

160218: porphyritic dacite, Fieldings Gully Well

Location and sampling

MARBLE BAR (SF 50-8), MARBLE BAR (2855) MGA Zone 50, 783660E 7639530N

Sampled on 4 October 2000.

The sample was taken from a boulder located 70 m west of a creek bed and 3.5 km at a bearing of 234° from Fieldings Gully Well.

Tectonic unit/relations

This sample is from a dark grey dacite or rhyolite flow or sill containing rare scattered up to 2 mm-diameter quartz phenocrysts, which occurs interbedded with a pillowed high-Mg basalt unit 200 m stratigraphically above the base of the Wyman Formation, East Pilbara Granite–Greenstone Terrane (Hickman and Van Kranendonk, in prep.).

Petrographic description

This is a plagioclase porphyritic dacite with altered mafic phenocrysts and an altered spherulitic groundmass. It had an alteration assemblage consisting of albite, sericite, chlorite, carbonate, leucoxene and quartz. Rare zircon was seen. The thin section has abundant plagioclase phenocrysts to 4 mm long, partly albitized and partly with various proportions of sericite, carbonate and chlorite as well as albite. Less abundant mafic phenocrysts to 4 mm long have been altered to sericite and chlorite, with or without carbonate and quartz, with inclusions of leucoxenized opaque oxide and prismatic apatite. Rare, mostly rounded microphenocrysts of quartz occur, to 1 mm in diameter, and there are sparsely disseminated, albite to sericite-altered and/or carbonate-altered microphenocrysts of plagioclase. The groundmass is mostly composed of albite- and sericite-altered spherulites, about 0.5 mm in diameter, with interstitial quartz and disseminated aggregates of leucoxene after microphenocrysts of opaque oxide, similar to the oxide enclosed by the mafic phenocrysts. Altered plagioclase phenocrysts make up about 10–12 vol.%, of this rock, with 3–5 vol.% altered mafic phenocrysts and a groundmass of quartz, albite and sericite. The original lithology is uncertain, but is more likely to have been a dacitic lava flow than a rhyolitic tuff.

Zircon morphology

The zircons isolated from this sample are typically light pinkish brown to dark brown, between 60 × 100 µm and 80 × 250 µm in size and are elongate and subhedral in shape. Most grains lack any obvious internal zonation, although fluid and mineral inclusions are common.

Analytical details

This sample was analysed on 8 and 11 July 2001. The counter deadtime during both analysis sessions was 32 ns. Seven analyses of the CZ3 standard obtained during the first analysis session indicated a Pb*/U calibration error of 2.01 (1σ%). Analyses 1.1 to 4.1 were obtained during the first analysis session. Six analyses of the CZ3 standard obtained during the second analysis session indicated a Pb*/U calibration error of 0.768 (1σ%). A calibration error of 1.0 (1σ%) was applied to analyses of unknowns obtained during the second analysis session. Common-Pb corrections were applied assuming Broken Hill common-Pb isotopic compositions for all analyses.

Table 24. Ion microprobe analytical results for sample 160218: porphyritic dacite, Fieldings Gully Well

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	178	122	147	0.203	0.27212	0.00115	0.18206	0.00150	0.6565	0.0135	24.630	0.531	98	3 318	7
2.1	161	102	132	0.278	0.27037	0.00122	0.16429	0.00160	0.6577	0.0136	24.520	0.532	98	3 308	7
3.1	174	86	142	0.345	0.27334	0.00122	0.12867	0.00156	0.6700	0.0138	25.251	0.547	99	3 325	7
4.1	165	102	135	0.192	0.27368	0.00116	0.16539	0.00143	0.6575	0.0136	24.810	0.536	98	3 327	7
5.1	144	71	115	0.376	0.26974	0.00121	0.12637	0.00161	0.6541	0.0073	24.327	0.306	98	3 304	7
6.1	107	71	87	0.115	0.26908	0.00133	0.17790	0.00175	0.6463	0.0075	23.977	0.317	97	3 301	8
7.1	145	80	117	0.313	0.26584	0.00120	0.14367	0.00161	0.6571	0.0074	24.085	0.304	99	3 282	7
8.1	151	92	125	0.391	0.27216	0.00120	0.15953	0.00166	0.6606	0.0074	24.791	0.311	99	3 318	7
9.1	145	73	115	0.229	0.26817	0.00121	0.12674	0.00147	0.6567	0.0074	24.282	0.306	99	3 295	7
10.1	72	40	61	0.972	0.28304	0.00201	0.14127	0.00322	0.6770	0.0084	26.421	0.396	99	3 380	11
11.1	137	70	109	0.318	0.27066	0.00121	0.13178	0.00159	0.6534	0.0074	24.382	0.308	98	3 310	7
12.1	123	65	98	0.282	0.26653	0.00127	0.13526	0.00164	0.6523	0.0074	23.973	0.308	99	3 286	7
13.1	100	56	81	0.231	0.27053	0.00144	0.14790	0.00191	0.6634	0.0078	24.746	0.334	99	3 309	8
14.1	131	94	110	0.277	0.27087	0.00125	0.19032	0.00174	0.6628	0.0075	24.753	0.314	99	3 311	7
15.1	135	70	110	0.306	0.26835	0.00122	0.13262	0.00160	0.6646	0.0075	24.590	0.312	100	3 296	7
16.1	121	62	98	0.250	0.26851	0.00127	0.13385	0.00157	0.6680	0.0076	24.731	0.320	100	3 297	7
17.1	125	59	101	0.174	0.26747	0.00126	0.12331	0.00158	0.6681	0.0076	24.639	0.317	100	3 291	7
18.1	131	63	105	0.315	0.26156	0.00123	0.11797	0.00165	0.6720	0.0076	24.235	0.309	102	3 256	7
19.1	100	51	81	0.304	0.26886	0.00147	0.12933	0.00192	0.6641	0.0079	24.620	0.336	100	3 299	9
20.1	123	61	98	0.152	0.26819	0.00123	0.13064	0.00142	0.6617	0.0075	24.469	0.311	99	3 295	7
21.1	143	93	118	0.266	0.26392	0.00115	0.16806	0.00156	0.6650	0.0074	24.198	0.303	100	3 270	7
22.1	143	77	114	0.098	0.26020	0.00111	0.13772	0.00128	0.6604	0.0074	23.692	0.295	101	3 248	7
23.1	95	56	77	0.240	0.26735	0.00149	0.15217	0.00205	0.6600	0.0078	24.329	0.332	99	3 291	9
24.1	129	66	104	0.241	0.27001	0.00122	0.13709	0.00154	0.6654	0.0075	24.770	0.314	99	3 306	7
25.1	143	85	117	0.189	0.27283	0.00113	0.15752	0.00138	0.6590	0.0073	24.789	0.306	98	3 322	6

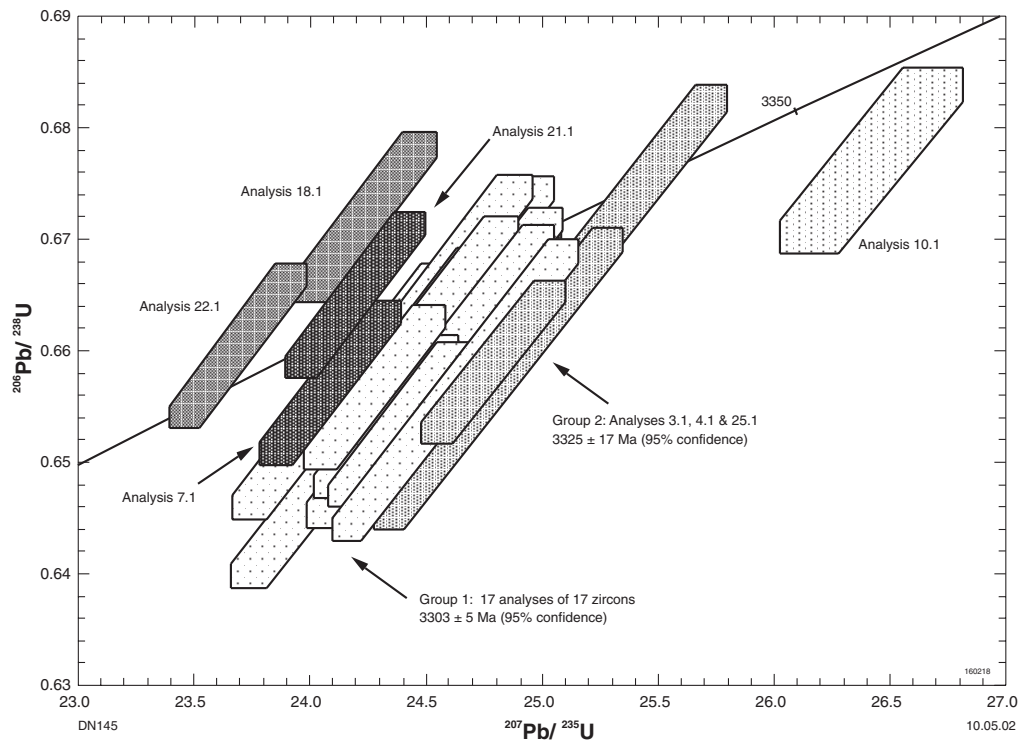


Figure 37. Concordia plot for sample 160218: porphyritic dacite, Fieldings Gully Well

Results

Twenty-five analyses were obtained from 25 zircons. Results are given in Table 24 and shown on a concordia plot in Figure 37.

Interpretation

The analyses are concordant to slightly discordant, with the discordance pattern consistent with a dominant recent episode of radiogenic-Pb loss, possibly combined with an ancient episode. Seventeen concordant and slightly discordant analyses of 17 zircons, 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 3303 ± 5 Ma (chi-squared = 1.63). Analyses 3.1, 4.1 and 25.1, 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 3325 ± 17 Ma (chi-squared = 0.10). Concordant analyses 7.1, 18.1, 21.1 and 22.1 indicate significantly younger $^{207}\text{Pb}/^{206}\text{Pb}$ dates, whereas near-concordant analysis 10.1 indicates a significantly older $^{207}\text{Pb}/^{206}\text{Pb}$ date than the main population.

Two interpretations of these results are possible. The preferred interpretation is that the date of 3303 ± 5 Ma indicated by the weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ ratio of the 17 analyses of Group 1 provides the age of igneous crystallization of the dacite. Concordant analyses 7.1, 18.1, 21.1 and 22.1, which indicate significantly younger $^{207}\text{Pb}/^{206}\text{Pb}$ dates than the main population, may then be interpreted to be of analysis sites that have undergone ancient radiogenic-Pb loss. However, the U and Th contents and $^{207}\text{Pb}/^{206}\text{Pb}$ date are not negatively correlated, as might be anticipated if the younger $^{207}\text{Pb}/^{206}\text{Pb}$ dates were attributable to ancient radiogenic-Pb loss that takes place preferentially from high U and Th analysis sites. If the dacite was extrusively emplaced, it is possible that it was reworked following its eruption. If this were the case, the youngest

$^{207}\text{Pb}/^{206}\text{Pb}$ date of 3248 ± 7 Ma (1σ error), indicated by analysis 22.1, would provide a maximum age for a reworking event and thus, for its original eruption.

Similar results indicating either ancient disturbance events, or volcanic or sedimentary reworking and redeposition shortly following emplacement, have been obtained for other samples of felsic volcanic rocks from the Wyman Formation and other formations of similar age within the Pilbara Craton (for example, results for samples 168909, 168910, 168913 and 168914 given in Nelson (2001), and samples 169000 and 160220 given in this volume).

STRATIGRAPHIC REFERENCE:

HICKMAN, A. H., and VAN KRAENDONK, M. J., in prep., Marble Bar, W.A. Sheet 2855: Western Australia Geological Survey, 1:100 000 Geological Series.

Recommended reference for this publication:

NELSON, D. R., 2002, 160218: porphyritic dacite, Fieldings Gully Well; in *Compilation of geochronology data, 2001: Western Australia Geological Survey, Record 2002/2*, p. 99–102.

OR

NELSON, D. R., 2002, 160218: porphyritic dacite, Fieldings Gully Well; Geochronology dataset 236; in *Compilation of geochronology data, June 2006 update: Western Australia Geological Survey*.

Data obtained: 11/07/2001; Data released: 26/06/2002