2), anchored at contemporaneous initial Pb ($^{207}\text{Pb}/^{206}\text{Pb} = 0.9122$ at 1043 Ma; Stacey and Kramers, 1975). The analyses form a single group, based on their $^{207}\text{Pb}/^{206}\text{Pb}$ and $^{238}\text{U}/^{206}\text{Pb}$ ratios.

Group I comprises 17 analyses (Table 1), which yield a regression that intersects the concordia curve at 1044 ± 8 Ma (MSWD = 0.73).

The date of 1044 ± 8 Ma for the 17 analyses in Group I is interpreted as the magmatic crystallization age of the rhyolite.

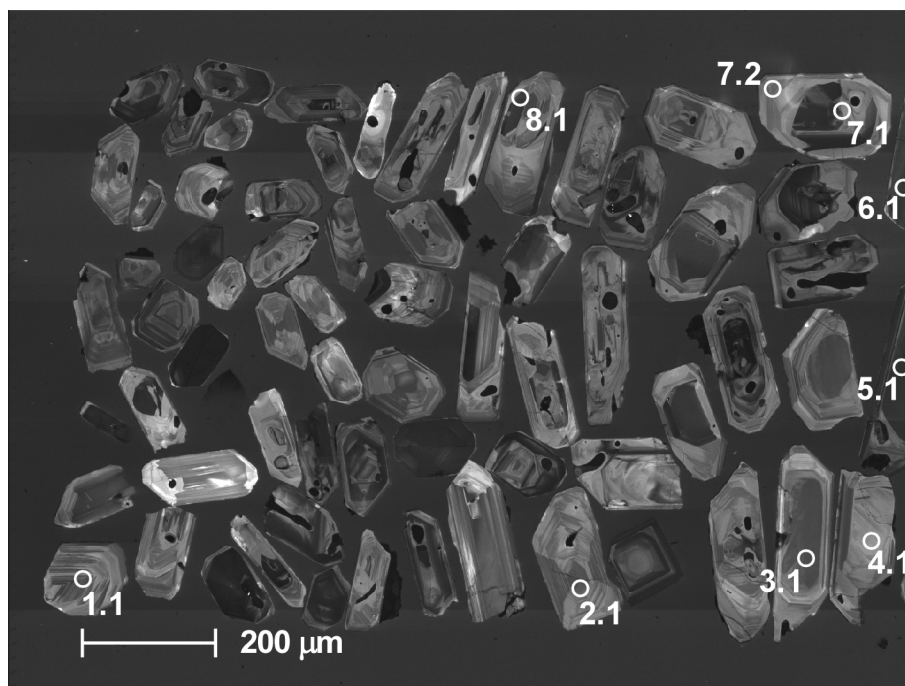


Figure 1. Cathodoluminescence image of representative zircons from sample 201702: porphyritic rhyolite, Kathleen Range. Numbered circles indicate the approximate locations of analysis sites

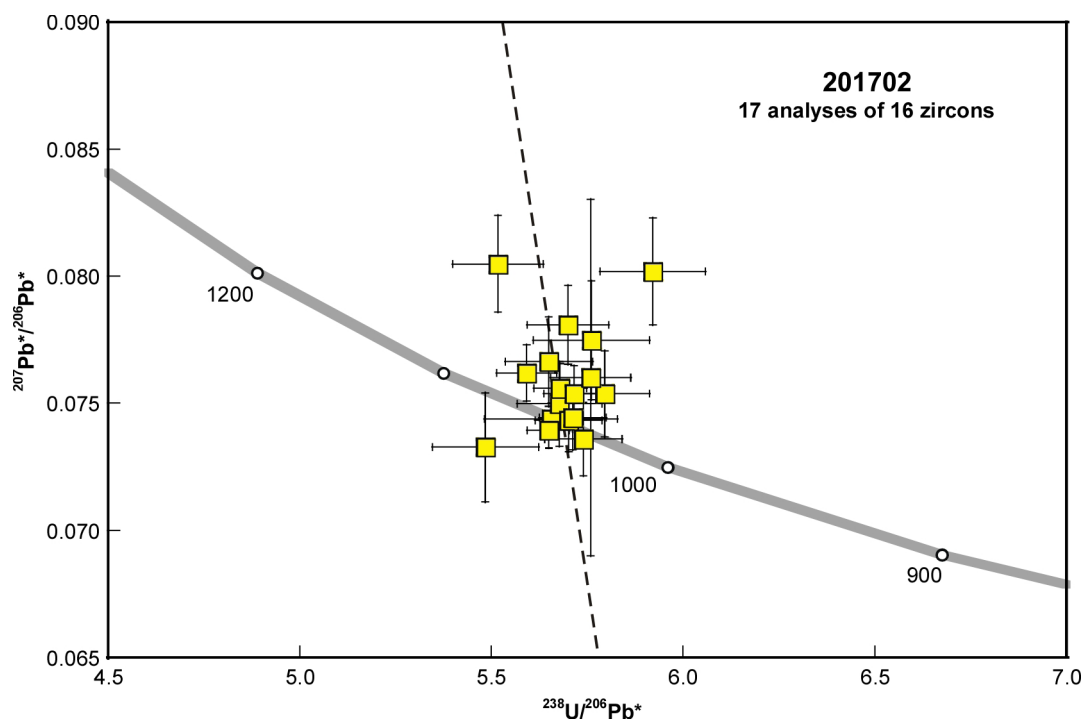


Figure 2. U-Pb analytical data, not corrected for common Pb, for zircons from sample 201702: porphyritic rhyolite, Kathleen Range. Yellow squares indicate Group I (magmatic zircons). The dashed line indicates a regression from initial Pb through data in Group I

Table 1. Ion microprobe analytical results for zircons from sample 201702: porphyritic rhyolite, Kathleen Range

Group ID	Spot no.	Grain. spot	^{238}U (ppm)	^{232}Th (ppm)	$\frac{^{232}\text{Th}}{^{238}\text{U}}$	f_{204} (%)	$^{238}\text{U}/^{206}\text{Pb} \pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb} \pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^* \pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^* \pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^*$ date (Ma) $\pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date (Ma) $\pm 1\sigma$	Disc. (%)						
I	14	13.1	29	28	0.99	0.744	5.485	0.138	0.07327	0.00213	5.526	0.141	0.06710	0.00418	1072	26	841	130	-27.5
I	17	16.1	33	37	1.16	1.552	5.921	0.138	0.08019	0.00210	6.015	0.145	0.06733	0.00538	991	23	848	166	-16.9
I	15	14.1	51	60	1.22	0.588	5.678	0.110	0.07498	0.00167	5.711	0.112	0.07008	0.00298	1040	19	931	87	-11.7
I	3	3.1	65	91	1.44	0.341	5.740	0.101	0.07359	0.00145	5.759	0.102	0.07074	0.00220	1032	17	950	64	-8.6
I	2	2.1	63	109	1.78	0.392	5.759	0.104	0.07600	0.00701	5.782	0.105	0.07273	0.00729	1028	18	1006	203	-2.2
I	4	4.1	31	35	1.18	0.562	5.761	0.152	0.07748	0.00233	5.793	0.154	0.07278	0.00408	1026	26	1008	114	-1.8
I	1	1.1	49	80	1.67	0.875	5.517	0.118	0.08048	0.00190	5.565	0.121	0.07316	0.00382	1065	22	1018	106	-4.6
I	7	7.1	159	252	1.64	0.248	5.680	0.069	0.07558	0.00097	5.694	0.070	0.07350	0.00134	1043	12	1028	37	-1.5
I	9	8.1	90	169	1.93	0.082	5.702	0.087	0.07433	0.00124	5.706	0.087	0.07365	0.00142	1041	15	1032	39	-0.9
I	16	15.1	331	488	1.52	0.065	5.656	0.173	0.07438	0.00063	5.660	0.173	0.07384	0.00070	1049	31	1037	19	-1.1
I	13	12.1	278	390	1.45	0.000	5.649	0.055	0.07393	0.00067	5.649	0.055	0.07393	0.00067	1051	9	1040	18	-1.1
I	10	9.1	114	157	1.42	0.259	5.592	0.078	0.07619	0.00111	5.606	0.078	0.07402	0.00156	1058	14	1042	42	-1.5
I	12	11.1	51	53	1.06	0.152	5.796	0.116	0.07537	0.00170	5.805	0.117	0.07409	0.00213	1025	19	1044	58	1.9
I	6	6.1	91	137	1.55	-0.082	5.712	0.087	0.07442	0.00124	5.708	0.087	0.07511	0.00142	1041	15	1071	38	2.9
I	5	5.1	113	164	1.50	0.000	5.715	0.078	0.07538	0.00111	5.715	0.078	0.07538	0.00111	1039	13	1079	30	3.6
I	8	7.2	48	51	1.09	0.000	5.650	0.114	0.07664	0.00176	5.650	0.114	0.07664	0.00176	1051	20	1112	46	5.5
I	11	10.1	59	103	1.80	-0.242	5.700	0.106	0.07809	0.00155	5.686	0.106	0.08013	0.00211	1044	18	1200	52	13.0

References

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Recommended reference for this publication

- Lu, Y, Wingate, MTD, Kirkland, CL, Howard, HM, Quentin de Gromard, R and Haines, PW 2017, 201702: porphyritic rhyolite, Kathleen Range; Geochronology Record 1402: Geological Survey of Western Australia, 4p.

Data obtained: 15 August 2014

Data released: 12 May 2017