

209610: clinopyroxene syenogranite, Paddy Bore

(Yilgarn Craton granites, Southern Cross Domain, Youanmi Terrane, Yilgarn Craton)

Location and sampling

SIR SAMUEL (SG 51-13), DEPOT SPRINGS (2942)
MGA Zone 51, 244765E 6937007N

Sampled on 14 June 2012

This sample was collected from an outcrop south of an east-trending track, about 7.4 km southeast of Hansen Well, 5.0 km north-northwest of Beaty Bore, and 3.2 km northeast of Paddy Bore.

Tectonic unit/relations

The unit sampled is a clinopyroxene syenogranite, collected from a local unit within a larger area of foliated granitic rocks containing greenstone xenoliths in the Waroonga Shear Zone, which is a large-scale, complex, transpressional shear zone that forms part of the boundary between the Eastern Goldfields Superterrane and the Youanmi Terrane in the Yilgarn Craton (Zibra et al., 2014). This granite type is unusual in this area and has a similar age and composition to the granitic rocks of the syenite group of Champion and Sheraton (1997), which are most abundant in the western part of the Eastern Goldfields Superterrane (Libby et al., 1978; Smithies and Champion, 1999).

Petrographic description

The sample is a medium-grained clinopyroxene syenogranite, consisting of about 40–45% K-feldspar, 20–25% plagioclase, 20–25% quartz, 10% aegirine-augite, 1% actinolitic hornblende, 1% titanite, and accessory apatite, opaque oxide minerals, zircon, and secondary epidote. K-feldspar occurs as anhedral grains up to 3.5 mm in size, and is marked either by clay alteration or trails of strongly aligned tiny albite inclusions. Plagioclase occurs as anhedral, equant to slightly elongate grains to 4 mm in size that are distinguished either by very fine multiple twinning or incipient fine deformation twinning. Quartz also occurs as irregular anhedral grains, up to 4.5 mm in size, that are variably strained (marked undulose extinction), subgrained or recrystallized to a granoblastic aggregate in narrow zones between feldspars. Green aegirine-augite occurs as subhedral, fractured crystals up to 2 mm in size, with some forming small glomeroporphyritic aggregates. Actinolitic hornblende rims some aegirine-augite crystals. Titanite occurs as euhedral to subhedral

boat-shaped crystals up to 0.7 mm long. Apatite occurs as euhedral crystals to 0.25 mm in size. Black opaque minerals, probably magnetite, are less than 0.1 mm in size and anhedral to subhedral.

Zircon morphology

Zircons isolated from this sample are colourless, and mainly subhedral. The crystals are up to 250 μm long, and equant to elongate, with aspect ratios up to 2:1. In cathodoluminescence (CL) images, concentric zoning is ubiquitous, and sector zoning is also common. A CL image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed on 6–7 March 2015, using SHRIMP-B. Ten analyses of the BR266 standard were obtained during the session, of which nine analyses indicated an external spot-to-spot (reproducibility) uncertainty of 0.50% (1σ) and a $^{238}\text{U}/^{206}\text{Pb}^*$ calibration uncertainty of 0.16% (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

Eighteen analyses were obtained from 18 zircons. Results are listed in Table 1, and shown in a concordia diagram (Fig. 2).

Interpretation

The analyses are concordant to slightly discordant (Fig. 2), and form a single group, based on their $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ ratios.

Group I comprises 18 analyses (Table 1), which yield a weighted mean $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 2661 ± 6 Ma (MSWD = 0.75).

The date of 2661 ± 6 Ma for the 18 analyses in Group I is interpreted as the magmatic crystallization age of the syenogranite.

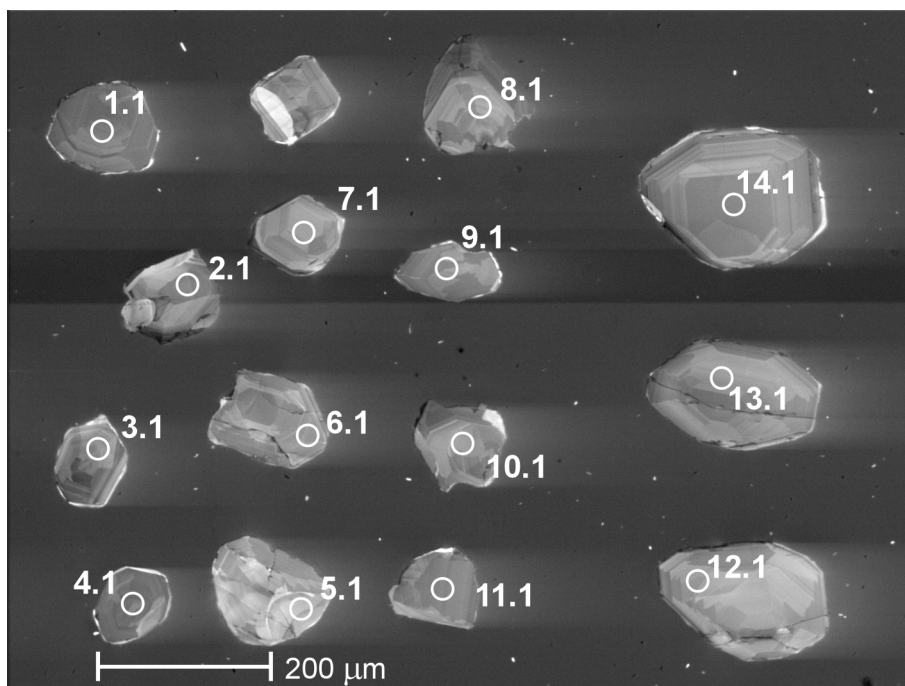


Figure 1. Cathodoluminescence image of representative zircons from sample 209610: clinopyroxene syenogranite, Paddy Bore. Numbered circles indicate the approximate locations of analysis sites.

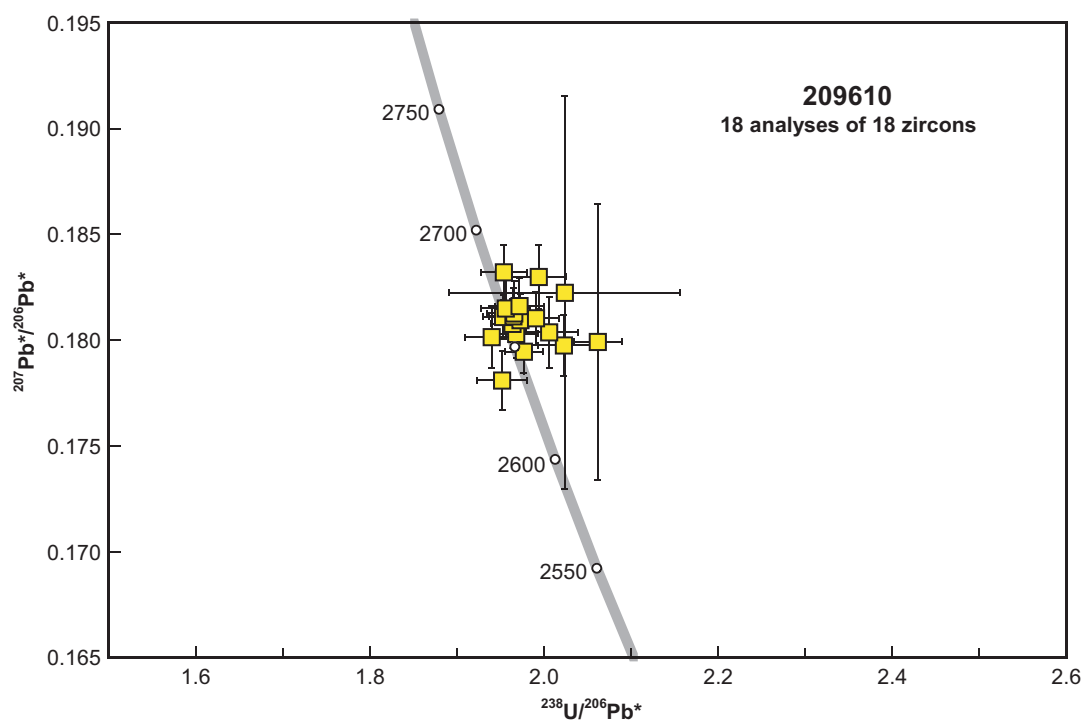


Figure 2. U–Pb analytical data for sample 209610: clinopyroxene syenogranite, Paddy Bore. Yellow squares indicate Group I (magmatic zircons).

Table 1. Ion microprobe analytical results for zircons from sample 209610: clinopyroxene syenogranite, Paddy Bore

Group ID	Spot no.	Grain. spot	^{238}U (ppm)	^{232}Th (ppm)	$\frac{^{232}\text{Th}}{^{238}\text{U}}$	f204 (%)	$^{238}\text{U}/^{206}\text{Pb} \pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb} \pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^* \pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^* \pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^* \text{ date (Ma)} \pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^* \text{ date (Ma)} \pm 1\sigma$	Disc. (%)
I	16	16.1	66	47	0.74	-0.079	1.953 0.029	0.17738 0.00135	1.952 0.029	0.17809 0.00141	2667 32	2635 13	-1.2
I	15	15.1	118	132	1.16	0.098	1.975 0.022	0.18034 0.00099	1.977 0.022	0.17946 0.00104	2639 24	2648 10	0.3
I	17	17.1	60	58	1.00	0.108	2.021 0.030	0.18071 0.00137	2.023 0.030	0.17975 0.00145	2589 32	2651 13	2.3
I	3	3.1	80	65	0.85	0.070	2.061 0.028	0.18054 0.00650	2.062 0.028	0.17991 0.00651	2549 29	2652 60	3.9
I	10	10.1	62	50	0.83	0.030	1.940 0.030	0.18040 0.00144	1.940 0.030	0.18014 0.00146	2680 34	2654 13	-1.0
I	11	11.1	93	135	1.50	0.000	1.968 0.025	0.18029 0.00114	1.968 0.025	0.18029 0.00114	2649 28	2656 11	0.2
I	8	8.1	52	49	0.97	-0.168	2.009 0.033	0.17887 0.00154	2.006 0.033	0.18037 0.00167	2608 35	2656 15	1.8
I	18	18.1	93	80	0.89	0.037	1.963 0.025	0.18111 0.00115	1.964 0.025	0.18077 0.00117	2653 28	2660 11	0.3
I	1	1.1	97	63	0.67	-0.097	1.975 0.025	0.18009 0.00117	1.973 0.025	0.18095 0.00124	2643 28	2662 11	0.7
I	9	9.1	79	67	0.88	0.000	1.991 0.027	0.18104 0.00125	1.991 0.027	0.18104 0.00125	2623 29	2662 11	1.5
I	4	4.1	113	90	0.82	0.031	1.952 0.023	0.18137 0.00104	1.953 0.023	0.18110 0.00105	2665 26	2663 10	-0.1
I	2	2.1	75	89	1.22	0.071	1.964 0.028	0.18176 0.00130	1.965 0.028	0.18113 0.00135	2651 31	2663 12	0.4
I	12	12.1	56	50	0.93	-0.032	1.967 0.031	0.18099 0.00149	1.966 0.031	0.18127 0.00152	2651 35	2665 14	0.5
I	13	13.1	69	48	0.72	0.026	1.956 0.028	0.18173 0.00135	1.956 0.028	0.18150 0.00137	2662 32	2667 13	0.2
I	6	6.1	75	61	0.84	0.048	1.971 0.028	0.18203 0.00130	1.972 0.028	0.18161 0.00134	2644 31	2668 12	0.9
I	5	5.1	62	32	0.54	-0.031	2.025 0.133	0.18197 0.00928	2.024 0.133	0.18224 0.00928	2588 148	2673 84	3.2
I	7	7.1	58	53	0.94	-0.030	1.995 0.031	0.18271 0.00147	1.994 0.031	0.18298 0.00150	2620 34	2680 14	2.2
I	14	14.1	80	106	1.37	0.044	1.953 0.026	0.18359 0.00127	1.954 0.026	0.18320 0.00130	2665 30	2682 12	0.6

References

- Champion, DC and Sheraton, JW 1997, Geochemistry and Nd isotope systematics of Archaean granites of the Eastern Goldfields, Yilgarn Craton, Australia: implications for crustal growth processes: *Precambrian Research*, v. 83, p. 109–132.
- Libby, WG, Lewis, JD and Gower, CF 1978, Contributions to the geology of the Eastern Goldfields Province of the Yilgarn Block: Geological Survey of Western Australia, Report 9, 162p.
- Smithies, RH and Champion, DC 1999, Late Archaean felsic alkaline igneous rocks in the Eastern Goldfields, Yilgarn Craton, Western Australia: a result of lower crustal delamination?: *Journal of the Geological Society, London*, v. 156, p. 561–576.
- 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.
- Zibra, I, Gessner, K, Pawley, MJ, Wyche, S, Chen, SF, Korsch, RJ, Blewett, RS, Jones, T, Milligan, P, Jones, LEA, Doublier, MP, Hall, CE, Romano, SS, Ivanic, TJ, Patison, N, Kennett, BLN and Van Kranendonk, MJ 2014, Preliminary interpretation of deep seismic line 10GA-YU2: Youanmi Terrane and western Kalgoorlie Terrane, in Younami and Southern Carnarvon seismic and magnetotelluric (MT) workshop 2013 *compiled by* S Wyche, TJ Ivanic and I Zibra: Geological Survey of Western Australia, Record 2013/6, p. 87–96.

Recommended reference for this publication

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