

169043: quartz–K-feldspar–plagioclase rhyolite porphyry, No. 5 Well

Location and sampling

NULLAGINE (SF 51-5), MOUNT EDGAR (2955)
MGA Zone 51, 202890E 7634300N

Sampled on 15 September 2000

The sample was taken from a 0.5 m-diameter boulder located 10 m south of the Mount Edgar – Yandicoogina track, 3 km east of No. 5 Well. The boulder is part of a porphyry dyke.

Tectonic unit/relations

The sample is from a dark greenish-grey to black porphyry with clear, rounded quartz phenocrysts up to 2 mm in diameter, and white, pink, and red tabular feldspar phenocrysts up to 3 mm long. The porphyry forms a prominent dyke that trends at 5–10° and has intruded the foliated Kennell Granodiorite, of which sample 169038 (Nelson, 2002) is representative, of the Mount Edgar Granitoid Complex, East Pilbara Granite–Greenstone Terrane. The sample was dated to determine if the dyke is related to the c. 2765 Ma Bamboo Creek member of the Hardey Formation (Williams and Bagas, in prep.).

Petrographic description

The principal phenocryst minerals in this sample are quartz (15–20 vol.%), K-feldspar (7–8 vol.%), plagioclase (2–3 vol.%), and biotite (1 vol.%). These are set within a dark grey, siliceous, spherulitic and microcrystalline groundmass (70 vol.%). The sample is an altered quartz–K-feldspar–plagioclase rhyolite porphyry, with sericite, carbonate, and chlorite alteration. Small quartz phenocrysts and inequigranular, mostly larger feldspar phenocrysts are visible in a dark grey siliceous groundmass. About a third of the groundmass is spherulitic, whereas the remainder is microcrystalline. In thin section, there are abundant quartz phenocrysts from 0.2 to 1.5 mm in diameter, mostly euhedral or slightly rounded, and rarely with resorption channels. Feldspar phenocrysts are less abundant, mostly 1–4 mm long, and are composed of K-feldspar and abundant carbonate, with less abundant sericite in some phenocrysts. The K-feldspar could be secondary, and it is not certain whether these were originally K-feldspar or plagioclase, but the presence of rare albitized plagioclase phenocrysts, to 1 mm in diameter, suggests K-feldspar. Rare biotite phenocrysts have been altered to iron-rich chlorite and sericite. The groundmass adjacent to the phenocrysts is spherulitic, with quartz-rich or quartzofeldspathic spherulites to 1.5 mm in diameter, but away from the phenocrysts, the groundmass is a microcrystalline aggregate of yellow, possibly phengitic sericite and quartz.

Thin plates of biotite have been replaced by sericite and leucoxene, but no other accessory minerals were identified.

Zircon morphology

The zircons isolated from this sample are typically colourless to pale yellow or dark brown, euhedral and equant to slightly elongate, and between 50 × 80 µm and 160 × 280 µm in size. A majority of grains are internally structureless, but a minority have faint internal zonation. Fluid and mineral inclusions are common. Cathodoluminescence images of representative zircons are given in Figure 1.

Analytical details

This sample was analysed on 12 and 17 June 2002. The counter deadtime was 32 ns during the first analysis session and 24 ns during the second analysis session. During the first analysis session, five analyses of the CZ3 standard indicated a Pb*/U calibration uncertainty of 0.843% (1σ). Analyses 1.1 to 11.1 were obtained during the first analysis session. During the second analysis session, nine analyses of the CZ3 standard indicated a Pb*/U calibration uncertainty of 0.942% (1σ). A calibration uncertainty of 1.0% (1σ) was applied to analyses of unknowns obtained during the both analysis sessions. Common-Pb corrections were applied assuming Broken Hill common-Pb isotopic compositions for all analyses, with the exception of analysis 2.1, for which isotopic compositions determined using the method of Cumming and Richards (1975) were assumed.

Results

Twenty-four analyses were obtained from 23 zircons. Results are given in Table 1 and shown on a concordia plot in Figure 2.

Interpretation

The analyses are concordant to slightly discordant, with the discordance pattern consistent with several recent episodes of radiogenic-Pb loss. Twenty-one concordant to slightly discordant analyses of 20 zircons have ²⁰⁷Pb/²⁰⁶Pb ratios defining a single population and indicating a weighted mean ²⁰⁷Pb/²⁰⁶Pb date of 2760 ± 4 Ma (chi-squared = 1.18). Discordant analyses 2.1, 3.1, and 10.1 indicate slightly younger ²⁰⁷Pb/²⁰⁶Pb dates than the main population.

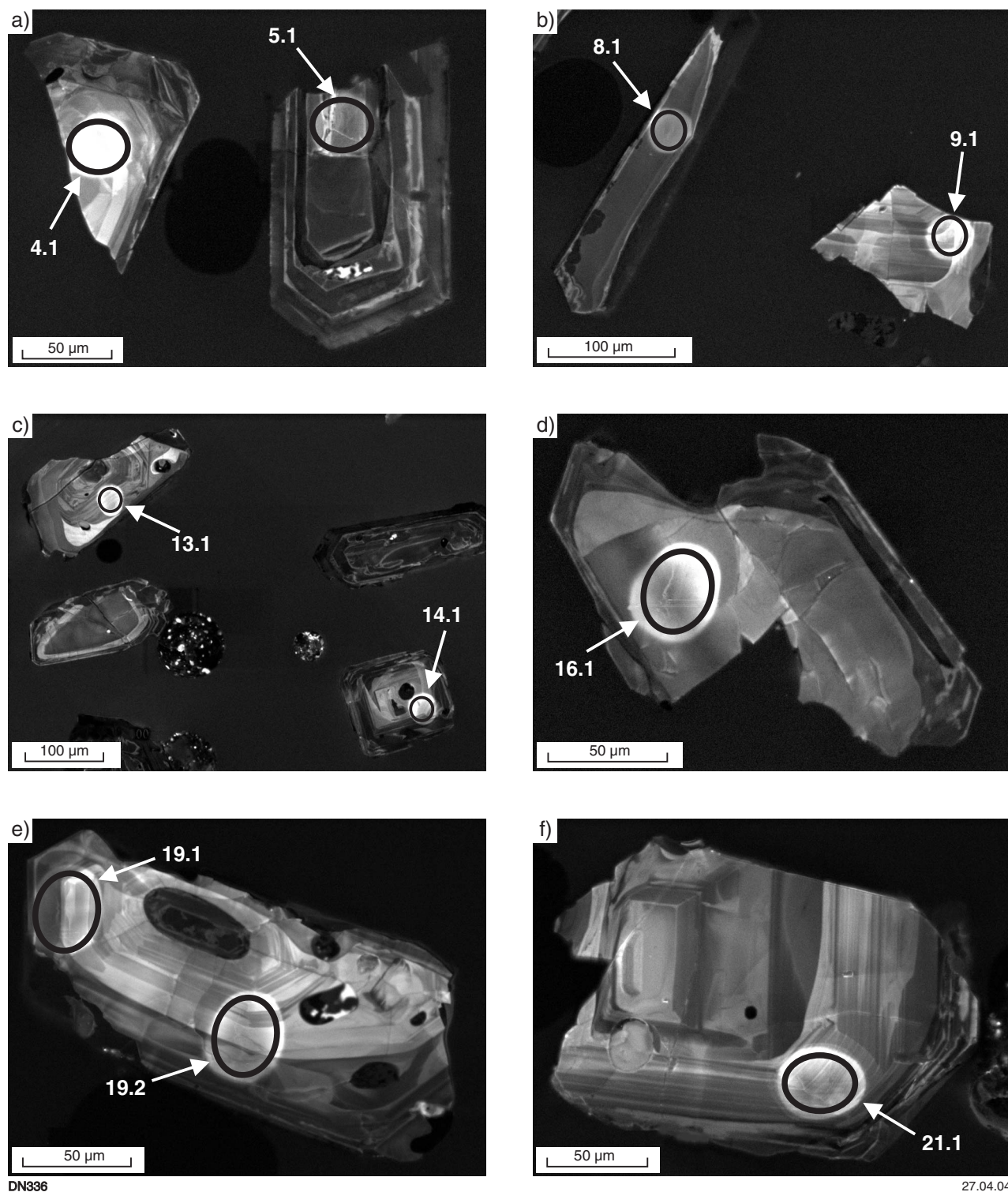


Figure 1. Cathodoluminescence images of representative zircons from sample 169043: quartz–K-feldspar–plagioclase rhyolite porphyry, No. 5 Well

The date of 2760 ± 4 Ma indicated by the weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ ratio of 21 concordant to slightly discordant analyses of 20 zircons is interpreted as the age of igneous crystallization of the porphyry. The remaining discordant analyses are interpreted to be of analysis sites that have undergone radiogenic-Pb loss during several recent disturbance events.

Recommended reference for this publication:

NELSON, D. R., 2004, 169043: quartz–K-feldspar–plagioclase rhyolite porphyry, No. 5 Well; Geochronology dataset 154; in Compilation of geochronology data, June 2006 update: Western Australia Geological Survey.

Data obtained: 17/06/2002; Data released: 06/12/2004

Table 1. Ion microprobe analytical results for sample 169043: quartz–K-feldspar–plagioclase rhyolite porphyry, No. 5 Well

<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	528	359	324	0.367	0.19134	0.00056	0.19082	0.00094	0.5098	0.0053	13.450	0.149	96	2 754	5
2.1	1 374	772	561	2.447	0.14626	0.00066	0.24517	0.00153	0.3179	0.0032	6.410	0.074	77	2 303	8
3.1	695	412	354	0.217	0.18118	0.00047	0.16515	0.00073	0.4368	0.0045	10.911	0.119	88	2 664	4
4.1	43	34	28	0.739	0.19445	0.00237	0.20789	0.00449	0.5290	0.0070	14.183	0.270	98	2 780	20
5.1	497	430	306	0.231	0.19073	0.00055	0.22868	0.00092	0.5001	0.0052	13.152	0.145	95	2 748	5
6.1	231	256	156	0.127	0.19240	0.00075	0.30577	0.00137	0.5194	0.0055	13.780	0.162	98	2 763	6
7.1	159	124	102	0.117	0.19392	0.00094	0.21582	0.00150	0.5255	0.0057	14.050	0.174	98	2 776	8
8.1	709	843	483	0.046	0.19242	0.00041	0.32758	0.00075	0.5199	0.0053	13.793	0.147	98	2 763	3
9.1	61	51	40	0.461	0.19125	0.00163	0.22288	0.00289	0.5261	0.0064	13.873	0.217	99	2 753	14
10.1	290	224	179	0.357	0.18982	0.00072	0.21243	0.00124	0.5053	0.0053	13.226	0.153	96	2 741	6
11.1	235	147	146	0.067	0.19241	0.00072	0.16790	0.00098	0.5273	0.0056	13.989	0.164	99	2 763	6
12.1	211	144	129	0.054	0.19101	0.00081	0.16787	0.00109	0.5216	0.0055	13.737	0.163	98	2 751	7
13.1	54	34	33	0.947	0.19326	0.00219	0.13608	0.00403	0.5186	0.0065	13.820	0.247	97	2 770	19
14.1	55	45	35	0.874	0.19205	0.00212	0.20953	0.00406	0.5121	0.0064	13.560	0.239	97	2 760	18
15.1	57	54	38	0.812	0.19542	0.00205	0.25169	0.00403	0.5216	0.0063	14.054	0.238	97	2 788	17
16.1	138	166	96	0.336	0.19270	0.00107	0.32323	0.00209	0.5279	0.0057	14.027	0.179	99	2 765	9
17.1	47	38	30	0.790	0.19191	0.00218	0.20995	0.00416	0.5189	0.0065	13.729	0.247	98	2 759	19
18.1	80	91	55	0.275	0.19280	0.00139	0.31466	0.00269	0.5307	0.0061	14.108	0.202	99	2 766	12
19.1	90	83	59	0.627	0.19014	0.00148	0.24325	0.00278	0.5240	0.0059	13.737	0.199	99	2 743	13
20.1	78	66	51	0.655	0.19065	0.00166	0.21915	0.00313	0.5216	0.0061	13.712	0.211	98	2 748	14
19.2	51	43	33	0.612	0.19395	0.00195	0.22964	0.00362	0.5159	0.0063	13.796	0.230	97	2 776	16
21.1	72	71	47	0.503	0.19425	0.00161	0.26713	0.00308	0.5158	0.0060	13.815	0.209	97	2 778	14
22.1	59	57	38	0.625	0.19284	0.00186	0.25740	0.00362	0.5118	0.0062	13.607	0.224	96	2 767	16
23.1	37	30	24	1.293	0.19014	0.00274	0.21019	0.00545	0.5189	0.0069	13.603	0.283	98	2 743	24

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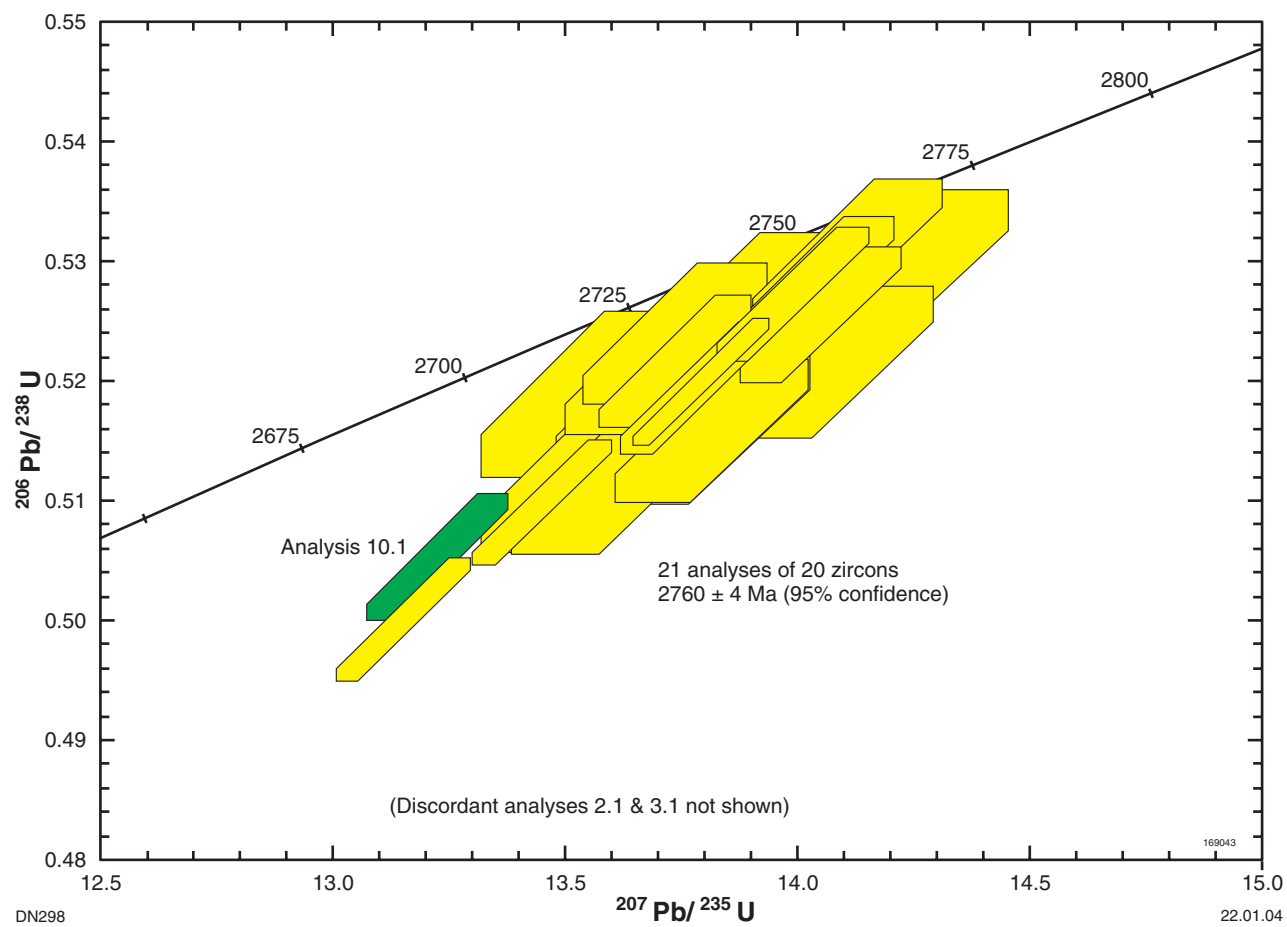


Figure 2. Concordia plot for sample 169043: quartz–K-feldspar–plagioclase rhyolite porphyry, No. 5 Well