

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

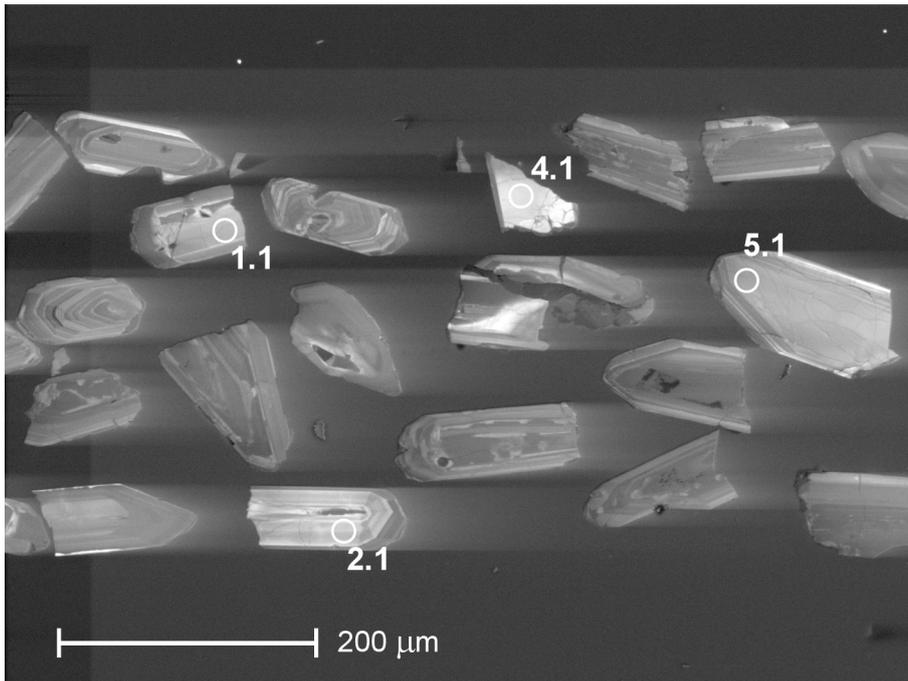


Figure 2. Cathodoluminescence image of representative zircons from sample 205717: felsic schist, Briars mine. Numbered circles indicate the approximate locations of analysis sites

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)	²³² Th/ ²³⁸ U	f ₂₀₄ (%)	²³⁸ U/ ²⁰⁶ Pb ± 1σ	²⁰⁷ Pb/ ²⁰⁶ Pb ± 1σ	²³⁸ U/ ²⁰⁶ Pb* ± 1σ	²⁰⁷ Pb*/ ²⁰⁶ Pb* ± 1σ	²³⁸ U/ ²⁰⁶ Pb* date (Ma) ± 1σ	²⁰⁷ Pb*/ ²⁰⁶ Pb* date (Ma) ± 1σ	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

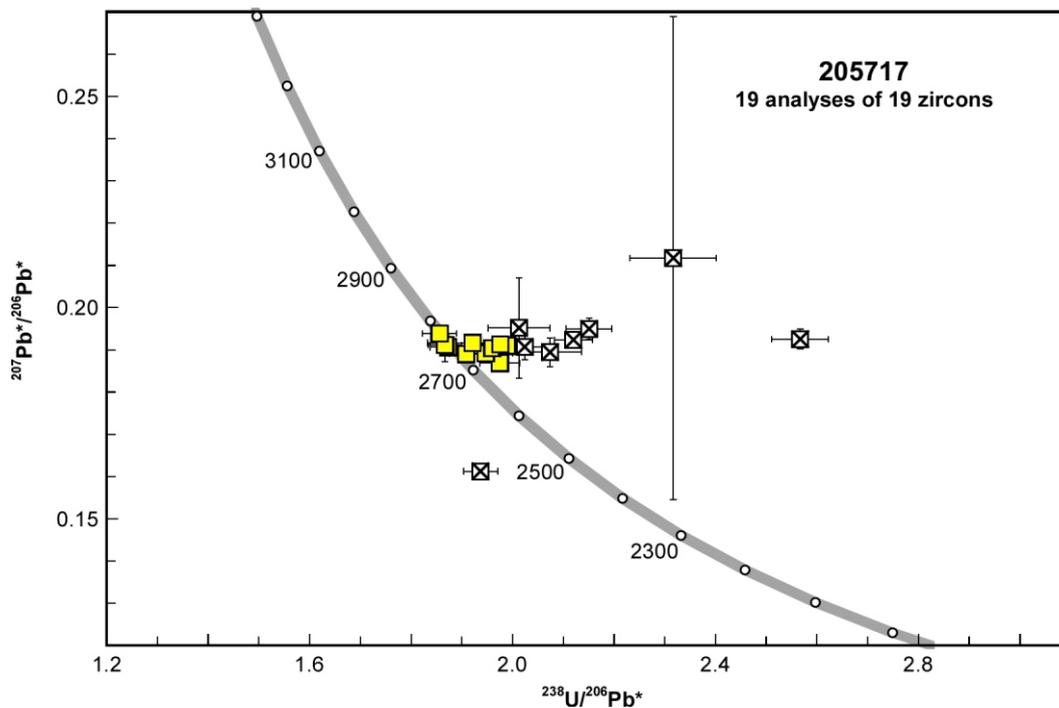


Figure 3. U–Pb analytical data for sample 205717: felsic schist, Briars mine. Yellow squares indicate Group I (magmatic zircons); crossed squares indicate Group D (discordance >5%). One analysis in Group D is not shown

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 metasediment, 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.

Data obtained: 21 February 2015

Data released: 28 April 2017