

206751: fine-grained metatonalite, Forrest Zone

(Undawidgi Supersuite, Forrest Zone, Coompana Province)

Location and sampling

FORREST (SH 52-10), FORREST (4536)
MGA Zone 52, 439176E 6623576N

Sampled on 23 September 2014

This sample was collected from the 432.75 – 433.10 m depth interval of diamond drillcore FOR010, a stratigraphic hole drilled in 2013 by the Geological Survey of Western Australia. The drillhole is located on the Nullarbor Plain, about 43.3 km northeast of Forrest Aerodrome, 37.0 km southwest of Decoration Cave, and 34.0 km north-northwest of Reid.

Tectonic unit/relations

The unit sampled is the 1505–1487 Ma Undawidgi Supersuite of the Forrest Zone, in the western Coompana Province. The Undawidgi Supersuite is a component of basement rocks beneath the Eucla Basin, and consists of metadiorite, metasyenite, a variety of foliated metagranites, and felsic schist, the latter probably derived from volcanic rock (Spaggiari et al., 2015). Stratigraphic hole FOR010 was drilled into an area of northeast-trending magnetic fabric within a large gravity low (Spaggiari et al., 2015). A sample of medium-grained monzogranite gneiss from lower in this drillcore yielded a crystallization age of 1487 ± 9 Ma (GSWA 192592, Wingate et al., 2015b). Other Undawidgi Supersuite samples from Forrest Zone drillcores FOR011 and FOR012 yielded crystallization ages of 1505–1488 Ma (Wingate et al., 2015a). Rocks of the Undawidgi Supersuite in drillcore FOR010 are intruded by granites of the Moodini Supersuite, dated at 1192–1175 Ma (Wingate et al., 2015a).

Petrographic description

The sample is a fine-grained metatonalite, although the portion examined petrographically is a metamonzogranite, and consists of about 40% K-feldspar, 30% quartz, 20% plagioclase, 5% biotite, and accessory iron–titanium oxide minerals, epidote, apatite, and chlorite. Anhedral K-feldspar (microcline), subhedral, weakly clouded plagioclase (oligoclase, An₂₈), and amoeboid quartz form an interlocking, equigranular (approximately 0.5 mm) assemblage. Ferromagnesian minerals are disseminated throughout the rock and chlorite is an alteration product of iron–titanium oxide minerals.

Zircon morphology

Zircons isolated from this sample are mainly colourless and subhedral to euhedral. The crystals are up to 250 μm long, and equant to slightly elongate, with aspect ratios up to 3:1. In cathodoluminescence (CL) images, concentric zoning is ubiquitous, and a few crystals appear to consist of resorbed zoned cores overgrown by internally featureless zircon rims. A CL image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed on 26–27 March 2015, using SHRIMP-B. Twelve analyses of the BR266 standard were obtained during the session, of which 11 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 0.13% (1 σ). Calibration uncertainties are included in the errors of $^{238}\text{U}/^{206}\text{Pb}^*$ ratios and dates listed in Table 1. Common-Pb corrections were applied to all analyses using contemporaneous isotopic compositions determined according to the model of Stacey and Kramers (1975).

Results

Twenty analyses were obtained from 19 zircons. Results are listed in Table 1, and shown in a concordia diagram (Fig. 2).

Interpretation

The analyses are concordant to moderately discordant (Fig. 2). Two analyses are >5% discordant. The dates obtained from these two analyses (Group D; Table 1) are unreliable, and are considered not to be geologically significant. The remaining 18 analyses define two groups, based on their $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ ratios.

Group I comprises 17 analyses (Table 1), which yield a weighted mean $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 1492 ± 9 Ma (MSWD = 1.4).

Group P comprises one analysis (Table 1), which yields a $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 1425 ± 20 Ma (1 σ).

The date of 1492 ± 9 Ma for the 17 analyses in Group I is interpreted as the magmatic crystallization age of the tonalite. The date of 1425 ± 20 Ma (1 σ) for the single analysis in Group P is interpreted to reflect minor loss of radiogenic Pb.

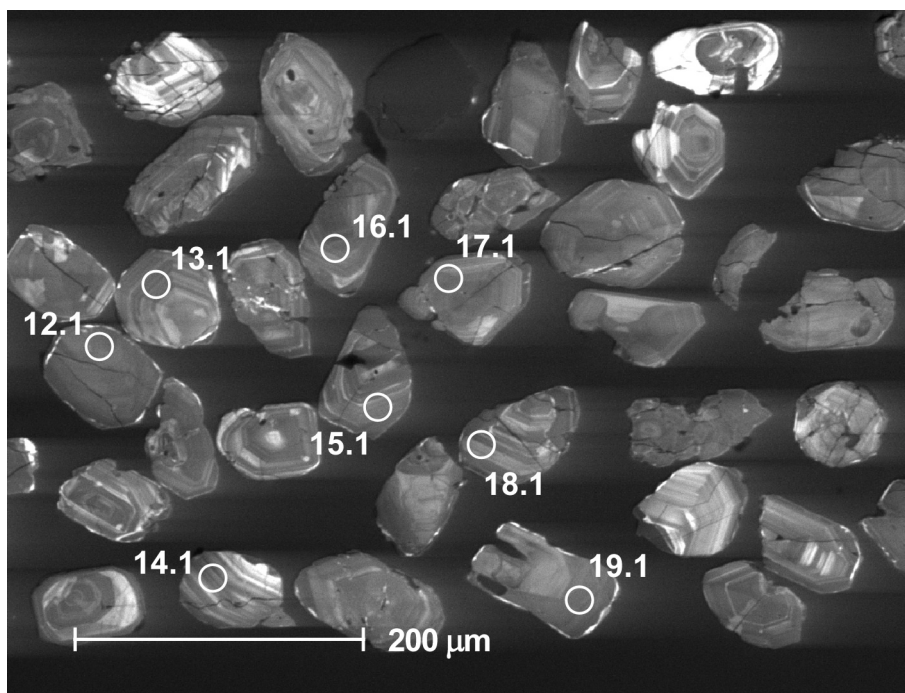


Figure 1. Cathodoluminescence image of representative zircons from sample 206751: fine-grained metatonalite, Forrest Zone. Numbered circles indicate the approximate locations of analysis sites.

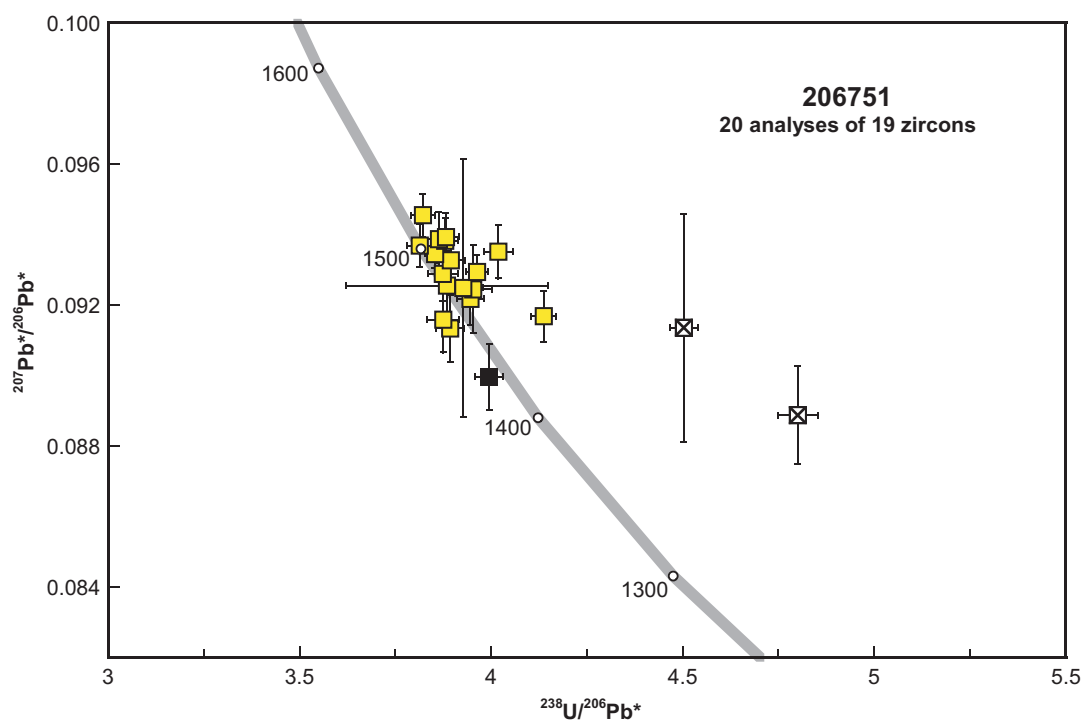


Figure 2. U-Pb analytical data for sample 206751: fine-grained metatonalite, Forrest Zone. Yellow squares indicate Group I (magmatic zircons); black square indicates Group P (radiogenic-Pb loss); crossed squares indicate Group D (discordance >5%).

Table 1. Ion microprobe analytical results for zircons from sample 206751: fine-grained metatonalite, Forrest Zone

Group ID	Spot no.	Grain. spot	²³⁸ U (ppm)	²³² Th (ppm)	²³² Th / ²³⁸ U	f ₂₀₄ (%)	²³⁸ U/ ²⁰⁶ Pb ± 1σ	²⁰⁷ Pb/ ²⁰⁶ Pb ± 1σ	²³⁸ U/ ²⁰⁶ Pb* ± 1σ	²⁰⁷ Pb*/ ²⁰⁶ Pb* ± 1σ	²³⁸ U/ ²⁰⁶ Pb* date (Ma) ± 1σ	²⁰⁷ Pb*/ ²⁰⁶ Pb* date (Ma) ± 1σ	Disc. (%)						
I	19	18.1	203	215	1.09	0.361	3.879	0.036	0.09444	0.00066	3.893	0.036	0.09134	0.00095	1474	12	1454	20	-1.4
I	9	8.1	147	128	0.90	0.124	3.870	0.042	0.09265	0.00079	3.875	0.042	0.09159	0.00093	1480	14	1459	19	-1.4
I	1	1.1	341	178	0.54	0.317	4.124	0.033	0.09441	0.00052	4.137	0.033	0.09169	0.00072	1396	10	1461	15	4.5
I	6	5.1	228	137	0.62	0.128	3.941	0.035	0.09328	0.00064	3.946	0.036	0.09218	0.00075	1456	12	1471	16	1.0
I	2	2.1	93	78	0.87	0.220	3.944	0.048	0.09434	0.00098	3.953	0.048	0.09245	0.00125	1454	16	1477	26	1.5
I	5	4.1	130	216	1.71	-0.026	3.928	0.051	0.09227	0.00365	3.927	0.051	0.09249	0.00365	1463	17	1478	75	1.0
I	12	11.1	173	205	1.23	0.193	3.877	0.262	0.09422	0.00079	3.885	0.263	0.09256	0.00099	1477	95	1479	20	0.2
I	18	17.1	174	210	1.25	-0.021	3.875	0.039	0.09270	0.00074	3.874	0.039	0.09289	0.00076	1480	13	1486	16	0.4
I	3	3.1	459	142	0.32	0.075	3.960	0.029	0.09358	0.00044	3.963	0.029	0.09294	0.00048	1450	10	1487	10	2.4
I	7	6.1	207	149	0.74	0.017	3.894	0.036	0.09342	0.00066	3.895	0.036	0.09327	0.00068	1473	12	1493	14	1.4
I	10	9.1	557	658	1.22	0.000	3.854	0.027	0.09345	0.00040	3.854	0.027	0.09345	0.00040	1487	9	1497	8	0.7
I	8	7.1	209	146	0.72	0.074	4.016	0.037	0.09415	0.00069	4.019	0.037	0.09352	0.00076	1432	12	1498	15	4.4
I	20	19.1	245	141	0.59	0.000	3.814	0.034	0.09369	0.00062	3.814	0.034	0.09369	0.00062	1501	12	1502	12	0.1
I	17	16.1	271	157	0.60	0.066	3.877	0.033	0.09439	0.00058	3.880	0.033	0.09383	0.00064	1478	11	1505	13	1.8
I	16	15.1	177	140	0.82	-0.041	3.865	0.038	0.09352	0.00072	3.864	0.038	0.09387	0.00077	1484	13	1506	15	1.4
I	13	12.1	221	131	0.61	0.047	3.881	0.035	0.09434	0.00064	3.882	0.035	0.09393	0.00068	1477	12	1507	14	1.9
I	14	13.1	310	430	1.43	0.080	3.819	0.031	0.09524	0.00055	3.822	0.031	0.09455	0.00061	1498	11	1519	12	1.4
P	15	14.1	223	326	1.51	0.427	3.978	0.036	0.09362	0.00062	3.995	0.036	0.08997	0.00093	1440	12	1425	20	-1.1
D	4	3.2	123	77	0.65	0.349	4.784	0.053	0.09187	0.00098	4.801	0.053	0.08888	0.00140	1220	12	1402	30	13.0
D	11	10.1	294	177	0.62	0.233	4.493	0.037	0.09336	0.00319	4.503	0.037	0.09136	0.00323	1293	10	1454	67	11.1

References

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Recommended reference for this publication

Wingate, MTD, Lu, Y, Spaggiari, CV and Smithies, RH 2015, 206751: fine-grained metatonalite, Forrest Zone; *Geochronology Record* 1275: Geological Survey of Western Australia, 4p.

Data obtained: 27 March 2015

Data released: 31 December 2015