

168934: biotite monzogranite, Waloo Waloo Pool

Location and sampling

PRYAMID (SF 50-7)

MGA Zone 50, 507500E 7654430N

Sampled on 26 September 1999

The sample was taken from a 2 m-diameter boulder located on the southwestern side of a tor-covered outcrop, about 70 m east of the access track, 60 m south of a prominent easterly trending dolerite dyke, and 3 km west-northwest of Waloo Waloo Pool.

Tectonic unit/relations

This sample is from a medium- and even-grained biotite monzogranite of the Cherratta Granitoid Complex. The monzogranite outcrops as an inlier within the Fortescue Group and, near the sampling site, is unconformably overlain by clastic sedimentary rocks of the Hardey Formation. At the sampling site, it has been intruded by ≤ 1 cm-thick, slightly coarser leucocratic granitic veins or zones of secondary alteration.

Petrographic description

The principal minerals present in this sample are weakly saussuritized plagioclase (35–40 vol.%), microcline (30–35 vol.%), quartz (25 vol.%), and chloritized biotite (5 vol.%), with accessory muscovite (trace), magnetite (trace), apatite (trace), leucoxene (trace), epidote (trace), carbonate (trace), prehnite (trace), and zircon (trace). Similar abundances of plagioclase and K-feldspar in the hand specimen and stained offcut indicate that this is a fine-grained, weakly altered biotite monzogranite. Plagioclase occurs as grains and subhedral laths up to 4 mm long, with albite, sericite, and clinozoisite alteration. Microcline occurs as slightly perthitic, anhedral to subhedral grains up to 6 mm long, commonly enclosing small, altered plagioclase grains. Quartz occurs as anhedral, locally poikilitic grains up to 4 mm long with ragged grain boundaries and some subgrains, suggesting weak deformation. Minor decussate biotite, up to 1 mm in grain size, has been altered to chlorite, locally with epidote, carbonate or prehnite, and minor muscovite with or without epidote occurs within altered plagioclase laths. Magnetite and apatite are disseminated, with leucoxene partly after magnetite and partly after possible titanite.

Zircon morphology

The zircons isolated from this sample are yellow-brown, dark brown, and black, generally between $20 \times 120 \mu\text{m}$ and $60 \times 350 \mu\text{m}$ in size, and have a range of morphologies including subequant, elongate to needle-shaped, and prismatic, subrounded, and irregular. Many grains are highly metamict. Many have euhedral zonation, but a significant minority are internally structureless or have structureless interiors surrounded by faintly zoned exterior zones. Mineral inclusions are common.

Analytical details

The sample was analysed on 6 August 2000. The counter deadtime was 32 ns. Nine analyses of the CZ3 standard obtained during the analysis session indicated a Pb^*/U calibration error of 1.51 (1 σ %). Common-Pb corrections were applied assuming Broken Hill common-Pb isotopic compositions for all analyses, with the exception of analyses

Table 53. Ion microprobe analytical results for sample 168934: biotite monzogranite, Waloo Waloo Pool

<i>Grain .spot</i>	<i>U (ppm)</i>	<i>Th (ppm)</i>	<i>Pb (ppm)</i>	<i>f206%</i>	<i>²⁰⁷Pb/²⁰⁶Pb</i>	<i>±1σ</i>	<i>²⁰⁸Pb/²⁰⁶Pb</i>	<i>±1σ</i>	<i>²⁰⁶Pb/²³⁸U</i>	<i>±1σ</i>	<i>²⁰⁷Pb/²³⁵U</i>	<i>±1σ</i>	<i>% concordance</i>	<i>²⁰⁷Pb/²⁰⁶Pb age</i>	<i>±1σ</i>
1.1	194	194	143	-0.005	0.22101	0.00079	0.26610	0.00122	0.5748	0.0089	17.517	0.287	98	2 988	6
2.1	47	25	32	-0.049	0.22177	0.00185	0.14528	0.00279	0.5858	0.0099	17.912	0.354	99	2 994	13
3.1	143	74	112	-0.014	0.26322	0.00096	0.13572	0.00099	0.6517	0.0102	23.652	0.392	99	3 266	6
4.1	119	28	78	0.013	0.22818	0.00111	0.06317	0.00134	0.5947	0.0094	18.709	0.321	99	3 039	8
5.1	83	53	56	0.069	0.21935	0.00137	0.17243	0.00205	0.5684	0.0091	17.189	0.308	97	2 976	10
6.1	102	50	70	0.028	0.21882	0.00113	0.13534	0.00139	0.5831	0.0093	17.593	0.305	100	2 972	8
7.1	147	100	106	0.017	0.22194	0.00089	0.18435	0.00113	0.5927	0.0093	18.137	0.302	100	2 995	6
8.1	137	48	95	0.012	0.22844	0.00106	0.09241	0.00138	0.6054	0.0095	19.069	0.323	100	3 041	7
9.1	227	37	152	0.102	0.23087	0.00078	0.04415	0.00081	0.6059	0.0094	19.285	0.313	100	3 058	5
10.1	97	56	67	0.048	0.22202	0.00116	0.15395	0.00152	0.5840	0.0094	17.878	0.312	99	2 995	8
11.1	147	124	107	-0.003	0.22187	0.00089	0.22968	0.00120	0.5829	0.0091	17.833	0.297	99	2 994	6
12.1	57	18	40	-0.014	0.23758	0.00156	0.08240	0.00179	0.6156	0.0102	20.166	0.376	100	3 104	10
13.1	210	199	156	0.029	0.22179	0.00077	0.25897	0.00118	0.5816	0.0090	17.787	0.290	99	2 994	6
14.1	82	49	58	0.026	0.22211	0.00131	0.16395	0.00184	0.5898	0.0095	18.063	0.323	100	2 996	10
15.1	119	26	88	1.304	0.24983	0.00150	0.08254	0.00271	0.6201	0.0098	21.359	0.377	98	3 184	10
16.1	293	192	225	-0.014	0.23513	0.00062	0.17864	0.00072	0.6328	0.0097	20.517	0.327	102	3 087	4
17.1	171	41	117	0.071	0.22927	0.00089	0.06580	0.00096	0.6154	0.0096	19.455	0.321	101	3 047	6
18.1	127	71	88	-0.017	0.21901	0.00096	0.15073	0.00114	0.5886	0.0093	17.774	0.301	100	2 973	7
19.1	119	45	82	3.515	0.23044	0.00227	0.10871	0.00482	0.5394	0.0086	17.139	0.338	91	3 055	16
20.1	232	35	159	0.567	0.23017	0.00088	0.04284	0.00134	0.6128	0.0095	19.449	0.319	101	3 053	6

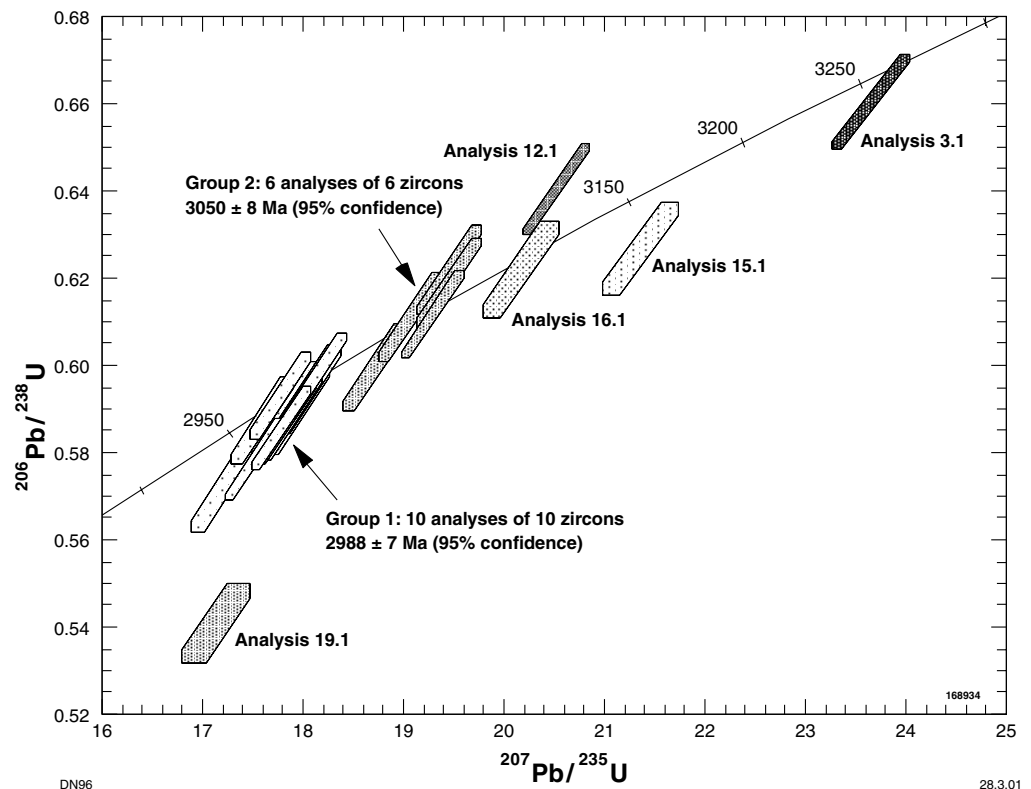


Figure 57. Concordia plot for sample 168934: biotite monzogranite, Waloo Waloo Pool

15.1, 19.1, and 20.1, for which isotopic compositions determined using the method of Cumming and Richards (1975) were assumed.

Results

Twenty analyses were obtained from 20 zircons. Results are given in Table 53 and shown on a concordia plot in Figure 57.

Interpretation

Most analyses are concordant or slightly to highly discordant, with the discordance pattern consistent with a single recent episode of radiogenic-Pb redistribution. On the basis of their $^{207}\text{Pb}/^{206}\text{Pb}$ ratios, many analyses may be assigned to two groups. Ten concordant and slightly discordant analyses of 10 zircons (1.1, 2.1, 5.1, 6.1, 7.1, 10.1, 13.1, 14.1, and 18.1), assigned to Group 1, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicate a weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ date of 2988 ± 7 Ma (chi-squared = 1.45). Six concordant and highly discordant analyses of six zircons (4.1, 8.1, 9.1, 17.1, 19.1, and 20.1), assigned to Group 2, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicate a weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ date of 3050 ± 8 Ma (chi-squared = 1.03). The remaining analyses (3.1, 12.1, 15.1, and 16.1) cannot be assigned to either of these populations.

Several alternative interpretations of these results are possible. The date of 2988 ± 7 Ma indicated by the weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ ratio of the 10 analyses of Group 1 may be interpreted as a maximum time of igneous crystallization of the monzogranite. The remaining analyses, indicating older dates, may therefore be

attributed to the presence of xenocryst zircons within the monzogranite. An alternative, and less favoured, interpretation is that the 10 analyses of Group 1 date the time, at 2988 ± 7 Ma, of crystallization of the thin granitic dykes evident in this sample. The date of 3050 ± 8 Ma indicated by the the weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ ratio of the six analyses of Group 2 may therefore be interpreted to correspond to the time of igneous crystallization of the monzogranite, with the remaining older analyses obtained on xenocryst zircons within the monzogranite.

STRATIGRAPHIC REFERENCE:

HICKMAN, A. H., and KOJAN, C. J., 2003, Geology of the Pinderi Hills 1:100 000 sheet: Western Australia Geological Survey, 1:100 000 Geological Series Explanatory Notes.

Recommended reference for this publication:

NELSON, D. R., 2001, 168934: biotite monzogranite, Waloo Waloo Pool; in *Compilation of geochronology data, 2000*: Western Australia Geological Survey, Record 2001/2, p. 171–174.

OR

NELSON, D. R., 2001, 168934: biotite monzogranite, Waloo Waloo Pool; Geochronology dataset 205; in *Compilation of geochronology data, June 2006 update*: Western Australia Geological Survey.

Data obtained: 06/08/2000; Data released: 13/09/2001