

205717: felsic schist, Briars mine

(Wilgie Mia Formation, Polelle Group, Murchison Supergroup,
Murchison Domain, Youanmi Terrane, Yilgarn Craton)

Location and sampling

KIRKALOCKA (SH 50-3), MOUNT MAGNET (2441)
MGA Zone 50, 573294E 6894726N

Sampled on 19 May 2010

This sample was collected from the historic Briars gold mine on Boogardie Station, about 5.0 km northwest of Mod Well, 2.5 km south-southwest of Triangle Bore, and 1.4 km east-southeast of 30 Feet Bore.

Tectonic unit/relations

The unit sampled is the 2790–2735 Ma Wilgie Mia Formation of the Polelle Group, Murchison Supergroup (Van Kranendonk et al., 2013). The 2800–2735 Ma Polelle Group consists of mafic–ultramafic volcanic rocks, intermediate to felsic volcanic and volcanoclastic sedimentary rocks, and banded iron-formation (Van Kranendonk et al., 2013). The Wilgie Mia Formation is the uppermost unit of the Polelle Group and consists of metamorphosed basalt, komatiitic basalt, banded iron-formation, and felsic volcanoclastic rocks. A felsic volcanoclastic metasandstone of the Wilgie Mia Formation, collected about 118 km to the north, on the south side of the Weld Range, yielded a maximum depositional age of 2747 ± 4 Ma (GSWA 155572, Wingate et al., 2013). A porphyritic microgranite that crosscuts the Wilgie Mia Formation near the northeastern end of the Weld Range yielded a magmatic crystallization age of 2741 ± 7 Ma (GSWA 185926, Wingate et al., 2011).

Petrographic description

The sample is a felsic schist, consisting of about 40% plagioclase, 40% quartz, 10% muscovite, minor sericite, amphibole, biotite, chlorite, and accessory iron–titanium oxide minerals, epidote, and apatite. Plagioclase and quartz form microcrystalline to very fine-grained, anhedral aggregates. Some plagioclase grains display albite twinning indicating a composition of oligoclase (An14). Mica displays weak subparallel orientation. Weak saussurite alteration of the feldspar is widespread. No evidence of secondary rounding or of detrital matrix is observed, indicating the schist represents a metamorphosed and deformed felsic volcanic rock.

Zircon morphology

Zircons isolated from this sample are colourless to dark brown, and subhedral to euhedral. The crystals are up to 200 μm long, and mainly elongate, with aspect ratios up to 6:1. In cathodoluminescence (CL) images, most crystals exhibit concentric zoning, and many contain high-uranium, metamict zones. A CL image of representative zircons is shown in Figure 2.

Analytical details

This sample was analysed on 20–21 February 2015, using SHRIMP-B. Twelve analyses of the BR266 standard were obtained during the session, of which nine analyses indicated an external spot-to-spot (reproducibility) uncertainty of 1.40% (1σ) and a $^{238}\text{U}/^{206}\text{Pb}^*$ calibration uncertainty of 0.58% (1σ). Isotopic mass fractionation of $^{207}\text{Pb}/^{206}\text{Pb}$ ratios during the session was corrected by reference to the OGC1 standard; measured ratios were decreased by 0.38%. 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

Nineteen analyses were obtained from 19 zircons. Results are listed in Table 1, and shown in a concordia diagram (Fig. 3).

Interpretation

The analyses are concordant to strongly discordant (Fig. 3). Nine analyses are >5% discordant. The dates obtained from these nine analyses (Group D; Table 1) are unreliable, and are considered not to be geologically significant. The remaining 10 analyses form a single group, based on their $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ ratios.

Group I comprises 10 analyses (Table 1), which yield a weighted mean $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 2748 ± 11 Ma (MSWD = 1.5).

The date of 2748 ± 11 Ma for the ten analyses in Group I is interpreted as the magmatic crystallization age of the felsic volcanic protolith.

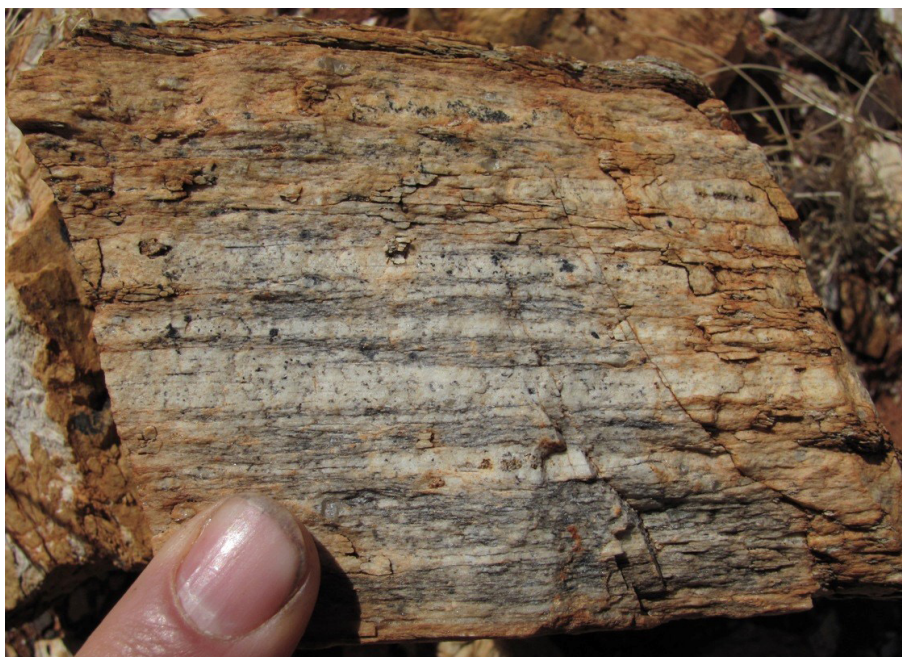


Figure 1. Outcrop image for sample 205717: felsic schist, Briars mine

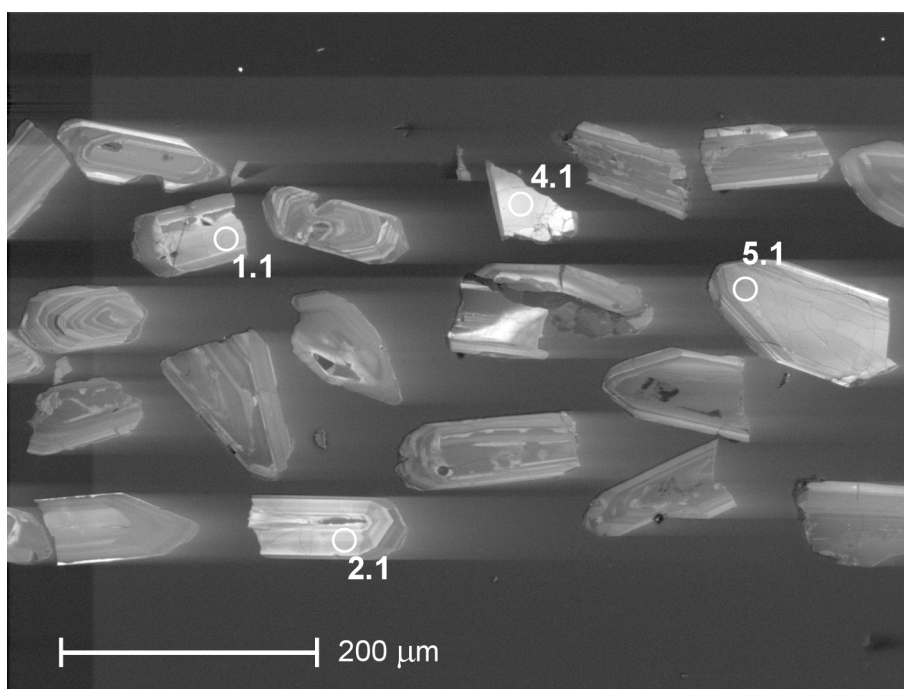


Figure 2. Cathodoluminescence image of representative zircons from sample 205717: felsic schist, Briars mine. Numbered circles indicate the approximate locations of analysis sites

Table 1. Ion microprobe analytical results for zircons from sample 205717: felsic schist, Briars mine

Group ID	Spot no.	Grain. spot	^{238}U (ppm)	^{232}Th (ppm)	$\frac{^{232}\text{Th}}{^{238}\text{U}}$	f_{204} (%)	$^{238}\text{U}/^{206}\text{Pb} \pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb} \pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^* \pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^* \pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^* \text{ date (Ma)} \pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^* \text{ date (Ma)} \pm 1\sigma$	Disc. (%)
I	5	5.1	123	32	0.27	0.307	1.969 0.039	0.18957 0.00172	1.975 0.039	0.18682 0.00185	2641 44	2714 16	2.7
I	10	10.1	192	204	1.10	0.061	1.908 0.033	0.18953 0.00111	1.909 0.033	0.18898 0.00113	2716 39	2733 10	0.6
I	16	16.1	29	3	0.12	0.000	1.947 0.053	0.18920 0.00234	1.947 0.053	0.18920 0.00234	2672 60	2735 20	2.3
I	9	9.1	125	63	0.53	-0.014	1.960 0.036	0.19021 0.00127	1.960 0.036	0.19033 0.00127	2658 41	2745 11	3.2
I	6	6.1	155	53	0.35	0.094	1.871 0.035	0.19144 0.00122	1.873 0.035	0.19060 0.00126	2758 42	2747 11	-0.4
I	11	11.1	263	106	0.42	0.015	1.989 0.034	0.19106 0.00107	1.989 0.034	0.19092 0.00107	2625 37	2750 9	4.5
I	13	13.1	156	89	0.59	0.028	1.867 0.033	0.19140 0.00389	1.867 0.033	0.19115 0.00389	2765 41	2752 33	-0.5
I	15	15.1	62	27	0.45	0.096	1.974 0.043	0.19213 0.00175	1.976 0.043	0.19127 0.00182	2640 48	2753 16	4.1
I	19	19.1	212	92	0.45	0.015	1.921 0.088	0.19179 0.00108	1.921 0.088	0.19165 0.00109	2701 105	2756 9	2.0
I	3	3.1	177	73	0.43	0.450	1.848 0.034	0.19794 0.00117	1.856 0.034	0.19391 0.00134	2778 42	2776 11	-0.1
D	8	8.1	82	54	0.67	0.208	3.449 0.073	0.09582 0.00535	3.456 0.074	0.09403 0.00544	1638 31	1509 109	-8.5
D	17	17.1	191	156	0.84	0.029	1.936 0.034	0.16148 0.00106	1.937 0.034	0.16123 0.00107	2684 39	2469 11	-8.7
D	4	4.1	28	20	0.73	0.593	2.062 0.062	0.19472 0.00271	2.074 0.062	0.18942 0.00339	2536 64	2737 29	7.3
D	2	2.1	58	25	0.44	1.420	1.995 0.047	0.20341 0.00199	2.024 0.048	0.19070 0.00306	2588 52	2748 26	5.8
D	7	7.1	229	192	0.87	0.564	2.108 0.038	0.19738 0.00119	2.120 0.038	0.19234 0.00142	2491 37	2762 12	9.8
D	1	1.1	77	87	1.16	0.803	2.546 0.055	0.19972 0.00186	2.567 0.056	0.19253 0.00240	2121 40	2764 20	23.3
D	18	18.1	68	84	1.28	0.999	2.129 0.045	0.20391 0.00173	2.151 0.045	0.19496 0.00250	2462 44	2784 21	11.6
D	14	14.1	30	13	0.44	0.061	2.012 0.061	0.19566 0.01184	2.013 0.061	0.19512 0.01186	2600 66	2786 100	6.7
D	12	12.1	247	99	0.41	3.356	2.240 0.043	0.24162 0.04821	2.317 0.085	0.21168 0.05713	2313 74	2918 437	20.7

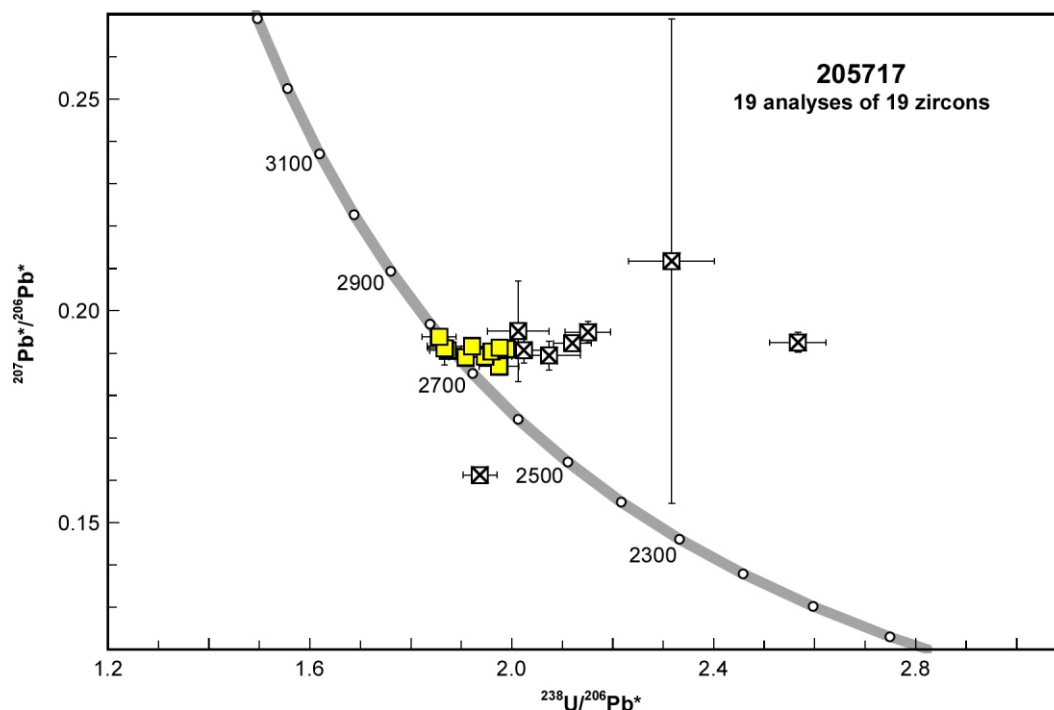


Figure 3. U–Pb analytical data for sample 205717: felsic schist, Briars mine. Yellow squares indicate Group I (magmatic zircons); crossed squares indicate Group D (discordance >5%). One analysis in Group D is not shown

References

- 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.
- Van Kranendonk, MJ, Ivanic, TJ, Wingate, MTD, Kirkland, CL and Wyche, S 2013, Long-lived, autochthonous development of the Archean Murchison Domain, and implications for Yilgarn Craton tectonics: *Precambrian Research*, v. 229, p. 49–92.
- Wingate, MTD, Kirkland, CL, Guillianse, JN, Ivanic, TJ, Wyche, S and Van Kranendonk, MJ 2013, 155572: felsic volcanoclastic metasandstone, Weld Range; *Geochronology Record 1097*: Geological Survey of Western Australia, 5p.
- Wingate, MTD, Kirkland, CL and Ivanic, TJ 2011, 185926: porphyritic microgranite, Rocky Bore; *Geochronology Record 873*: Geological Survey of Western Australia, 4p.

Recommended reference for this publication

Lu, Y, Wingate, MTD, Kirkland, CL and Zibra, I 2017, 205717: felsic schist, Briars mine; *Geochronology Record 1397*: Geological Survey of Western Australia, 4p.

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Data released: 28 April 2017