190228: biotite–hornblende granite, Mount Scott

(*Pitjantjatjara Supersuite, Musgrave Province*)

Location and sampling

SCOTT (SG 52-6), HOLT (4546)
MGA Zone 52, 407398E 7146377N

Sampled on 29 June 2007

This sample was collected from the side of a rounded outcrop about 14.0 km north-northeast of Mount Scott and 19.0 km southwest of Mount Holt.

Tectonic unit/relations

The unit sampled is granite attributed to the 1219–1155 Ma Pitjantjatjara Supersuite of the Musgrave Province (Smithies et al., 2009). The Pitjantjatjara Supersuite comprises syn- to post-tectonic granites emplaced during the Musgrave Orogeny. The Musgrave Orogeny caused intense deformation and amphibolite- to granulite-facies crustal reworking, and produced voluminous felsic magmas. The granite is located within the Tjuni Purlka Tectonic Zone (Smithies et al., 2010), a major zone of multigenerational shearing and deformation in the Musgrave region from c. 1220 Ma to c. 1050 Ma.

Petrographic description

The granite has a visually estimated mineralogy comprising 31% plagioclase, 30% quartz, 23% microcline, 10% hornblende, 5–6% biotite, and <1% oxide minerals, plus accessory apatite, zircon, and monazite. The sample is fine grained, and contains small mafic clots and abundant feldspar and quartz domains. The texture is granoblastic interlobate, with grains mostly from 0.2 mm to 2.0 mm long. Myrmekite is developed on plagioclase–microcline grain boundaries. Hornblende and biotite are partly poikiloblastic and yellow-brown, suggesting elevated titanium contents. Accessory zircon and monazite grains are commonly associated with the mafic aggregates. Weak clay alteration occurs locally in feldspars, although the rock is largely fresh. This rock may have been metamorphosed to amphibolite facies.

Zircon morphology

Zircons from this sample are euhedral, up to 300 μm long, and have aspect ratios up to 6:1. The crystals are mainly colourless and transparent, and contain numerous inclusions; a few crystals contain cores. Cathodoluminescence (CL) images reveal ubiquitous idiomorphic zoning, with some crystals also exhibiting contorted internal textures consistent with magmatic dissolution and regrowth. A CL image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed on 10–11 April 2008, using SHRIMP-A. Sixteen analyses of the Temora standard were obtained during the session, of which 15 indicated an external spot-to-spot (reproducibility) uncertainty of 1.83% (1σ) and a $^{238}U/^{206}Pb^*$ calibration uncertainty of 0.51% (1σ). Calibration uncertainties are included in the errors of $^{238}U/^{206}Pb^*$ 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 20 zircons. Results are listed in Table 1, and shown in a concordia diagram (Fig. 2).

Interpretation

The analyses are concordant to slightly discordant. Nine analyses are characterized by >5% discordance. The dates obtained from these nine analyses (Group D; Table 1) are imprecise or unreliable, and are not considered geologically significant. The remaining 11 analyses define a single coherent group, based on their $^{207}Pb^*/^{206}Pb^*$ ratios.

Group I comprises 11 analyses (Table 1), which yield a concordia age of 1191 ± 14 Ma (MSWD = 1.7). These analyses indicate moderate to high Th/U ratios (0.77 – 2.43), and were located on zircons with indications of oscillatory zoning.

The date of 1191 ± 14 Ma for the 11 analyses in Group I is interpreted as the magmatic crystallization age of the granite.

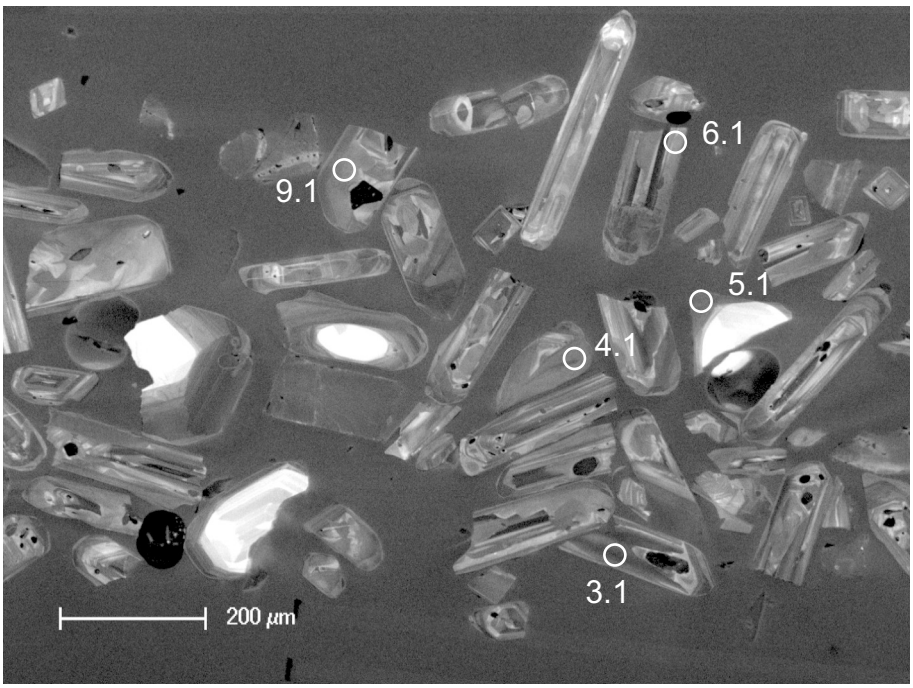

Figure 1. Cathodoluminescence image of representative zircons from sample 190228: biotite–hornblende granite, Mount Scott. Numbered circles indicate the approximate positions of analysis sites.

References

Smithies, RH, Howard, HM, Evins, PM, Kirkland, CL, Bodorkos, S and Wingate, MTD 2009, The west Musgrave Complex — some new geological insights from recent mapping, geochronology, and geochemical studies: Geological Survey of Western Australia, Record 2008/19, 20p.

Smithies, RH, Howard, HM, Evins, PM, Kirkland, CL, Kelsey, DE, Hand, M, Wingate, MTD, Collins, AS, Belousova, E and Allchurch, S 2010, Geochemistry, geochronology, and petrogenesis of Mesoproterozoic felsic rocks in the west Musgrave Province, central Australia, and implications for the Mesoproterozoic tectonic evolution of the region: Geological Survey of Western Australia, Report 106, 73p.

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 and Evins, PM 2011, 190228: biotite–hornblende granite, Mount Scott; Geochronology Record 839: Geological Survey of Western Australia, 4p.

Data obtained: 11 April 2008
Data released: 30 June 2011

Table 1. Ion microprobe analytical results for zircons from sample 190228: biotite–hornblende granite, Mount Scott

Group ID	Spot no.	Grain spot	^{238}U (ppm)	^{232}Th (ppm)	$^{232}Th/^{238}U$	f204 (%)	$^{238}U/^{206}Pb$ ± 1 σ		$^{207}Pb/^{206}Pb$ ± 1 σ		$^{238}U/^{206}Pb^*$ ± 1 σ		$^{207}Pb^*/^{206}Pb^*$ ± 1 σ		$^{238}U/^{206}Pb^*$ date (Ma) ± 1 σ		$^{207}Pb^*/^{206}Pb^*$ date (Ma) ± 1 σ		Disc. (%)
I	14	14.1	245	236	0.99	0.279	4.914	0.098	0.08006	0.00066	4.928	0.098	0.07771	0.00095	1191	22	1140	24	-4.5
I	6	6.1	169	178	1.09	0.129	5.063	0.110	0.07888	0.00085	5.070	0.110	0.07780	0.00128	1160	24	1142	33	-1.6
I	1	1.1	208	141	0.70	0.190	4.864	0.098	0.07969	0.00076	4.873	0.098	0.07809	0.00131	1203	22	1149	33	-4.7
I	8	8.1	203	231	1.18	0.101	4.953	0.113	0.07963	0.00072	4.958	0.113	0.07878	0.00079	1184	25	1167	20	-1.5
I	3	3.1	227	495	2.25	0.030	4.791	0.096	0.07952	0.00070	4.792	0.097	0.07927	0.00265	1222	23	1179	66	-3.6
I	20	20.1	158	218	1.42	0.105	4.980	0.100	0.08060	0.00082	4.985	0.101	0.07971	0.00089	1179	22	1190	22	0.9
I	12	12.1	187	151	0.84	0.077	5.217	0.105	0.08038	0.00082	5.221	0.105	0.07973	0.00090	1130	21	1190	22	5.1
I	7	7.1	185	222	1.24	-0.077	4.853	0.098	0.08034	0.00082	4.850	0.098	0.08099	0.00114	1209	23	1221	28	1.0
I	11	11.1	97	108	1.16	0.144	4.754	0.100	0.08229	0.00107	4.761	0.102	0.08108	0.00350	1229	24	1223	85	-0.5
I	18	18.1	172	406	2.43	-0.095	4.992	0.101	0.08032	0.00082	4.987	0.101	0.08112	0.00083	1178	22	1224	20	3.8
I	13	13.1	172	283	1.70	-0.082	4.766	0.110	0.08052	0.00078	4.762	0.110	0.08121	0.00085	1229	26	1227	21	-0.2
D	10	10.1	126	195	1.61	0.758	4.959	0.102	0.07980	0.00094	4.997	0.103	0.07345	0.00190	1176	23	1026	52	-14.6
D	9	9.1	164	131	0.83	0.452	4.981	0.110	0.07889	0.00086	5.004	0.110	0.07510	0.00144	1175	24	1071	39	-9.7
D	15	15.1	135	144	1.10	0.448	4.843	0.100	0.07935	0.00089	4.865	0.101	0.07559	0.00124	1205	23	1084	33	-11.2
D	19	19.1	99	175	1.82	0.074	4.944	0.103	0.07686	0.00106	4.948	0.105	0.07623	0.00373	1187	24	1101	98	-7.8
D	2	2.1	175	138	0.81	0.334	4.956	0.101	0.07945	0.00085	4.972	0.104	0.07665	0.00393	1181	23	1112	102	-6.2
D	4	4.1	179	125	0.72	0.056	4.913	0.099	0.07786	0.00100	4.916	0.100	0.07739	0.00141	1194	23	1131	36	-5.5
D	5	5.1	186	150	0.83	0.083	5.233	0.115	0.08108	0.00087	5.238	0.115	0.08038	0.00173	1126	23	1206	42	6.6
D	17	17.1	107	158	1.53	-0.052	5.172	0.107	0.08061	0.00105	5.169	0.108	0.08105	0.00214	1140	22	1223	52	6.8
D	16	16.1	154	177	1.19	-0.134	4.979	0.101	0.08107	0.00084	4.972	0.100	0.08221	0.00087	1181	22	1250	21	5.5

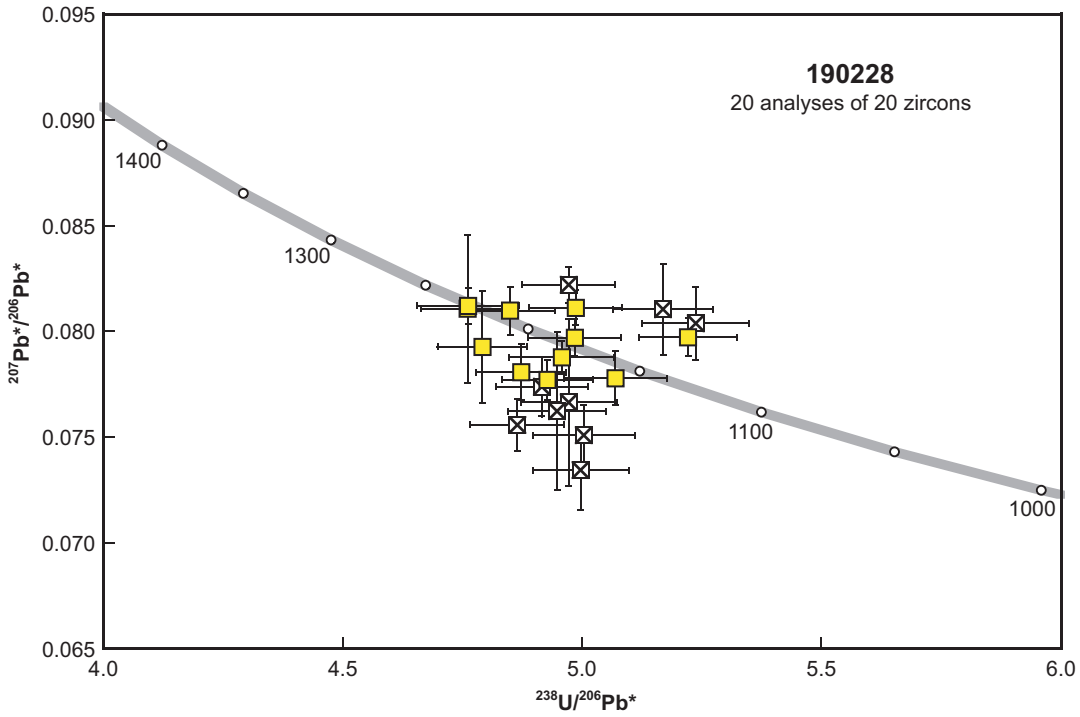

Figure 2. **U–Pb analytical data for sample 190228: biotite–hornblende granite, Mount Scott. Yellow squares indicate Group I (magmatic zircons); crossed squares indicate Group D (discordance >5%).**