

142892: porphyritic rhyolite, Two Mile Well

Location and sampling

PYRAMID (SF 50-7)

118°08'19"E 21°04'04"S

Sampled on 8 September 1997

The sample was taken from a low, rounded boulder about 20 m west of the track from Satirist Homestead ruins to Millindinna Well, about 1 km southeast of Two Mile Well. The site is located about 2 km north of both Mount Satirist, and from the Satirist Homestead ruins.

Tectonic unit/relations

This sample is from a quartz–feldspar porphyry that has intruded clastic sediments of the Mallina Formation, De Grey Group.

Petrographic description

The major minerals present in this sample are plagioclase as phenocrysts (including albite, 45 vol.%), quartz (25 vol.%) K-feldspar (probably primary microcline, 25 vol.%) and chlorite after biotite with or without amphibole, mainly in the groundmass (5 vol.%), with accessory amounts of muscovite and apatite. Abundant phenocrysts of plagioclase, K-feldspar and quartz, with a less abundant altered mafic mineral, are set in a fine groundmass of sutured quartz, feldspar and chlorite after a mafic mineral. As is common in porphyries, quartz phenocrysts have been rounded by solution in an environment of reducing pressure during ascent. Some of the plagioclase phenocrysts are sharply euhedral, though in part complex. K-feldspar phenocrysts have been slightly rounded. Relief against quartz shows the plagioclase to be more sodic than mid-oligoclase. Lack of suitably oriented grains prevents more precise identification, but it is probably albite. The K-feldspar lacks well-defined microcline twinning but it probably crystallized as microcline, in which case the twinning may not be evident at a recognizable scale. Relatively rare masses of chlorite and muscovite probably represent altered biotite phenocrysts. Secondary minerals include chlorite, which has three associations. Most of the chlorite is in the groundmass as fine, elongate to equant grains that are probably after biotite. In the second association, chlorite forms small elongate masses that are probably healed fractures. In the third association, chlorite forms oval masses with muscovite. This association is attributed to the replacement of mafic phenocrysts. Sericite is less abundant than chlorite in the groundmass. It is mostly very fine, but a few grains have become sufficiently coarse to be called muscovite. Muscovite is also a product of alteration of some of the K-feldspar phenocrysts. Sericite in sharply defined grains, coarser than groundmass sericite, accompanies opaque material as an alteration product of plagioclase. Epidote was not recognized. Lack of epidote in the alteration suite of secondary minerals in plagioclase supports the supposition that the plagioclase is albite. The phenocrysts have been little deformed but there is some suggestion of flow texture in the groundmass of the rock. This probably represents flowage during emplacement rather than deformation subsequent to emplacement. A possible opened fracture may have been an emplacement event in the very viscous acid magma. The rock may have been metamorphosed at low or very low grade to chloritize the mafic fraction of the rock and to promote the partial sericitic and muscovitic alteration of the feldspars. This metamorphism also may have determined the groundmass crystallinity. It is not possible to say whether the groundmass at emplacement was vitreous, cryptocrystalline or much as it is today.

The rock is an albite-dominant porphyritic soda rhyolite with abundant phenocrysts, metamorphosed at low to very low grade.

Zircon morphology

The zircons isolated from this sample are commonly pale yellow-green, yellow-brown to dark brown and between $150 \times 250 \mu\text{m}$ and $250 \times 400 \mu\text{m}$ in size. Most are euhedral in shape and are internally strongly zoned. Many are black and metamict.

Analytical details

This sample was analysed on 13 and 18 September 1998. The counter deadtime during both analysis sessions was 32 ns. During the first analysis session, ten analyses of the CZ3 standard indicated a Pb^*/U calibration error of 1.88 (1 σ %). Analyses 1.1 to 10.1 were obtained during the first analysis session. During the second analysis session, six analyses of the CZ3 standard were obtained and indicated a Pb^*/U calibration error of 0.733 (1 σ %). Common-Pb corrections were applied assuming isotopic compositions determined using the method of Cumming and Richards (1975) for all analyses with the exception of analyses 5.1, 8.1, 9.1, 10.1, 12.1, 14.1, 15.1, 17.1, 22.1, 25.1 and 27.1, for which Broken Hill common-Pb isotopic compositions were assumed.

Results

Twenty-eight analyses were obtained from 28 zircons. Results are given in Table 38 and shown on a concordia plot in Figure 39.

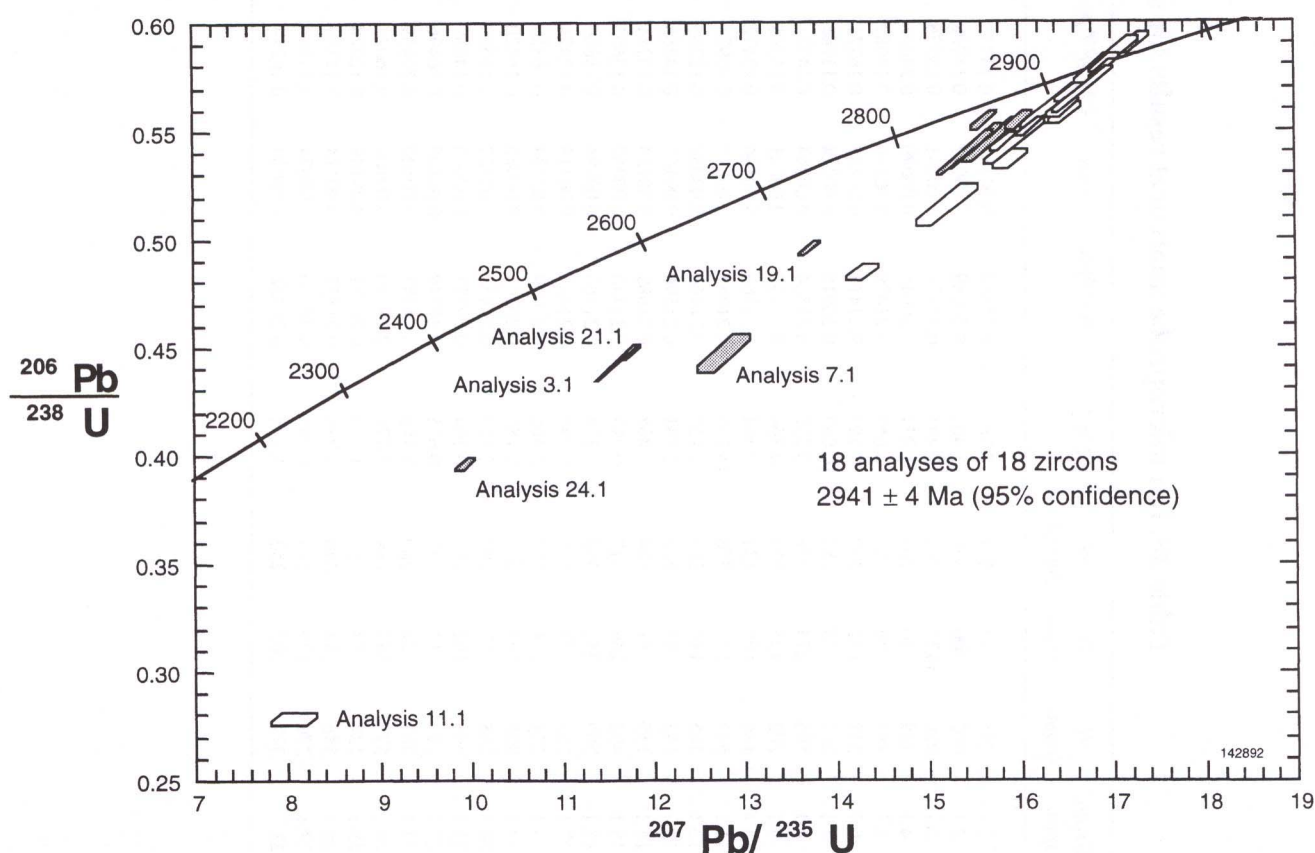


Figure 39. Concordia plot for sample 142892: porphyritic rhyolite, Two Mile Well

Table 38. Ion microprobe analytical results for sample 142892: porphyritic rhyolite, Two Mile 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 ±1σ Age</i>
1.1	185	94	131	5.762	0.21638	0.00189	0.14735	0.00403	0.5133	0.0099	15.314	0.338	90	2954 14
2.1	602	400	430	3.407	0.20969	0.00085	0.18908	0.00176	0.5399	0.0102	15.610	0.309	96	2903 7
3.1	1920	1127	996	0.495	0.19179	0.00031	0.15576	0.00044	0.4407	0.0083	11.654	0.222	85	2758 3
4.1	389	340	269	1.031	0.20945	0.00070	0.24498	0.00121	0.5371	0.0102	15.511	0.304	96	2901 5
5.1	155	79	100	0.659	0.21479	0.00110	0.14087	0.00157	0.5424	0.0104	16.063	0.328	95	2942 8
6.1	218	132	159	3.193	0.21418	0.00137	0.16721	0.00276	0.5581	0.0107	16.480	0.344	97	2937 10
7.1	267	108	181	10.063	0.20918	0.00214	0.11768	0.00478	0.4456	0.0085	12.852	0.293	82	2899 17
8.1	505	274	338	0.230	0.21524	0.00054	0.14771	0.00062	0.5663	0.0107	16.807	0.326	98	2945 4
9.1	202	125	133	0.869	0.21132	0.00101	0.16348	0.00156	0.5429	0.0104	15.819	0.320	96	2916 8
10.1	189	108	131	0.581	0.21366	0.00104	0.15472	0.00143	0.5795	0.0111	17.073	0.348	100	2933 8
11.1	517	171	556	45.145	0.21057	0.00575	0.05924	0.01368	0.2781	0.0028	8.075	0.244	54	2910 44
12.1	405	184	269	0.155	0.21464	0.00059	0.12245	0.00072	0.5750	0.0045	17.018	0.146	100	2941 4
13.1	185	85	113	2.841	0.21596	0.00163	0.14465	0.00346	0.4826	0.0040	14.370	0.172	86	2951 12
14.1	155	81	104	0.888	0.21689	0.00123	0.14281	0.00215	0.5552	0.0047	16.603	0.179	96	2958 9
15.1	492	246	317	0.297	0.21440	0.00057	0.13603	0.00080	0.5490	0.0042	16.229	0.137	96	2939 4
16.1	509	352	369	3.178	0.21163	0.00094	0.18666	0.00205	0.5520	0.0043	16.106	0.151	97	2918 7
17.1	166	78	115	0.740	0.21435	0.00113	0.12474	0.00187	0.5876	0.0049	17.367	0.181	101	2939 9
18.1	221	131	157	2.565	0.21604	0.00134	0.16359	0.00282	0.5550	0.0046	16.533	0.180	96	2951 10
19.1	986	593	609	2.188	0.20263	0.00065	0.16320	0.00137	0.4936	0.0037	13.791	0.118	91	2848 5
20.1	268	187	199	2.819	0.21431	0.00122	0.19503	0.00262	0.5646	0.0045	16.683	0.173	98	2938 9
21.1	309	162	159	0.164	0.19223	0.00066	0.14689	0.00092	0.4455	0.0035	11.809	0.105	86	2761 6
22.1	191	117	133	0.655	0.21340	0.00105	0.16496	0.00177	0.5777	0.0048	16.998	0.172	100	2932 8
23.1	367	284	280	2.788	0.21397	0.00102	0.20839	0.00220	0.5778	0.0045	17.048	0.165	100	2936 8
24.1	573	349	289	3.479	0.18340	0.00102	0.16033	0.00227	0.3947	0.0030	9.982	0.100	80	2684 9
25.1	124	53	80	1.233	0.21731	0.00149	0.12228	0.00270	0.5343	0.0046	16.008	0.187	93	2961 11
26.1	346	184	248	3.216	0.21558	0.00114	0.14549	0.00244	0.5581	0.0044	16.589	0.166	97	2948 9
27.1	270	130	174	0.398	0.20660	0.00074	0.13448	0.00113	0.5521	0.0044	15.728	0.143	98	2879 6
28.1	377	207	252	1.398	0.21322	0.00084	0.16244	0.00164	0.5423	0.0042	15.943	0.146	95	2930 6

Interpretation

Many analyses are discordant, with the discordance trends indicating both ancient and recent loss of radiogenic Pb. Eighteen concordant and variably discordant analyses of 18 zircons have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean date of 2941 ± 4 Ma (chi-squared = 0.99). This is interpreted as corresponding to the time of crystallization of the porphyry. The remaining discordant analyses (2.1, 3.1, 4.1, 7.1, 9.1, 16.1, 19.1, 21.1, 24.1 and 27.1) are interpreted to have lost radiogenic Pb during past (non-recent) disturbance events.

STRATIGRAPHIC REFERENCE:

SMITHIES, R. H., and FARRELL, T. P., 2000, Geology of the Satirist 1:100 000 sheet: Western Australia Geological Survey, 1:100 000 Geological Series Explanatory Notes, 42p.

Recommended reference for this publication:

NELSON, D. R., 1999, 142892: porphyritic rhyolite, Two Mile Well; in Compilation of geochronology data, 1998: Western Australia Geological Survey, Record 1999/2, p. 148–151.

OR

NELSON, D. R., 1999, 142892: porphyritic rhyolite, Two Mile Well; Geochronology dataset 356; in Compilation of geochronology data, June 2006 update: Western Australia Geological Survey.

Data obtained: 18/04/1998; Data released: 16/06/1999