

184149: stromatic migmatite, Borrows Hill

(*Wirku Metamorphics, Musgrave Province*)

Location and sampling

COOPER (SG 52-10), BLACKSTONE (4545)
MGA Zone 52, 408773E 7081530N

Sampled on 9 July 2006

The sample was collected from the side of a metre-high ridge, 120 m west of a north–south track. The sample site is approximately 20 km south of Peak Hill, and 17 km east-southeast of Borrows Hill.

Tectonic unit/relations

This pelitic paragneiss, from the southwestern area of BLACKSTONE, is associated with the Wirku Metamorphics of the Musgrave Province (Smithies et al., 2009). The Wirku Metamorphics are the oldest exposed basement rocks in the region. In the Musgrave Province, most rocks older than c. 1330 Ma are gneisses and all of these older rocks are believed to have a primary sedimentary and subordinate volcanoclastic origin. Many of these basement rocks are strongly affected by subsequent deformation and melting events. The Wirku Metamorphics includes all rocks in the west Musgrave Province formerly grouped into the Birksgate, Wirku, or Piti Palya Metamorphics (Smithies et al., 2009). The Wirku Metamorphics were metamorphosed to granulite facies during the 1225–1150 Ma Musgravian Orogeny.

Petrographic description

The sample is a medium-grained, holocrystalline, felsic rock dominated by approximately equal proportions of K-feldspar and plagioclase, along with abundant hypersthene (~20 modal %), red biotite averaging 0.5 mm long (~3 modal %), anhedral Fe–Ti oxide minerals (~3 modal %), and small grains of rare clinopyroxene. Quartz has crystallized in small interstitial zones and seams, making up <10 modal % of the rock. Anhedral to subhedral hypersthene is observed as optically continuous

crystals intergrown with biotite and K-feldspar. Apatite and zircon are also present.

Zircon morphology

Zircons isolated from this sample are small (<100 µm long), euhedral, near equant crystals. The grains are colourless and clear and have aspect ratios up to 2:1. In cathodoluminescence (CL) images, the grains are homogeneous with low CL response. A CL image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed on 14–15 December 2006, using SHRIMP-A. Thirteen analyses of the Temora standard indicated an external spot-to-spot (reproducibility) uncertainty of 2.61% (1σ) and a $^{238}\text{U}/^{206}\text{Pb}^*$ calibration uncertainty of 0.73% (1σ). Common-Pb corrections were applied to all analyses using contemporaneous common-Pb isotopic compositions determined according to the model of Stacey and Kramers (1975).

Results

Twenty-three analyses were obtained from 23 zircons. Results are listed in Table 1 and shown in a concordia diagram (Fig. 2).

Interpretation

The analyses are concordant (Fig. 2) and define a single population.

Group I comprises 23 analyses (Table 1) and yields a concordia age of 1185 ± 4 Ma (MSWD = 1.03). These analyses have moderate U contents (583–195) and high Th/U ratios (2.90–1.68).

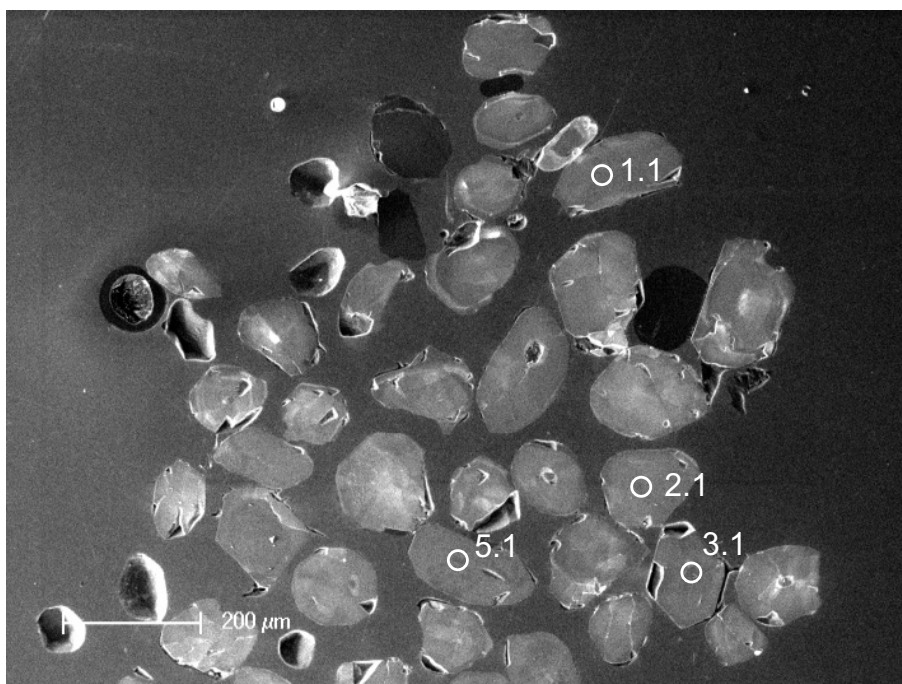


Figure 1. Cathodoluminescence image of representative zircons from sample 184149: stromatic migmatite, Borrows Hill. Numbered circles indicate the approximate positions of analysis sites.

The concordia age of 1185 ± 4 Ma, for the 23 analyses in Group I, is interpreted as the age of magmatic crystallization of the leucosomes.

References

- Smithies RH, Howard HM, Evins PM, Kirkland CL, Bordorkos, 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.
- 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, Bodorkos, S Wingate, MTD and Smithies, RH 2009, 184149: stromatic migmatite, Borrows Hill; Geochronology Record 824: Geological Survey of Western Australia, 4p.

Data obtained: 15 December 2006
Data released: 30 September 2009

Table 1. Ion microprobe analytical results for zircons from sample 184149: stromatic migmatite, Borrowers Hill

Group	Spot	Grain.	^{238}U	^{232}Th	$^{232}\text{Th}/^{238}\text{U}$	f^{204}	$^{238}\text{U}/^{206}\text{Pb}$	$^{207}\text{Pb}/^{206}\text{Pb}$	$^{238}\text{U}/^{206}\text{Pb}^*$	$^{207}\text{Pb}^*/^{206}\text{Pb}^*$	$^{238}\text{U}/^{206}\text{Pb}^*$	$^{207}\text{Pb}^*/^{206}\text{Pb}^*$	date (Ma)	$\pm 1\sigma$	date (Ma)	$\pm 1\sigma$	Disc. (%)
I	2	2.1	247	472	1.98	0.010	4.915	0.129	4.916	0.129	0.07862	0.00039	1163	10	1163	10	-2.7
I	23	23.1	248	607	2.53	0.123	4.983	0.132	4.989	0.133	0.07873	0.00053	1178	29	1178	29	-1.1
I	1	1.1	284	684	2.49	0.065	4.965	0.130	4.968	0.130	0.07880	0.00044	1182	28	1182	28	-1.3
I	8	8.1	253	503	2.06	0.039	4.795	0.126	4.797	0.126	0.07880	0.00038	1221	29	1167	10	-4.6
I	15	15.1	266	627	2.43	0.012	4.835	0.127	4.836	0.127	0.07895	0.00063	1171	16	1171	16	-3.5
I	20	20.1	353	694	2.03	0.036	5.067	0.133	5.069	0.133	0.07899	0.00034	1161	28	1172	8	1.0
I	7	7.1	342	605	1.82	0.037	4.891	0.128	4.893	0.128	0.07915	0.00034	1199	29	1176	8	-2.0
I	22	22.1	308	713	2.39	0.075	4.955	0.130	4.959	0.130	0.07920	0.00037	1184	28	1177	9	-0.6
I	21	21.1	321	754	2.43	0.019	5.185	0.136	5.186	0.136	0.07927	0.00034	1137	27	1179	8	3.6
I	16	16.1	322	746	2.39	0.029	5.011	0.131	5.012	0.131	0.07937	0.00034	1173	28	1181	9	0.7
I	4	4.1	535	1505	2.90	0.028	4.898	0.128	4.900	0.128	0.07939	0.00027	1197	29	1182	7	-1.3
I	9	9.1	329	684	2.15	0.025	4.802	0.126	4.803	0.126	0.07957	0.00063	1219	29	1186	16	-2.8
I	11	11.1	195	363	1.93	0.045	4.882	0.130	4.885	0.130	0.07960	0.00044	1201	29	1187	11	-1.1
I	5	5.1	517	934	1.87	0.008	4.913	0.129	4.914	0.129	0.07964	0.00026	1194	29	1188	6	-0.5
I	17	17.1	251	542	2.23	0.001	5.051	0.133	5.051	0.133	0.07970	0.00045	1164	28	1190	11	2.1
I	13	13.1	251	544	2.24	-0.025	4.854	0.128	4.853	0.128	0.07978	0.00039	1208	29	1192	10	-1.4
I	14	14.1	372	703	1.95	-0.014	4.950	0.130	4.949	0.130	0.07980	0.00032	1186	28	1192	8	0.5
I	19	19.1	247	577	2.41	0.077	4.965	0.131	4.969	0.131	0.07983	0.00046	1182	28	1193	11	0.9
I	12	12.1	431	1112	2.67	0.016	4.830	0.127	4.831	0.127	0.07986	0.00029	1213	29	1193	7	-1.6
I	18	18.1	335	544	1.68	0.033	4.907	0.129	4.909	0.129	0.07986	0.00033	1195	29	1194	8	-0.1
I	3	3.1	416	1013	2.52	0.041	4.919	0.129	4.921	0.129	0.07987	0.00030	1193	29	1194	7	0.1
I	6	6.1	583	1083	1.92	0.016	4.918	0.133	4.919	0.133	0.07990	0.00028	1193	29	1194	7	0.1
I	10	10.1	267	680	2.63	-0.012	4.903	0.129	4.902	0.129	0.08053	0.00038	1197	29	1210	9	1.1

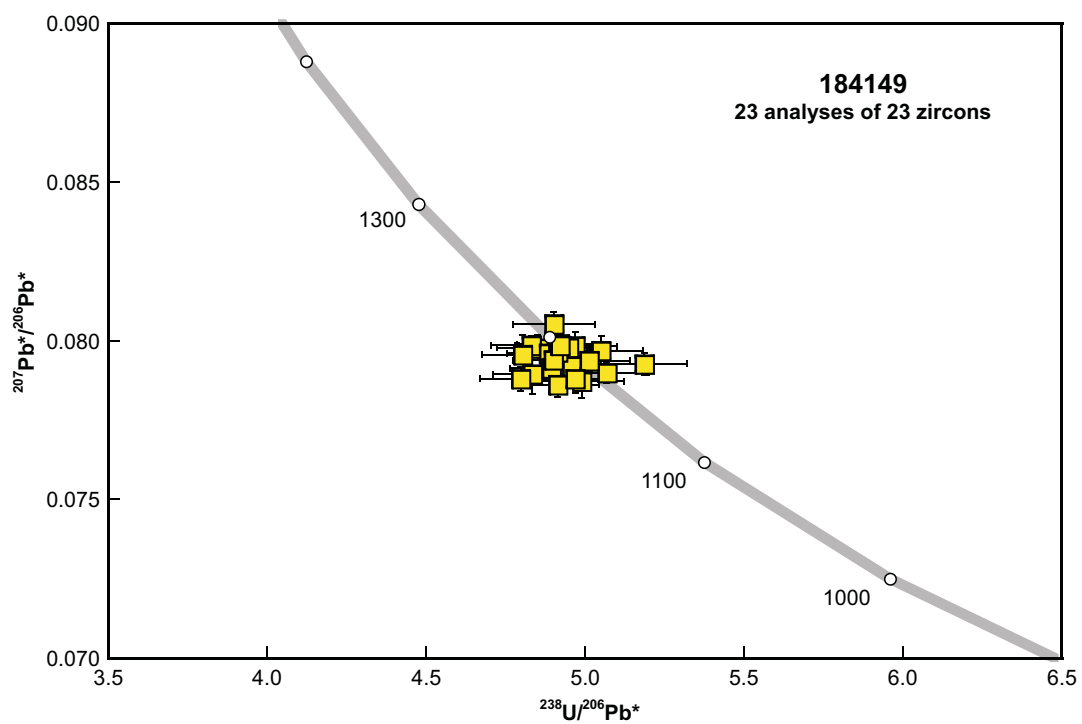


Figure 2. U-Pb analytical data for sample 184149: stromatic migmatite, Borrowers Hill. Yellow squares indicate Group I (magmatic zircons).