

184359: metarhyodacite, Dovers Hills

(Walungurru Volcanics, Warumpi Province, Arunta Orogen)

Location and sampling

MACDONALD (SF 52-14), MACDONALD (4651)
MGA Zone 52, 470527 E 7442546N

Sampled on 9 August 2007

The sample was collected from an area of boulder-covered low hills and tors of massive rhyodacite in the Dovers Hills, on the south side of the Kintore–Kiwirrkurra Road, about 19.7 km west of Mount Tietkens.

Tectonic unit/relations

The unit sampled is the Walungurru Volcanics, a succession of felsic, intermediate, and mafic volcanic rocks, that includes silicified, cryptocrystalline, porphyritic andesite, as well as dacite, basaltic andesite, basalt, and dolerite (Meixner et al., 2004). The Walungurru Volcanics are part of the Warumpi Province, which is the southwestern part of the Arunta Orogen. The Warumpi Province is interpreted to have formed as a magmatic arc outboard of the North Australian Craton (NAC) during the c. 1690–1660 Ma Argilke Igneous Event (Scrimgeour et al., 2005). Transpressional accretion of the Warumpi Province onto the NAC occurred during the 1640–1635 Ma Liebig Orogeny, forming the Central Australian Suture (Scrimgeour et al., 2005). The sampled rhyodacite contains rounded to angular quartz and feldspar, and, locally, euhedral hornblende phenocrysts in a glassy matrix. Variations in the distribution of phenocrysts suggest that this is a crystal-rich volcanic sandstone or pyroclastic rock. There are hints of bedding or layering. The metarhyodacite is cut by east-northeast trending localized shear zones up to 50 cm wide, and thin en echelon quartz veins.

Petrographic description

This sample is a recrystallised metarhyodacite, with a visually assessed mineralogy that includes 30% plagioclase phenocrysts, 6% quartz phenocrysts, 2% microcline phenocrysts, 12% mafic aggregates, and about 50% quartzofeldspathic groundmass. Plagioclase phenocrysts are up to 4 mm long and are mostly fresh with minor scattered patches of sericite or saussurite alteration. Quartz phenocrysts are up to 6 mm long, and mainly resorbed and fragmented. Anhedral microcline phenocrysts up to 5 mm long are disaggregated and contain minor epidote.

Mafic aggregates are 0.5 to 4 mm long and composed of decussate biotite and hornblende, commonly with minor to abundant quartz or magnetite, the latter with rims of titanite. Some aggregates also contain epidote or accessory apatite, with rare zircon. K-feldspar, and minor apatite and magnetite, occur in the microcrystalline quartzofeldspathic groundmass. The sample has undergone amphibolite or high greenschist facies metamorphism.

Zircon morphology

Zircons isolated from this sample are euhedral and are mainly transparent and contain abundant inclusions. The crystals are up to 300 μm long, with aspect ratios up to 5:1. Cathodoluminescence (CL) images reveal ubiquitous oscillatory growth zoning. A CL image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed on 10 July 2008, using SHRIMP-B. Sixteen analyses of the Temora standard were obtained during the session and, following rejection of one analysis as an outlier, the remaining 15 analyses indicated an external spot-to-spot (reproducibility) uncertainty of 0.50% (1 σ), and a $^{238}\text{U}/^{206}\text{Pb}^*$ calibration uncertainty of 0.21% (1 σ). Common-Pb corrections were applied to all analyses using contemporaneous common-Pb isotopic compositions determined according to the Pb isotopic model of Stacey and Kramers (1975).

Results

Twenty analyses were obtained from 20 zircons. Results are listed in Table 1, and shown in a concordia diagram (Fig. 2).

Interpretation

All analyses are concordant (Fig. 2) and define a single group.

Group I comprises 20 analyses (Table 1), which yield a concordia age of 1650 ± 4 Ma (MSWD = 1.05), interpreted as the age of magmatic crystallization of the rhyodacite.

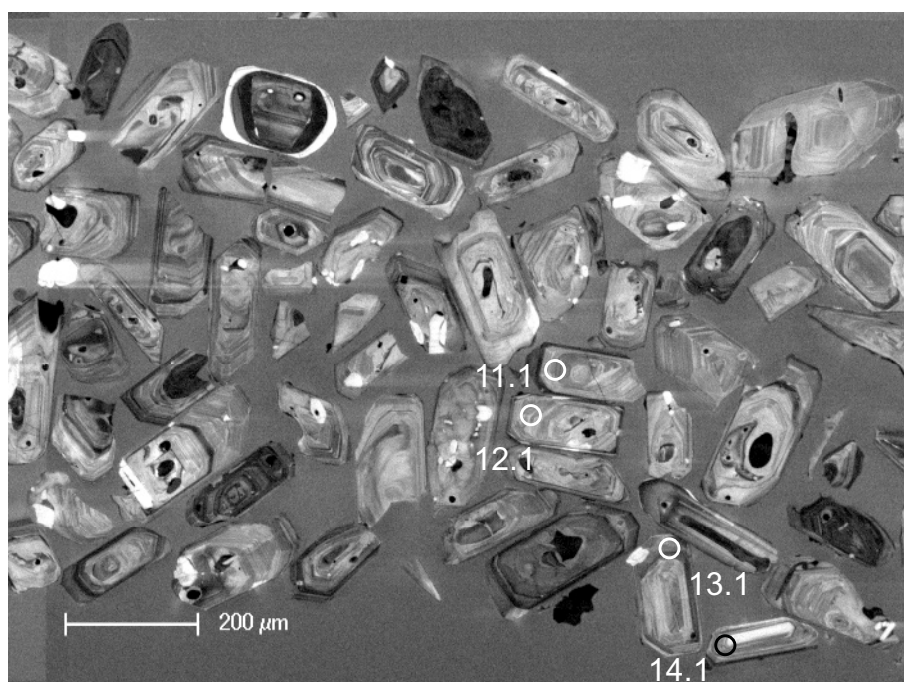


Figure 1. Cathodoluminescence image of representative zircons from sample 184359: metarhyodacite, Dovers Hills. Numbered circles indicate the approximate positions of analysis sites.

References

- Meixner, T, Close, DF, Scrimgeour, IR and Edgoose, CJ 2004, Mount Rennie, Northern Territory (First Edition). 1:250 000 interpreted geological map series, SF 52-15: Northern Territory Geological Survey, Darwin.
- Scrimgeour, IR, Kinny, PD, Close, DF and Edgoose, CJ 2005, High-T granulites and polymetamorphism in the southern Arunta Region, central Australia: Evidence for a 1.64 Ga accretional event: *Precambrian Research*, v. 142, p. 1–27.
- Stacey, JS and Kramers, JD 1975, Approximation of terrestrial lead isotope evolution by a two-stage model: *Earth and Planetary Science Letters*, v. 26, p. 207–221.

Recommended reference for this publication

- Kirkland, CL, Wingate, MTD, Spaggiari, CV and Tyler, IM 2009, 184359: metarhyodacite, Dovers Hills; *Geochronology Record* 815, Geological Survey of Western Australia, 4p.

Data obtained: 10 July 2008

Data released: 30 June 2009

Table 1. Ion microprobe analytical results for zircons from sample 184359: metathiodacite, Dovers Hills

Group ID.	Spot no.	Grain. spot	^{238}U (ppm)	^{232}Th (ppm)	$^{232}\text{Th}/^{238}\text{U}$	f^{204} (%)	$^{238}\text{U}/^{206}\text{Pb}$ $\pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb}$ $\pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}$ $\pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb}$ $\pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}$ date (Ma) $\pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb}$ date (Ma) $\pm 1\sigma$	Disc. (%)						
I	9	9.1	133	96	0.75	-0.071	3.408	0.025	0.10218	0.00066	3.406	0.025	0.10280	0.00117	1660	11	1675	21	0.9
I	14	14.1	116	118	1.05	-0.032	3.443	0.025	0.10228	0.00071	3.442	0.025	0.10256	0.00076	1644	11	1671	14	1.6
I	4	4.1	93	59	0.65	-0.053	3.442	0.028	0.10207	0.00082	3.440	0.028	0.10253	0.00088	1645	12	1670	16	1.5
I	18	18.1	152	105	0.71	-0.064	3.414	0.024	0.10152	0.00062	3.411	0.024	0.10207	0.00065	1657	10	1662	12	0.3
I	11	11.1	169	128	0.78	-0.003	3.391	0.036	0.10190	0.00102	3.391	0.036	0.10193	0.00135	1666	16	1659	24	-0.4
I	7	7.1	131	107	0.84	-0.108	3.436	0.025	0.10065	0.00071	3.432	0.025	0.10159	0.00091	1648	11	1653	17	0.3
I	15	15.1	142	102	0.75	-0.036	3.411	0.024	0.10125	0.00067	3.410	0.024	0.10156	0.00093	1658	10	1653	17	-0.3
I	16	16.1	189	137	0.75	0.026	3.371	0.034	0.10166	0.00057	3.372	0.034	0.10143	0.00058	1674	15	1651	11	-1.4
I	1	1.1	136	103	0.78	0.009	3.411	0.025	0.10148	0.00102	3.412	0.025	0.10141	0.00133	1657	11	1650	24	-0.4
I	8	8.1	124	87	0.72	0.068	3.467	0.025	0.10196	0.00070	3.469	0.026	0.10137	0.00077	1633	11	1649	14	1.0
I	2	2.1	114	92	0.83	-0.050	3.471	0.026	0.10093	0.00072	3.470	0.026	0.10136	0.00072	1633	11	1649	13	1.0
I	20	20.1	145	113	0.80	0.098	3.455	0.032	0.10203	0.00065	3.459	0.032	0.10118	0.00067	1637	13	1646	12	0.5
I	3	3.1	162	112	0.72	0.056	3.415	0.024	0.10159	0.00061	3.417	0.024	0.10111	0.00067	1655	10	1645	12	-0.6
I	12	12.1	124	85	0.70	0.087	3.417	0.025	0.10185	0.00069	3.420	0.025	0.10110	0.00114	1654	11	1644	21	-0.6
I	6	6.1	118	86	0.75	0.101	3.356	0.025	0.10192	0.00071	3.360	0.025	0.10105	0.00123	1680	11	1644	23	-2.2
I	5	5.1	161	111	0.72	0.079	3.444	0.024	0.10159	0.00060	3.446	0.024	0.10091	0.00069	1642	10	1641	13	-0.1
I	13	13.1	159	106	0.69	0.066	3.470	0.024	0.10128	0.00102	3.473	0.024	0.10071	0.00121	1631	10	1637	22	0.4
I	19	19.1	116	85	0.76	0.161	3.465	0.026	0.10191	0.00071	3.470	0.026	0.10052	0.00122	1632	11	1634	23	0.1
I	10	10.1	175	122	0.72	0.064	3.420	0.036	0.10068	0.00058	3.422	0.036	0.10013	0.00115	1653	15	1627	21	-1.6
I	17	17.1	91	48	0.54	0.007	3.451	0.027	0.09928	0.00078	3.452	0.028	0.09922	0.00118	1640	12	1609	22	-1.9

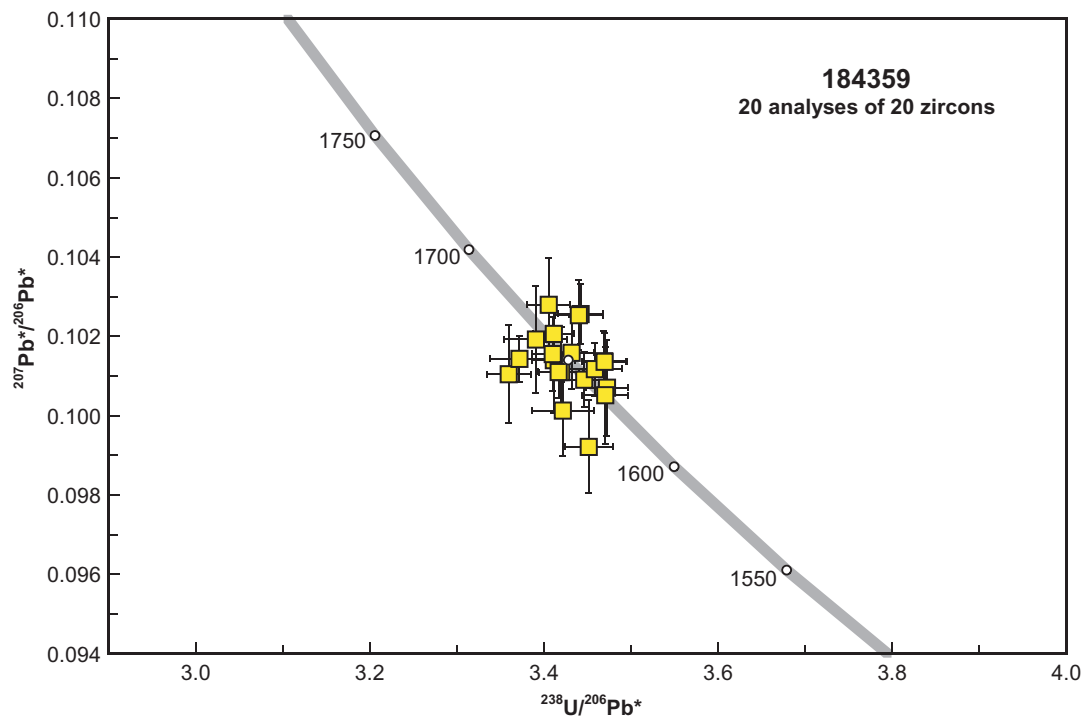


Figure 2. U-Pb analytical data for sample 184359: metarhyodacite, Dovers Hills. Yellow squares indicate Group I (magmatic zircons).