

182416: metasandstone, Rason Lake Road

(Lindsay Hill Formation, Barren Basin, Albany–Fraser Orogen)

Location and sampling

PLUMRIDGE (SH 51-8), BARTLETT (3839)
MGA Zone 51, 663584E 6774594N

Sampled on 16 October 2008

This sample was collected from the southwestern end of a ridge of outcrop, located about 18.4 km southeast of Lindsay Hill, 16.5 km north-northeast of Blue Robin Hill, and 2.7 km northeast of Rason Lake Road.

Tectonic unit/relations

The unit sampled is a metasandstone assigned to the Lindsay Hill Formation of the Barren Basin. The Barren Basin contains Paleoproterozoic metasedimentary rocks of the Woodline, Stirling Range, Fly Dam, and Lindsay Hill Formations, Mount Barren Group, and other unnamed units within the east Albany–Fraser Orogen (Spaggiari et al., 2011). These units unconformably overlie the Yilgarn Craton, reworked equivalents of the Yilgarn Craton, and the Biranup Zone (Hall et al., 2008; Spaggiari et al., 2009). The basin may represent the products of a depositional system utilizing accommodation space produced through extensional processes that came to dominate the orogen during the late Paleoproterozoic (e.g. Spaggiari et al., 2011; Kirkland et al., 2011).

The metasandstone represented by GSWA 182416 contains a strong schistosity and compositional layering, with quartz-rich and micaceous laminations partly stained with limonite, and minor opaque oxide that is visible in hand specimen. It is interbedded with metaconglomerate that contains subangular to subrounded pebbles that range from 5–10 cm long and closely packed (clast-supported), to 0.5 – 2 cm long and more sparse (matrix-supported). The succession also contains finely laminated metasiltstone with iron-rich laminae and pale grey quartzite (Spaggiari et al., 2011).

Petrographic description

The sample is a metasandstone, comprising about 40% quartz, 35% muscovite, 17% feldspar, 7% opaque oxide minerals, and accessory leucoxene, zircon, and tourmaline. Muscovite is 0.1 – 3.0 mm wide and anastomoses around lenses of inequigranular quartz, including single-crystal quartz grains up to 1.5 mm long. Feldspar is difficult to distinguish from quartz and is of similar size. Some of the micaceous lamellae have limonite staining. The micaceous

lamellae are interrupted by grains and lenses of medium- to coarse-grained quartz. Aggregates of opaque oxide minerals and leucoxene are up to 1.5 mm long and are preferentially developed within the micaceous lamellae. Zircon appears concentrated within the micaceous lamellae. Patches of microcrystalline tourmaline occur within the quartz-rich lenses.

Zircon morphology

Zircons from this sample are anhedral to subhedral, and colourless and clear to brown and opaque. The grains are up to 400 µm long, and equant to slightly elongate, with aspect ratios up to 3:1. The crystals are variably rounded, and some are broken, forming angular fragments. Cathodoluminescence (CL) images reveal near-ubiquitous oscillatory zoning. A CL image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed on 4–6 March 2010, using SHRIMP-A. Twenty-four analyses of the BR266 standard were obtained during the session, of which 22 analyses indicated an external spot-to-spot (reproducibility) uncertainty of 0.87% (1σ) and a $^{238}\text{U}/^{206}\text{Pb}^*$ calibration uncertainty of 0.29% (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 common-Pb isotopic compositions determined according to the model of Stacey and Kramers (1975).

Results

Thirty-nine analyses were obtained from 39 zircons. Results are listed in Table 1, and shown in a concordia diagram (Fig. 2) and a probability density diagram (Fig. 3).

Interpretation

The analyses are concordant to strongly discordant (Fig. 2). Five analyses are >5% discordant. The dates obtained from these five analyses (Group D; Table 1) are imprecise or unreliable, and are considered not to be geologically significant. The remaining 34 analyses can be divided into two groups based on their $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ ratios.

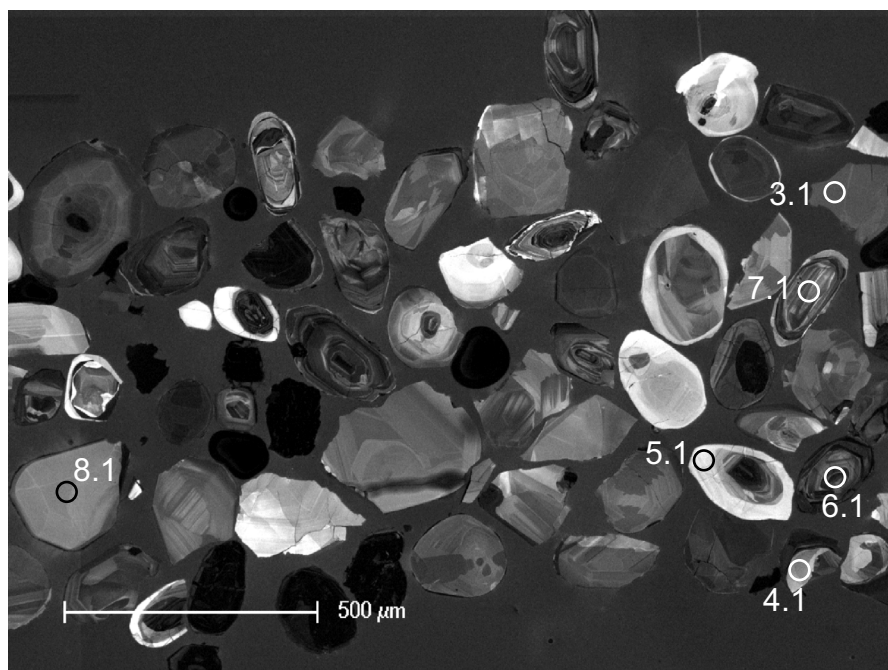


Figure 1. Cathodoluminescence image of representative zircons from sample 182416: metasandstone, Rason Lake Road. Numbered circles indicate the approximate locations of analysis sites.

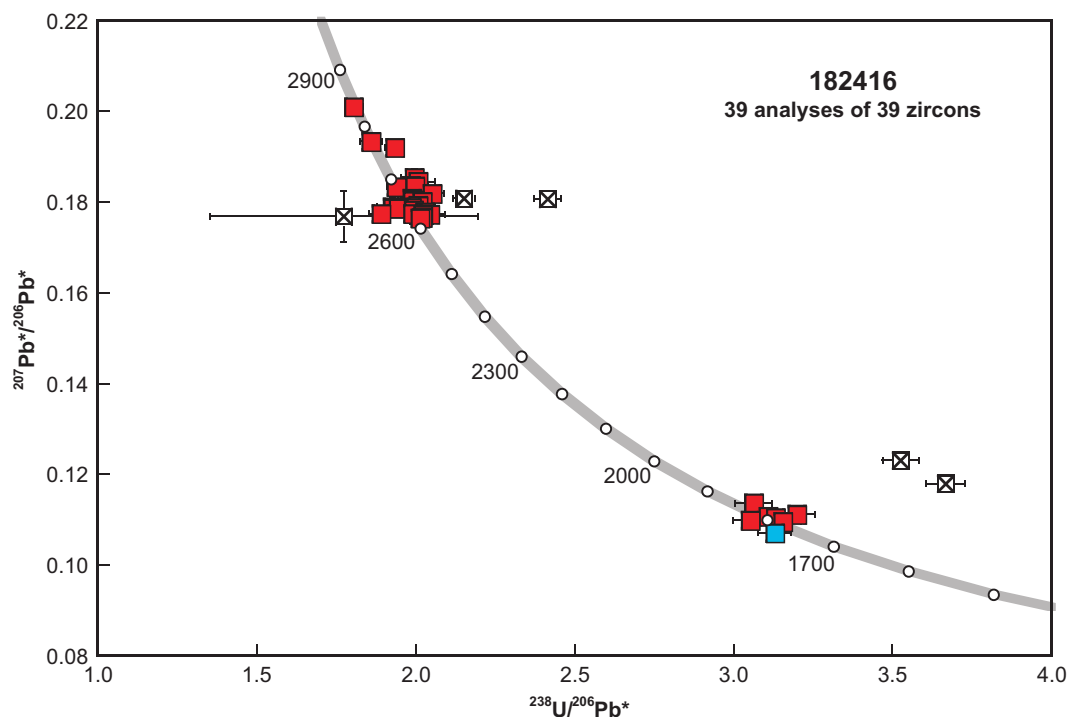


Figure 2. U-Pb analytical data for sample 182416: metasandstone, Rason Lake Road. Blue square indicates Group Y (youngest detrital zircon); red squares indicate Group S (older detrital zircons); crossed squares indicate Group D (discordance >5%).

Table 1. Ion microprobe analytical results for zircons from sample 182416: metasandstone, Rason Lake Road

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. (%)						
Y	20	20.1	63	47	0.78	0.185	3.123	0.053	0.10877	0.00094	3.129	0.053	0.10716	0.00112	1788	27	1752	19	-2.1
S	27	27.1	64	69	1.11	0.079	3.153	0.057	0.11035	0.00096	3.155	0.057	0.10966	0.00104	1775	29	1794	17	1.1
S	14	14.1	41	57	1.41	0.036	3.051	0.055	0.11025	0.00110	3.052	0.055	0.10994	0.00115	1827	29	1798	19	-1.6
S	31	31.1	62	80	1.34	0.115	3.128	0.058	0.11143	0.00101	3.131	0.058	0.11042	0.00113	1787	29	1806	19	1.1
S	7	7.1	80	96	1.24	0.061	3.107	0.050	0.11135	0.00085	3.109	0.050	0.11082	0.00090	1798	26	1813	15	0.8
S	11	11.1	42	52	1.26	0.148	3.194	0.058	0.11246	0.00114	3.198	0.059	0.11117	0.00131	1754	29	1819	21	3.6
S	22	22.1	39	39	1.04	-0.311	3.072	0.057	0.11104	0.00123	3.063	0.057	0.11376	0.00160	1821	30	1860	25	2.1
S	39	39.1	98	60	0.63	0.053	2.012	0.034	0.17691	0.00094	2.013	0.034	0.17643	0.00096	2599	37	2620	9	0.8
S	24	24.1	29	11	0.39	-0.033	2.022	0.041	0.17631	0.00153	2.021	0.041	0.17660	0.00156	2591	44	2621	15	1.2
S	33	33.1	88	74	0.87	0.060	2.022	0.035	0.17773	0.00098	2.023	0.035	0.17720	0.00101	2589	37	2627	9	1.4
S	29	29.1	21	18	0.89	0.340	2.037	0.048	0.18040	0.00187	2.044	0.049	0.17737	0.00220	2567	51	2628	21	2.3
S	34	34.1	23	24	1.07	0.360	1.983	0.046	0.18071	0.00192	1.990	0.046	0.17750	0.00228	2624	51	2630	21	0.2
S	13	13.1	32	30	0.98	-0.027	1.891	0.037	0.17730	0.00140	1.890	0.037	0.17753	0.00142	2737	44	2630	13	-4.1
S	25	25.1	56	56	1.04	0.017	2.027	0.037	0.17806	0.00115	2.028	0.037	0.17791	0.00116	2584	40	2633	11	1.9
S	37	37.1	46	63	1.43	0.138	1.990	0.039	0.17949	0.00133	1.993	0.039	0.17826	0.00142	2621	43	2637	13	0.6
S	8	8.1	29	26	0.93	0.034	1.945	0.039	0.17892	0.00157	1.945	0.039	0.17862	0.00160	2674	45	2640	15	-1.3
S	16	16.1	54	35	0.67	0.096	1.927	0.033	0.17949	0.00195	1.929	0.033	0.17864	0.00198	2692	38	2640	18	-2.0
S	32	32.1	36	53	1.52	-0.033	1.987	0.041	0.17861	0.00155	1.987	0.041	0.17890	0.00158	2628	46	2643	15	0.6
S	5	5.1	15	6	0.44	0.059	1.925	0.048	0.17952	0.00204	1.926	0.048	0.17900	0.00211	2696	56	2644	20	-2.0
S	9	9.1	67	66	1.02	0.069	1.948	0.032	0.17970	0.00104	1.950	0.032	0.17909	0.00108	2669	37	2644	10	-0.9
S	23	23.1	13	10	0.76	0.206	2.003	0.053	0.18115	0.00380	2.007	0.053	0.17931	0.00395	2607	58	2647	37	1.5
S	10	10.1	28	14	0.52	-0.064	2.021	0.041	0.17963	0.00237	2.019	0.041	0.18020	0.00240	2593	44	2655	22	2.3
S	1	1.1	19	2	0.12	-0.096	1.992	0.046	0.17944	0.00185	1.990	0.046	0.18030	0.00195	2624	51	2656	18	1.2
S	2	2.1	15	13	0.91	0.116	1.991	0.050	0.18145	0.00205	1.994	0.050	0.18042	0.00218	2621	55	2657	20	1.4
S	3	3.1	45	46	1.04	0.000	1.989	0.036	0.18090	0.00124	1.989	0.036	0.18090	0.00124	2625	40	2661	11	1.3
S	30	30.1	75	27	0.37	0.052	2.050	0.037	0.18235	0.00113	2.051	0.037	0.18189	0.00115	2560	38	2670	10	4.1
S	18	18.1	138	193	1.45	0.046	1.937	0.030	0.18378	0.00148	1.938	0.030	0.18337	0.00149	2682	34	2684	13	0.1
S	38	38.1	40	50	1.28	-0.181	2.002	0.040	0.18194	0.00141	1.998	0.040	0.18355	0.00154	2616	44	2685	14	2.6
S	12	12.1	24	10	0.44	-0.214	1.990	0.041	0.18176	0.00163	1.985	0.041	0.18367	0.00180	2630	46	2686	16	2.1
S	15	15.1	12	1	0.09	-0.150	2.011	0.053	0.18329	0.00235	2.008	0.053	0.18463	0.00253	2605	58	2695	23	3.3
S	28	28.1	35	49	1.44	-0.596	2.007	0.041	0.18018	0.00147	1.995	0.041	0.18550	0.00186	2619	45	2703	17	3.1
S	21	21.1	126	84	0.69	0.089	1.932	0.029	0.19291	0.00081	1.934	0.029	0.19211	0.00084	2687	33	2760	7	2.7
S	36	36.1	78	29	0.39	-0.013	1.859	0.033	0.19331	0.00181	1.859	0.033	0.19342	0.00181	2775	40	2771	15	-0.1
S	19	19.1	168	50	0.31	0.023	1.806	0.027	0.20127	0.00075	1.806	0.027	0.20106	0.00076	2840	35	2835	6	-0.2
D	6	6.1	63	220	3.60	-0.153	3.671	0.062	0.11659	0.00176	3.666	0.062	0.11793	0.00186	1555	24	1925	28	19.2
D	35	35.1	190	248	1.35	0.000	3.525	0.057	0.12318	0.00135	3.525	0.057	0.12318	0.00135	1610	24	2003	19	19.6
D	4	4.1	37	12	0.35	0.191	1.771	0.420	0.17862	0.00566	1.774	0.421	0.17692	0.00570	2882	686	2624	54	-9.8
D	17	17.1	71	121	1.76	0.119	2.412	0.041	0.18183	0.00109	2.415	0.041	0.18077	0.00115	2234	32	2660	11	16.0
D	26	26.1	119	210	1.83	0.000	2.151	0.035	0.18090	0.00088	2.151	0.035	0.18090	0.00088	2461	34	2661	8	7.5

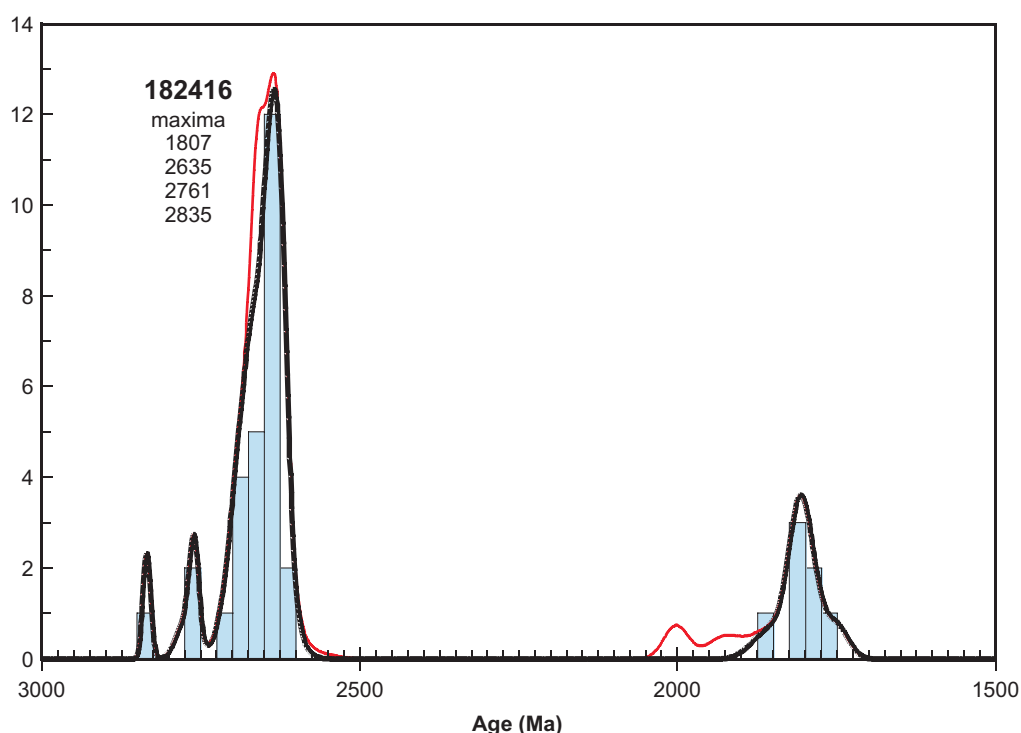


Figure 3. Probability density diagram and histogram for sample 182416: metasandstone, Rason Lake Road. Thick curve, maxima values, and frequency histogram (bin width 25 Ma) include only data <5% discordant (34 analyses of 34 zircons). Thin curve includes all data (39 analyses of 39 zircons).

Group Y comprises a single analysis (20.1, Table 1), which yields a $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 1752 ± 19 Ma (1σ).

Group S comprises 33 analyses (Table 1), which yield $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ dates of 2835–1794 Ma.

It is possible that all of the analyses in Groups Y and S are of unmodified detrital zircons, in which case the date of 1752 ± 19 Ma (1σ) for the single analysis in Group Y represents a maximum age of deposition for the precursor sandstone. A more conservative estimate of the maximum depositional age is given by the weighted mean $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 1798 ± 24 Ma (MSWD = 1.6) for the six youngest analyses in Groups Y and S.

The 34 analyses in combined Groups Y and S indicate dates that define significant age components at c. 2635 and 1807 Ma. These are interpreted as the ages of zircon-crystallizing rocks in the detrital source region(s), or the ages of detrital components within sediments that have been reworked into this rock.

References

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Recommended reference for this publication

Data obtained: 6 March 2013

Data released: 31 January 2014