

# 183474: hornblende syenogranite, South Hill

## (Warakurna Supersuite, Musgrave Complex)

### Location and sampling

COOPER (SG 52-10), BELL ROCK (4645)  
MGA Zone 50, 467560E 7071861

Sampled on 3 August 2005

The sample was collected from the edge of a 2 m tall boulder about 0.5 km east-southeast of South Hill.

### Tectonic unit/relations

This sample is a massive, unmetamorphosed, hornblende-(biotite) granite in the southern part of BELL ROCK (Howard et al., 2007). It lies to the south of the geophysically defined (total magnetic intensity) near-surface contact between the mainly Mesoproterozoic Musgrave Complex to the north, and the Neoproterozoic Officer Basin.

### Petrographic description

This sample is composed of 20% quartz, 55% microcline, 10% plagioclase, 10% hornblende, 2% opaque oxide minerals, and 1% clay of various origins, as well as minor clinopyroxene, apatite, zircon, and monazite. Microcline is up to 12 mm in diameter and is perthitic, with plagioclase exsolved and as inclusions. Plagioclase also occurs as crystals up to 8 mm long and a single microcline grain has plagioclase as inclusions and as a continuous rim in a rapakivi texture, whereas another plagioclase grain has a rim of K-feldspar. Granular quartz inclusions occur mostly in the margins of larger microcline grains and within smaller grains. Rounded and partly resorbed quartz grains up to 4 mm in diameter have K-feldspar within resorption hollows. Interstitial quartz is also present. Poikilitic greenish brown hornblende is abundant as grains up to 5 mm long with inclusions of fresh or clay-altered clinopyroxene and opaque oxide minerals. Some clay has also veined and replaced plagioclase. Apatite, zircon, and monazite occur as crystals up to 0.4 mm long.

### Zircon morphology

Most zircons from this sample are distinctly euhedral and colourless and clear, although a sub-population is light brown and turbid. The grains contain numerous fluid inclusions. They are up to 500  $\mu\text{m}$  long, with aspect ratios up to 6:1. Concentric growth zoning is common and several zircons show disrupted internal structures, consistent with some degree of magmatic resorption. A cathodoluminescence image of representative zircons is shown in Figure 1.

### Analytical details

This sample was analysed on 15–16 June 2006, using SHRIMP A. Twenty-four analyses of the Temora standard were obtained during the session, and following deletion of two analyses as outliers, the remaining 22 analyses indicated an external spot-to-spot (reproducibility) uncertainty of 1.48% ( $1\sigma$ ) and a  $^{238}\text{U}/^{206}\text{Pb}^*$  calibration uncertainty of 0.34% ( $1\sigma$ ).

Common-Pb corrections were applied initially to all analyses using contemporaneous common-Pb isotopic compositions determined according to the model of Stacey and Kramers (1975), and these data are presented in Table 1. However, owing to a negative correlation (Fig. 2) between  $^{207}\text{Pb}^*/^{206}\text{Pb}^*$  date (corrected for common Pb) and  $f_{204}$ , explicit correction for common Pb was avoided for the purpose of weighted mean date calculations (see below).

### Results

Thirty-one analyses were obtained from 31 zircons. Results are listed in Table 1 and shown in a concordia diagram (Fig. 3).

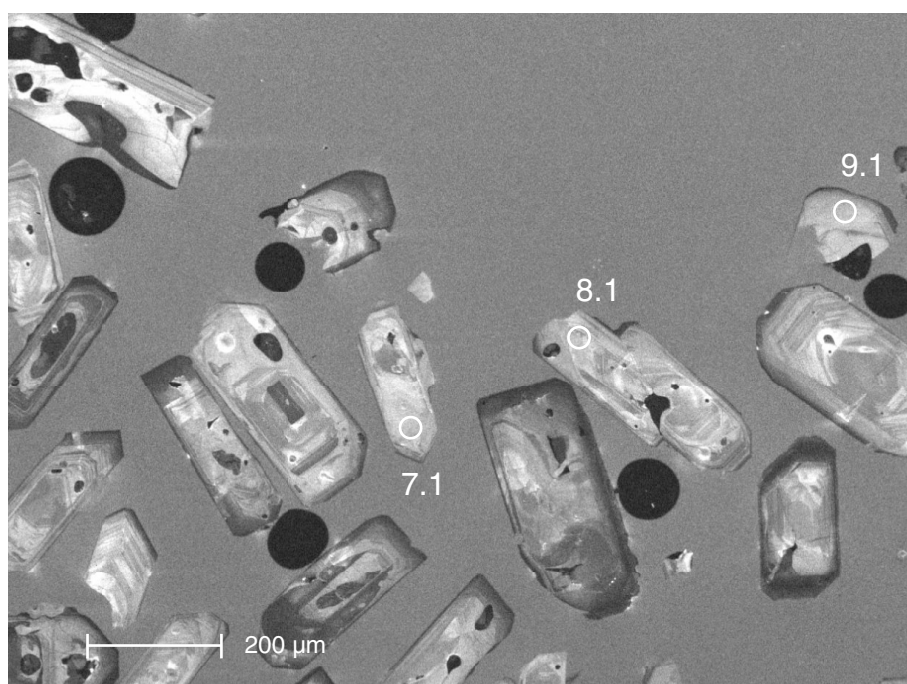
### Interpretation

Following correction for common Pb, the analyses range from moderately reversely to normally discordant, and 13 analyses are characterized by moderate discordance ( $>5\%$ ). However, owing to a negative correlation between  $^{207}\text{Pb}^*/^{206}\text{Pb}^*$  date (corrected for common Pb using  $^{204}\text{Pb}$ ) and  $f_{204}$  (Fig. 2), the preferred date is based on the intersection with the concordia curve of a regression line (Fig. 3), anchored at contemporaneous common Pb ( $^{238}\text{U}/^{206}\text{Pb} = 0$ ,  $^{207}\text{Pb}/^{206}\text{Pb} = 0.913$  at 1070 Ma; Stacey and Kramers, 1975).

Group 1 comprises 30 analyses of 30 idiomorphically zoned zircons (Table 1) for which the regression yields a concordia intercept date of  $1072 \pm 8$  Ma (MSWD = 1.5).

Group 2 comprises a single analysis of a texturally distinct zircon core (Table 1) and yields a  $^{207}\text{Pb}^*/^{206}\text{Pb}^*$  date of  $1176 \pm 34$  Ma ( $1\sigma$ ). This date is significantly older than the concordia intercept date for Group 1 zircons.

The date of  $1072 \pm 8$  Ma for the 30 analyses in Group 1 is interpreted as the age of magmatic crystallization of the syenogranite. The date of 1176 Ma for the single analysis in Group 2 is interpreted to reflect a zircon inherited from older rocks.



**Figure 1. Cathodoluminescence image of representative zircons from sample 183474: hornblende syenogranite, South Hill. Numbered circles indicate the approximate positions of analysis sites**

## References

- Howard, HM, Smithies, RH, Pirajno, F, Stewart, AJ, and Skwarnecki, MS, 2007, Bell Rock, WA 1:100 000 Sheet 4645: Geological Survey of Western Australia, 1:100 000 Geological Series.
- 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 Bodorkos, S, 2008, 183474: hornblende syenogranite, South Hill; Geochronology dataset 723, *in* Compilation of geochronology data: Geological Survey of Western Australia.

Data obtained: 17 June 2006  
Data released: 31 July 2008

Table 1. Ion microprobe analytical results for zircons from sample 183474: hornblende syenogranite, South Hill

Grp no.	Spot no.	Grain .spot	$^{238}\text{U}$ (ppm)	$^{232}\text{Th}$ (ppm)	$\frac{^{232}\text{Th}}{^{238}\text{U}}$	$\delta^{204}\text{Pb}$ (‰)	$^{238}\text{U}/^{206}\text{Pb}$ $\pm 1\sigma$	$^{207}\text{Pb}/^{206}\text{Pb}$ $\pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^*$ $\pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^*$ $\pm 1\sigma$	$^{238}\text{U}/^{206}\text{Pb}^*$ date (Ma) $\pm 1\sigma$	$^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date (Ma) $\pm 1\sigma$	Disc (%)
1	26	26.1	61	50	0.84	1.495	5.536 $\pm$ 0.095	0.07953 $\pm$ 0.00118	5.620 $\pm$ 0.099	0.06713 $\pm$ 0.00331	1056 $\pm$ 17	842 $\pm$ 103	-20.2
1	29	29.1	80	68	0.88	1.237	5.518 $\pm$ 0.093	0.07916 $\pm$ 0.00111	5.587 $\pm$ 0.097	0.06888 $\pm$ 0.00363	1061 $\pm$ 17	895 $\pm$ 109	-15.7
1	9	9.1	75	51	0.70	1.646	5.336 $\pm$ 0.092	0.08299 $\pm$ 0.00118	5.425 $\pm$ 0.099	0.06930 $\pm$ 0.00504	1091 $\pm$ 18	908 $\pm$ 150	-16.8
1	11	11.1	147	132	0.92	1.049	5.666 $\pm$ 0.090	0.07919 $\pm$ 0.00079	5.726 $\pm$ 0.093	0.07045 $\pm$ 0.00246	1038 $\pm$ 16	942 $\pm$ 72	-9.3
1	3	3.1	59	51	0.89	1.353	5.444 $\pm$ 0.094	0.08196 $\pm$ 0.00113	5.519 $\pm$ 0.099	0.07068 $\pm$ 0.00419	1074 $\pm$ 18	948 $\pm$ 121	-11.7
1	19	19.1	75	50	0.69	1.038	5.704 $\pm$ 0.097	0.08004 $\pm$ 0.00119	5.764 $\pm$ 0.102	0.07138 $\pm$ 0.00408	1031 $\pm$ 17	968 $\pm$ 117	-6.1
1	12	12.1	76	53	0.72	1.412	5.374 $\pm$ 0.093	0.08357 $\pm$ 0.00146	5.451 $\pm$ 0.102	0.07177 $\pm$ 0.00635	1086 $\pm$ 19	979 $\pm$ 180	-9.8
1	20	20.1	85	61	0.73	0.416	5.616 $\pm$ 0.094	0.07601 $\pm$ 0.00108	5.639 $\pm$ 0.101	0.07253 $\pm$ 0.00544	1052 $\pm$ 17	1001 $\pm$ 152	-4.9
1	18	18.1	92	69	0.77	0.393	5.622 $\pm$ 0.107	0.07648 $\pm$ 0.00104	5.644 $\pm$ 0.109	0.07319 $\pm$ 0.00283	1052 $\pm$ 19	1019 $\pm$ 78	-3.1
1	2	2.1	134	106	0.81	0.642	5.391 $\pm$ 0.086	0.07868 $\pm$ 0.00072	5.425 $\pm$ 0.087	0.07331 $\pm$ 0.00171	1091 $\pm$ 16	1023 $\pm$ 47	-6.2
1	13	13.1	65	56	0.89	1.369	5.514 $\pm$ 0.096	0.08484 $\pm$ 0.00122	5.590 $\pm$ 0.108	0.07337 $\pm$ 0.00703	1061 $\pm$ 19	1024 $\pm$ 194	-3.4
1	1	1.1	89	68	0.79	0.743	5.377 $\pm$ 0.088	0.08003 $\pm$ 0.00090	5.417 $\pm$ 0.092	0.07380 $\pm$ 0.00411	1092 $\pm$ 17	1036 $\pm$ 112	-5.1
1	25	25.1	72	61	0.88	0.526	5.488 $\pm$ 0.093	0.07822 $\pm$ 0.00112	5.517 $\pm$ 0.099	0.07381 $\pm$ 0.00511	1074 $\pm$ 18	1036 $\pm$ 140	-3.5
1	31	31.1	89	66	0.76	0.565	5.513 $\pm$ 0.092	0.07894 $\pm$ 0.00103	5.544 $\pm$ 0.094	0.07420 $\pm$ 0.00291	1069 $\pm$ 17	1047 $\pm$ 79	-2.1
1	21	21.1	55	45	0.84	0.649	5.655 $\pm$ 0.101	0.07983 $\pm$ 0.00135	5.692 $\pm$ 0.105	0.07439 $\pm$ 0.00412	1043 $\pm$ 18	1052 $\pm$ 112	0.8
1	17	17.1	148	123	0.86	0.106	5.600 $\pm$ 0.091	0.07550 $\pm$ 0.00077	5.606 $\pm$ 0.094	0.07461 $\pm$ 0.00364	1058 $\pm$ 16	1058 $\pm$ 98	0.0
1	7	7.1	56	37	0.68	0.711	5.390 $\pm$ 0.096	0.08068 $\pm$ 0.00127	5.429 $\pm$ 0.102	0.07471 $\pm$ 0.00535	1090 $\pm$ 19	1061 $\pm$ 144	-2.7
1	24	24.1	62	55	0.92	0.483	5.721 $\pm$ 0.099	0.07927 $\pm$ 0.00121	5.748 $\pm$ 0.109	0.07521 $\pm$ 0.00663	1034 $\pm$ 18	1074 $\pm$ 177	3.9
1	27	27.1	105	131	1.29	0.235	5.173 $\pm$ 0.114	0.07767 $\pm$ 0.00100	5.186 $\pm$ 0.115	0.07570 $\pm$ 0.00181	1137 $\pm$ 23	1087 $\pm$ 48	-4.4
1	8	8.1	74	59	0.83	0.764	5.411 $\pm$ 0.092	0.08216 $\pm$ 0.00115	5.452 $\pm$ 0.125	0.07574 $\pm$ 0.01284	1086 $\pm$ 23	1088 $\pm$ 340	0.2
1	15	15.1	125	75	0.62	0.189	5.581 $\pm$ 0.104	0.07734 $\pm$ 0.00087	5.592 $\pm$ 0.110	0.07575 $\pm$ 0.00513	1061 $\pm$ 19	1089 $\pm$ 136	2.6
1	4	4.1	87	89	1.06	0.270	5.530 $\pm$ 0.092	0.07821 $\pm$ 0.00097	5.545 $\pm$ 0.093	0.07594 $\pm$ 0.00203	1069 $\pm$ 17	1093 $\pm$ 54	2.3
1	23	23.1	104	80	0.80	0.271	5.358 $\pm$ 0.088	0.07828 $\pm$ 0.00093	5.373 $\pm$ 0.090	0.07600 $\pm$ 0.00244	1100 $\pm$ 17	1095 $\pm$ 64	-0.5
1	22	22.1	97	86	0.91	0.189	5.418 $\pm$ 0.090	0.07835 $\pm$ 0.00097	5.429 $\pm$ 0.091	0.07677 $\pm$ 0.00185	1090 $\pm$ 17	1115 $\pm$ 48	2.3
1	16	16.1	105	72	0.71	0.506	5.562 $\pm$ 0.091	0.08107 $\pm$ 0.00093	5.591 $\pm$ 0.092	0.07681 $\pm$ 0.00174	1061 $\pm$ 16	1116 $\pm$ 45	5.2
1	6	6.1	84	76	0.93	0.334	5.510 $\pm$ 0.093	0.07991 $\pm$ 0.00103	5.528 $\pm$ 0.101	0.07710 $\pm$ 0.00628	1072 $\pm$ 18	1124 $\pm$ 163	4.8
1	30	30.1	78	54	0.72	0.115	5.642 $\pm$ 0.095	0.07843 $\pm$ 0.00110	5.648 $\pm$ 0.096	0.07746 $\pm$ 0.00198	1051 $\pm$ 16	1133 $\pm$ 51	7.8
1	28	28.1	104	113	1.13	0.091	5.446 $\pm$ 0.089	0.07824 $\pm$ 0.00093	5.451 $\pm$ 0.089	0.07747 $\pm$ 0.00105	1086 $\pm$ 16	1133 $\pm$ 27	4.4
1	5	5.1	126	98	0.80	-0.050	5.513 $\pm$ 0.089	0.07826 $\pm$ 0.00081	5.510 $\pm$ 0.090	0.07869 $\pm$ 0.00214	1075 $\pm$ 16	1164 $\pm$ 54	8.3
1	10	10.1	83	61	0.75	0.283	5.445 $\pm$ 0.092	0.08123 $\pm$ 0.00106	5.460 $\pm$ 0.097	0.07884 $\pm$ 0.00494	1084 $\pm$ 18	1168 $\pm$ 124	7.7
2	14	14.1	119	74	0.64	0.339	5.139 $\pm$ 0.084	0.08204 $\pm$ 0.00087	5.156 $\pm$ 0.084	0.07917 $\pm$ 0.00136	1143 $\pm$ 17	1176 $\pm$ 34	3.0

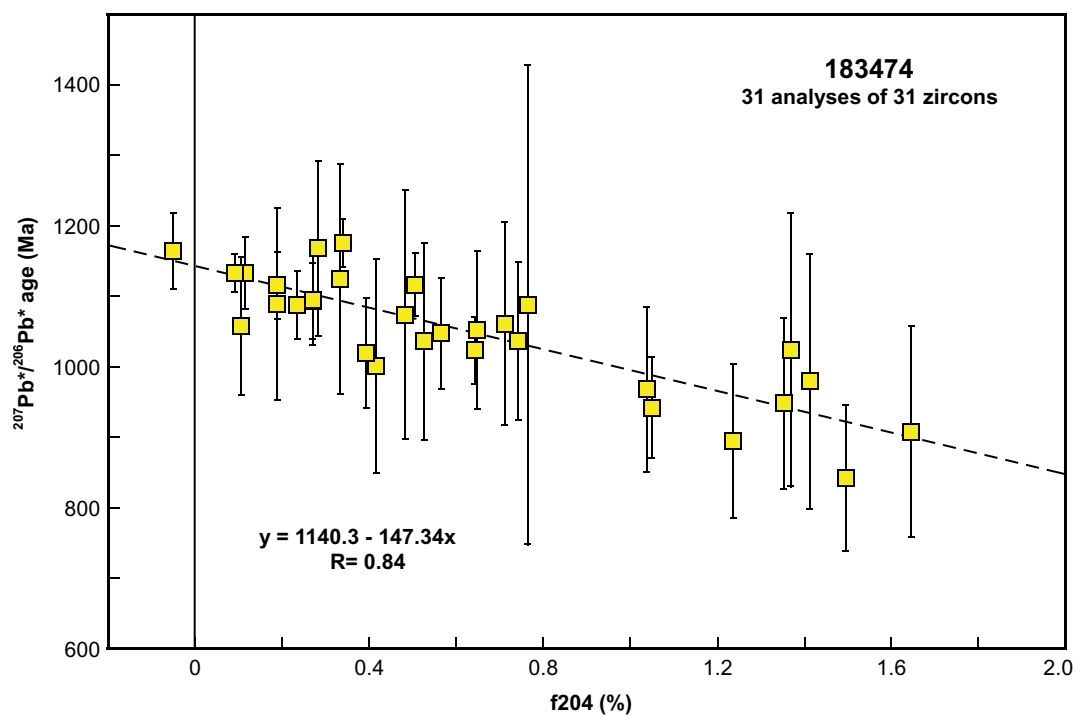


Figure 2. Correlation between  $^{207}\text{Pb}^*/^{206}\text{Pb}^*$  date (corrected for common Pb using measured  $^{204}\text{Pb}$ ) and  $f_{204}$  for sample 183474: hornblende syenogranite, South Hill. All data are included in the linear regression, and the equation of the best-fit line is shown. R is Pearson's correlation coefficient

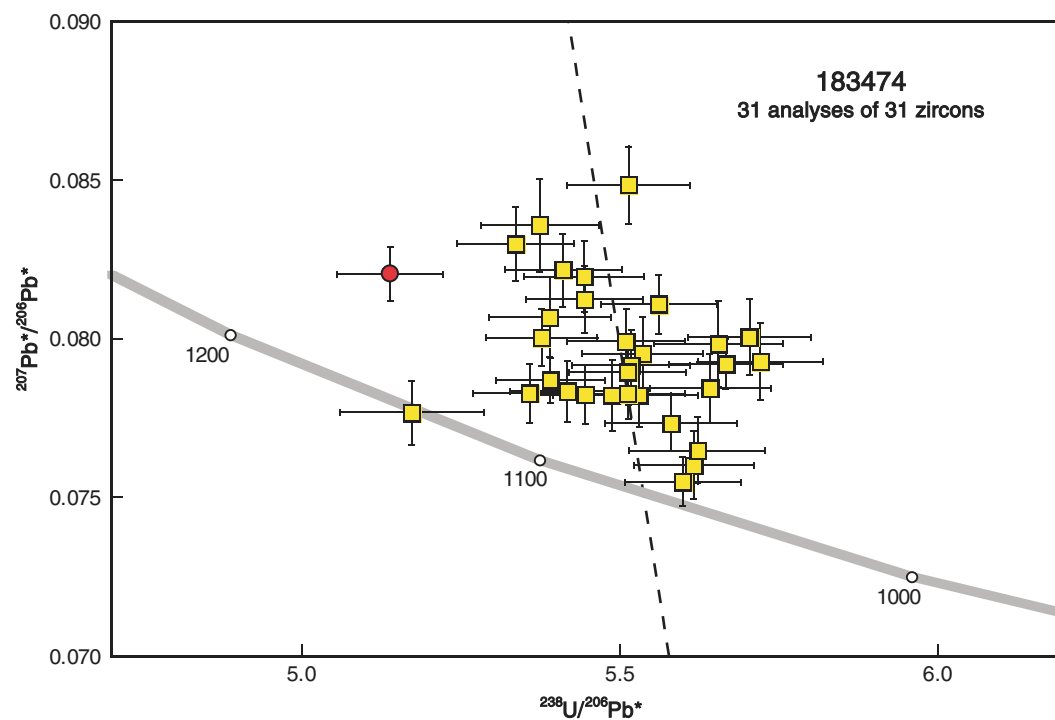


Figure 3. U-Pb analytical data for sample 183474: hornblende syenogranite, South Hill. Yellow squares denote Group 1 (igneous crystallization); red circle denotes Group 2 (xenocrystic zircon)