

# 195866: metaconglomerate, Peak Hill mine

## (Crispin Mylonite, Peak Hill Schist, Capricorn Orogen)

### Location and sampling

PEAK HILL (SG 50-8), BRYAH (2646)  
MGA Zone 50, 672643E 7158929N

Sampled on 24 May 2012

This sample was collected from an area of low scattered outcrops, about 13.3 km northeast of Murphy Well, 13.0 km west-northwest of Wilgeena mine, and 4.0 km south of Peak Hill mine.

### Tectonic unit/relation

The unit sampled is a metaconglomerate known as the Crispin Conglomerate (Gee, 1986) or the Crispin Mylonite (Pirajno and Occhipinti, 1998), assigned to the Peak Hill Schist. The Peak Hill Schist outcrops at the southwestern end of the Archean Marymia Inlier and consists of mylonitized and metamorphosed rocks derived from quartz-rich and/or quartzofeldspathic precursors (Pirajno and Occhipinti, 1998). At this locality, the rock is a matrix-supported metaconglomerate (Fig. 1) consisting of 10–15% subrounded to slightly elongate pebbles to cobbles, with a few boulder-size clasts, within a fine- to medium-grained schistose matrix. Most clasts (c. 95%) are of fine-grained recrystallized quartzite, although minor clasts of fine-grained black chert are present. A strongly sheared metamonzogranite of the Peak Hill Schist, sampled 10.0 km to the east, yielded a magmatic crystallization age of  $2662 \pm 6$  Ma (GSWA 195870, Wingate et al., 2014).

### Petrographic description

The sample is a metaconglomerate, although only the matrix was examined petrographically. The matrix consists of 50–55% muscovite and sericite, and 45–50% quartz. Quartz occurs as microcrystalline to fine-grained (up to 1 mm across), corroded, rounded, and embayed grains and composite grains. Sericite and muscovite folia contain grains up to 0.4 mm long, although individual flakes of muscovite in the rock are up to 3 mm long.

### Zircon morphology

Zircons isolated from this sample are colourless to dark brown, and range from anhedral and strongly rounded

to subhedral. The crystals are up to 250 mm long, and equant to slightly elongate, with aspect ratios up to 3:1. Some crystals have pitted outer surfaces and, in cathodoluminescence (CL) images, many exhibit concentric zoning truncated at grain edges, features consistent with abrasion during sedimentary transport. A CL image of representative zircons is shown in Figure 2.

### Analytical details

This sample was analysed during two sessions on 5–6 July 2013, using SHRIMP-B. Analyses 1.1 to 16.1 (spot numbers 1–16) were obtained during the first session, together with six analyses of the BR266 standard, which indicated an external spot-to-spot (reproducibility) uncertainty of 0.89% ( $1\sigma$ ) and a  $^{238}\text{U}/^{206}\text{Pb}^*$  calibration uncertainty of 0.40% ( $1\sigma$ ). Analyses 17.1 to 51.1 (spot numbers 17–52) were obtained during the second session, together with eight analyses of the BR266 standard, which indicated an external spot-to-spot (reproducibility) uncertainty of 0.50% ( $1\sigma$ ) and a  $^{238}\text{U}/^{206}\text{Pb}^*$  calibration uncertainty of 0.16% ( $1\sigma$ ). 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

Fifty-two analyses were obtained from 51 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 moderately discordant (Fig. 3). Seven analyses are >5% discordant. The dates obtained from these seven analyses (Group D, Table 1) are unreliable, and considered not to be geologically significant. The remaining 45 analyses can be divided into two groups, based on their  $^{207}\text{Pb}^*/^{206}\text{Pb}^*$  ratios.

Group Y comprises one analysis (Table 1), which yields a  $^{207}\text{Pb}^*/^{206}\text{Pb}^*$  date of  $2170 \pm 18$  Ma ( $1\sigma$ ).

Group S comprises 44 analyses of 43 zircons (Table 1), which yield  $^{207}\text{Pb}^*/^{206}\text{Pb}^*$  dates of 2857–2614 Ma.



Figure 1. Outcrop image for sample 195866: metaconglomerate, Peak Hill mine.

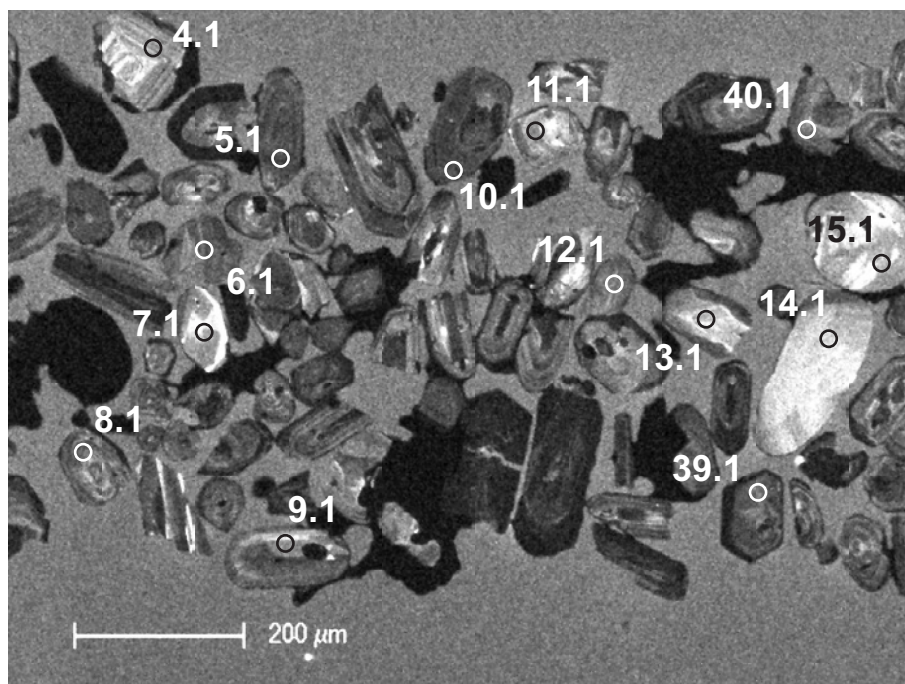


Figure 2. Cathodoluminescence image of representative zircons from sample 195866: metaconglomerate, Peak Hill mine. Numbered circles indicate the approximate locations of analysis sites.

Table 1. Ion microprobe analytical results for zircons from sample 195866: metaconglomerate, Peak Hill Mine

Group ID	Spot no.	Grain. spot	<sup>238</sup> U (ppm)	<sup>232</sup> Th (ppm)	<sup>232</sup> Th/ <sup>238</sup> U	f204 (%)	<sup>238</sup> U/ <sup>206</sup> Pb ± 1σ	<sup>207</sup> Pb/ <sup>206</sup> Pb ± 1σ	<sup>238</sup> U/ <sup>206</sup> Pb* ± 1σ	<sup>207</sup> Pb*/ <sup>206</sup> Pb* ± 1σ	<sup>238</sup> U/ <sup>206</sup> Pb* date (Ma) ± 1σ	<sup>207</sup> Pb*/ <sup>206</sup> Pb* date (Ma) ± 1σ	Disc. (%)
Y	15	15.1	85	71	0.87	0.000	2.551 0.043	0.13543 0.00137	2.551 0.043	0.13543 0.00137	2132 31	2170 18	1.8
S	6	6.1	126	142	1.16	0.124	1.977 0.030	0.17697 0.00117	1.979 0.030	0.17588 0.00124	2636 33	2614 12	-0.8
S	50	49.1	173	103	0.62	0.012	1.975 0.022	0.17664 0.00092	1.975 0.022	0.17653 0.00093	2641 24	2621 9	-0.8
S	17	17.1	126	81	0.66	0.072	1.955 0.024	0.17775 0.00100	1.957 0.024	0.17711 0.00104	2661 27	2626 10	-1.3
S	10	10.1	272	185	0.70	0.116	2.068 0.026	0.18028 0.00086	2.070 0.026	0.17925 0.00090	2540 26	2646 8	4.0
S	13	13.1	64	66	1.06	-0.043	1.972 0.038	0.17897 0.00180	1.971 0.038	0.17936 0.00184	2645 43	2647 17	0.1
S	31	31.1	256	350	1.41	0.201	2.045 0.019	0.18118 0.00069	2.049 0.019	0.17938 0.00076	2562 19	2647 7	3.2
S	47	46.1	227	257	1.17	0.125	2.076 0.020	0.18078 0.00077	2.079 0.020	0.17966 0.00083	2532 21	2650 8	4.4
S	34	34.1	74	73	1.02	0.343	2.003 0.031	0.18379 0.00140	2.010 0.031	0.18074 0.00164	2603 34	2660 15	2.1
S	51	50.1	139	230	1.70	0.073	1.949 0.024	0.18169 0.00103	1.951 0.024	0.18104 0.00107	2668 27	2662 10	-0.2
S	9	9.1	97	53	0.56	0.222	1.994 0.033	0.18309 0.00140	1.999 0.033	0.18112 0.00155	2615 36	2663 14	1.8
S	32	32.1	309	353	1.18	0.089	2.015 0.018	0.18201 0.00066	2.017 0.018	0.18122 0.00069	2596 19	2664 6	2.6
S	45	44.1	228	115	0.52	-0.023	1.966 0.019	0.18114 0.00075	1.965 0.019	0.18135 0.00076	2651 21	2665 7	0.5
S	30	30.1	60	54	0.93	0.028	2.021 0.033	0.18176 0.00143	2.022 0.033	0.18151 0.00145	2591 35	2667 13	2.8
S	33	33.1	235	55	0.24	0.078	1.961 0.019	0.18243 0.00076	1.962 0.019	0.18174 0.00079	2655 21	2669 7	0.5
S	19	19.1	185	80	0.44	0.038	2.049 0.028	0.18211 0.00084	2.050 0.028	0.18177 0.00086	2562 30	2669 8	4.0
S	21	21.1	229	172	0.78	0.063	1.999 0.019	0.18251 0.00076	2.000 0.020	0.18195 0.00079	2614 21	2671 7	2.1
S	27	27.1	313	240	0.79	0.094	2.008 0.018	0.18318 0.00068	2.010 0.018	0.18234 0.00071	2603 19	2674 6	2.7
S	36	36.1	174	103	0.61	0.011	1.972 0.021	0.18254 0.00089	1.973 0.021	0.18244 0.00090	2644 24	2675 8	1.2
S	49	48.1	122	102	0.87	0.043	2.006 0.024	0.18302 0.00102	2.007 0.024	0.18264 0.00105	2606 26	2677 9	2.6
S	44	43.1	164	103	0.65	-0.010	2.001 0.021	0.18282 0.00087	2.001 0.021	0.18291 0.00087	2612 23	2679 8	2.5
S	23	23.1	165	81	0.51	0.044	1.965 0.022	0.18392 0.00090	1.966 0.022	0.18353 0.00092	2651 24	2685 8	1.3
S	20	20.1	178	111	0.64	0.052	1.935 0.021	0.18502 0.00088	1.936 0.021	0.18455 0.00091	2685 24	2694 8	0.4
S	5	5.1	345	235	0.70	0.037	1.972 0.024	0.18490 0.00083	1.973 0.024	0.18457 0.00084	2643 27	2694 8	1.9
S	46	45.1	89	99	1.15	0.000	2.015 0.031	0.18475 0.00611	2.015 0.031	0.18475 0.00611	2598 33	2696 55	3.6
S	4	4.1	94	78	0.86	-0.045	1.949 0.032	0.18453 0.00134	1.948 0.032	0.18493 0.00137	2671 36	2698 12	1.0
S	25	25.1	202	114	0.58	0.040	1.954 0.019	0.18727 0.00079	1.954 0.019	0.18692 0.00080	2664 22	2715 7	1.9
S	7	7.1	116	52	0.46	-0.020	1.938 0.030	0.18729 0.00129	1.937 0.030	0.18747 0.00130	2683 35	2720 11	1.4
S	42	42.1	184	113	0.63	0.028	1.883 0.020	0.18850 0.00085	1.884 0.020	0.18825 0.00087	2745 23	2727 8	-0.7
S	2	2.1	378	216	0.59	0.039	1.910 0.023	0.18881 0.00075	1.911 0.023	0.18847 0.00076	2713 27	2729 7	0.6
S	40	40.1	174	114	0.68	0.072	1.927 0.020	0.18934 0.00083	1.928 0.020	0.18870 0.00087	2693 23	2731 8	1.4
S	41	41.1	192	116	0.62	0.038	1.921 0.020	0.18954 0.00086	1.922 0.020	0.18921 0.00087	2700 23	2735 8	1.3
S	35	35.1	283	271	0.99	0.052	1.909 0.017	0.18985 0.00071	1.910 0.017	0.18939 0.00073	2714 20	2737 6	0.8
S	3	3.1	221	131	0.61	0.039	1.931 0.025	0.18988 0.00095	1.931 0.025	0.18953 0.00097	2690 29	2738 8	1.8

Table 1. continued

Group ID	Spot no.	Grain. spot	$^{238}\text{U}$ (ppm)	$^{232}\text{Th}$ (ppm)	$\frac{^{232}\text{Th}}{^{238}\text{U}}$	$f_{204}$ (%)	$^{238}\text{U}/^{206}\text{Pb} \pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb} \pm 1\sigma$	$^{238}\text{U}/^{208}\text{Pb}^* \pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^* \pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^*$ date (Ma) $\pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date (Ma) $\pm 1\sigma$	Disc. (%)
S	24	24.1	189	125	0.68	0.018	1.890 0.019	0.18974 0.00085	1.890 0.019	0.18959 0.00086	2737 23	2739 7	0.0
S	38	38.1	157	130	0.85	0.043	1.899 0.021	0.19008 0.00092	1.900 0.021	0.18969 0.00094	2726 25	2739 8	0.5
S	1	1.1	152	62	0.42	0.061	1.924 0.028	0.19050 0.00116	1.925 0.028	0.18996 0.00119	2697 32	2742 10	1.6
S	22	22.1	185	143	0.80	0.084	1.911 0.021	0.19080 0.00091	1.913 0.021	0.19005 0.00095	2711 24	2743 8	1.1
S	12	12.1	132	68	0.53	-0.105	1.922 0.029	0.18955 0.00123	1.920 0.029	0.19048 0.00128	2702 34	2746 11	1.6
S	14	14.1	72	55	0.79	-0.068	1.903 0.035	0.19027 0.00168	1.901 0.035	0.19088 0.00173	2724 42	2750 15	0.9
S	18	18.1	225	220	1.01	0.009	1.921 0.019	0.19105 0.00099	1.921 0.019	0.19097 0.00100	2702 22	2751 9	1.8
S	37	37.1	258	293	1.17	0.088	1.968 0.018	0.19184 0.00076	1.970 0.018	0.19106 0.00080	2647 20	2751 7	3.8
S	48	47.1	158	116	0.76	0.022	1.906 0.021	0.19156 0.00093	1.907 0.021	0.19136 0.00094	2718 25	2754 8	1.3
S	16	16.1	82	33	0.41	0.160	1.850 0.032	0.20195 0.00157	1.852 0.032	0.20053 0.00167	2783 40	2831 14	1.7
S	43	16.2	130	88	0.70	0.066	1.891 0.022	0.20441 0.00108	1.893 0.023	0.20382 0.00111	2735 27	2857 9	4.3
D	39	39.1	179	236	1.36	0.246	2.232 0.023	0.18204 0.00089	2.237 0.023	0.17985 0.00100	2382 21	2651 9	10.2
D	8	8.1	204	228	1.16	0.000	2.132 0.028	0.18136 0.00104	2.132 0.028	0.18136 0.00104	2479 28	2665 9	7.0
D	28	28.1	305	291	0.98	0.091	2.129 0.019	0.18272 0.00072	2.131 0.019	0.18192 0.00075	2480 19	2670 7	7.1
D	29	29.1	157	103	0.68	0.112	2.178 0.024	0.18337 0.00099	2.180 0.024	0.18237 0.00104	2434 23	2675 9	9.0
D	11	11.1	144	308	2.21	-0.020	2.196 0.032	0.18235 0.00127	2.196 0.032	0.18253 0.00128	2419 30	2676 12	9.6
D	52	51.1	332	380	1.18	0.125	2.082 0.018	0.19227 0.00408	2.084 0.018	0.19115 0.00409	2526 18	2752 35	8.2
D	26	26.1	191	144	0.78	0.114	1.913 0.020	0.20865 0.00093	1.916 0.020	0.20763 0.00098	2708 23	2887 8	6.2

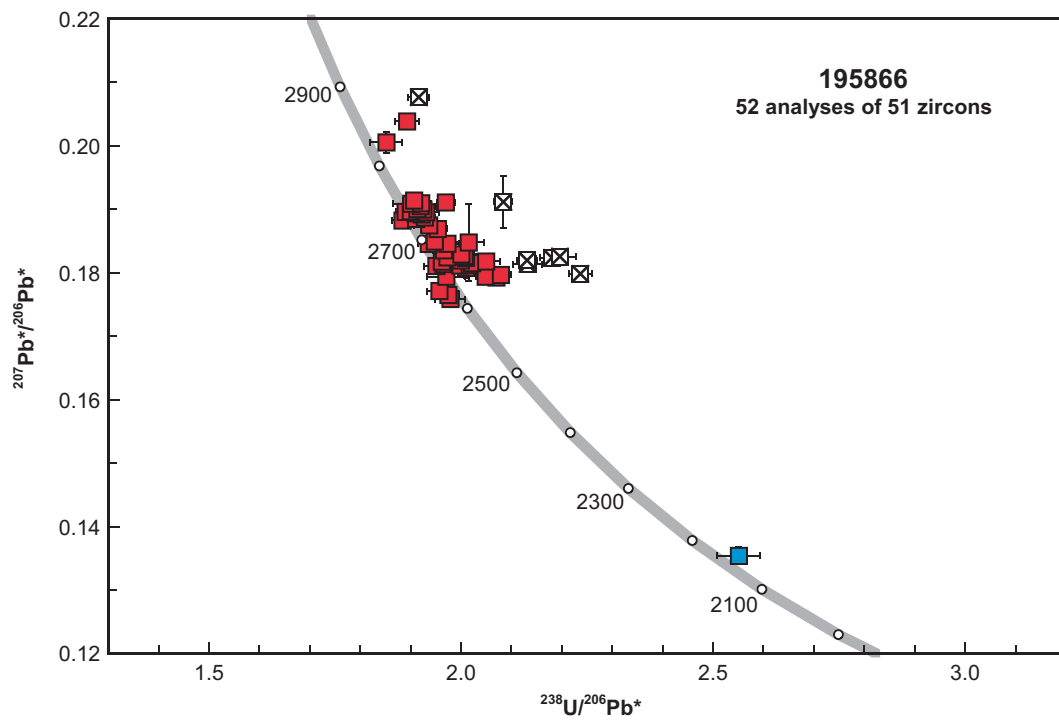


Figure 3. U-Pb analytical data for sample 195866: metaconglomerate, Peak Hill mine. Blue square indicates Group Y (youngest detrital zircon); red squares indicate Group S (older detrital zircons); crossed squares indicate Group D (discordance >5%).

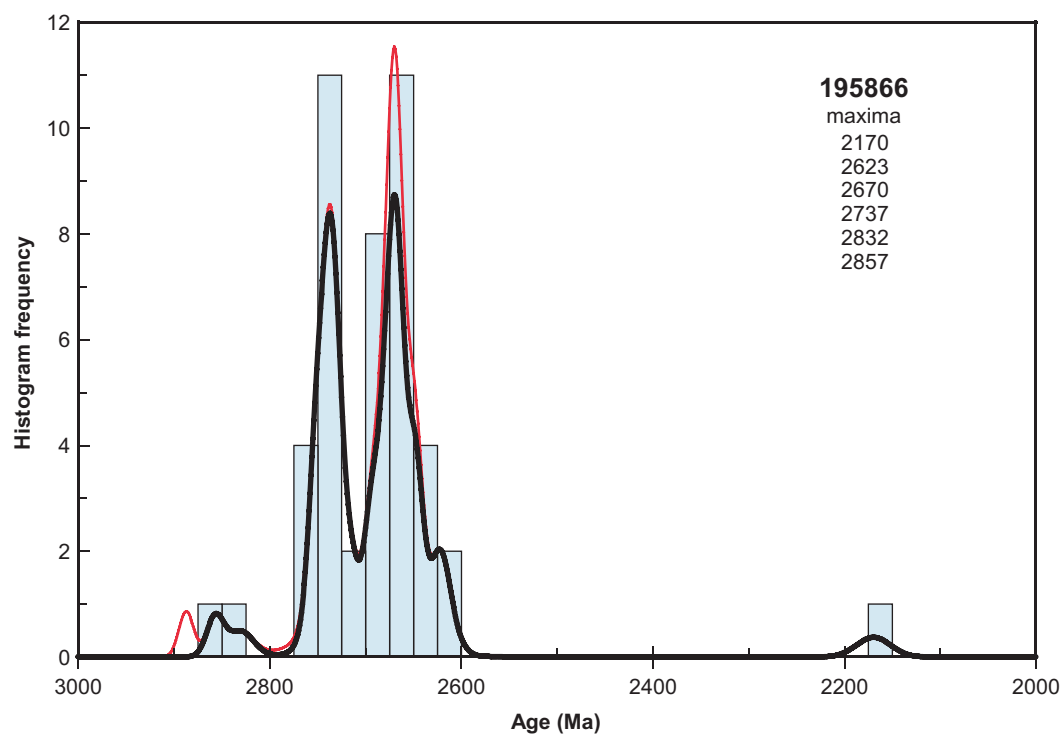


Figure 4. Probability density diagram and histogram for sample 195866: metaconglomerate, Peak Hill mine. Thick curve, maxima values, and frequency histogram (bin width 25 Ma) include only data <5% discordant (45 analyses of 44 zircons). Thin curve includes all data (52 analyses of 51 zircons).

It is possible that all of the analyses in Groups Y and S are of unmodified detrital zircons, in which case the date of  $2170 \pm 18$  Ma ( $1\sigma$ ) for the single analysis in Group Y represents a maximum depositional age for the sedimentary protolith. A more conservative estimate of the maximum age of deposition is provided by the weighted mean  $^{207}\text{Pb}^*/^{206}\text{Pb}^*$  date of  $2642 \pm 12$  Ma (MSWD = 2.7) for the nine youngest analyses in Group S.

The data indicate significant age components at c. 2737, 2670, and 2623 Ma, based on approximately 15, 16, and 5 analyses, respectively. These dates 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.

## References

- Gee, RD 1986, Peak Hill, Western Australia (2nd edition): Geological Survey of Western Australia, 1:250 000 Geological Series Explanatory Notes, 24p.
- Pirajno, F and Occhipinti, SA 1998, Geology of the Bryah 1:100 000 sheet: Geological Survey of Western Australia, 1:100 000 Geological Series Explanatory Notes, 41p.
- 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.
- Wingate, MTD, Kirkland, CL and Johnson, SP 2014, 195870: metamonzogranite, Stalley Well; Geochronology Record 1154: Geological Survey of Western Australia, 4p.

## Recommended reference for this publication

Wingate, MTD, Kirkland, CL and Johnson, SP 2014, 195866: metaconglomerate, Peak Hill mine; Geochronology Record 1153: Geological Survey of Western Australia, 6p.

Data obtained: 6 July 2013

Data released: 31 January 2014