184353: monzogranite, Kiwirrkurra

(Mount Webb Granite, Mount Webb Suite, Warumpi Province, Arunta Orogen)

Location and sampling

WEBB (SF 52-10), POLLOCK (4452)
MGA Zone 52, 371948 E 7472029N

Sampled on 6 August 2007

The sample was collected from a series of low granite ridges adjacent to a dolerite dyke and related hybrid granitic rocks, near the Kiwirrkurra – Gary Junction Road, about 4.4 km south of the Kiwirrkurra town site.

Tectonic unit/relations

The unit sampled is the Mount Webb Granite, a heterogeneous, hornblende–biotite monzogranite containing patches of sodic–calcic altered granite, sericite-altered granite, and aplite. The Mount Webb Granite has yielded ion microprobe U–Pb zircon ages of 1643 ± 4, 1639 ± 5, and 1639 ± 5 Ma, with inherited components at 1680–1690, 1775–1769, and 1830–1877 Ma (Wyborn et al., 1998). The granite is thought to be comagmatic with felsic volcanic rocks belonging to the Pollock Hills Formation. The sample is a medium- to coarse-grained, biotite–hornblende metamonzogranite, and was collected from a site sampled previously by Wyborn et al. (1998).

Petrographic description

This sample represents a foliated monzogranite, with a visually estimated mineralogy including 29% quartz, 33% K-feldspar, 25% altered plagioclase, 9% mafic aggregates, 4% partly recrystallized granophyre, and <1% opaque oxide minerals. K-feldspar is up to 6 mm in diameter and is partially rimmed by recrystallised quartz, K-feldspar, and granophyric quartz–K-feldspar intergrowths. Other K-feldspar grains are intergrown with altered plagioclase. Abundant plagioclase is up to 4 mm in size. Foliated, fine-grained biotite occurs in lenses. The biotite is partly altered and is associated with epidote, titanite, and magnetite in various proportions. Zircon occurs mostly in and adjacent to the mafic lenses. Apatite is an accessory phase. Plagioclase exhibits pervasive saussuritic alteration with sericite dominant over epidote. Biotite shows weak alteration to chlorite or to clay, with or without prehnite. Initial recrystallization and deformation under possible amphibolite-facies conditions was followed by low-temperature hydrothermal alteration.

Zircon morphology

Zircons isolated from this sample are euhedral and range from clear and colourless to turbid and brown. The grains are up to 250 μm long, with aspect ratios up to 4:1. Cathodoluminescence (CL) images reveal oscillatory zoned crystals, many of which have internal zone truncations, suggesting a complex growth history with multiple phases of growth, dissolution, and regrowth. A CL image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed over two sessions on 7 August 2008, using SHRIMP-A. Analyses 1.1 to 3.1 (spot numbers 1–3) were obtained during the first session, together with five analyses of the Temora standard, which indicated an external spot-to-spot (reproducibility) uncertainty of 1.04% (1σ), and a $^{238}U/^{206}Pb^*$ calibration uncertainty of 0.51% (1σ). Analyses 4.1 to 15.1 (spot numbers 4–15) were obtained during the second session, together with 11 analyses of the Temora standard. Following rejection of one analysis as an outlier, the remaining 10 analyses indicated an external spot-to-spot (reproducibility) uncertainty of 0.70% (1σ), and a $^{238}U/^{206}Pb^*$ calibration uncertainty of 0.29% (1σ). Calibration uncertainties are included in the errors of $^{238}U/^{206}Pb^*$ 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 Pb isotopic model of Stacey and Kramers (1975).

Results

Fifteen analyses were obtained from 15 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 can be divided into two groups, based on their $^{207}Pb^*/^{206}Pb^*$ ratios.

Group I comprises 14 analyses (Table 1), which yield a weighted mean $^{207}Pb^*/^{206}Pb^*$ date of 1640 ± 7 Ma (MSWD = 1.02).

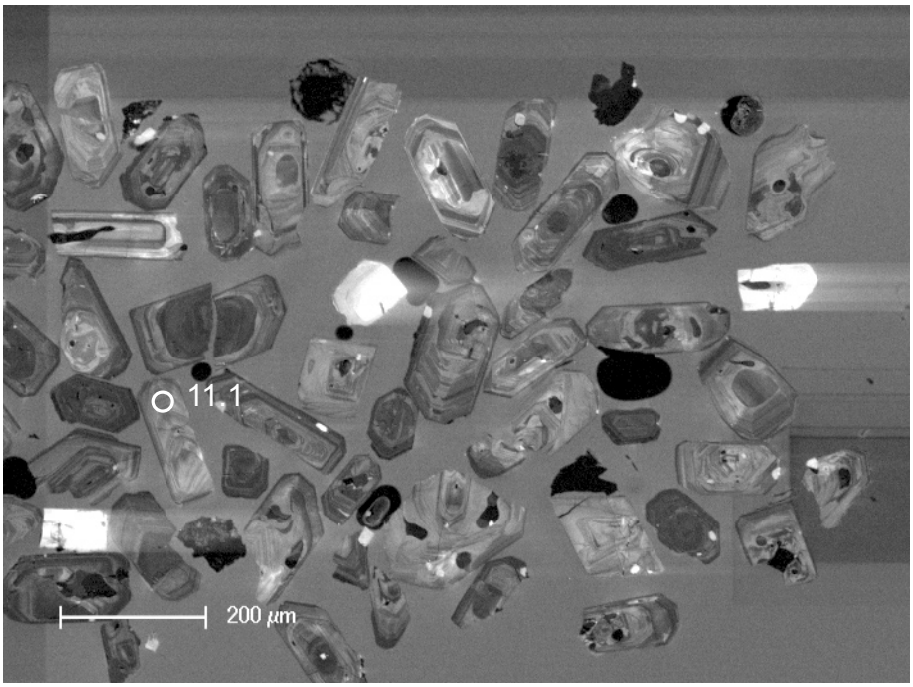

Figure 1. Cathodoluminescence image of representative zircons from sample 184353: monzogranite, Kiwirrkurra. Numbered circle indicates the approximate positions of analysis sites.

Group P comprises a single analysis (15.1; Table 1), which yields a $^{207}Pb^*/^{206}Pb^*$ date of 1587 ± 14 Ma (1σ).

The date of 1640 ± 7 Ma for the 14 analyses in Group I is interpreted as the age of magmatic crystallization of the monzogranite. This age is identical, within uncertainty, to previous U–Pb zircon results for this granite (Wyborn et al., 1998). The date of 1587 ± 14 Ma (1σ) for the single analysis in Group P is interpreted to reflect minor ancient loss of radiogenic Pb or, possibly, slight over-correction for common Pb.

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.

Wyborn, L, Murray, H, Page, R, Idnurm, M and Sun, S 1998, A newly discovered major Proterozoic granite-alteration system in the Mount Webb region, Central Australia, and implications for Cu–Au mineralisation: AGSO Research Newsletter, v. 28, p. 1–6.

Recommended reference for this publication

Kirkland, CL, Wingate, MTD, Spaggiari, CV and Tyler, IM 2009, 184353: monzogranite, Kiwirrkurra; Geochronology Record 820: Geological Survey of Western Australia, 4p.

Data obtained: 7 August 2008
Data released: 30 June 2009

Table 1. Ion microprobe analytical results for zircons from sample 184353: monzogranite, Kiwirrkurra

Group ID.	*Spot no.*	*Grain. spot*	^{238}U *(ppm)*	^{232}Th *(ppm)*	$^{232}Th/^{238}U$	*f204 (%)*	$^{238}U/^{206}Pb$ *± 1 σ*		$^{207}Pb/^{206}Pb$ *± 1 σ*		$^{238}U/^{206}Pb^*$ *± 1 σ*		$^{207}Pb^*/^{206}Pb^*$ *± 1 σ*		$^{238}U/^{206}Pb^*$ *date (Ma)*	*± 1 σ*	$^{207}Pb^*/^{206}Pb^*$ *date (Ma)*	*± 1 σ*	*Disc. (%)*
I	4	4.1	215	153	0.74	0.039	3.511	0.029	0.10194	0.00055	3.512	0.031	0.10160	0.00056	1615	16	1654	10	2.3
I	2	2.1	160	100	0.65	-0.005	3.531	0.041	0.10152	0.00066	3.531	0.045	0.10157	0.00103	1608	23	1653	19	2.7
I	3	3.1	229	155	0.70	0.006	3.413	0.040	0.10148	0.00055	3.413	0.043	0.10142	0.00058	1656	24	1650	11	-0.4
I	9	9.1	143	92	0.66	0.055	3.469	0.030	0.10181	0.00067	3.471	0.032	0.10133	0.00072	1632	17	1649	13	1.0
I	5	5.1	174	126	0.75	0.031	3.535	0.030	0.10152	0.00060	3.536	0.031	0.10125	0.00065	1605	16	1647	12	2.5
I	13	13.1	114	64	0.58	0.144	3.476	0.032	0.10231	0.00077	3.481	0.034	0.10106	0.00091	1628	18	1644	17	1.0
I	6	6.1	137	93	0.70	0.079	3.472	0.031	0.10169	0.00068	3.475	0.032	0.10101	0.00075	1631	17	1643	14	0.7
I	14	14.1	109	62	0.59	0.087	3.496	0.032	0.10170	0.00077	3.499	0.034	0.10094	0.00080	1620	18	1642	15	1.3
I	1	1.1	159	100	0.65	-0.052	3.486	0.040	0.10048	0.00064	3.484	0.044	0.10093	0.00109	1627	23	1641	20	0.9
I	7	7.1	232	165	0.74	-0.004	3.458	0.028	0.10081	0.00066	3.458	0.030	0.10085	0.00066	1638	16	1640	12	0.1
I	8	8.1	167	113	0.70	0.156	3.501	0.030	0.10163	0.00063	3.506	0.032	0.10028	0.00076	1617	17	1629	14	0.7
I	12	12.1	130	84	0.67	0.112	3.480	0.031	0.10078	0.00069	3.484	0.033	0.09982	0.00074	1627	17	1621	14	-0.4
I	11	11.1	171	119	0.72	0.161	3.418	0.029	0.10084	0.00063	3.423	0.031	0.09944	0.00076	1652	17	1614	14	-2.4
I	10	10.1	134	86	0.66	0.160	3.444	0.031	0.10071	0.00069	3.450	0.032	0.09933	0.00085	1641	17	1612	16	-1.8
P	15	15.1	198	151	0.79	0.195	3.441	0.029	0.09972	0.00057	3.448	0.030	0.09804	0.00072	1642	16	1587	14	-3.4

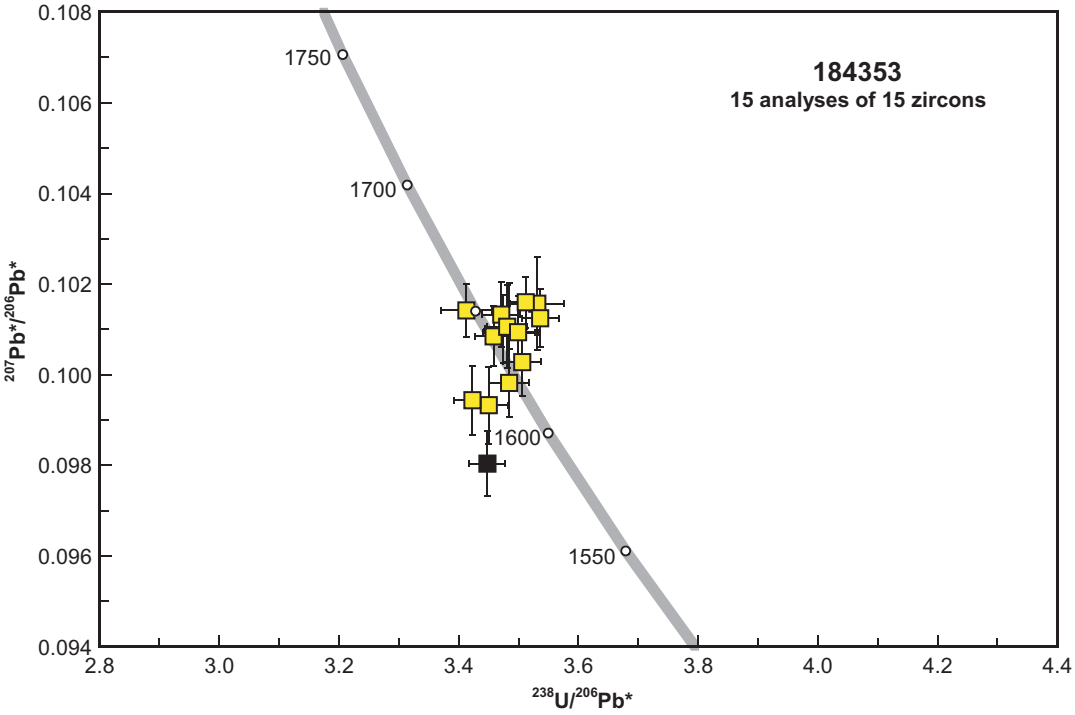

Figure 2. **U–Pb analytical data for sample 184353: monzogranite, Kiwirrkurra. Yellow squares indicate Group I (magmatic zircons); black square indicates Group P (radiogenic-Pb loss).**