

169011: quartz dolerite, Strama Gap

Location and sampling

EDMUND (SF 50-14)

MGA Zone 50, 457820E 7398630N

Sampled on 27 April 1999

The sample was taken from a hill on the northeast side of Irregully Creek, 1 km north of Strama Gap and 1.5 km north-northeast of Strama Bore.

Tectonic unit/relations

This sample was taken from the lower contact of a dolerite sill that has intruded shales near the stratigraphic top of the Blue Billy Formation of the Edmund Group.

Petrographic description

The principal mineral and textural components present in this sample are mesostasis (35 vol.%), plagioclase (25–30 vol.%), clinopyroxene (20–25 vol.%), opaque oxides (7–8 vol.%), smectite (3–4 vol.%), hornblende (2 vol.%), biotite (1–2 vol.%), and apatite (1–2 vol.%), with rare baddeleyite (trace) and zircon (trace). This is a mesostasis-rich quartz dolerite, with abundant skeletal opaque oxides, minor hornblende, biotite, clays, accessory apatite, and rare, extremely small crystals of probable baddeleyite and zircon. An initial petrographic assessment of this rock indicates a massive, medium-grained dolerite characterized by abundant plagioclase and prismatic clinopyroxene, as random crystals up to 5 mm long, with some of the pyroxene extending small interstitial protuberances between the plagioclase laths in a subophitic texture. There is also extensive interstitial, patchy, very fine crystalline mesostasis. Irregularly fibrous sericite occurs in the plagioclase, which is otherwise fresh. Some of the pyroxene grains have hourglass zoning and a pale-brownish colour. Granular to skeletal opaque oxides are scattered as individual grains, up to 1 mm in size, which occur in aggregates up to 2 mm in diameter, partly in and adjacent to pyroxene, and partly in patches of brown primary hornblende, biotite or greenish smectites. Areas of hornblende are adjacent to pyroxene, with deep blue-green probable hastingsite rimming brown possible titanpargasite. Patches of mesostasis up to 5 mm across are randomly scattered with internal microspherulitic to microgranophyric, granular and granophyric textures. Abundant apatite occurs in these areas, as well as irregular masses of smectite, some of which enclose biotite and/or brown hornblende. The apatite occurs as needles that are locally as long as 2 mm, but less than 50 μm wide, and are commonly hollow. Blue-green hornblende rims some patches of brown hornblende. Patches of smectite with stubby, euhedral quartz crystals projecting into them may be in miarolitic cavities. Rare, brown, elongate prismatic crystals with a high refractive index, pleochroic haloes, and 50 to 120 μm long, occur within areas of smectite. These crystals are probably either baddeleyite or zircon. Rare small crystals of probable baddeleyite were tentatively identified within quartz and granophyre.

Zircon morphology

The zircons isolated from this sample are mostly colourless to light green-brown, yellow-brown or black, between 10 \times 30 μm and 50 \times 200 μm in size, and have a range of different morphologies, including elongate, euhedral and subhedral whole grains, commonly with rectangular cross sections, irregular-shaped subhedral fragments and structureless, fractured elongate grains with rounded terminations.

Baddeleyite morphology

The baddeleyites isolated from this sample are mostly dark yellow-brown, between $10 \times 20 \mu\text{m}$ and $25 \times 70 \mu\text{m}$ in size, and are rectangular or irregular in shape.

Analytical details

The sample was analysed on 9 November 2000. The counter deadtime was 32 ns. Seven analyses of the CZ3 standard obtained during the analysis session indicated a Pb^*/U calibration error of 1.55 (1 σ %). Common-Pb corrections were applied assuming Broken Hill common-Pb isotopic compositions for all analyses.

Results

Nine analyses were obtained from eight zircons and four analyses were obtained from four baddeleyites. Results for zircons are given in Table 4 and shown on a concordia plot in Figure 5. Results for baddeleyites are given in Table 5 and shown on a Gaussian-summation probability density plot in Figure 6.

Interpretation

Many zircon analyses are 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, all analyses may be assigned to three groups. Concordant analyses 6.1, 6.2, and 7.1, and slightly reversely discordant analysis 8.1, all assigned to Group 1, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ date of $1072 \pm 12 \text{ Ma}$ (chi-squared = 0.95). Analyses of Group 1 were obtained on distinctive, thin ($\leq 20 \mu\text{m}$ -thick), euhedral and commonly rectangular grains, with the analyses indicating high U and Th concentrations at these analysis sites. The

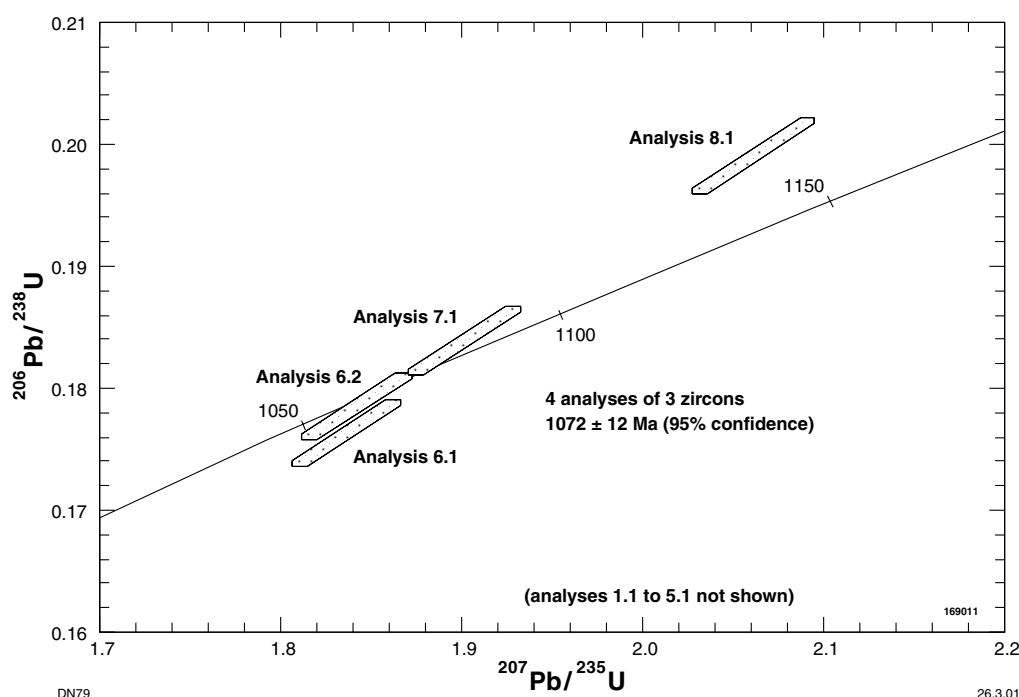


Figure 5. Concordia plot for sample 169011: quartz dolerite, Strama Gap

Table 4. Ion microprobe analytical results for zircons from sample 169011: quartz dolerite, Strama Gap

Grain .spot	U (ppm)	Th (ppm)	Pb (ppm)	f206%	$^{207}\text{Pb}/^{206}\text{Pb}$	$\pm 1\sigma$	$^{208}\text{Pb}/^{206}\text{Pb}$	$\pm 1\sigma$	$^{206}\text{Pb}/^{238}\text{U}$	$\pm 1\sigma$	$^{207}\text{Pb}/^{235}\text{U}$	$\pm 1\sigma$	% concordance	$^{207}\text{Pb}/^{206}\text{Pb}$ age	$\pm 1\sigma$
1.1	197	79	129	0.127	0.21528	0.00072	0.10415	0.00086	0.5737	0.0091	17.030	0.284	99	2 946	5
2.1	199	97	125	0.330	0.21503	0.00083	0.11830	0.00119	0.5425	0.0086	16.083	0.270	95	2 944	6
3.1	133	29	50	0.088	0.12266	0.00088	0.06255	0.00136	0.3692	0.0059	6.244	0.115	102	1 995	13
4.1	165	31	63	0.095	0.12256	0.00076	0.05387	0.00109	0.3743	0.0060	6.325	0.113	103	1 994	11
5.1	276	201	107	0.070	0.12281	0.00055	0.17957	0.00099	0.3438	0.0054	5.821	0.098	95	1 997	8
6.1	1 167	4 316	389	0.020	0.07553	0.00027	1.11176	0.00186	0.1763	0.0027	1.836	0.030	97	1 083	7
6.2	1 248	4 515	416	0.067	0.07482	0.00030	1.08293	0.00186	0.1785	0.0028	1.842	0.030	100	1 064	8
7.1	1 241	3 638	381	0.063	0.07500	0.00027	0.85498	0.00143	0.1839	0.0029	1.902	0.031	102	1 069	7
8.1	1 902	7 228	713	0.061	0.07509	0.00023	1.10198	0.00151	0.1991	0.0031	2.061	0.034	109	1 071	6

Table 5. Ion microprobe analytical results for baddeleyites from sample 169011: quartz dolerite, Strama Gap

Grain .spot	f206%	$^{207}\text{Pb}/^{206}\text{Pb}$	$\pm 1\sigma$	$^{208}\text{Pb}/^{206}\text{Pb}$	$\pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb}$ age	$\pm 1\sigma$
1.1	0.126	0.07488	0.00090	0.46159	0.00300	1 065	24
2.1	0.624	0.07483	0.00179	0.08469	0.00379	1 064	48
3.1	0.184	0.07604	0.00133	0.06307	0.00264	1 096	35
4.1	0.934	0.07326	0.00277	0.02085	0.00586	1 021	77

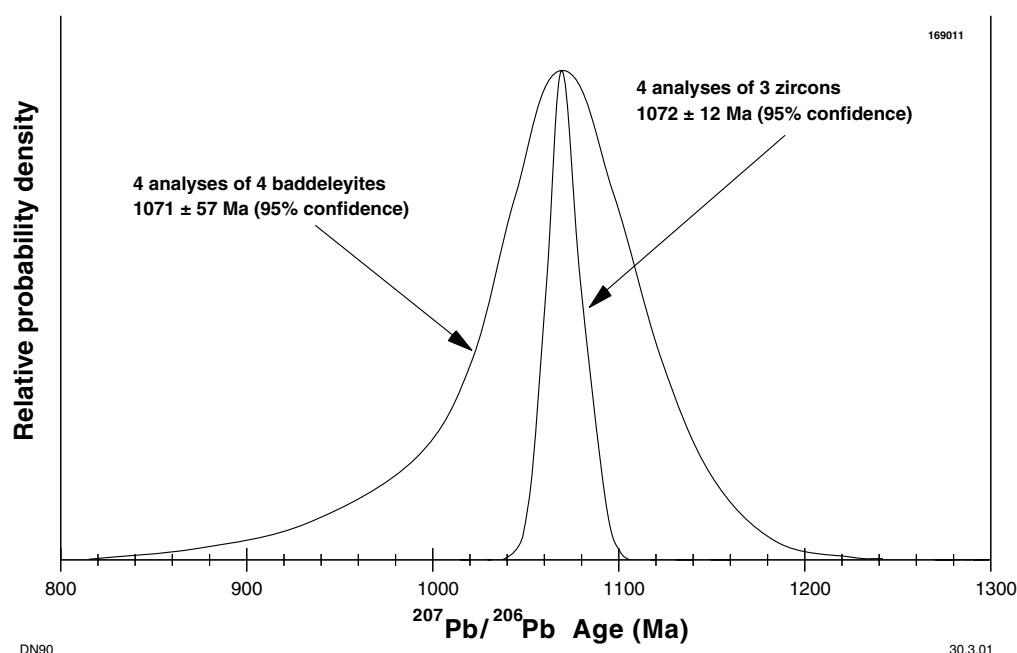


Figure 6. Gaussian-summation probability density plot for sample 169011: quartz dolerite, Strama Gap

reverse discordance of analysis 8.1 may be due to the high U concentration at this analysis site. Concordant analyses 3.1 and 4.1, and slightly discordant analysis 5.1, assigned to Group 2, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ date of 1996 ± 25 Ma (chi-squared = 0.03). Concordant analysis 1.1 and discordant analysis 2.1, assigned to Group 3, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ date of 2950 ± 4 Ma.

The baddeleyite analyses have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ date of 1071 ± 57 Ma (chi-squared = 0.29).

When combined, the four zircon analyses of Group 1 and the four baddeleyite analyses have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ date of 1072 ± 8 Ma (chi-squared = 0.55).

The date of 1072 ± 8 Ma indicated by the weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ ratio of four zircon and four baddeleyite analyses is interpreted as the time of igneous crystallization of the dolerite. The older $^{207}\text{Pb}/^{206}\text{Pb}$ dates indicated by the zircon analyses of Groups 2 and 3 are interpreted to be of xenocrysts. Additional discussion and interpretation of the results obtained for this sample are given in Wingate (in prep.).

STRATIGRAPHIC REFERENCE:

MARTIN, D. McB., THORNE, A. M., and COPP I. A., 1999, A provisional revised stratigraphy for the Bangemall Group on the Edmund 1:250 000 sheet: Western Australia Geological Survey, Annual Review 1998–99, p. 51–55.

WINGATE, M. T. D., 2002, Age and palaeomagnetism of dolerite sills intruded into the Bangemall Supergroup on the Edmund 1:250 000 map sheet, Western Australia: Western Australia Geological Survey, Record 2002/4.

Recommended reference for this publication:

NELSON, D. R., 2001, 169011: quartz dolerite, Strama Gap; in Compilation of geochronology data, 2000: Western Australia Geological Survey, Record 2001/2, p. 17–20.

OR

NELSON, D. R., 2001, 169011: quartz dolerite, Strama Gap; Geochronology dataset 150; in Compilation of geochronology data, June 2006 update: Western Australia Geological Survey.

Data obtained: 09/11/2000; Data released: 13/09/2001
