

182604: metaconglomerate, Rocky Well

(*Merolia Domain, Burtville Terrane, Yilgarn Craton*)

Location and sampling

MINIGWAL (SH 51-7), LIGHTFOOT (3539)
MGA Zone 51, 503315E 6781602N

Sampled on 18 August 2007

This sample was collected from a small but prominent ridge in dense bush, about 600 m north of a east-trending track, 3.6 km northeast of Rocky Well, and 122 km south of Cosmo Newbery.

Tectonic unit/relations

The unit sampled is a metaconglomerate composed almost entirely of colourless to white recrystallized quartz, and is located within the northeastern part of the Irwin Hills greenstone belt, in the Merolia Domain of the western Burtville Terrane (Pawley et al., 2009). The protolith may have been a monomictic conglomerate, composed mainly of quartzite, or chert pebbles and cobbles (Fig. 1). The clasts are flattened, and increase in size up to about 15 cm, towards the top of the outcrop. At the sampling locality, the unit is 10 to 15 m thick, and overlies a <5 m thick, fine-grained sandstone unit, plus cherts. The unit can be traced along strike for several tens of metres, where it eventually thins out and is overlain by chert and clastic sedimentary rocks. To the east, this sediment package is bounded by granite, and to the west by metabasalt.

Petrographic description

The sample is composed of interlocking quartz grains up to 10 mm long, with small aggregates and prisms of colourless amphibole, and sparse limonitized pyrite up to 0.3 mm in size. Some mineral grains have been leached out, and are now represented by millimetre- to centimetre-scale voids partly rimmed by limonite. Some of this leached material was probably amphibole. The grain size of the quartz may in part reflect exaggerated grain growth during metamorphism.

Zircon morphology

Zircons isolated from this sample are anhedral to subhedral, and colourless to dark brown. The crystals are up to 250 μm long, and equant to elongate, with aspect ratios up to 4:1. Concentric growth zoning is ubiquitous,

and some crystals contain metamict high-uranium zones. A cathodoluminescence image of representative zircons is shown in Figure 2.

Analytical details

This sample was analysed during two sessions, on 7–8 August 2008, using SHRIMP-A. Five analyses of the Temora standard were obtained during the first session, and indicated an external spot-to-spot (reproducibility) uncertainty of 1.04% (1σ) and a $^{238}\text{U}/^{206}\text{Pb}^*$ calibration uncertainty of 0.51% (1σ). Eleven analyses of the Temora standard were obtained during the second session, of which ten analyses indicated an external spot-to-spot (reproducibility) uncertainty of 0.70% (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 isotopic compositions determined according to the model of Stacey and Kramers (1975).

Results

Twenty analyses were obtained from 20 zircons. Results are listed in Table 1, and shown in a concordia diagram (Fig. 3) and a probability density diagram (Fig. 4).

Interpretation

The analyses are concordant to strongly discordant (Fig. 3). Six analyses are >10% discordant. The dates obtained from these six analyses (Group D, Table 1) are imprecise or unreliable, and are not considered geologically significant. The remaining 14 analyses can be divided into two groups, based on their $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ ratios.

Group Y comprises a single analysis (4.1, Table 1), which yields a $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 2595 ± 6 Ma (1σ).

Group S comprises 13 analyses of 13 zircons (Table 1), which yield $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ dates of 2765–2652 Ma.

It is possible that all analyses are of unmodified detrital zircons, in which case the date of 2595 ± 6 Ma (1σ) for the single analysis in Group Y represents a maximum depositional age for the protolith of this metamorphic rock.



Figure 1. Outcrop photograph of sample 182604: metaconglomerate, Rocky Well.

The 65 analyses in combined Groups Y and S indicate dates that define a significant age component at c. 2719 Ma, and minor components at c. 2764 and 2595 Ma (Fig. 4). These are interpreted as the ages of zircon-crystallizing rocks in the detrital source region(s), or as the ages of detrital components within sediments that have been reworked into this rock.

References

- Pawley, M, Romano, SS, Hall, CE, Wyche, S and Wingate, MTD 2009, The Yamarna Shear Zone: a new terrane boundary in the northeastern Yilgarn Craton?, *in* Geological Survey of Western Australia Annual Review 2007–08: Geological Survey of Western Australia, Perth, Western Australia, p. 27–33.
- 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

Wingate, MTD, Kirkland, CL and Doublier, MP 2011, 182604: metaconglomerate, Rocky Well; *Geochronology Record* 946: Geological Survey of Western Australia, 5p.

Data obtained: 8 August 2008
Data released: 30 June 2011

Table 1. Ion microprobe analytical results for zircons from sample 182604: metaconglomerate, Rocky Well

Group ID	Spot no.	Grain spot	^{238}U (ppm)	^{232}Th (ppm)	$^{232}\text{Th}/^{238}\text{U}$	f_{204} (%)	$^{238}\text{U}/^{206}\text{Pb}$ $\pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb}$ $\pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^*$ $\pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb}^*$ $\pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^*$ date (Ma) $\pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb}^*$ date (Ma) $\pm 1\sigma$	Disc. (%)
Y	4	4.1	229	171	0.77	-0.002	2.111 0.024	0.17383 0.00057	2.111 0.026	0.17384 0.00060	2500 38	2595 6	3.7
S	16	16.1	78	74	0.98	1.154	2.002 0.021	0.19024 0.00121	2.025 0.023	0.17994 0.00219	2587 35	2652 20	2.5
S	13	13.1	47	179	3.92	0.330	2.101 0.024	0.18592 0.00166	2.108 0.025	0.18298 0.00187	2503 37	2680 17	6.6
S	20	20.1	50	38	0.79	0.100	1.913 0.023	0.18651 0.00141	1.915 0.024	0.18562 0.00145	2709 42	2704 13	-0.2
S	6	6.1	85	124	1.50	0.368	2.100 0.030	0.18913 0.00104	2.107 0.032	0.18585 0.00142	2503 47	2706 13	7.5
S	10	10.1	69	63	0.95	0.145	1.959 0.020	0.18752 0.00109	1.962 0.021	0.18622 0.00134	2656 36	2709 12	2.0
S	3	3.1	248	236	0.98	-0.001	1.916 0.021	0.18697 0.00065	1.916 0.023	0.18698 0.00066	2708 41	2716 6	0.3
S	5	5.1	255	209	0.85	0.030	1.939 0.022	0.18767 0.00056	1.940 0.024	0.18740 0.00057	2680 41	2719 5	1.4
S	15	15.1	147	120	0.84	-0.005	2.041 0.018	0.18738 0.00077	2.041 0.019	0.18742 0.00078	2570 29	2720 7	5.5
S	11	11.1	130	122	0.97	0.187	1.972 0.018	0.18917 0.00084	1.976 0.019	0.18751 0.00094	2640 31	2720 8	3.0
S	9	9.1	103	393	3.92	0.230	2.114 0.022	0.19000 0.00092	2.119 0.023	0.18794 0.00121	2492 33	2724 11	8.5
S	7	7.1	93	221	2.45	0.133	2.021 0.025	0.19017 0.00095	2.024 0.027	0.18899 0.00123	2589 43	2733 11	5.3
S	19	19.1	148	139	0.97	0.348	2.008 0.018	0.19235 0.00085	2.015 0.019	0.18924 0.00102	2598 31	2736 9	5.0
S	12	12.1	117	40	0.36	0.072	1.860 0.017	0.19327 0.00085	1.862 0.018	0.19262 0.00089	2772 33	2765 8	-0.3
D	14	14.1	273	231	0.87	0.042	2.262 0.018	0.18171 0.00055	2.263 0.019	0.18134 0.00059	2359 24	2665 5	11.5
D	17	17.1	114	490	4.45	0.608	2.577 0.025	0.19114 0.00104	2.593 0.026	0.18571 0.00145	2102 25	2705 13	22.3
D	8	8.1	147	898	6.29	0.726	2.562 0.022	0.19354 0.00081	2.581 0.024	0.18707 0.00117	2111 23	2717 10	22.3
D	1	1.1	111	532	4.97	0.570	2.223 0.027	0.19411 0.00097	2.236 0.029	0.18903 0.00130	2383 38	2734 11	12.8
D	18	18.1	164	2862	18.07	0.911	2.890 0.031	0.19767 0.00094	2.916 0.032	0.18955 0.00141	1901 24	2738 12	30.6
D	2	2.1	153	2373	16.02	2.258	3.336 0.039	0.21229 0.00097	3.413 0.044	0.19216 0.00182	1656 24	2761 16	40.0

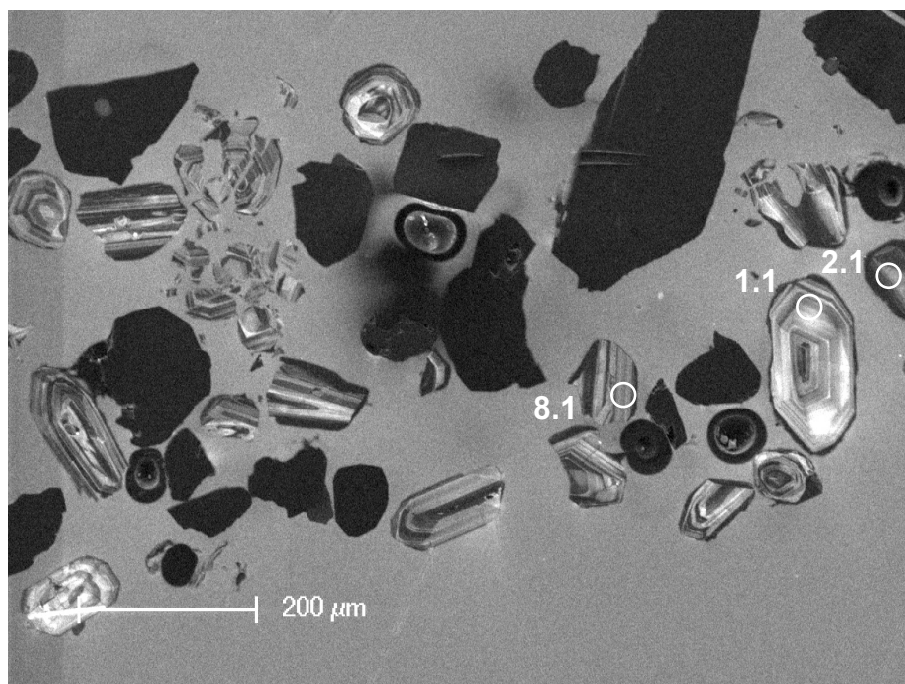


Figure 2. Cathodoluminescence image of representative zircons from sample 182604: metaconglomerate, Rocky Well. Numbered circles indicate approximate positions of analysis sites. The dark crystals are not zircons.

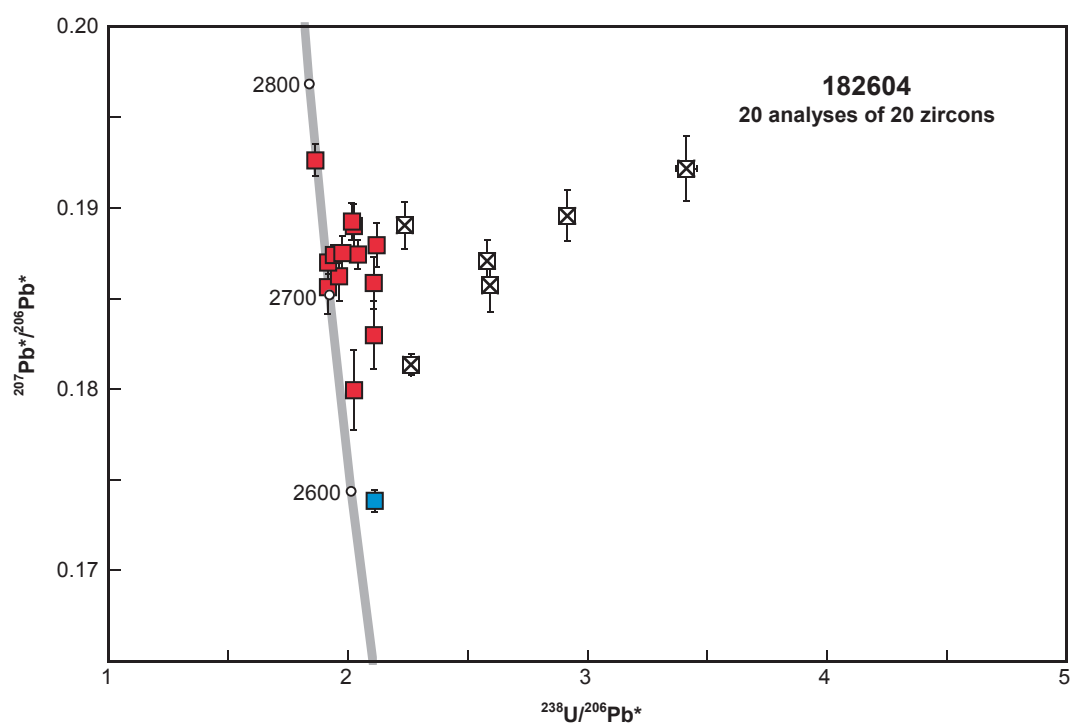


Figure 3. U-Pb analytical data for sample 182604: metaconglomerate, Rocky Well. Blue square indicates Group Y (youngest detrital zircon); red squares indicate Group S (older detrital zircons); crossed squares indicate Group D (discordance >10%).

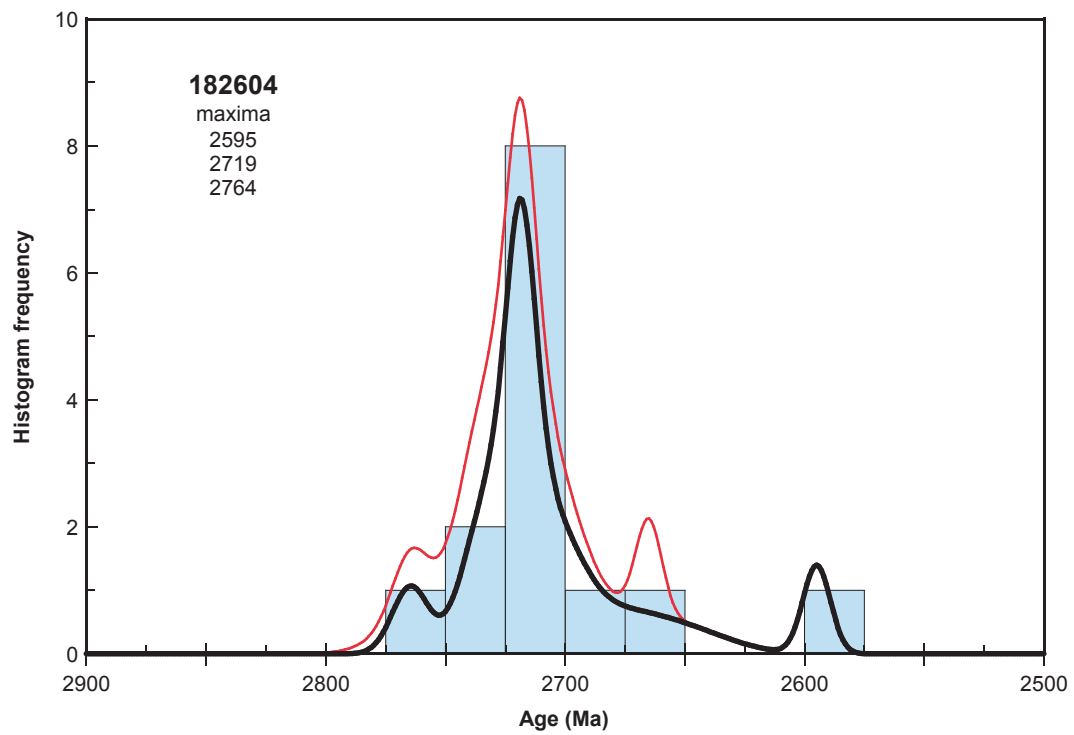


Figure 4. Probability density diagram for sample 182604: metaconglomerate, Rocky Well. Thick curve, maxima values, and frequency histogram (bin width 25 Ma) include only data with discordance <10% (14 analyses of 14 zircons). Thin curve includes all data (20 analyses of 20 zircons).