169086: biotite monzogranite, Boora Boora Bore

Location and sampling

EDMUND (SF 50-14), MAROONAH (2051)
MGA Zone 50, 348770E 7454720N

Sampled on 2 September 2001

The sample was taken from a 1 m-diameter boulder situated 200 m south of the access track, 5 km northwest of Boora Boora Bore.

Tectonic unit/relations

The sample is from a dark grey, even- and medium-grained biotite monzogranite of the Gascoyne Complex. The monzogranite forms a dyke, up to 3 m wide, that has intruded a pegmatite-banded, foliated to gneissic granodiorite, of which sample 169087 (Nelson, this volume) is representative. The sample was taken to provide a minimum age for the gneissic banding in the granodiorite, and to define the age range of magmatism. Both the gneiss and the dyke have been intruded by a later generation of pegmatite dykes. The sample contains zones of alteration along fractures but is free of obvious veins.

Petrographic description

The principal minerals in this sample are quartz (35–40 vol.%), plagioclase (35–40 vol.%), K-feldspar (20 vol.%), and biotite (5 vol.%) with epidote (<1 vol.%) and altered allanite (<1 vol.%), and accessory titanite (trace), apatite (trace), and zircon (trace). This is a relatively quartz rich, foliated biotite monzogranite. Much of the quartz occurs as anhedral but elongate grains up to 4 mm long, commonly parallel to the foliation. These larger quartz grains have undulose extinction, but fine-grained recrystallized quartz is rare. Plagioclase occurs as anhedral but usually elongate grains to 2 mm in length, with less abundant microcline, from 0.2 to 2 mm in grain size and less well oriented than the plagioclase. Some of the plagioclase grains have rims of biotite, fine muscovite, and epidote, and some grains contain very minor sericite. The biotite is mostly less than 1 mm in grain size, but occurs in lenses up to 5 mm long defining a weak foliation. Minor fine-grained titanite is present in some of the biotite grains, indicating adjustment to lower temperatures, but alteration to chlorite is rare. The lenses contain grains of altered probable allanite, which are locally over 1 mm long, and commonly rimmed with epidote. Separate epidote grains, up to 1.5 mm in grain size in places, are apparently derived from plagioclase. There is accessory apatite, but most of the zircons are minute, forming inclusions in biotite, and have pleochroic haloes.

Zircon morphology

The zircons isolated from this sample are pale brown, dark reddish-brown and black, generally between 40 × 100 µm and 200 × 380 µm in size, and euhedral. Most are structureless but a minority have faint internal zonation or contain rounded cores and euhedral, facetted rims. Cathodoluminescence images of representative zircons are given in Figure 1.

Analytical details

This sample was analysed on 30 June 2002. The counter deadtime during the analysis session was 24 ns. Five analyses of the CZ3 standard were obtained during the analysis session. Following deletion of one standard analysis as an outlier, the remaining four analyses indicated a Pb*/U calibration uncertainty of 0.811% (1σ). A calibration uncertainty of 1.0% (1σ) was applied to analyses of unknowns obtained during this analysis session. Common-Pb corrections were applied assuming Broken Hill common-Pb isotopic compositions for all analyses.

Results

Sixteen analyses were obtained from 16 zircons. Results are given in Table 1 and shown on a concordia plot in Figure 2.

Interpretation

Most analyses are concordant to slightly discordant, with the discordance patterns consistent with a single recent episode of radiogenic-Pb loss. Fifteen concordant or near-concordant analyses of 15 zircons have $^{207}Pb/^{206}Pb$ ratios defining a single population and indicating a weighted mean date of 1784 ± 5 Ma (chi-squared = 0.77). Slightly discordant analysis 5.1 indicated a significantly older $^{207}Pb/^{206}Pb$ date than the main population.

The date of 1784 ± 5 Ma indicated by the weighted mean $^{207}Pb/^{206}Pb$ ratio of 15 concordant or near-concordant analyses is interpreted to indicate the age of igneous crystallization of the monzogranite. The significantly older $^{207}Pb/^{206}Pb$ date indicated by slightly discordant analysis 5.1 is interpreted to be of a xenocryst zircon.

Recommended reference for this publication:

NELSON, D. R., 2004, 169086: biotite monzogranite, Boora Boora Bore; Geochronology dataset 117; in Compilation of geochronology data, June 2006 update: Western Australia Geological Survey.

Data obtained: 30/06/2002; Data released: 06/12/2004

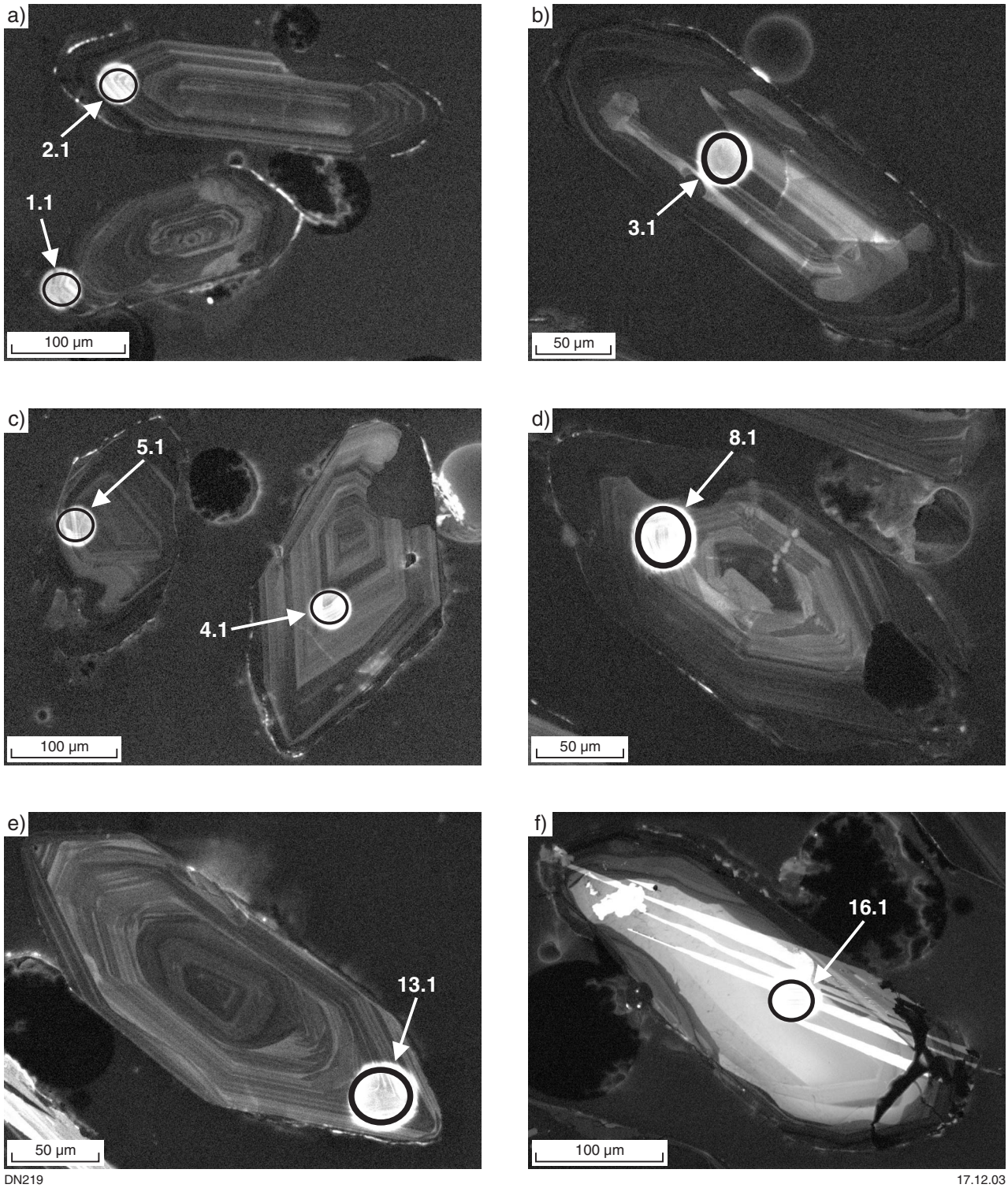

Figure 1. Cathodoluminescence images of representative zircons from sample 169086: biotite monzogranite, Boora Boora Bore

Table 1. Ion microprobe analytical results for sample 169086: biotite monzogranite, Boora Boora Bore

Grain .spot	*U (ppm)*	*Th (ppm)*	*Pb (ppm)*	*f206%*	$^{207}Pb/^{206}Pb$	*±1σ*	$^{208}Pb/^{206}Pb$	*±1σ*	$^{206}Pb/^{238}U$	*±1σ*	$^{207}Pb/^{235}U$	*±1σ*	*% concordance*	$^{207}Pb/^{206}Pb$ *Age*	*±1σ*
1.1	2733	750	919	0.095	0.10929	0.00022	0.07977	0.00032	0.3275	0.0033	4.935	0.052	102	1 788	4
2.1	645	262	212	0.256	0.10879	0.00053	0.11547	0.00095	0.3093	0.0032	4.639	0.055	98	1 779	9
3.1	419	25	130	0.382	0.10804	0.00073	0.01382	0.00123	0.3169	0.0033	4.720	0.062	100	1 767	12
4.1	270	99	90	0.448	0.10937	0.00100	0.10442	0.00195	0.3134	0.0033	4.726	0.070	98	1 789	17
5.1	446	175	147	0.536	0.11002	0.00079	0.11572	0.00153	0.3062	0.0032	4.645	0.062	96	1 800	13
6.1	316	118	106	0.582	0.10807	0.00093	0.10448	0.00183	0.3144	0.0033	4.684	0.067	100	1 767	16
7.1	189	77	64	0.862	0.10736	0.00135	0.11434	0.00278	0.3153	0.0034	4.668	0.082	101	1 755	23
8.1	197	76	66	0.630	0.10866	0.00128	0.10755	0.00258	0.3133	0.0034	4.693	0.079	99	1 777	21
9.1	538	203	176	0.287	0.10916	0.00061	0.10872	0.00110	0.3084	0.0032	4.641	0.057	97	1 785	10
10.1	298	126	100	0.437	0.10848	0.00093	0.12111	0.00181	0.3135	0.0033	4.689	0.067	99	1 774	16
11.1	308	113	102	0.128	0.10801	0.00081	0.10611	0.00149	0.3164	0.0033	4.711	0.064	100	1 766	14
12.1	350	148	118	0.305	0.10895	0.00075	0.12222	0.00139	0.3138	0.0033	4.714	0.062	99	1 782	13
13.1	361	130	119	0.452	0.10849	0.00082	0.10320	0.00157	0.3121	0.0032	4.668	0.063	99	1 774	14
14.1	333	111	109	0.302	0.10848	0.00077	0.09506	0.00139	0.3119	0.0032	4.664	0.062	99	1 774	13
15.1	959	467	329	0.180	0.10941	0.00041	0.14047	0.00075	0.3173	0.0032	4.788	0.054	99	1 790	7
16.1	20	11	13	2.155	0.19240	0.00533	0.15787	0.01101	0.5077	0.0087	13.468	0.463	96	2 763	45

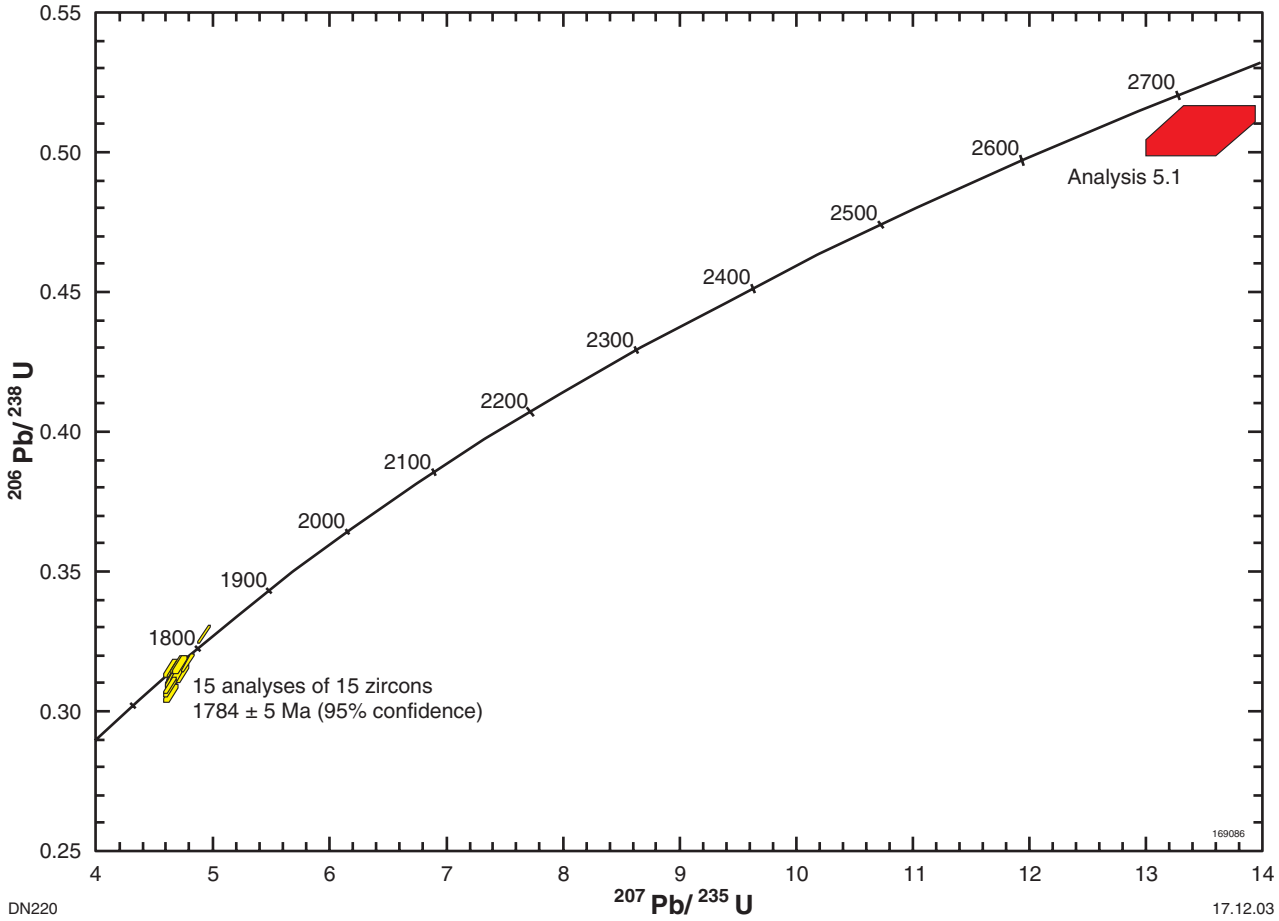

Figure 2. Concordia plot for sample 169086: biotite monzogranite, Boora Boora Bore