

187175: muscovite–tourmaline pegmatite, Morgan Range

(Paterson Orogen, Musgrave region)

Location and sampling

SCOTT (SG 52-6), HOLT (4546)

MGA Zone 52, 445835E 7137334N

Sampled on 28 May 2007

This sample was collected from the southern side of a hill, approximately 8.4 km north-northwest of Amy Giles Hill, and 7.9 km northeast of the highest point on the Morgan Range.

Tectonic unit/relations

The unit sampled is a pegmatite that intrudes 1085–1040 Ma gabbro of the Warakurna Supersuite along the northeastern margin of the Tjuni Purlka Tectonic Zone. The Tjuni Purlka Tectonic Zone is the main broad zone of multigenerational shearing in the Musgrave region, which became the focus of deformation from c. 1220 Ma to c. 1050 Ma (Smithies et al., 2010). The pegmatite is assigned to the Paterson Orogen, which forms the boundary between the North and West Australian Cratons (Bagas, 2004). A significant magmatic event in the Paterson Orogen has been recognized at 650–611 Ma, and this event may be responsible for mineralization at the giant Telfer gold–copper deposit (Rowins et al., 1997).

Petrographic description

The pegmatite has a visually estimated mineralogy comprising 37% quartz, 37% plagioclase, 10% tourmaline, 8% braid perthite, 7% muscovite, and accessory zircon and apatite. The rock has a granoblastic texture. Quartz displays undulose extinction and sutured grain boundaries, and has been locally recrystallized.

Zircon morphology

Zircons isolated from this sample are euhedral, up to 500 µm long, and have aspect ratios up to 6:1. The grains are large, brown to black, highly enriched in ^{238}U , and are dark in cathodoluminescence (CL) images. A CL image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed on 6 March 2008, using SHRIMP-A. Five analyses of the CZ3 standard obtained

during the session indicated an external spot-to-spot (reproducibility) uncertainty of 0.50% (1σ), and a $^{238}\text{U}/^{206}\text{Pb}^*$ calibration uncertainty of 0.39% (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

Twelve analyses were obtained from 12 zircons. Results are listed in Table 1, and shown on a concordia diagram (Fig. 2) and $^{238}\text{U}^*/^{206}\text{Pb}^*$ age versus uranium plot (Fig. 3).

Interpretation

The analyses are concordant to moderately reversely discordant (Fig. 2), and have $^{238}\text{U}/^{206}\text{Pb}^*$ dates that correlate with increasing uranium content (Fig. 3). Reverse discordance is common in ion microprobe analyses of high-uranium metamict zircons, and reflects sputtering characteristics different to those in the lower-uranium zircon standard, but does not affect $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ ratios. All analyses define a single group, based on their $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ and Th/U ratios.

Group I comprises 12 analyses (Table 1), which yield a weighted mean $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 625 ± 11 Ma (MSWD = 0.64). These analyses indicate high uranium contents (1226–4321 ppm), and low Th/U ratios (0.001–0.015).

The date of 625 ± 11 Ma for the 12 analyses in Group I is interpreted as the magmatic crystallization age of the pegmatite.

References

- Bagas, L 2004, Proterozoic evolution and tectonic setting of the northwest Paterson Orogen, Western Australia: *Precambrian Research*, v. 128, p. 475–496.
- Rowins, SM, Groves, DI, McNaughton, NJ, Palmer, MR and Eldridge, CS 1997, A reinterpretation of the role of granitoids in the genesis of Neoproterozoic gold mineralisation in the Telfer Dome, Western Australia: *Economic Geology*, v. 92, p. 133–160.
- Smithies, RH, Howard, HM, Evins, PM, Kirkland, CL, Kelsey, DE, Hand, M, Wingate, MTD, Collins, AS, Belousova, E and Allchurch, S 2010, Geochemistry, geochronology, and petrogenesis

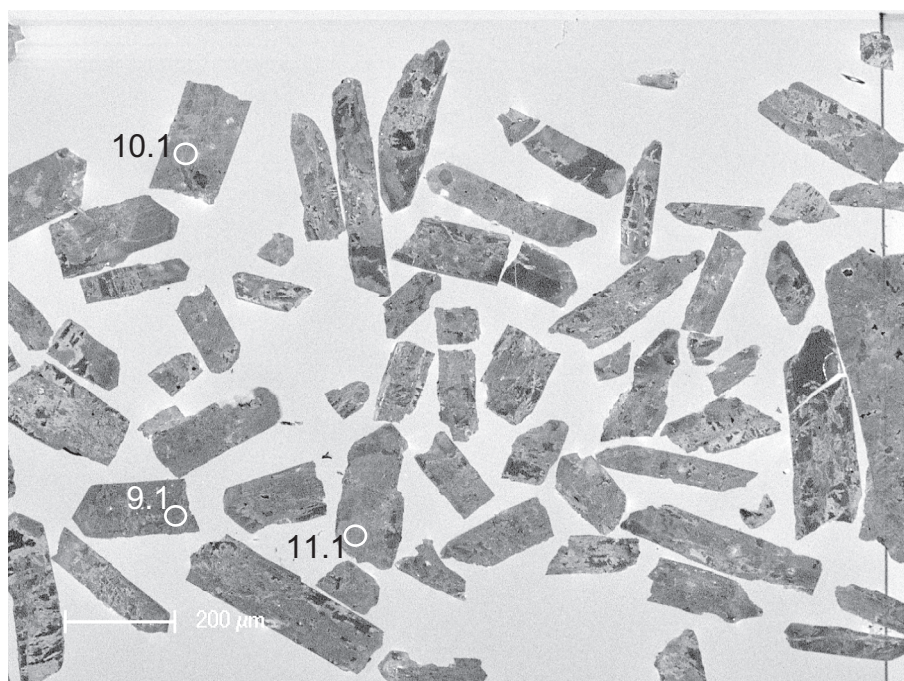


Figure 1. Cathodoluminescence image of representative zircons from sample 187175: muscovite–tourmaline pegmatite, Morgan Range. Numbered circles indicate the approximate positions of analysis sites.

of Mesoproterozoic felsic rocks in the west Musgrave Province, central Australia, and implications for the Mesoproterozoic tectonic evolution of the region: Geological Survey of Western Australia, Report 106, 73p.

Stacey, JS and Kramers, JD 1975, Approximation of terrestrial lead isotope evolution by a two-stage model: *Earth and Planetary Science Letters*, v. 26, p. 207–221.

Recommended reference for this publication

Kirkland, CL, Wingate, MTD and Smithies, RH 2011, 187175: muscovite–tourmaline pegmatite, Morgan Range; *Geochronology Record* 936: Geological Survey of Western Australia, 4p.

Data obtained: 6 March 2008
Data released: 30 June 2011

Table 1. Ion microprobe analytical results for zircons from sample 187175: tourmaline-muscovite pegmatite, Morgan Range

Group ID	Spot no.	Grain spot	^{238}U (ppm)	^{232}Th (ppm)	$^{232}\text{Th}/^{238}\text{U}$	f_{204} (%)	$^{238}\text{U}/^{206}\text{Pb} \pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb} \pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^* \pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb}^* \pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^* \pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb}^* \pm 1\sigma$	date (Ma) $\pm 1\sigma$	date (Ma) $\pm 1\sigma$	Disc. (%)				
I	8	8.1	1433	1	0.00	0.160	10.030	0.185	0.06131	0.00036	10.047	0.186	0.06000	0.00047	612	11	604	17	-1.3
I	11	11.1	1764	2	0.00	1.850	10.058	0.217	0.07515	0.00032	10.248	0.221	0.06003	0.00112	600	13	605	40	0.7
I	9	9.1	3204	2	0.00	0.120	9.670	0.129	0.06126	0.00018	9.682	0.129	0.06028	0.00027	634	8	614	10	-3.3
I	5	5.1	2251	2	0.00	0.018	9.802	0.069	0.06067	0.00114	9.804	0.069	0.06052	0.00115	626	4	622	41	-0.6
I	3	3.1	1226	6	0.01	3.050	9.541	0.071	0.08563	0.00055	9.841	0.076	0.06066	0.00172	624	5	627	61	0.6
I	2	2.1	4321	9	0.00	1.090	8.502	0.057	0.06972	0.00021	8.596	0.060	0.06080	0.00165	709	5	632	58	-12.2
I	4	4.1	2307	34	0.02	0.026	9.513	0.066	0.06105	0.00027	9.515	0.066	0.06084	0.00029	644	4	634	10	-1.7
I	12	12.1	1689	3	0.00	0.831	10.067	0.072	0.06766	0.00035	10.151	0.074	0.06085	0.00079	606	4	634	28	4.5
I	6	6.1	1838	2	0.00	0.718	9.825	0.070	0.06705	0.00033	9.896	0.071	0.06117	0.00070	621	4	645	25	3.8
I	7	7.1	2856	4	0.00	0.474	9.392	0.065	0.06507	0.00024	9.437	0.065	0.06119	0.00046	649	4	646	16	-0.5
I	10	10.1	3928	8	0.00	0.928	9.105	0.261	0.06894	0.00201	9.190	0.263	0.06133	0.00207	666	19	651	72	-2.3
I	1	1.1	2800	4	0.00	0.296	9.815	0.070	0.06462	0.00216	9.844	0.071	0.06220	0.00219	624	4	681	75	8.4

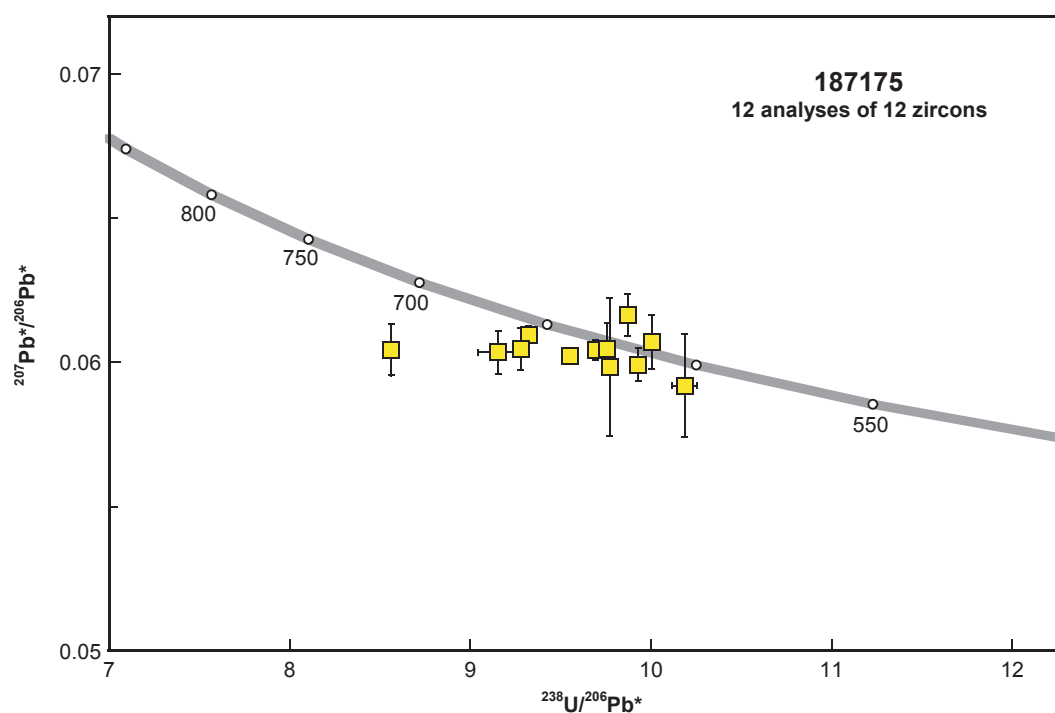


Figure 2. U-Pb analytical data for sample 187175: muscovite-tourmaline pegmatite, Morgan Range. Yellow squares indicate Group I (magmatic zircons).

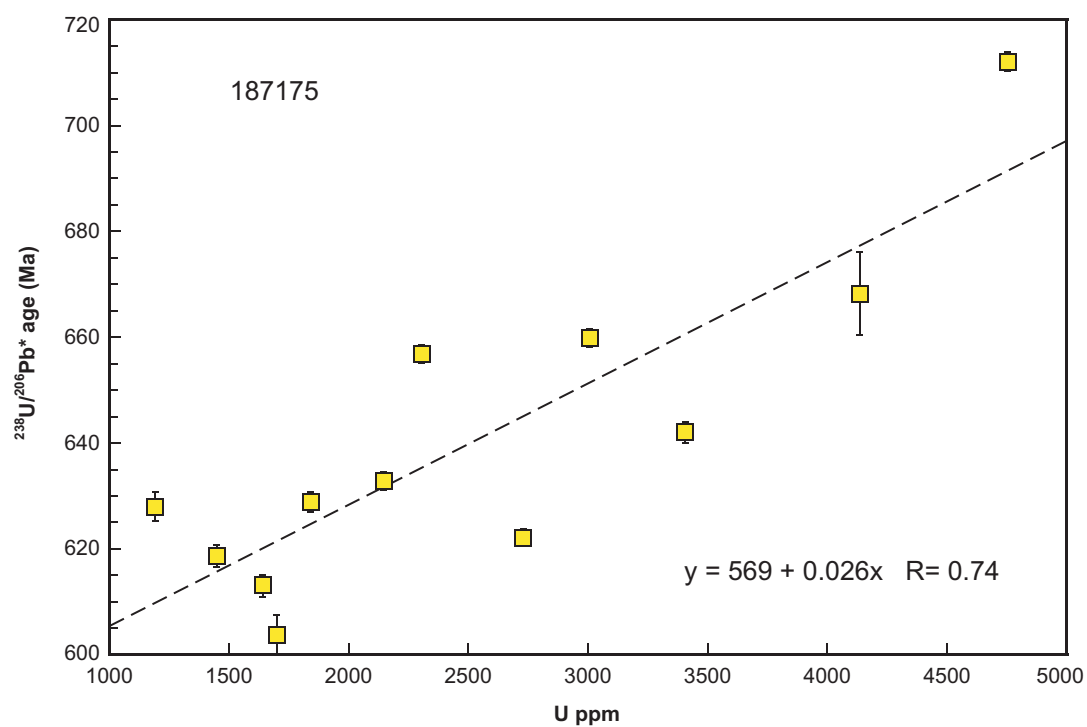


Figure 3. Correlation between $^{238}\text{U}^*/^{206}\text{Pb}^*$ age and uranium content for zircon analyses in sample 187175: muscovite-tourmaline pegmatite, Morgan Range. All Group I data are included in the linear regression, and the equation of the best-fit line is shown. R is Pearson's correlation coefficient.