

194637: feldspar-porphyritic microgranite, Windich Hill

(Warakurna Supersuite, Musgrave Province)

Location and sampling

TALBOT (SG 52-9), MOUNT EVELINE (4345)
MGA Zone 52, 343933E 7116860N

Sampled on 8 September 2008

This sample was collected from outcrop on the western edge of a hill, about 2.4 km southwest of Windich Hill, 6.6 km northeast of Meewajarra Soak, and 86.6 km east of Warburton.

Tectonic unit/relations

The unit sampled is a microgranite assigned to the Warakurna Supersuite. The Warakurna Supersuite intrudes granite and gneiss of the 1345–1293 Ma Wankanki Supersuite and the 1220–1150 Ma Pitjantjatjara Supersuite (Smithies et al., 2010), and includes all intrusive components related to the c. 1075 Ma Giles Event (Smithies et al., 2009). Rocks of this supersuite outcrop across approximately 1.5 million km² of central and western Australia, together forming the Warakurna Large Igneous Province (Wingate et al., 2004).

Petrographic description

The microgranite has a visually estimated mineralogy comprising 55% K-feldspar, 20% albitized plagioclase, 20% quartz, 3% amphibole, 2% myrmekite, 0.5% biotite, and accessory opaque oxide minerals, epidote, and limonite. Abundant feldspar phenocrysts occur in a dark grey groundmass that is rich in K-feldspar. Albitized plagioclase phenocrysts are up to 6 or 7 mm in diameter, are locally rimmed by microcline, and commonly clouded with granular epidote or fine-grained biotite. The groundmass is inequigranular, and contains K-feldspar, minor quartz, possible plagioclase, biotite, and fine-grained hornblende in various proportions, as well as fine-grained opaque oxide minerals. Albitized plagioclase phenocrysts, similar to those in the host rock, occur singly or in aggregates within an irregular xenolith at one end of the thin section. The xenolith groundmass is rich in microcrystalline biotite and K-feldspar, with plagioclase and rare tourmaline. Two smaller, elliptical, K-feldspar-rich fragments occur within the xenolith.

Zircon morphology

Zircons from this sample are euhedral, between 200 and 300 µm long, and have aspect ratios up to 6:1. The crystals are colourless and clear; some contain fluid inclusions. In cathodoluminescence (CL) images, idiomorphic zoning is ubiquitous. A CL image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed on 15–16 July 2010, using SHRIMP-A. Eleven analyses of the BR266 standard were obtained during the session, of which ten indicated an external spot-to-spot (reproducibility) uncertainty of 0.50% (1σ) and a ²³⁸U/²⁰⁶Pb* calibration uncertainty of 0.34% (1σ). Calibration uncertainties are included in the errors of ²³⁸U/²⁰⁶Pb* 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-two analyses were obtained from 21 zircons. Results are listed in Table 1, and shown in concordia diagrams (Figs 2 and 4) and an X–Y correlation plot (Fig. 3).

Interpretation

The analyses are concordant to moderately discordant (Fig. 2). However, the ²⁰⁷Pb*/²⁰⁶Pb* dates correlate with their common-Pb content (*f*₂₀₄, Fig. 3), indicating that corrections using ²⁰⁴Pb are inaccurate for some or all of these analyses. The date for this sample is therefore determined from the intersection of a regression through uncorrected data (Table 1), anchored at the contemporaneous initial Pb (²⁰⁷Pb/²⁰⁶Pb = 0.9134 at 1060 Ma; Stacey and Kramers, 1975) and the concordia curve (Fig. 4). The analyses define a single group, based on their ²⁰⁷Pb/²⁰⁶Pb and ²³⁸U/²⁰⁶Pb ratios.

Group I comprises 22 analyses of 21 zircons (Table 1), for which the regression intersects the concordia curve at 1064 ± 7 Ma (MSWD = 0.67).

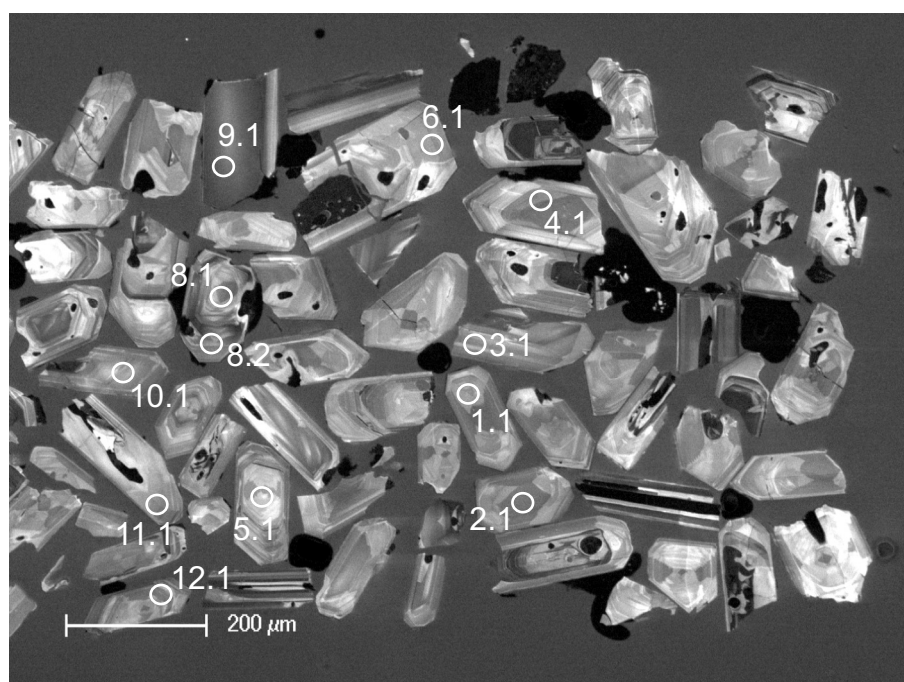


Figure 1. Cathodoluminescence image of representative zircons from sample 194637: feldspar-porphyritic microgranite, Windich Hill. Numbered circles indicate the approximate positions of analysis sites.

The date of 1064 ± 7 Ma for the 22 analyses in Group I is interpreted as the magmatic crystallization age of the microgranite.

References

- Smithies, RH, Howard, HM, Evins, PM, Kirkland, CL, Bodorkos, S and Wingate, MTD 2009, West Musgrave Complex — new geological insights from recent mapping, geochronology, and geochemical studies: Geological Survey of Western Australia, Record 2008/19, 20p.
- Smithies, RH, Howard, HM, Evins, PM, Kirkland, CL, Kelsey, DE, Hand, M, Wingate, MTD, Collins, AS, Belousova, E and Allchurch, S 2010, Geochemistry, geochronology, and petrogenesis of Mesoproterozoic felsic rocks in the west Musgrave Province, central Australia, and implications for the Mesoproterozoic tectonic evolution of the region: Geological Survey of Western Australia, Report 106, 73p.
- 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, Pirajno, F and Morris, PA 2004, Warakurna large igneous province: a new Mesoproterozoic large igneous province in west-central Australia: *Geology*, v. 32, p. 105–108.

Recommended reference for this publication

Kirkland, CL, Wingate, MTD and Smithies, RH 2011, 194637: feldspar-porphyritic microgranite, Windich Hill; *Geochronology Record* 963: Geological Survey of Western Australia, 5p.

Data obtained: 16 July 2010

Data released: 30 June 2011

Table 1. Ion microprobe analytical results for zircons from sample 194637: feldspar-porphyritic microgranite, Windich Hill

Group ID	Spot no.	Grain spot	^{238}U (ppm)	^{232}Th (ppm)	$\frac{^{232}\text{Th}}{^{238}\text{U}}$	f_{204} (%)	$^{238}\text{U}/^{206}\text{Pb}$ $\pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb}$ $\pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^*$ $\pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^*$ $\pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^*$ date (Ma) $\pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date (Ma) $\pm 1\sigma$	Disc. (%)						
I	12	12.1	79	75	0.97	1.093	5.546	0.093	0.07827	0.00120	5.607	0.095	0.06918	0.00267	1058	17	904	79	-17.0
I	6	6.1	73	55	0.78	1.154	5.435	0.089	0.08059	0.00238	5.499	0.091	0.07096	0.00348	1077	17	956	100	-12.6
I	5	5.1	37	35	0.97	2.037	5.423	0.109	0.08929	0.00184	5.536	0.115	0.07227	0.00501	1070	21	993	141	-7.8
I	20	20.1	113	126	1.15	0.944	5.604	0.094	0.08032	0.00101	5.657	0.096	0.07243	0.00210	1049	17	998	59	-5.1
I	18	18.1	60	51	0.88	0.821	5.659	0.104	0.08043	0.00137	5.705	0.106	0.07356	0.00269	1041	18	1029	74	-1.1
I	2	2.1	72	59	0.85	0.801	5.402	0.087	0.08043	0.00122	5.446	0.088	0.07372	0.00238	1087	16	1034	65	-5.1
I	14	14.1	62	51	0.85	0.439	5.483	0.098	0.07879	0.00133	5.507	0.099	0.07510	0.00213	1076	18	1071	57	-0.4
I	1	1.1	87	96	1.14	0.473	5.577	0.084	0.07922	0.00109	5.604	0.085	0.07524	0.00179	1059	15	1075	48	1.5
I	10	10.1	84	81	1.00	0.248	5.616	0.092	0.07738	0.00111	5.630	0.092	0.07529	0.00152	1054	16	1076	41	2.1
I	15	15.1	96	104	1.12	0.368	5.612	0.092	0.07851	0.00103	5.633	0.093	0.07542	0.00157	1053	16	1080	42	2.4
I	16	16.1	91	90	1.02	0.273	5.571	0.091	0.07801	0.00117	5.586	0.092	0.07572	0.00164	1062	16	1088	44	2.4
I	3	3.1	67	62	0.95	0.238	5.574	0.094	0.07796	0.00125	5.587	0.094	0.07595	0.00171	1061	17	1094	45	3.0
I	17	17.1	75	64	0.88	0.900	5.430	0.095	0.08364	0.00130	5.479	0.097	0.07608	0.00256	1081	18	1097	67	1.5
I	22	8.2	83	57	0.70	0.308	5.435	0.092	0.07893	0.00112	5.452	0.092	0.07634	0.00162	1086	17	1104	42	1.6
I	9	9.1	120	108	0.93	0.235	5.509	0.084	0.07838	0.00097	5.522	0.084	0.07641	0.00132	1073	15	1106	34	3.0
I	7	7.1	134	170	1.30	0.187	5.634	0.083	0.07807	0.00087	5.644	0.083	0.07650	0.00112	1052	15	1108	29	5.1
I	13	13.1	72	56	0.79	0.616	5.595	0.096	0.08207	0.00128	5.630	0.097	0.07688	0.00225	1054	17	1118	58	5.7
I	21	21.1	56	50	0.92	0.271	5.651	0.107	0.07977	0.00136	5.667	0.107	0.07749	0.00190	1048	19	1134	49	7.6
I	8	8.1	56	49	0.91	0.092	5.468	0.098	0.08018	0.00139	5.473	0.099	0.07941	0.00160	1082	18	1182	40	8.5
I	19	19.1	62	48	0.80	-0.474	5.483	0.100	0.07591	0.00136	5.457	0.100	0.07992	0.00224	1085	19	1195	55	9.2
I	11	11.1	75	52	0.72	0.144	5.595	0.095	0.08142	0.00123	5.603	0.095	0.08020	0.00151	1059	17	1202	37	11.9
I	4	4.1	87	83	0.99	0.111	5.543	0.087	0.08159	0.00110	5.549	0.087	0.08064	0.00129	1068	16	1213	31	11.9

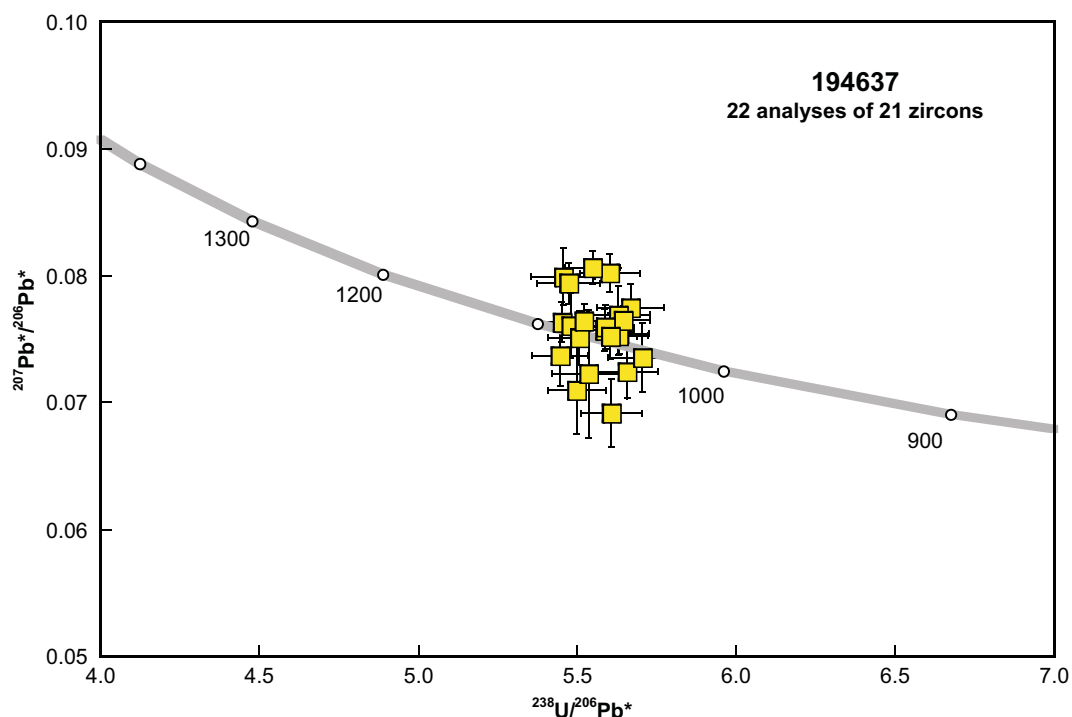


Figure 2. U–Pb analytical data for sample 194637: feldspar-porphyritic microgranite, Windich Hill. Yellow squares indicate Group I (magmatic zircons).

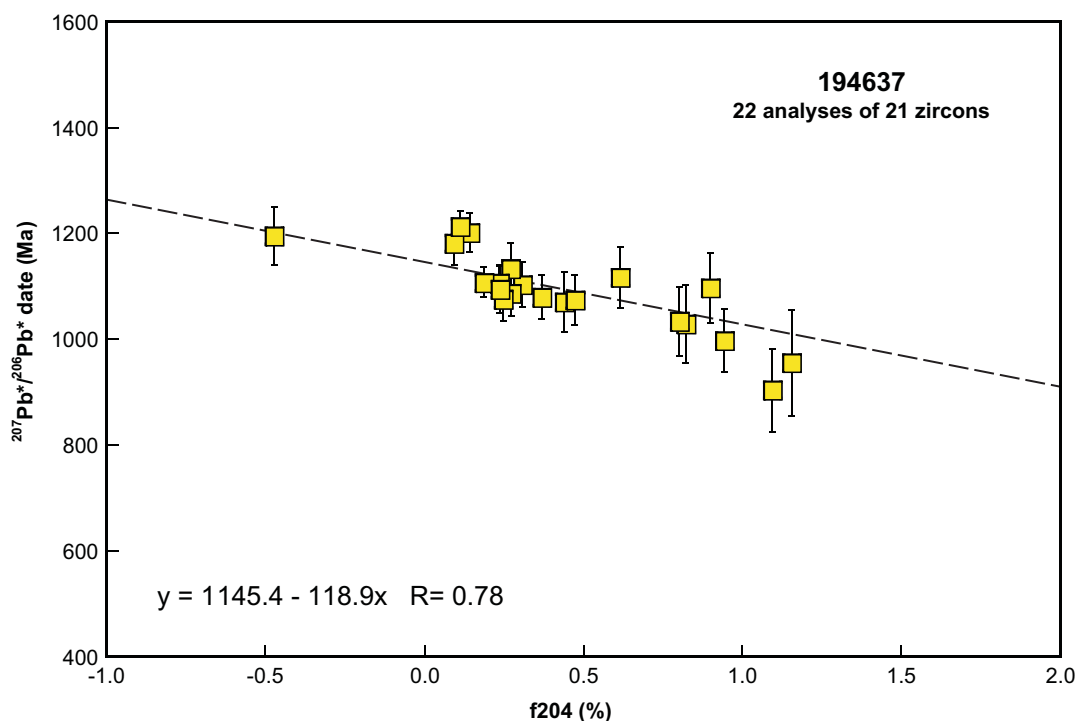


Figure 3. Correlation between $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ age (corrected for common-Pb using measured ^{204}Pb) and f^{204} for zircon analyses in sample 194637: feldspar-porphyritic microgranite, Windich Hill. Dashed line indicates a regression through data in Group I, and the equation of the best-fit line is shown. R is Pearson's correlation coefficient. Symbols as in Figure 2.

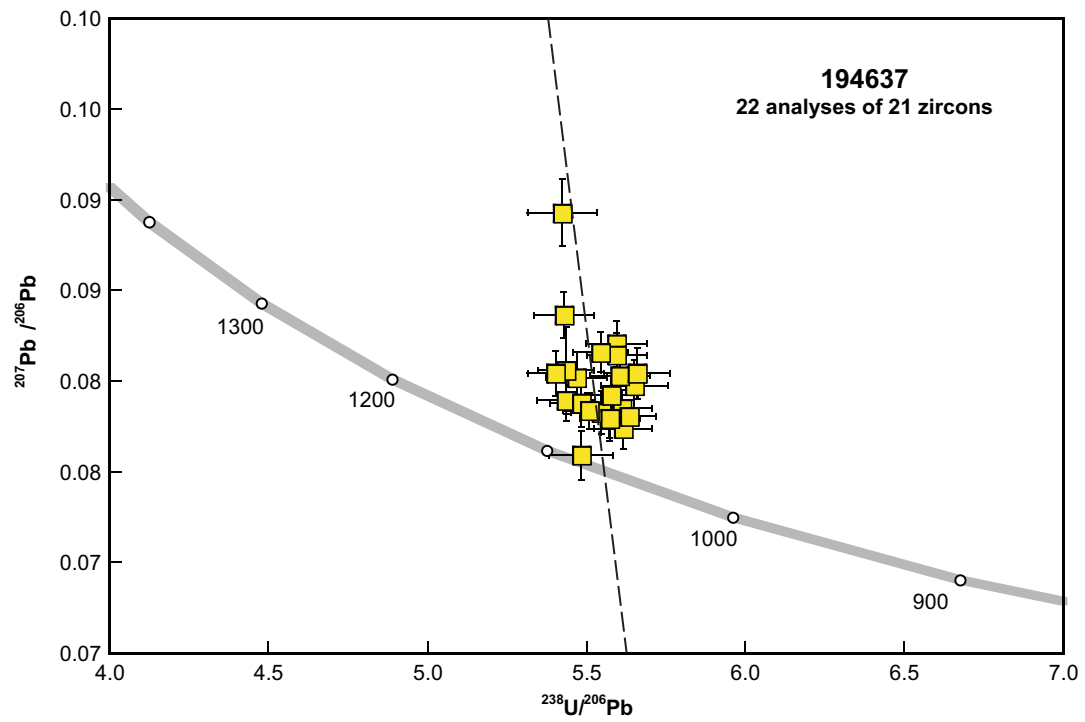


Figure 4. U-Pb analytical data, not corrected for common Pb, for zircons from sample 194637: feldspar-porphyrritic microgranite, Windich Hill. Dashed line indicates a regression, from initial Pb, through data in Group I. Symbols as in Figure 2.