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New SHRIMP U-Pb zircon ages from the Gawler Craton and Curnamona Province, South Australia, 2008 – 2010

G. L. Fraser & N. L. Neumann

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by

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Contents

INTRODUCTION

OVERVIEW

This report presents SHRIMP U-Pb zircon geochronology results from the southern Gawler Craton and Curnamona Province, South Australia, acquired over the period 2008 – 2010, as part of Geoscience Australia's Onshore Energy Security Program (OESP). This geochronology project was specifically targeted to provide timing constraints relevant to the interpretation of deep seismic reflection profiles, also acquired under the OESP, in collaboration with Primary Industry and Resources South Australia (PIRSA). Consequently, the geographic coverage is heavily biased towards areas along, or adjacent to, the seismic profiles, as shown in Figures i and ii.

Geochronological samples from the southern Gawler Craton come from a broad-scale transect across northern Eyre Peninsula, in the vicinity of the seismic line 08GA-G1 (Figures i and ii). Results from this region are presented in approximate geographic order, from east to west, and are subdivided according to the tectonic domains of Ferris *et al*. (2002). Within the Curnamona Province, samples are concentrated in the out-cropping Mount Painter and Mount Babbage Inliers, and from selected drillholes along the seismic line 08GA-C1 (Figures i and ii). Results from the Curnamona Province are also presented in approximate geographical order, from north to south, and are subdivided according to the domain definitions of Conor and Preiss (2008).

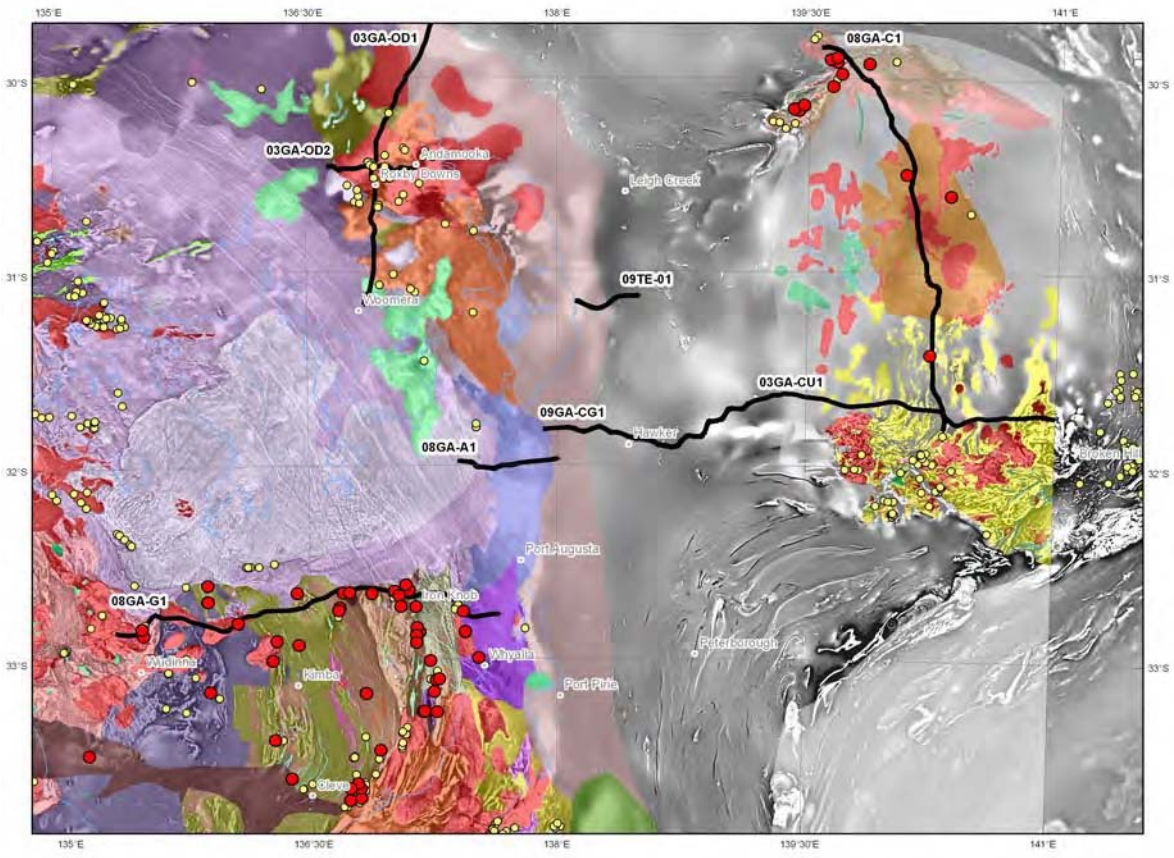

Figure i. *Location of the new SHRIMP geochronology samples (red circles) analysed during this study, with existing zircon geochronology (yellow circles; from Reid, 2007) and seismic lines. The background image is a solid geology map (from Cowley, 2006), laid over a magnetic intensity image.*

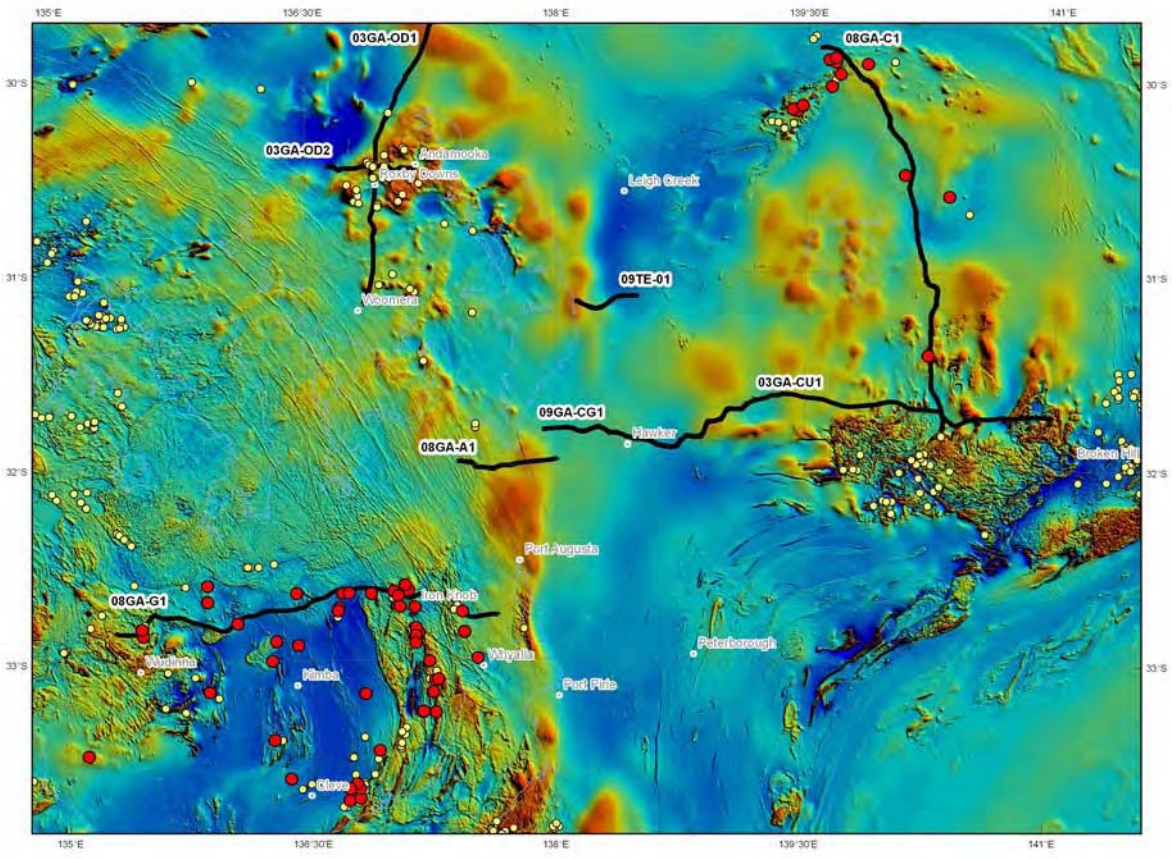

Figure ii. *Location of the new SHRIMP geochronology samples (red circles) analysed during this study, with existing zircon geochronology (yellow circles; from Reid, 2007) and seismic lines. Background is a magnetic intensity image.*

The samples presented in this record are ordered according to geological domains or regions, as discussed above, with a sample location map for each area presented at the beginning of that section. Each sample report includes a summary table, sample and zircon descriptions, U-Pb isotopic results, a geochronological interpretation and a data table.

SHRIMP ZIRCON GEOCHRONOLOGY METHODOLOGY

Zircons were separated from rock samples and concentrated by crushing, Wilfley table, Frantz electromagnetic separation, heavy liquids (methylene iodide, specific gravity 3.3), and handpicking. Zircons were mounted in 25mm diameter epoxy discs together with the U-concentration standard SL13 (238 ppm U), the U–Pb standard TEMORA-2 (416.8 ± 0.3 Ma; Black *et al*., 2003), and the $^{207}Pb/^{206}Pb$ standard OG1 (3465.4 ± 0.6 Ma; Stern *et al*., 2009). Reflected light, transmitted light and cathodoluminescence images were used to ensure that analyses were made on discrete growth phases.

All U–Pb isotopic results reported here were collected on the SHRIMP IIe instrument at Geoscience Australia. Isotopic data were collected using a primary oxygen ion beam of ~2 to 4 nA intensity and ~20 microns diameter. Secondary ions were collected on a single electron multiplier via cycling of the magnet through 5 to 7 scans across the mass range of interest. For igneous samples, zircons with a range of morphologies and cathodoluminescence responses were analysed to determine a magmatic crystallisation age and to identify any inherited and/or metamorphic ages present. For sedimentary rocks, more than 60 grains were analysed from each sample, where appropriate, in order to ensure a 95% chance of identifying each age component that comprises a significant proportion of the complete age spectrum (Dodson *et al*., 1988; Vermeesch, 2004), and only grains with surface imperfections were avoided.

Data processing used the SQUID-1 software of Ludwig (2001a) and processed data were plotted via Isoplot (Ludwig, 2001b). Corrections for common Pb ($^{206}Pb_c$) used the measured abundances of ^{204}Pb and assumed crustal common Pb compositions of Stacey and Kramers (1975). All ages discussed are ^{204}Pb-corrected $^{207}Pb/^{206}Pb$ ages, except where noted. When displaying the data using concordia and/or weighted mean age diagrams, data point error ellipses and error bars are plotted at the 1σ uncertainty level. In determining the maximum depositional age for sedimentary samples, we have used the youngest age cluster to calculate an age, where this cluster is defined as the group of youngest ages that are separate from the next youngest individual(s), as indicated in the probability density histogram, by grouping the largest number of youngest ages which have a probability of fit value great than 0.05, or as calculated by the mixture modelling method (Sambridge and Compston, 1994).

Instrumental mass fractionation (IMF) was monitored via regular analyses of the $^{207}Pb/^{206}Pb$ reference zircon OG1 (Stern *et al.*, 2009) during each analytical session. In certain, cases where the measured $^{207}Pb/^{206}Pb$ for OG1 differed significantly from the reference value, an IMF correction (Stern *et al.*, 2009) was applied to $^{207}Pb/^{206}Pb$ ratios measured on concurrently-analysed unknowns. This correction has only been applied to weighted mean ages, based on statistically-coherent groups of analyses. The $^{207}Pb/^{206}Pb$ ratios and ages for individual analyses, reported in the data tables, are not corrected for IMF. For every interpreted age reported here, the summary table indicates whether or not an IMF correction has been applied.

ACKNOWLEDGEMENTS

We would like to acknowledge the support and contributions of colleagues from the Geological Survey Branch, Primary Industries and Resources South Australia (PIRSA). In particular, Steve Hore, Stacey McAvaney, Michael Szpunar and Anthony Reid are thanked for their collaboration during field work, including sample collection, and for numerous geological discussions that improved our regional geologic understanding, and highlighted important knowledge gaps. Support and discussions with Tim Baker, Martin Fairclough, Liz Jagodzinski, Rian Dutch, Wolfgang Preiss, Claire Fricke and Wayne Cowley (all PIRSA) are also acknowledged.

Zircon geochronology is critically dependent on the quality of sample material. At Geoscience Australia we are fortunate to have a highly skilled and dedicated team in the mineral separation laboratory. We thank Chris Foudoulis, Steve Ridgway, Emma Chisholm and David DiBugnara for the production of high-quality zircon mounts, and associated images, without which this work would not have been possible.

Patrick Burke was responsible for maintaining the SHRIMP instrument and assisted with instrument tuning and troubleshooting. We also thank Richard Stern and Keith Sircombe for their leadership of the geochronology team at Geoscience Australia, and for advice and technical assistance. Our geochronology colleagues at Geoscience Australia - Simon Bodorkos, Chris Carson and Andrew Cross – are thanked for discussions on various aspects of data collection, processing and interpretation. Simon Bodorkos, Andrew Cross and Natalie Kositcin are thanked for reviewing draft versions of this Record. Lindsay Highet is thanked for producing the maps used throughout this Record.

Southern Gawler Craton

The distribution of samples from the southern Gawler Craton is shown in Figure iii, in the context of the geological domain subdivision of Ferris *et al*. (2002).

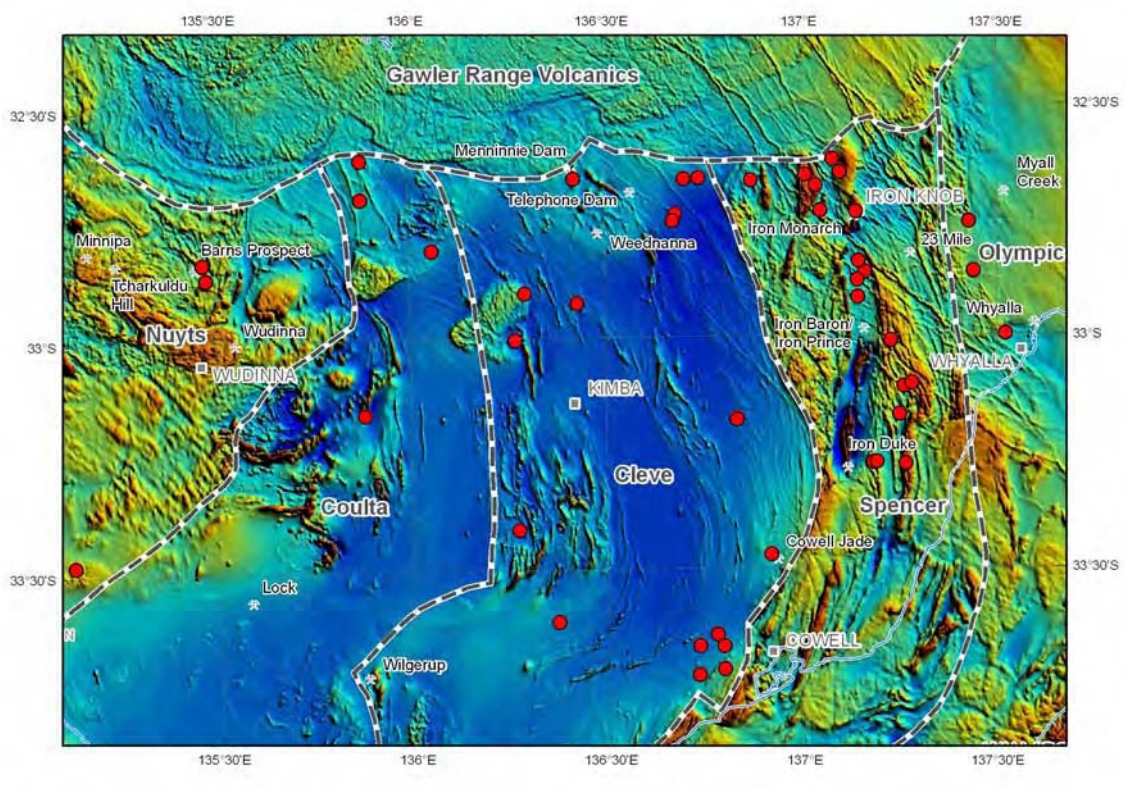

Figure iii. *Locations of new samples analysed for SHRIMP U-Pb zircon geochronology from the southern Gawler Craton, South Australia, on a magnetic intensity image, together with geological domain names and boundaries.*

Southern Gawler Craton

OLYMPIC DOMAIN

The Olympic Domain is the easternmost subdivision of the Gawler Craton (Figure iv; Ferris *et al*., 2002). It includes the Olympic Dam and Carrapateena IOCG±U deposits in the north, and the historical Cu-Au mines of the Moonta-Wallaroo district in the south. It is bounded to the east by overlying Adelaidean sediments of Neoproterozoic age, and separated from the Spencer Domain to the west, in the northern Eyre Peninsula, by the Roopena Fault. Rocks within the Olympic Domain include Paleoproterozoic metasedimentary rocks of the Wallaroo Group (Conor, 1995). Overlying the Wallaroo Group are relatively flat-lying, red beds of the Pandurra Formation (Cowley, 1991).

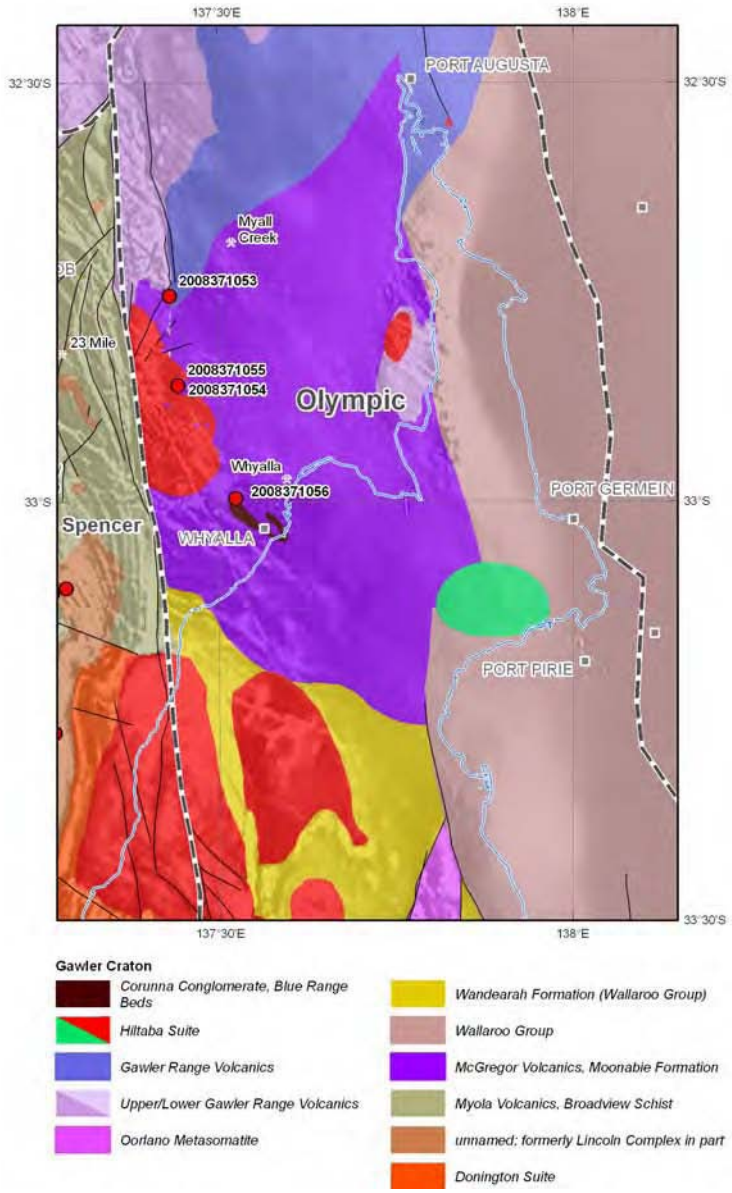

Figure iv. *Locations of new samples analysed for SHRIMP U-Pb zircon geochronology from the Olympic Domain, Gawler Craton, South Australia, displayed on a partially transparent solid geology map (Cowley, 2006) laid over a magnetic intensity image.*

1. MOONABIE FORMATION, SE MOUNT WHYALLA: 2008371055

GA Sample ID:	**2008371055**
GA Sample Number:	**1958093**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**728592 6361377 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**28/5/2008**
Formal Name:	**Moonabie Formation**
Informal Name:	
Lithology:	**quartz-rich sandstone**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6062**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**2 – 8/8/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.21% (2σ) [55 of 59]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.1 ± 1.9 Ma [30 of 30]**
Interpreted Age:	**1755 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum deposition age**

Sample Description

This sample comes from ~20 km NW of the city of Whyalla, eastern Eyre Peninsula, South Australia. The sample was collected ~50 metres west of the top of SE Mt Whyalla, within gently east-dipping Moonabie Formation stratigraphically below the volcanic sample 2008371054 (see below). The rock is a massive, grey, quartz-rich sandstone, with occasional large clasts (Figure 1.1).

Figure 1.1 (left). *Outcrop photo of Moonabie Formation at the site of sample 2008371055, on SE Mt Whyalla.*

Zircon Description

Zircon from this rock is reasonably abundant, and occurs as rounded, subhedral, clear grains, with some grains showing minor orange staining. Grains are typically ~100 x 150 μm in size. Most grains preserve some relic of oscillatory zoning and some are also sector zoned. Internal zoning appears to have been subsequently modified to leave a variably mottled or patchy internal zonation (Figure 1.2).

Most grains from this rock are interpreted to have an igneous origin, and their similarity in size, morphology and internal zoning suggests a relatively uniform igneous provenance.

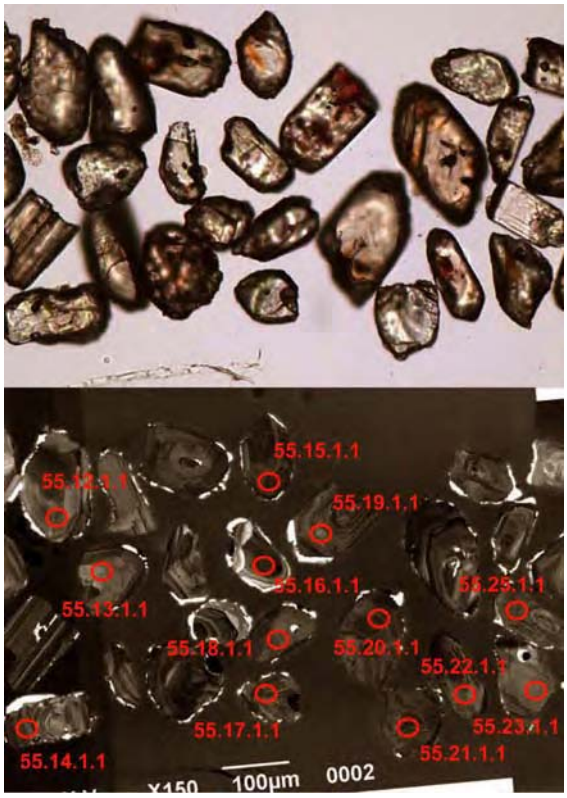

Figure 1.2. *Representative transmitted light and cathodoluminescence images of zircons from Moonabie Formation, SE Mt Whyalla (2008371055), with locations of some SHRIMP analyses.*

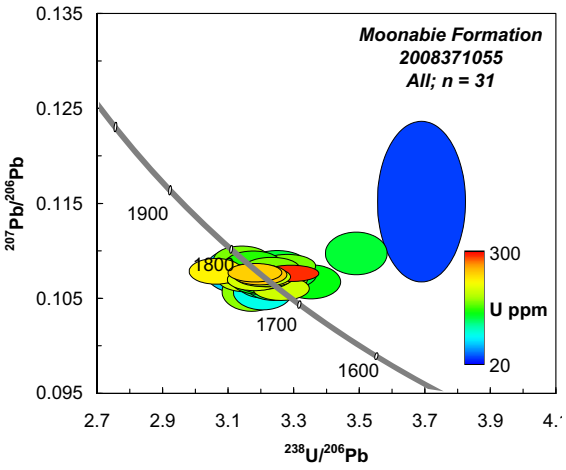

Figure 1.3. *Tera-Wasserburg concordia diagram showing results of zircon analyses from the Moonabie Formation (2008371055), coloured according to U content.*

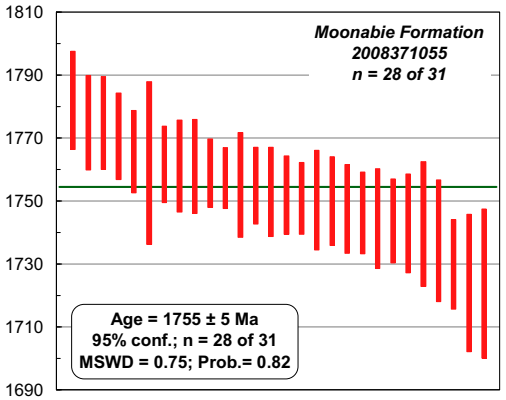

Figure 1.4. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of zircon analyses from the Moonabie Formation (2008371055).*

U-Pb Isotopic Results

Thirty-one analyses were collected, from 31 different zircon grains. Three analyses have been disregarded in age calculations due to the percentage of $^{206}Pb_c$ exceeding 0.5%. Of these three rejected analyses, two are also more than 10% discordant (Figure 1.3). The remaining 28 analyses contain <0.5% $^{206}Pb_c$, and are <10% discordant, and yield a single age population with a weighted mean $^{207}Pb/^{206}Pb$ age of 1755 ± 5 Ma (95% confidence; MSWD = 0.75; probability of fit = 0.82; n = 28; Figure 1.4).

Geochronological Interpretation

The age of 1755 ± 5 Ma represents a maximum depositional age for this sedimentary rock. The unimodal age data also indicate that the provenance of Moonabie Formation at this location was dominated by a source of age ~1755 Ma.

Table 1.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371055 (1958093), Moonabie Formation, SE Mt Whyalla.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Coherent ~1750 Ma detrital zircon component (n= 28)											
55.17.1.1	-0.09	174	76	0.45	3.10	1.5	.1090	0.9	1782	16	-1
55.23.1.1	0.06	136	70	0.53	3.21	1.5	.1085	0.8	1775	15	2
55.28.1.1	0.11	155	96	0.64	3.14	1.5	.1085	0.8	1775	15	0
55.25.1.1	0.14	172	98	0.59	3.24	1.5	.1083	0.8	1771	14	2
55.6.1.1	0.06	173	105	0.62	3.19	1.5	.1080	0.7	1766	13	1
55.4.1.1	0.14	73	42	0.60	3.08	1.7	.1078	1.4	1762	26	-3
55.29.1.1	0.01	170	107	0.65	3.13	1.8	.1077	0.7	1762	13	-1
55.24.1.1	0.15	168	91	0.56	3.15	1.7	.1077	0.8	1761	15	-1
55.14.1.1	0.08	229	84	0.38	3.01	1.5	.1077	0.8	1761	15	-5
55.15.1.1	0.07	246	109	0.46	3.14	1.4	.1076	0.6	1759	11	-1
55.10.1.1	0.02	291	193	0.69	3.25	1.4	.1075	0.5	1757	10	2
55.13.1.1	0.18	137	78	0.59	3.24	1.5	.1074	0.9	1755	17	1
55.5.1.1	0.06	251	124	0.51	3.13	1.5	.1073	0.7	1755	12	-2
55.3.1.1	0.14	164	85	0.54	3.13	1.5	.1072	0.8	1753	14	-2
55.21.1.1	0.13	232	147	0.65	3.18	1.4	.1072	0.7	1752	13	-1
55.16.1.1	0.02	196	93	0.49	3.17	1.5	.1071	0.7	1751	13	-1
55.8.1.1	0.08	123	75	0.63	3.18	1.8	.1071	0.9	1750	16	-1
55.12.1.1	0.13	160	76	0.49	3.17	1.5	.1071	0.7	1750	13	-1
55.9.1.1	0.19	175	147	0.87	3.22	1.5	.1069	0.8	1747	15	0
55.7.1.1	0.08	205	127	0.64	3.14	1.5	.1068	0.7	1746	13	-2
55.18.1.1	0.12	156	87	0.58	3.17	1.5	.1067	0.9	1744	16	-1
55.20.1.1	0.19	199	121	0.63	3.12	1.7	.1067	0.8	1744	14	-3
55.2.1.1	0.12	146	76	0.54	3.16	1.5	.1066	0.9	1743	16	-2
55.11.1.1	0.21	122	72	0.61	3.20	1.6	.1066	1.1	1743	20	0
55.26.1.1	0.24	130	57	0.45	3.20	1.5	.1063	1.1	1737	20	-1
55.30.1.1	0.16	202	121	0.62	3.22	1.5	.1059	0.8	1730	15	-1
55.31.1.1	0.24	94	45	0.49	3.17	1.6	.1055	1.2	1724	22	-3
55.1.1.1	0.28	177	107	0.63	3.10	1.8	.1055	1.3	1724	24	-4
Analyses with $^{206}Pb_c$ >0.5% and/or >10% discordant (n = 3)											
55.27.1.1	1.58	35	115	3.39	3.65	2.2	.1151	5.1	1881	92	20
55.22.1.1	0.56	137	153	1.15	3.45	1.5	.1096	1.5	1793	27	9
55.19.1.1	0.53	145	78	0.55	3.31	1.5	.1066	1.3	1742	23	2

2. VOLCANIC IN MOONABIE FORMATION, SE MOUNT WHYALLA: 2008371054

GA Sample ID:	**2008371054**
GA Sample Number:	**1958092**
Other Sample ID:	**R1721968 (PIRSA #)**
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**728615 6361333 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**28/5/2008**
Formal Name:	**Moonabie Formation**
Informal Name:	
Lithology:	**felsic volcanic sill or dyke**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6062**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**2 – 8/8/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.21% (2σ) [55 of 59]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.1 ± 1.9 Ma [30 of 30]**
Interpreted Age:	**1752 ± 10 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

This sample comes from ~20 km NW of the city of Whyalla, Eyre Peninsula, South Australia. Sampled from the top of SE Mt Whyalla, this rock occurs as a small sill or dyke of quartz-phyric felsic rock, ~10 metres in maximum dimension, sitting within gently east dipping Moonabie Formation. The rock contains quartz phenocrysts in a fine-grained groundmass (Figure 2.1).

Figure 2.1 (left). *Outcrop photo of volcanic in Moonabie Formation on SE Mt Whyalla (2008371054).*

Zircon Description

Relatively few zircons were retrieved from this sample, with only ~50 grains mounted for analysis. Zircons from this sample are typically rather equant, blocky, euhedral grains, ~100 x 120 μm in size. In transmitted light, grains range from clear to dark honey colour, and many grains are almost opaque. Most grains exhibit oscillatory internal zoning evident in cathodoluminescence (CL) images (Figure 2.2).

U-Pb Isotopic Results

Thirty-eight analyses were collected, from 37 different zircon grains. These analyses are dispersed along a discordia trend suggesting variable degrees of Pb-loss, during a single, non-zero age event. A discordia fitted through all 38 data points yields upper and lower intercept ages

of 1751 ± 10 Ma and 465 ± 94 Ma, respectively (MSWD 1.9, Figure 2.3). Alternatively, 12 analyses may be rejected on the basis of >0.5% $^{206}Pb_c$, and 2 analyses rejected due to significant reverse discordance. Twenty three of the remaining 24 analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1744 ± 6 Ma (95% confidence; MSWD = 1.05; probability of fit = 0.39). The rejected analysis from this weighted mean age is 10% discordant, and yields the youngest age of the group. Despite the acceptable statistical grouping of these 23 analyses, the evidence for non-zero age Pb-loss suggests this mean age is likely to be a slight underestimate of the true age. A discordia fitted through the 24 analyses with <0.5% $^{206}Pb_c$, and not including two reversely discordant analyses, yields upper and lower intercept ages of 1752 ± 10 Ma and 531 ± 210 Ma, respectively (MSWD = 0.90; Figure 2.4).

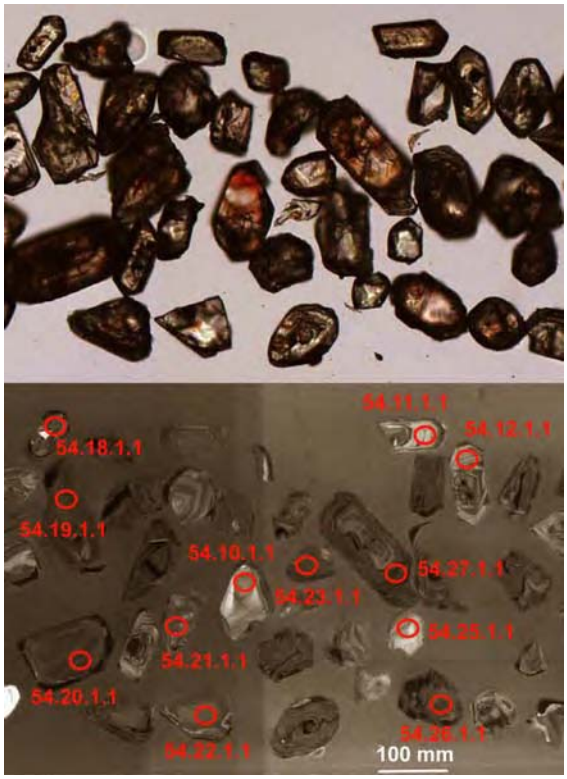

Figure 2.2. *Representative transmitted light and cathodoluminescence images of zircons from volcanic in Moonabie Formation, SE Mt Whyalla (2008371054), with locations of some SHRIMP analyses.*

Geochronological Interpretation

The upper intercept age of 1752 ± 10 Ma is interpreted as the crystallisation age of this volcanic or subvolcanic rock within the Moonabie Formation. This age also represents a minimum age for deposition of the underlying Moonabie Formation.

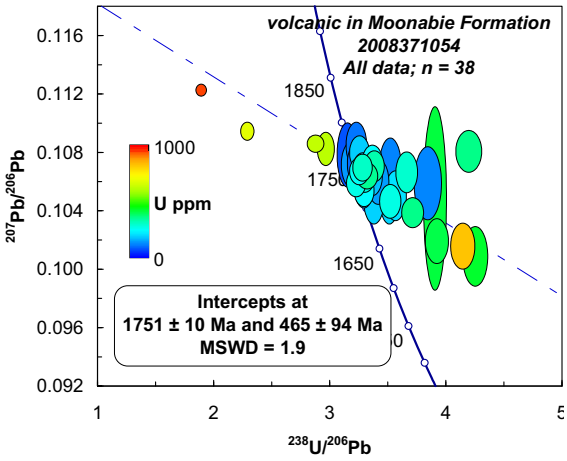

Figure 2.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the unnamed volcanic in the Moonabie Formation (2008371054), coloured according to U content.*

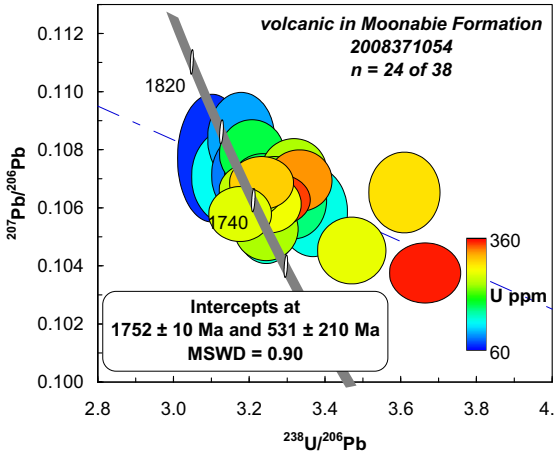

Figure 2.4. *Tera-Wasserburg concordia diagram showing results of zircon analyses from the unnamed volcanic in the Moonabie Formation (2008371054), coloured according to U content. Here, only analyses with <0.5% $^{206}Pb_c$ are shown, and two reversely discordant analyses have also been excluded.*

Table 2.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371054 (1958092), unnamed volcanic in Moonabie Formation.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Igneous crystallisation age (upper intercept of discordia), (n = 24)											
54.25.1.1	0.11	104	67	0.67	3.20	1.8	.1086	1.0	1776	18	1
54.2.1.1	0.05	182	205	1.16	3.23	1.8	.1081	0.7	1767	13	2
54.1.1.1	0.26	72	100	1.44	3.12	1.9	.1079	1.4	1765	25	-2
54.4.1.1	0.15	239	154	0.66	3.34	1.7	.1075	0.7	1757	12	4
54.30.1.1	-0.01	92	110	1.24	3.21	1.9	.1073	0.9	1755	16	0
54.9.1.1	0.16	195	261	1.39	3.24	1.7	.1073	0.8	1754	14	1
54.14.1.1	0.14	135	49	0.37	3.16	2.0	.1073	1.0	1754	18	-1
54.3.2.1	0.41	327	326	1.03	3.35	1.7	.1071	0.7	1751	12	4
54.37.1.1	0.08	303	197	0.67	3.25	1.7	.1071	0.6	1750	10	1
54.5.1.1	0.06	179	180	1.04	3.25	1.8	.1069	0.7	1748	13	1
54.20.1.1	0.14	226	190	0.87	3.29	1.7	.1069	0.7	1747	12	2
54.38.1.1	0.05	248	87	0.36	3.22	1.7	.1068	0.6	1746	11	0
54.26.1.1	0.35	293	395	1.39	3.63	1.7	.1067	0.9	1744	16	11
54.13.1.1	0.13	347	167	0.50	3.29	1.8	.1065	0.6	1740	10	2
54.32.1.1	0.20	170	190	1.15	3.34	1.8	.1065	0.8	1740	15	3
54.39.1.1	0.28	221	138	0.65	3.26	1.7	.1064	0.8	1739	14	1
54.8.1.1	0.11	273	225	0.85	3.27	1.7	.1063	0.6	1738	11	1
54.33.1.1	0.17	147	123	0.87	3.26	1.8	.1063	0.9	1737	17	1
54.15.1.1	0.28	139	76	0.57	3.39	1.8	.1061	1.0	1733	18	4
54.22.1.1	0.09	264	169	0.66	3.19	1.7	.1060	0.6	1732	11	-1
54.34.1.1	0.37	150	95	0.65	3.26	1.8	.1059	1.0	1730	19	0
54.3.1.1	0.19	238	175	0.76	3.26	1.7	.1055	0.7	1723	12	0
54.21.1.1	0.41	268	131	0.50	3.49	1.7	.1047	0.7	1710	13	5
54.17.1.1	0.35	354	565	1.65	3.69	1.7	.1040	0.7	1696	12	10
>0.5% ^{206}Pbc, >10% discordant, or <-10% discordant (n = 14)											
54.11.1.1	0.15	951	559	0.61	1.85	1.7	.1124	0.2	1839	4	-34
54.31.1.1	0.58	684	400	0.60	2.25	1.7	.1096	0.4	1792	7	-24
54.16.1.1	0.13	630	313	0.51	2.84	1.7	.1087	0.4	1778	7	-8
54.12.1.1	2.06	619	413	0.69	2.93	1.7	.1083	0.7	1771	13	-6
54.36.1.1	1.08	355	480	1.39	4.17	1.8	.1082	0.9	1769	16	28
54.10.1.1	0.75	116	87	0.78	3.49	1.8	.1070	1.3	1750	23	8
54.27.1.1	0.77	206	174	0.87	3.54	1.7	.1051	1.1	1716	20	7
54.29.1.1	1.02	118	459	4.00	3.81	2.0	.1060	1.6	1731	29	15
54.18.1.1	1.86	189	297	1.62	3.48	1.8	.1054	1.4	1720	25	6
54.19.1.1	3.37	412	442	1.11	3.88	1.7	.1049	4.0	1713	73	16
54.24.1.1	0.88	187	178	0.98	3.35	1.8	.1049	1.1	1712	20	2
54.35.1.1	1.78	403	167	0.43	3.89	1.7	.1020	1.0	1661	18	13
54.28.1.1	2.52	826	1330	1.66	4.12	1.7	.1017	1.0	1655	19	18
54.23.1.1	1.66	425	485	1.18	4.23	1.7	.1009	1.3	1641	25	20

3. PANDURRA FORMATION, RED ROCK HILL: 2008371053

GA Sample ID:	**2008371053**
GA Sample Number:	**1958091**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**727773 6373240 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**28/5/2008**
Formal Name:	**Pandurra Formation**
Informal Name:	
Lithology:	**Coarse-grained pink sandstone**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6102**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**06 – 12/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.07% (2σ) [10 of 10]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.5 ± 3.7 Ma [9 of 9]**
Acquisition Date:	**06 – 12/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.25% (2σ) [13 of 13]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.9 ± 3.5 Ma [10 of 10]**
Acquisition Date:	**31/1 – 01/2/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.0% (2σ) [12 of 12]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.8 ± 2.7 Ma [10 of 10]**
Acquisition Date:	**02 – 03/2/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.0% (2σ) [8 of 9]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.5 ± 2.7 Ma [8 of 8]**
Interpreted Age:	**1575 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample was collected ~6 km south-east of Roopena Station, on the eastern Eyre Peninsula, South Australia. The sample is a pink, coarse-grained, cross-bedded sandstone (Figure 3.1).

Zircon Description

Zircons from this sample range from ~80 µm to ~180 µm in length, and are clear and colourless to pale brown in colour. Some grains have an euhedral morphology, and preserve some prismatic terminations, whereas other grains are sub-rounded with minor pitting (Figure 3.2). Cathodoluminescence images record oscillatory zoning within most grains, while some grains have a homogeneous dark cathodoluminescence character.

Figure 3.1. *Coarse-grained, cross-bedded sandstone of the Pandurra Formation from Red Rock Hill (sample 2008371053).*

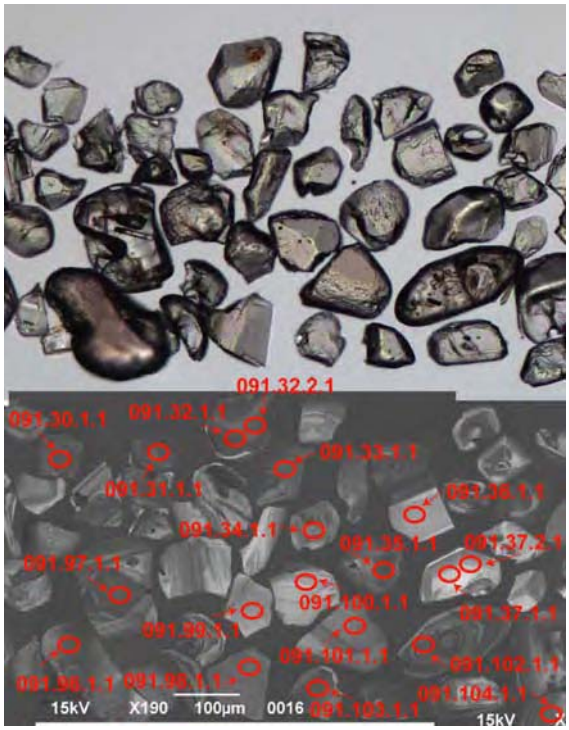

Figure 3.2. *Representative transmitted light and cathodoluminescence images of zircons from the Pandurra Formation (2008371053), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Seventy-two analyses were undertaken during the initial analytical session on this sample, including 70 provenance analyses and 2 re-analyses of youngest grains. Due to analytical conditions, there are large uncertainties on individual ages from this session, resulting in a large uncertainty on maximum depositional age calculation. Therefore, another analytical session on this sample was undertaken to increase both the number of ages in the provenance spectra and also to decrease the uncertainty on individual ages. During this second session, a further 74 analyses were completed. As the age of the OG1 standard is within uncertainty for both sessions, these datasets were combined, to give a total of 146 analyses, including 17 re-analyses on some zircons.

Two analyses containing common Pb contents greater than an arbitrary value of 0.5% were excluded from further consideration. In order to minimise biasing the dominant age populations, only one analysis from each zircon has been included in the probability density distribution and calculation of the maximum depositional age. As analytical precision was generally greater during the second analytical session, where a grain was analysed in both sessions, the analysis from the second session has been used in the age spectrum.

The remaining 127 analyses range in age from ~2540 Ma to ~1514 Ma, and include four ages between ~2450 Ma and ~2430 Ma, ages at ~2027 Ma and at ~2005 Ma, four ages between ~1908 Ma and 1809 Ma and a large range of ages between ~1782 Ma and the youngest individual age at ~1514 Ma (Figure 3.3).

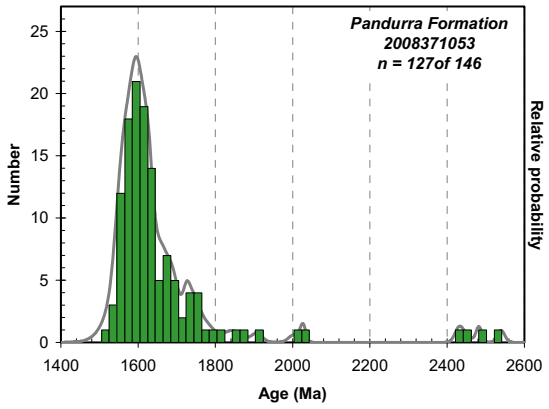

Figure 3.3. *Probability density diagram of zircon analyses from the Pandurra Formation (2008371053).*

The MSWD for the ~1782 Ma to ~1514 Ma cluster indicates that it is not a single population. Mixture modelling of these analyses suggests a youngest age of 1568 ± 9 Ma (2σ). Alternatively, using the MSWD and probability of fit as a guide, the youngest statistically coherent age grouping has a weighted mean $^{207}Pb/^{206}Pb$ age of 1575 ± 5 Ma (95% confidence; n = 59; MSWD = 1.3; probability of fit = 0.07; Figure 3.4).

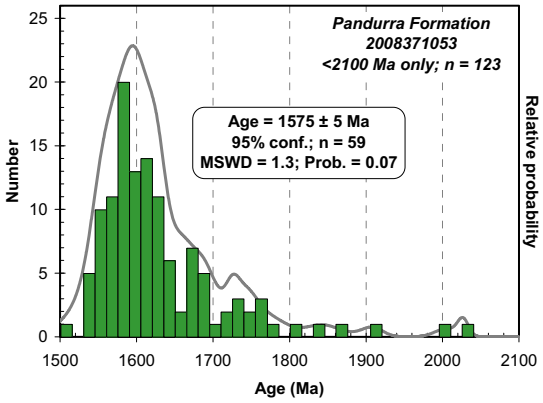

Figure 3.4. *Probability density diagram for zircon analyses from the Pandurra Formation (2008371053) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

Geochronological Interpretation

The weighted mean age of 1575 ± 5 Ma (95% confidence; n = 59) calculated from the youngest statistically coherent age grouping is within error of the youngest mixture modelling age, and can be used to define a maximum depositional age for this Pandurra Formation sample.

Table 3.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371053 (1958091), Pandurra Formation, Red Rock Hill.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircon (n = 127)											
091.105.1.1	0.06	97	153	1.63	2.08	1.3	.1682	0.6	2540	10	0
091.45.1.1	0.02	144	153	1.10	2.15	1.8	.1625	0.4	2482	7	1
091.39.2.1	0.20	50	227	4.65	2.16	1.5	.1590	0.9	2445	15	0
091.117.1.1	-0.07	70	14	0.20	2.19	1.7	.1576	0.6	2430	11	0
091.121.1.1	0.01	247	170	0.71	2.77	1.1	.1249	0.4	2027	7	2
091.109.1.1	-0.04	61	33	0.56	2.80	1.4	.1233	0.8	2005	15	2
091.20.1.1	0.12	128	90	0.73	2.89	1.3	.1168	0.8	1908	14	0
091.81.1.1	0.04	30	26	0.89	3.07	2.4	.1138	1.6	1861	28	2
091.54.1.1	0.14	73	20	0.29	3.09	1.9	.1127	1.0	1843	18	2
091.83.1.1	-0.22	38	29	0.79	3.16	1.7	.1106	1.5	1809	28	2
091.19.2.1	0.06	104	137	1.36	3.20	1.6	.1090	1.1	1782	20	2
091.82.1.1	0.06	62	41	0.68	3.19	1.4	.1081	1.1	1767	20	1
091.119.1.1	-0.02	62	90	1.49	3.23	1.4	.1075	1.1	1758	20	1
091.72.1.1	-0.11	50	74	1.53	3.20	1.5	.1075	1.1	1757	20	0
091.70.1.1	0.02	143	99	0.72	3.31	1.8	.1071	0.7	1750	12	3
091.91.1.1	-0.06	153	113	0.76	3.31	1.2	.1067	0.7	1743	12	2
091.13.1.1	0.05	146	144	1.01	3.18	1.6	.1063	0.7	1737	13	-1
091.29.2.1	0.00	131	59	0.47	3.27	1.2	.1060	0.7	1731	12	1
091.69.1.2	-0.01	253	223	0.91	3.28	1.1	.1057	0.5	1726	9	1
091.125.1.1	0.02	209	194	0.96	3.37	1.1	.1056	0.5	1724	10	3
091.42.1.1	0.10	144	84	0.60	3.32	1.8	.1049	0.7	1712	14	1
091.107.1.1	0.01	154	202	1.35	3.35	1.2	.1046	0.7	1707	12	1
091.114.1.1	0.07	70	75	1.10	3.44	1.7	.1038	1.3	1693	24	3
091.89.1.1	0.09	242	222	0.95	3.38	1.1	.1038	0.6	1693	11	1
091.21.2.1	-0.02	113	83	0.76	3.34	1.5	.1036	0.7	1690	13	0
091.1.1.1	0.06	205	310	1.56	3.36	1.2	.1034	0.7	1686	13	0
091.116.1.1	0.04	109	50	0.47	3.38	1.3	.1032	0.8	1683	15	1
091.126.1.1	-0.10	70	67	0.98	3.46	1.5	.1028	1.0	1676	18	2
091.92.1.1	-0.19	42	23	0.56	3.60	2.2	.1026	1.4	1671	26	6
091.115.1.1	-0.02	98	57	0.61	3.39	1.3	.1026	0.8	1671	14	0
091.28.2.1	-0.02	124	62	0.51	3.40	1.2	.1026	0.7	1671	13	1
091.5.1.1	0.03	90	76	0.88	3.47	1.6	.1025	0.9	1670	16	2
091.43.1.1	0.44	125	118	0.97	3.44	1.8	.1024	1.2	1668	21	2
091.36.1.1	0.08	33	27	0.86	3.56	2.6	.1023	1.5	1665	28	4
091.60.1.1	0.04	231	205	0.92	3.50	1.7	.1019	0.5	1659	10	2
091.34.1.1	0.07	79	51	0.67	3.50	1.9	.1018	1.0	1658	18	2
091.56.1.1	0.05	111	96	0.89	3.54	1.8	.1011	0.9	1645	16	3
091.78.1.1	-0.11	96	86	0.92	3.56	1.4	.1011	1.0	1644	19	3
091.99.1.1	0.06	40	36	0.93	3.46	1.6	.1009	1.4	1640	26	0
091.63.1.1	0.05	96	158	1.70	3.57	1.9	.1008	1.0	1639	18	3
091.15.1.1	-0.01	141	95	0.70	3.51	1.2	.1007	0.7	1637	12	1
091.87.1.1	-0.09	74	44	0.61	3.49	1.4	.1007	1.0	1637	19	1
091.66.1.1	0.26	103	113	1.13	3.57	1.8	.1005	1.4	1633	26	2
091.26.1.1	0.04	187	149	0.82	3.60	1.2	.1002	0.6	1629	12	3
091.86.1.1	0.02	384	101	0.27	3.52	1.1	.1002	0.5	1628	9	1
091.61.1.1	-0.03	115	168	1.51	3.55	1.8	.1002	0.9	1628	17	2
091.71.1.1	0.27	50	48	0.98	3.46	1.5	.1002	1.6	1627	30	-1
091.7.2.1	-0.04	86	62	0.75	3.54	1.3	.1001	0.9	1626	16	1
091.24.1.1	0.05	204	46	0.23	3.46	1.2	.1001	0.6	1625	11	-1
091.53.1.1	0.11	91	51	0.58	3.51	1.9	.1000	1.0	1625	19	0
091.118.1.1	0.00	203	168	0.86	3.56	1.2	.1000	0.6	1624	11	2
091.122.1.1	-0.28	83	94	1.17	3.59	1.3	.0999	1.2	1623	23	2
091.95.1.1	-0.15	42	175	4.28	3.61	1.6	.0999	1.6	1623	29	3
091.6.1.1	0.22	93	133	1.48	3.60	1.3	.0997	1.4	1619	26	3
091.11.1.1	0.19	163	121	0.77	3.48	1.2	.0997	1.0	1618	18	-1
091.16.1.1	-0.01	82	53	0.68	3.55	1.4	.0996	0.9	1616	16	1
091.2.1.1	0.07	80	75	0.96	3.59	1.5	.0995	1.2	1615	22	2
091.104.1.1	-0.01	163	103	0.65	3.47	1.3	.0995	0.6	1615	12	-1
091.73.1.1	0.22	221	148	0.69	3.74	1.1	.0995	0.8	1615	15	6
091.22.1.1	0.15	32	60	1.93	3.58	1.8	.0994	2.4	1612	45	2
091.27.2.1	0.08	100	139	1.44	3.66	1.4	.0993	1.2	1612	22	3
091.59.1.1	0.04	194	194	1.04	3.62	1.7	.0993	0.7	1611	13	2
091.127.1.1	0.04	125	142	1.17	3.53	1.3	.0992	0.8	1610	15	0
091.44.1.1	0.13	128	113	0.91	3.67	1.8	.0992	1.0	1610	19	4

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
091.120.1.1	-0.05	84	95	1.16	3.56	1.3	.0992	0.9	1609	16	1
091.46.1.1	-0.01	97	166	1.77	3.58	1.8	.0992	0.8	1609	15	1
091.84.1.1	0.07	77	73	0.97	3.59	1.4	.0990	1.1	1605	21	1
091.30.1.1	-0.01	175	170	1.01	3.57	1.7	.0989	0.6	1604	11	1
091.17.1.1	0.14	82	60	0.75	3.55	1.6	.0989	1.1	1603	20	0
091.9.1.1	-0.04	102	53	0.54	3.63	1.3	.0989	0.9	1603	16	2
091.94.1.1	-0.01	103	99	0.99	3.52	1.3	.0989	0.8	1603	15	-1
091.128.1.1	-0.05	37	42	1.17	3.69	1.6	.0989	1.3	1603	25	4
091.77.1.1	0.16	81	82	1.04	3.65	1.4	.0987	1.0	1600	19	2
091.68.1.2	0.01	185	146	0.82	3.54	1.2	.0987	0.6	1599	11	0
091.79.1.1	-0.04	148	199	1.38	3.61	1.2	.0987	0.7	1599	14	1
091.57.2.1	-0.04	34	38	1.14	3.77	1.7	.0986	1.7	1599	31	5
091.75.1.1	0.42	146	277	1.96	3.73	1.2	.0986	1.1	1599	21	4
091.50.1.1	0.02	100	55	0.57	3.70	1.8	.0986	0.8	1597	16	4
091.74.1.1	-0.01	261	211	0.84	3.52	1.1	.0984	0.5	1594	10	-1
091.8.1.1	0.23	38	34	0.93	3.63	1.7	.0982	1.9	1591	36	1
091.32.2.1	0.07	129	77	0.62	3.60	1.2	.0982	0.8	1590	15	1
091.47.2.1	0.20	102	114	1.15	3.58	1.5	.0981	1.1	1589	20	0
091.85.1.1	0.04	255	252	1.02	3.67	1.1	.0981	0.6	1588	11	2
091.25.1.1	0.01	48	30	0.66	3.53	1.6	.0980	1.3	1587	24	-1
091.88.1.1	0.10	95	105	1.15	3.58	1.3	.0979	1.1	1585	20	0
091.102.1.1	0.01	128	76	0.61	3.66	1.2	.0979	0.7	1585	14	2
091.90.1.1	0.15	118	101	0.89	3.57	1.3	.0979	0.9	1585	16	-1
091.111.1.1	0.02	60	38	0.65	3.74	1.5	.0979	1.2	1585	22	4
091.65.1.1	0.09	80	56	0.72	3.52	1.9	.0979	1.3	1584	25	-2
091.4.1.1	0.02	81	103	1.31	3.73	1.8	.0978	1.0	1583	18	3
091.97.1.1	0.10	144	184	1.32	3.75	1.2	.0978	0.8	1583	16	4
091.98.1.1	0.03	63	88	1.46	3.52	1.4	.0978	1.1	1583	21	-2
091.48.1.1	0.02	81	101	1.30	3.72	1.9	.0977	1.1	1580	21	3
091.110.1.1	0.07	80	57	0.74	3.44	1.4	.0976	1.1	1579	20	-4
091.64.1.1	0.16	102	126	1.28	3.71	1.8	.0976	1.0	1579	19	3
091.58.2.1	0.08	79	78	1.02	3.64	1.9	.0976	0.9	1578	17	1
091.41.1.1	0.11	153	269	1.82	3.72	1.8	.0975	0.8	1577	15	3
091.62.1.1	0.28	72	89	1.28	3.61	1.9	.0975	1.5	1577	27	0
091.51.1.1	0.00	109	64	0.61	3.65	1.8	.0974	0.8	1576	15	1
091.55.1.1	0.09	142	68	0.49	3.64	1.9	.0974	0.9	1576	16	1
091.103.1.1	0.05	149	132	0.91	3.70	1.2	.0974	0.7	1574	14	2
091.106.1.1	-0.01	204	116	0.59	3.75	1.2	.0972	0.6	1572	11	3
091.96.1.1	0.12	82	57	0.72	3.57	1.8	.0972	1.1	1572	21	-1
091.113.1.1	0.10	83	81	1.02	3.90	1.3	.0972	1.1	1571	20	7
091.52.2.1	-0.06	90	62	0.71	3.75	1.9	.0971	1.3	1570	24	3
091.40.1.1	0.09	98	43	0.46	3.65	1.8	.0971	1.0	1568	18	1
091.100.1.1	0.15	28	42	1.55	3.50	1.9	.0969	2.1	1566	40	-3
091.12.1.1	-0.35	47	49	1.10	3.89	1.6	.0969	2.2	1566	41	6
091.112.1.1	-0.07	162	75	0.48	3.79	1.3	.0968	0.7	1563	13	4
091.49.1.1	0.21	96	48	0.52	3.56	1.9	.0968	1.2	1563	23	-2
091.76.1.1	0.10	118	177	1.55	3.65	1.3	.0967	1.0	1561	18	0
091.124.1.1	0.09	78	38	0.50	3.69	1.3	.0965	1.1	1557	21	1
091.31.1.1	0.04	124	81	0.67	3.98	1.8	.0965	0.8	1557	15	8
091.108.1.1	0.00	209	296	1.46	3.83	1.2	.0964	0.6	1556	11	4
091.93.1.1	0.02	269	237	0.91	3.72	1.1	.0962	0.7	1553	12	1
091.35.1.1	0.03	142	158	1.15	3.79	1.8	.0962	0.7	1552	14	3
091.129.1.1	0.05	163	141	0.89	3.69	1.3	.0962	0.7	1551	14	0
091.80.1.1	0.27	56	48	0.89	3.63	1.5	.0961	1.6	1550	30	-1
091.18.1.1	0.25	60	67	1.15	3.65	1.5	.0961	1.5	1550	28	-1
091.123.1.1	0.02	152	293	2.00	3.68	1.2	.0961	0.7	1550	13	0
091.3.1.1	0.30	41	17	0.44	3.68	1.9	.0959	2.5	1546	47	0
091.67.2.1	0.01	124	43	0.36	3.63	1.2	.0957	0.7	1542	14	-2
091.37.2.1	0.14	26	23	0.94	3.69	1.9	.0957	2.1	1541	40	0
091.38.1.1	0.13	98	54	0.56	3.62	2.1	.0955	1.1	1537	20	-2
091.14.1.1	0.24	69	59	0.88	3.67	1.4	.0953	1.5	1535	29	-1
091.10.1.1	0.03	80	27	0.35	3.66	1.4	.0953	1.1	1534	21	-1
091.101.1.1	0.22	53	59	1.15	3.62	1.5	.0943	1.6	1514	29	-4
Repeat-grain analyses (n = 17)											
091.39.1.1	0.15	47	215	4.70	2.20	2.6	.1596	0.9	2451	15	2
091.19.1.1	0.17	94	115	1.26	3.23	1.3	.1073	1.2	1755	22	1
091.29.1.1	0.02	93	73	0.81	3.27	1.8	.1053	0.7	1719	13	0
091.69.1.1	0.05	259	229	0.91	3.22	1.8	.1053	0.5	1719	9	-1
091.21.1.1	-0.03	128	101	0.81	3.44	1.5	.1030	0.7	1680	13	2

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
091.28.1.1	0.11	88	48	0.57	3.43	1.9	.1018	0.9	1657	17	0
091.32.1.1	0.05	238	98	0.43	3.68	1.7	.1001	0.6	1626	11	5
091.27.1.1	0.03	106	115	1.12	3.61	1.3	.0995	0.8	1615	15	3
091.68.1.1	0.11	169	139	0.85	3.49	1.8	.0988	0.8	1602	14	-1
091.7.1.1	0.15	113	86	0.78	3.62	1.3	.0988	1.0	1601	18	2
091.47.1.1	0.33	85	56	0.69	3.54	1.9	.0977	1.3	1580	24	-1
091.58.3.1	0.16	74	68	0.95	3.72	1.4	.0976	1.3	1579	25	3
091.67.1.1	-0.01	127	65	0.53	3.67	1.8	.0971	0.7	1568	14	1
091.37.1.1	0.05	21	17	0.85	3.64	2.4	.0961	2.9	1550	55	-1
091.57.1.1	0.18	63	79	1.29	3.73	1.9	.0959	1.3	1546	25	1
091.52.1.1	0.14	107	62	0.60	3.74	1.8	.0951	1.1	1530	20	0
091.58.1.1	0.28	120	159	1.37	3.66	1.8	.0948	1.1	1524	20	-2
Analyses >0.5% $^{206}Pb_c$ (n = 2)											
091.33.1.1	0.84	113	65	0.59	3.89	1.8	.0960	1.7	1548	32	5
091.23.1.1	0.62	56	25	0.47	3.45	1.4	.1030	1.9	1680	34	2

4. PANDURRA FORMATION, MOUNT LAURA: 2008371056

GA Sample ID:	**2008371056**
GA Sample Number:	**1958094**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**735840 6346201 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**29/5/2008**
Formal Name:	**Pandurra Formation**
Informal Name:	
Lithology:	**Coarse-grained cream sandstone**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6102**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**06 – 12/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.25% (2σ) [13 of 13]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.9 ± 3.5 Ma [10 of 10]**
Acquisition Date:	**06 – 12/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.12% (2σ) [8 of 8]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.7 ± 4.5 Ma [9 of 9]**
Interpreted Age:	**1756 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample was collected from Mount Laura, near Whyalla, eastern Eyre Peninsula, South Australia. The sample was collected from the top sandstone of the outcropping section, ~1 m above a coarse conglomerate, and is a coarse-grained, poorly cemented sandstone (Figure 4.1).

Figure 4.1. *Coarse conglomerates overlain by coarse-grained sandstones of the Pandurra Formation from Mount Laura (sample 2008371056).*

Zircon Description

Zircons from this sample are relatively homogeneous in both their morphology and cathodoluminescence character. The grains range from ~125 µm to ~210 µm in length, and are clear and colourless, with some inclusions (Figure 4.2). Most grains have a sub-euhedral to rounded morphology with minor pitting on some surfaces. Cathodoluminescence images record oscillatory zoning within all grains.

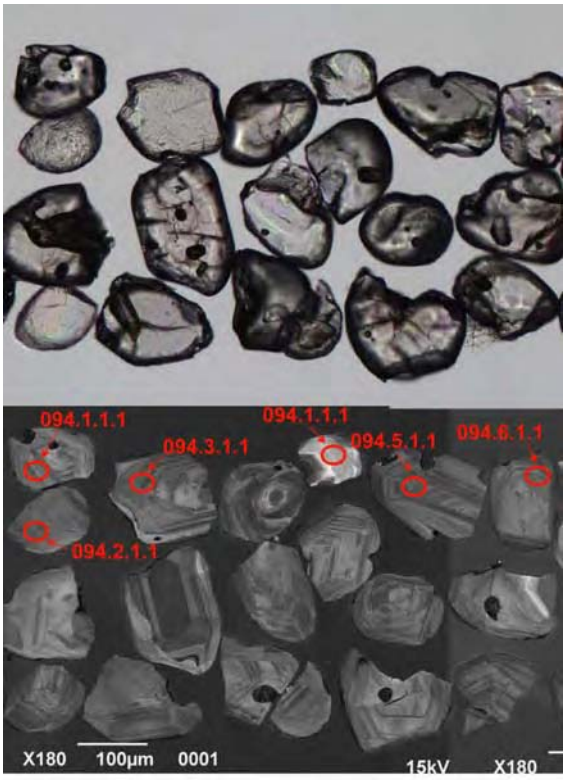

Figure 4.2. *Representative transmitted light and cathodoluminescence images of zircons from the Pandurra Formation (2008371056), with locations of some SHRIMP analyses.*

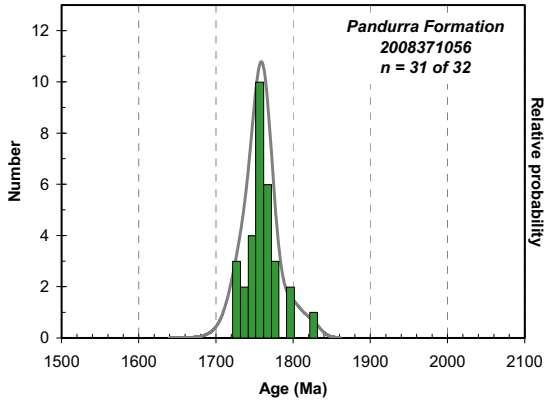

Figure 4.3. *Probability density diagram of zircon analyses from the Pandurra Formation (2008371056).*

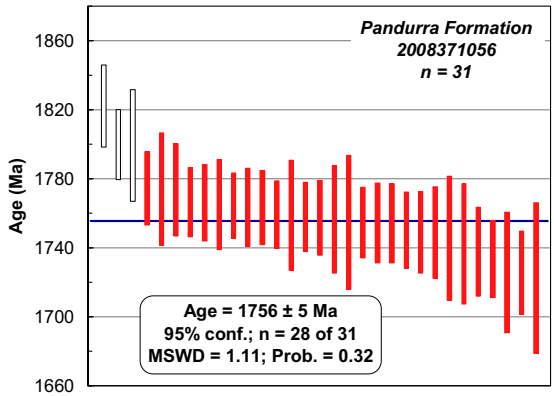

Figure 4.4. *Weighted mean age diagram of zircon analyses from the Pandurra Formation (2008371056). Open bars represent analyses not included in the age calculation.*

U-Pb Isotopic Results

Thirty-two analyses were undertaken, and one analysis with a common Pb content greater than an arbitrary value of 0.5% was excluded from further consideration. The remaining 31 analyses range in age from ~1823 Ma to ~1722 Ma (Figure 4.3), and the MSWD for the entire group indicates that it is not a single population. After excluding the oldest three individuals, the remaining analyses combine to provide a weighted mean $^{207}Pb/^{206}Pb$ age of 1756 ± 5 Ma (95% confidence; n = 28; MSWD = 1.11; probability of fit = 0.32; Figure 4.4).

Geochronological Interpretation

The youngest statistically coherent weighted mean age of 1756 ± 5 Ma (95% confidence; n = 28) can be used to define a maximum depositional age for this sample of the Pandurra Formation. The limited number of provenance ages identified within this sample suggests that the source region for the sandstone contained a limited range of ages.

Table 4.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371056 (1958094), Pandurra Formation, Mount Laura.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Pre ~1756 Ma detrital zircon (n = 3)											
094.17.1.1	0.10	162	66	0.42	3.05	1.8	.1114	0.7	1823	12	0
094.19.1.1	0.01	171	92	0.55	3.24	1.9	.1100	0.6	1800	10	4
094.21.1.1	0.16	102	61	0.62	3.13	1.8	.1100	0.9	1800	16	1
~1756 Ma detrital zircon (n = 28)											
094.34.1.1	-0.01	209	139	0.68	3.25	1.8	.1085	0.6	1774	11	2
094.8.1.1	0.12	96	49	0.53	3.25	1.8	.1085	0.9	1774	16	3
094.33.1.1	0.00	138	78	0.58	3.23	1.8	.1085	0.7	1774	13	2
094.23.1.1	0.01	211	139	0.68	3.23	1.7	.1080	0.6	1766	10	1
094.27.1.1	-0.05	159	86	0.56	3.26	1.7	.1080	0.6	1766	11	2
094.6.1.1	0.10	141	85	0.62	3.22	1.8	.1079	0.7	1765	13	1
094.20.1.1	0.04	220	150	0.70	3.25	1.7	.1079	0.5	1764	9	2
094.1.1.1	0.04	143	89	0.65	3.13	1.8	.1078	0.6	1763	11	-1
094.22.1.1	-0.01	155	101	0.67	3.28	2.1	.1078	0.6	1763	11	3
094.12.1.1	0.04	233	152	0.67	3.26	1.7	.1076	0.5	1759	10	2
094.28.1.1	0.04	114	70	0.63	3.29	1.8	.1076	0.9	1759	16	3
094.11.1.1	0.05	224	142	0.65	3.29	1.7	.1075	0.6	1758	10	3
094.14.1.1	0.02	179	107	0.62	3.23	1.8	.1075	0.6	1757	11	1
094.5.1.1	0.00	193	118	0.63	3.24	1.7	.1074	0.9	1756	16	1
094.9.1.1	0.08	82	113	1.42	3.24	1.9	.1073	1.1	1755	19	1
094.3.1.1	0.02	173	97	0.58	3.22	1.7	.1073	0.6	1755	10	1
094.2.1.1	0.03	178	96	0.56	3.20	1.7	.1073	0.6	1754	12	0
094.10.1.1	0.04	156	98	0.65	3.18	1.8	.1073	0.6	1754	11	-1
094.16.1.1	0.01	216	99	0.47	3.20	1.7	.1071	0.6	1750	11	0
094.30.1.1	0.11	189	106	0.58	3.30	1.7	.1070	0.6	1749	12	2
094.32.1.1	-0.02	126	93	0.76	3.28	1.8	.1070	0.7	1749	13	2
094.18.1.1	0.40	132	107	0.84	3.36	1.9	.1068	1.0	1745	18	4
094.29.1.1	0.16	106	75	0.73	3.34	1.8	.1066	1.0	1742	18	3
094.13.1.1	0.11	170	91	0.56	3.27	1.8	.1063	0.7	1738	13	1
094.25.1.1	0.01	156	94	0.62	3.19	1.8	.1061	0.6	1733	11	-1
094.15.1.1	0.14	152	126	0.85	3.36	1.8	.1056	1.0	1725	18	3
094.7.1.1	0.04	163	115	0.73	3.15	1.8	.1056	0.7	1725	12	-3
094.4.1.1	0.02	70	112	1.65	3.22	1.9	.1055	1.2	1722	22	-1
Analysis >0.5% $^{206}Pb_c$ (n = 1)											
094.24.1.1	0.63	180	159	0.91	3.30	1.8	.1071	1.4	1750	26	3

Southern Gawler Craton

SPENCER DOMAIN

The Spencer Domain (Ferris *et al*., 2002) is a north-south oriented region near the eastern margin of the Gawler Craton (Figure v). It is separated from the Cleve Domain to the west by the Kalinjala Mylonite Zone, and from the Olympic Domain to the east by the Roopena Fault. The southern part of the Spencer Domain is dominated by granitoids of the ~1850 Ma Donington Suite. On northern Eyre Peninsula, the Spencer Domain contains metasedimentary rocks of the Middleback Subgroup, including oxidised Banded Iron Formations in the Middleback Ranges that have been mined for iron-ore for the past century. Also present in the Middleback Ranges are granitoids and gneisses previously correlated with the Paleoproterozoic Donington Suite or Moody Suite, but identified in this study to be Mesoarchean in age (Fraser *et al*., 2010). The northern part of the Spencer Domain is overlain by the Corunna Conglomerate, which is in turn overlain by the flat-lying Gawler Range Volcanics.

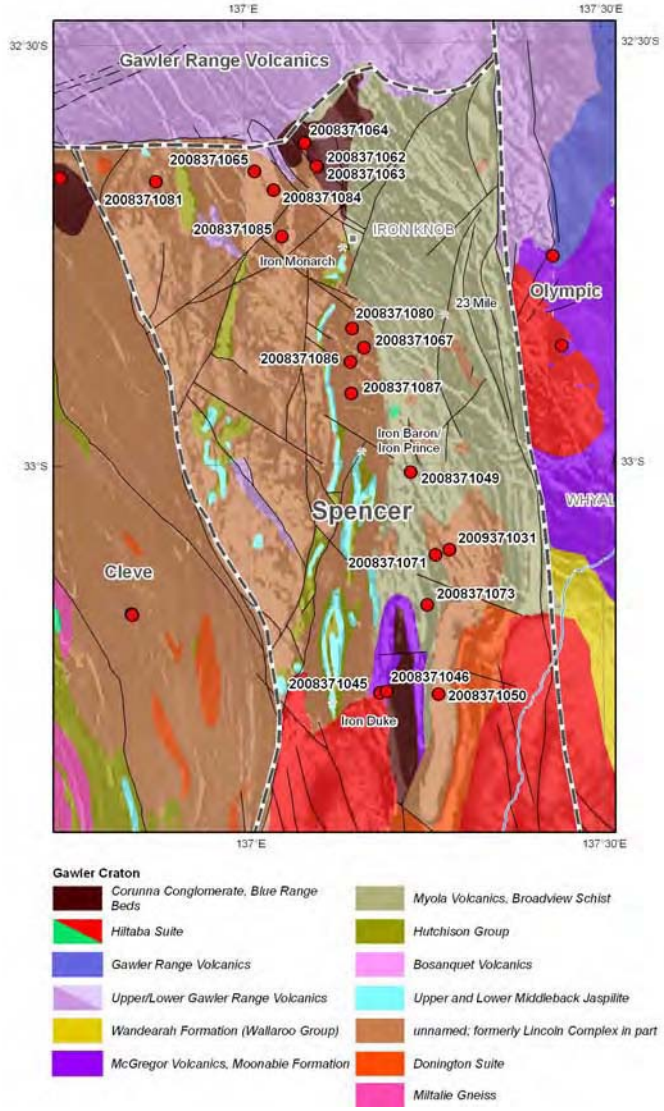

Figure v. *Locations of new samples analysed for SHRIMP U-Pb zircon geochronology from the Spencer Domain, Gawler Craton, South Australia, displayed on a partially transparent solid geology map (Cowley, 2006) laid over a magnetic intensity image.*

5. MYOLA VOLCANICS, AT MYOLA STATION: 2008371049

GA Sample ID:	**2008371049**
GA Sample Number:	**1958087**
Other Sample ID:	**R1721916 (PIRSA #)**
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**708290 6345274 Zone 53**
Collector:	**G. Fraser, N. Neumann, S. McAvaney, M. Szpunar**
Collection Date:	**27/5/2008**
Formal Name:	**Myola Volcanics**
Informal Name:	
Lithology:	**rhyolite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6063**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**18 – 22/9/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.79% (2σ) [38 of 40]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.9 ± 2.1 Ma [18 of 19]**
Interpreted Age:	**1792 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

This sample was collected from the type locality of the Myola Volcanics approximately 1 km NNE of Myola Station, and ~7 km east of the Iron Baron mine (see page 76 of Parker *et al*., 1988), Eyre Peninsula, South Australia. The sample is a purple-grey porphyritic rock breaking with concoidal fracture. It contains phenocrysts of quartz and plagioclase, which are flattened and stretched, and define a subvertical foliation and subhorizontal lineation (Figure 5.1).

Rock from this same outcrop has previously been dated via TIMS U-Pb zircon analyses, yielding an age of 1791 ± 4 Ma (Fanning *et al*., 1988). This age is based on six multigrain zircon fractions, all of which are significantly discordant and one "small sample" zircon fraction, consisting of six clear zircons, that yields a near-concordant $^{207}Pb/^{206}Pb$ age of ~1784 Ma. A discordia regression through six of the seven zircon fractions yields the upper intercept age of 1791 ± 4 Ma.

Figure 5.1. *Outcrop photo of Myola Volcanics, showing subhorizontal lineation.*

Zircon Description

Zircons separated from sample 2008371049 generally display stubby, euhedral morphologies, with typical aspect ratios of between 1.5 and 2. Many grains exhibit sharp pointed crystal

terminations. Zircons are clear and pale hyacinth in colour and many grains contain needle- or rod-like clear inclusions (Figure 5.2). In cathodoluminescence (CL) images zircons display fine-scale internal oscillatory zoning parallel with crystal faces. In most grains this oscillatory zoning extends from centre to edge, without a distinct core. Exceptions to this rule exist in grains in which core regions display patchy, sector zoned or oscillatory zoning that is truncated against an outer, oscillatory-zoned region, suggestive of episodic igneous zircon growth.

Morphologically, all zircons from this sample are interpreted as igneous. There is no convincing morphological evidence for distinctly older zircon cores that might represent inherited zircons.

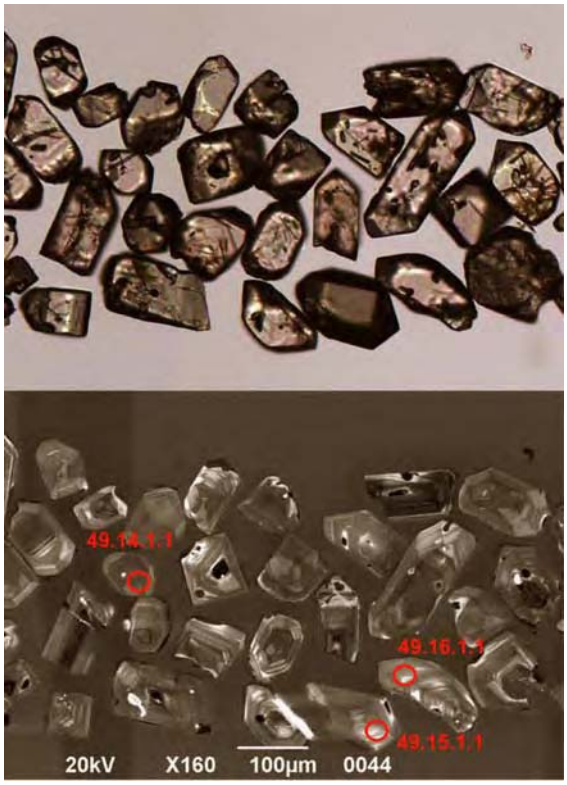

Figure 5.2. *Representative transmitted light and cathodoluminescence images of zircons from the Myola Volcanics (2008371049), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Twenty eight zircon analyses were collected from 28 zircons. All analyses are <5% discordant and contain <0.2% common Pb. All 28 analyses define a single age population with a weighted mean $^{207}Pb/^{206}Pb$ age of 1792 ± 5 Ma (95% confidence; MSWD = 0.91; probability of fit = 0.59; Figures 5.3 & 5.4). These zircons contain between ~80 and 230 ppm U, and Th/U between 0.5 and 0.8.

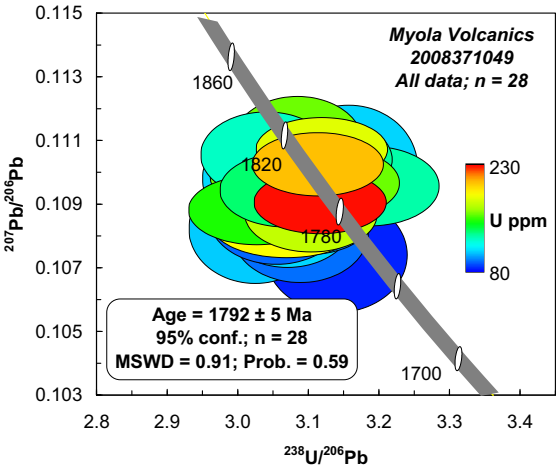

Figure 5.3. *Tera-Wasserburg concordia diagram showing results of zircon analyses from the Myola Volcanics (2008371049, coloured according to U content.*

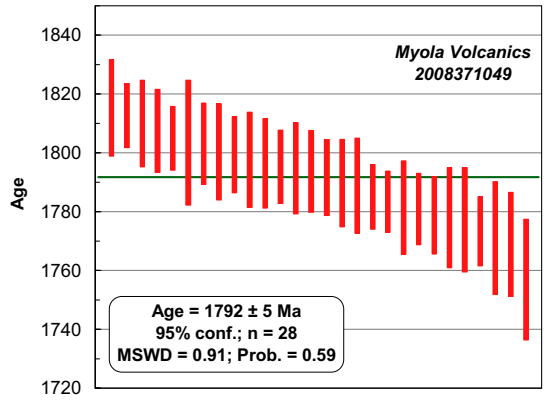

Figure 5.4. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of zircon analyses from the Myola Volcanics (2008371049).*

Geochronological Interpretation

The weighted mean age of 1792 ± 5 Ma is interpreted as the crystallisation age of this volcanic rock, and is consistent with the pre-existing TIMS data (Fanning *et al*., 1988).

Table 5.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371049 (1958087), Myola Volcanics.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Igneous crystallisation (n = 28)											
49.24.1.1	0.03	161	122	0.78	3.08	2.0	.1110	0.9	1815	16	0
49.1.1.1	-0.02	182	118	0.67	3.12	2.0	.1108	0.6	1813	11	1
49.18.1.1	-0.08	126	75	0.61	3.04	2.0	.1106	0.8	1810	15	-1
49.25.1.1	0.03	132	77	0.60	3.12	2.0	.1105	0.8	1807	14	1
49.4.1.1	0.05	205	143	0.72	3.11	2.0	.1103	0.6	1805	11	1
49.7.1.1	0.07	108	63	0.60	3.16	2.1	.1102	1.2	1803	21	2
49.27.1.1	0.13	157	109	0.72	3.09	2.1	.1102	0.8	1803	14	0
49.14.1.1	-0.05	162	110	0.71	3.05	2.0	.1101	0.9	1800	16	-1
49.22.1.1	-0.03	135	77	0.59	3.07	2.1	.1100	0.7	1799	13	-1
49.15.1.1	0.05	109	64	0.60	3.04	2.1	.1099	0.9	1798	16	-2
49.20.1.1	0.01	99	54	0.56	3.08	2.1	.1098	0.8	1796	15	-1
49.5.1.1	0.06	161	99	0.64	3.13	2.1	.1097	0.7	1795	13	0
49.9.1.1	0.09	116	63	0.56	3.08	2.0	.1097	0.8	1795	15	-1
49.26.1.1	0.03	130	70	0.56	3.19	2.0	.1097	0.8	1794	14	2
49.28.1.1	0.08	136	85	0.64	3.07	2.0	.1095	0.7	1792	13	-1
49.21.1.1	-0.04	101	67	0.68	3.08	2.4	.1094	0.8	1790	15	-1
49.17.1.1	0.16	119	68	0.59	3.07	2.1	.1094	0.9	1789	16	-2
49.6.1.1	0.06	229	172	0.78	3.12	2.0	.1091	0.6	1785	11	0
49.3.1.1	0.00	217	167	0.79	3.09	2.2	.1090	0.6	1783	10	-1
49.13.1.1	0.03	99	53	0.56	3.10	2.1	.1089	0.9	1781	16	-1
49.23.1.1	0.01	151	110	0.75	3.03	2.1	.1089	0.7	1781	12	-3
49.11.1.1	0.11	174	131	0.78	3.10	2.0	.1088	0.7	1779	13	-1
49.16.1.1	0.05	93	49	0.54	3.05	2.1	.1087	0.9	1778	17	-3
49.2.1.1	0.02	109	63	0.60	3.07	2.1	.1087	1.0	1777	18	-2
49.12.1.1	0.06	189	143	0.78	3.07	2.3	.1084	0.6	1773	12	-2
49.10.1.1	0.04	107	62	0.60	3.02	2.1	.1083	1.1	1771	19	-4
49.8.1.1	0.01	95	49	0.54	3.09	2.1	.1082	1.0	1769	18	-2
49.19.1.1	0.10	84	42	0.52	3.14	2.1	.1075	1.1	1757	20	-1

6. BROADVIEW SCHIST, ON BROADVIEW STATION: 2008371073

GA Sample ID:	**2008371073**
GA Sample Number:	**1958112**
Other Sample ID:	**R1721962 (PIRSA #)**
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**709960 6327698 Zone 53**
Collector:	**M. Szpunar**
Collection Date:	**June 2008**
Formal Name:	**Broadview Schist**
Informal Name:	
Lithology:	**foliated phyllitic schist**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6062**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**2 – 8/8/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.21% (2σ) [55 of 59]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.1 ± 1.9 Ma [30 of 30]**
Interpreted Age:	**1795 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum deposition age**

Sample Description

This sample was collected from Broadview Station, west of Whyalla on Eyre Peninsula, South Australia. It is a phyllitic schist folded about upright folds and contains a subvertical foliation (Figure 6.1).

Figure 6.1. *Outcrop photo of Broadview Schist, showing subvertical foliation.*

Zircon Description

This sample contains abundant, clear zircons, which occur as rounded and variably pitted grains, consistent with significant sedimentary transport. Grain size is relatively uniform, typically ~70 x 130 µm. Grain shapes range from elongate with aspect ratios of ~1:3, to equant, with equant grains tending to be more pitted than elongate grains (Figure 6.2).

U-Pb Isotopic Results

Eighty analyses were collected from 80 randomly selected grains. Eleven of these analyses are either >10% discordant or contain >0.5% common lead ($^{206}Pb_c$) and have not been included in age calculations. The remaining 69 analyses define a probability density distribution that is dominated by peaks at ~1800 Ma and ~1860 Ma. A range of older grains are also present in this sample, with ages at ~2010 Ma, 2130 to 2230 Ma, 2520 Ma, 2610 Ma, 2670 Ma, 2820 Ma, 3070 Ma and 3150 Ma (Figure 6.3).

Figure 6.2. *Representative transmitted light and cathodoluminescence images of zircons from the Broadview Schist (2008371073), with locations of some SHRIMP analyses.*

The youngest statistically coherent grouping of analyses defines a weighted mean $^{207}Pb/^{206}Pb$ age of 1795 ± 5 Ma, (95% confidence; MSWD = 1.4; probability of fit = 0.09, n = 26), and this age represents a maximum constraint on the time of deposition of this sedimentary rock.

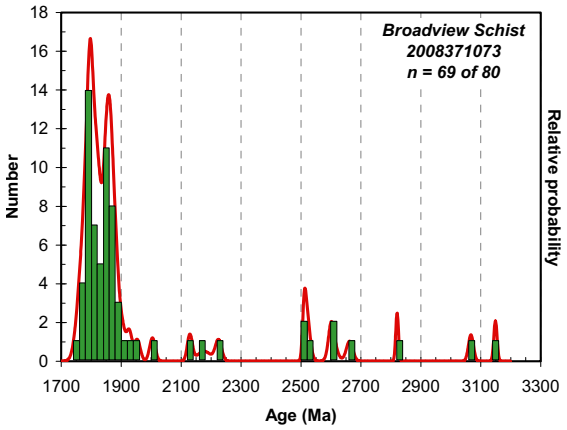

Figure 6.3. *Probability density diagram for zircon analyses from the Broadview Schist (2008371073).*

Geochronological Interpretation

The age of 1795 ± 5 Ma from the youngest group of zircons in this sample provides a maximum age for the deposition of this sedimentary rock.

Table 6.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371073 (1958112), Broadview Schist.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Older detrital zircons (n = 53)											
73.57.1.1	0.01	173	85	0.51	1.56	1.7	.2444	0.3	3149	6	-1
73.36.1.1	0.13	90	38	0.43	1.62	1.8	.2322	0.5	3067	8	-1
73.21.1.1	0.01	335	286	0.88	1.84	1.7	.1994	0.3	2821	5	1
73.63.1.1	0.14	84	46	0.56	1.91	1.9	.1810	0.7	2662	11	-2
73.35.1.1	0.25	56	85	1.57	2.06	2.0	.1752	0.8	2608	14	2
73.76.1.1	0.11	136	77	0.59	2.05	1.8	.1745	0.5	2601	9	2
73.3.1.1	0.11	112	70	0.64	2.07	1.8	.1667	0.6	2525	10	-1
73.41.1.1	0.21	225	176	0.81	2.16	1.9	.1660	0.5	2518	8	3
73.42.1.1	0.18	437	68	0.16	2.12	1.7	.1653	0.3	2511	5	1
73.64.1.1	0.07	145	65	0.46	2.40	1.8	.1398	0.6	2225	11	-1
73.48.1.1	0.25	279	118	0.44	2.41	1.7	.1360	1.3	2177	22	-3
73.23.1.1	-0.01	207	159	0.79	2.64	1.9	.1323	0.5	2129	9	3
73.38.1.1	0.02	213	94	0.46	2.72	1.7	.1233	0.5	2004	10	-1
73.47.1.1	0.07	219	79	0.37	2.91	1.7	.1198	0.6	1953	10	3
73.34.1.1	0.05	289	153	0.55	2.84	1.7	.1181	0.5	1927	9	-1
73.12.1.1	0.09	179	120	0.70	2.89	1.7	.1164	0.6	1901	11	-1
73.52.1.1	0.18	160	79	0.51	3.18	1.8	.1162	1.0	1899	18	8
73.65.1.1	-0.01	117	98	0.87	3.05	1.8	.1154	0.7	1887	13	3
73.51.1.1	0.00	317	127	0.41	3.03	1.7	.1152	0.5	1883	8	2
73.25.1.1	0.24	148	76	0.53	3.09	1.8	.1148	0.7	1877	13	4
73.54.1.1	0.13	336	287	0.88	2.99	1.7	.1148	0.5	1877	9	1
73.80.1.1	0.11	248	131	0.54	2.96	1.7	.1144	0.6	1870	11	0
73.40.1.1	0.10	315	162	0.53	2.90	1.7	.1142	0.5	1867	9	-2
73.15.1.1	-0.01	123	90	0.75	3.03	1.8	.1141	0.7	1866	13	1
73.30.1.1	-0.01	295	105	0.37	2.97	1.7	.1140	0.5	1865	8	0
73.81.1.1	0.08	360	177	0.51	3.06	1.7	.1139	0.5	1862	9	2
73.73.1.1	0.03	272	129	0.49	3.24	1.7	.1138	0.6	1862	10	7
73.79.1.1	0.15	161	84	0.54	3.02	1.8	.1137	0.8	1859	14	1
73.39.1.1	0.38	208	130	0.65	3.03	1.7	.1135	0.8	1856	14	1
73.43.1.1	0.14	299	173	0.60	3.06	1.7	.1132	0.5	1852	10	2
73.24.1.1	0.12	345	171	0.51	3.00	1.7	.1132	0.5	1852	9	0
73.11.1.1	0.02	216	99	0.47	2.94	1.7	.1131	0.6	1850	10	-2
73.10.1.1	0.10	208	131	0.65	3.04	1.7	.1130	0.6	1848	11	1
73.71.1.1	0.15	159	80	0.52	3.07	1.8	.1128	0.8	1844	15	2
73.69.1.1	0.25	184	62	0.35	3.03	1.8	.1127	0.9	1844	15	0
73.62.1.1	0.36	123	88	0.74	3.18	1.8	.1127	1.1	1844	20	5
73.37.1.1	0.21	420	206	0.51	3.03	1.7	.1127	0.7	1844	13	0
73.18.1.1	0.32	182	106	0.60	3.14	1.7	.1127	0.8	1843	14	3
73.4.1.1	-0.03	106	100	0.97	3.06	1.8	.1118	0.8	1829	15	0
73.22.1.1	0.06	236	118	0.52	3.09	1.7	.1118	0.6	1829	10	1
73.27.1.1	0.04	335	133	0.41	3.09	1.8	.1117	0.5	1827	8	1
73.75.1.1	0.31	113	44	0.41	2.98	1.8	.1114	1.1	1822	19	-2
73.49.1.1	0.07	411	70	0.18	3.12	1.7	.1113	0.4	1820	8	1
Youngest detrital zircon component (n = 26)											
73.33.1.1	0.11	211	98	0.48	3.00	1.7	.1112	0.7	1818	12	-2
73.46.1.1	0.00	364	81	0.23	3.18	1.7	.1108	0.4	1813	8	3
73.58.1.1	0.12	275	77	0.29	3.17	1.7	.1108	0.6	1812	11	2
73.8.1.1	0.27	213	119	0.58	3.15	1.7	.1104	0.7	1806	13	2
73.45.1.1	0.06	255	85	0.34	3.25	1.7	.1102	0.6	1802	10	4
73.68.1.1	0.48	388	131	0.35	3.21	1.7	.1101	0.6	1801	11	3
73.14.1.1	0.11	176	54	0.32	3.15	1.8	.1101	0.8	1801	14	1
73.70.1.1	0.06	296	180	0.63	3.15	1.7	.1099	0.6	1798	11	1
73.50.1.1	0.39	440	141	0.33	3.37	1.7	.1099	0.6	1798	11	7
73.16.1.1	0.03	216	68	0.32	3.11	1.7	.1099	0.6	1797	11	0
73.7.1.1	0.02	507	74	0.15	3.14	1.7	.1098	0.4	1796	7	1
73.61.1.1	0.25	120	80	0.69	3.24	1.8	.1098	1.0	1795	19	4
73.6.1.1	0.04	286	226	0.82	3.16	1.7	.1097	0.6	1794	11	1
73.31.1.1	0.09	209	105	0.52	3.10	1.8	.1097	0.7	1794	13	0
73.55.1.1	0.07	268	70	0.27	3.19	1.7	.1095	0.7	1791	13	2
73.13.1.1	0.20	253	74	0.30	3.22	1.7	.1094	1.0	1790	18	3
73.19.1.1	0.14	101	48	0.49	3.10	1.9	.1094	1.0	1790	18	-1
73.5.1.1	0.07	152	205	1.39	3.11	1.8	.1092	0.8	1787	14	-1
73.26.1.1	0.08	173	170	1.01	3.12	1.8	.1092	1.0	1786	17	0
73.67.1.1	0.27	186	30	0.17	3.26	2.1	.1090	0.8	1783	14	3

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
73.72.1.1	0.11	349	337	1.00	3.20	1.7	.1089	0.5	1781	9	2
73.17.1.1	0.34	226	86	0.40	3.25	1.7	.1087	1.3	1777	23	3
73.66.1.1	0.38	205	225	1.13	3.08	1.8	.1084	0.8	1773	15	-2
73.32.1.1	0.07	155	46	0.31	3.08	1.8	.1081	0.8	1767	14	-2
73.20.1.1	0.13	128	81	0.65	3.06	1.8	.1078	0.8	1762	15	-3
73.2.1.1	0.07	164	84	0.53	3.08	1.8	.1076	0.8	1760	14	-3
Analyses >10% discordant and/or $^{206}Pb_c$ >0.5% (n = 11)											
73.53.1.1	0.61	323	121	0.39	3.24	1.7	.1138	0.7	1860	13	7
73.78.1.1	0.64	53	50	0.97	2.99	2.0	.1120	1.9	1833	34	-2
73.60.1.1	1.22	292	163	0.58	3.14	1.7	.1121	0.8	1833	15	3
73.77.1.1	2.05	958	325	0.35	3.18	1.7	.1131	0.5	1850	10	5
73.59.1.1	4.59	118	93	0.82	3.12	1.9	.1111	5.2	1816	94	1
73.74.1.1	1.54	280	134	0.49	3.31	1.7	.1142	1.0	1866	19	10
73.29.1.1	0.62	397	508	1.32	3.62	1.7	.1071	0.6	1750	11	11
73.28.1.1	0.39	387	167	0.45	3.51	1.8	.1117	0.6	1826	10	13
73.9.1.1	1.35	646	401	0.64	4.15	1.7	.1087	1.1	1777	20	28
73.44.1.1	1.06	912	855	0.97	2.72	1.7	.1719	0.3	2575	5	28
73.56.1.1	1.46	541	117	0.22	3.03	1.8	.1620	0.9	2474	15	35

7. WERTIGO GRANITE: 2008371071

GA Sample ID:	**2008371071**
GA Sample Number:	**1958110**
Other Sample ID:	**R1721975 (PIRSA #)**
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**711211 6334263 Zone 53**
Collector:	**M. Szpunar**
Collection Date:	**June 2008**
Formal Name:	**Wertigo Granite**
Informal Name:	
Lithology:	**gneissic granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6063**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**18 – 22/9/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.79% (2σ) [38 of 40]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.9 ± 2.1 Ma [18 of 19]**
Interpreted Age:	**1792 ± 6 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**
Interpreted Age:	**1865 ± 9 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Inherited zircon component**

Sample Description

This sample was collected from near Carrolby Rockhole, on the south side of the road to Kimba Gap, Eyre Peninsula, South Australia. The sample consists of even-grained, medium-grained, grey gneissic granite composed dominantly of quartz and plagioclase with minor biotite. The gneissic fabric is defined by prominent leucocratic banding suggesting partial melt segregation (Figure 7.1).

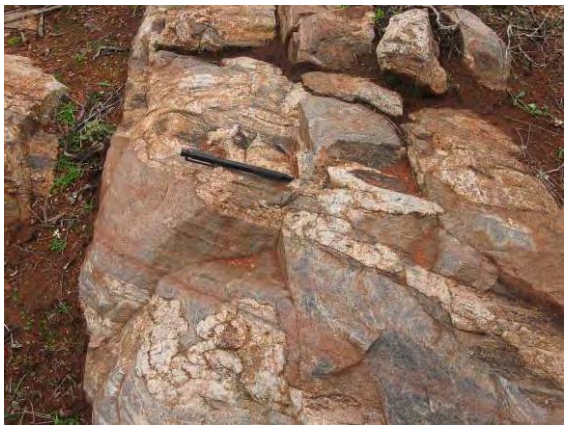

Figure 7.1. *Outcrop photo of Wertigo Granite. Note the prominent leucocratic banding.*

The Wertigo Granite has previously been dated via zircon U-Pb SHRIMP analyses (Fanning *et al*., 2007). Of 12 analyses, 10 were discordant. The two near-concordant analyses yielded ages of 1812 ± 22 Ma and 1848 ± 15 Ma. A discordia line through 9 of the 12 analyses yielded a rather poorly defined upper intercept age of 1845 ± 21 Ma. This age is inconsistent with mapped

relationships, which suggest the the Wertigo Granite intrudes the Myola Volcanics. The age of the Wertigo Granite in comparison with the Myola Volcanics was, therefore, an aim of the current geochronology.

Zircon Description

Zircons from this rock are subhedral with few grains preserving sharp pointed terminations, and generally slightly elongate with aspect ratios of ~3. There is a range of grain sizes from ~50 microns up to ~200 µm in length. In cathodoluminescence (CL) images the zircons exhibit a range of internal zoning patterns. Some grains preserve well defined, fine-scale oscillatory zoning and these grains tend to also preserve the most euhedral grain morphologies. More commonly, grains preserve patches of oscillatory zoning apparently overprinted by more patchy, mottled zonation suggestive of partial recrystallisation. The extent of mottled internal zoning overprinting oscillatory zoning correlates with a change from clear to brown in transmitted light (Figure 7.2).

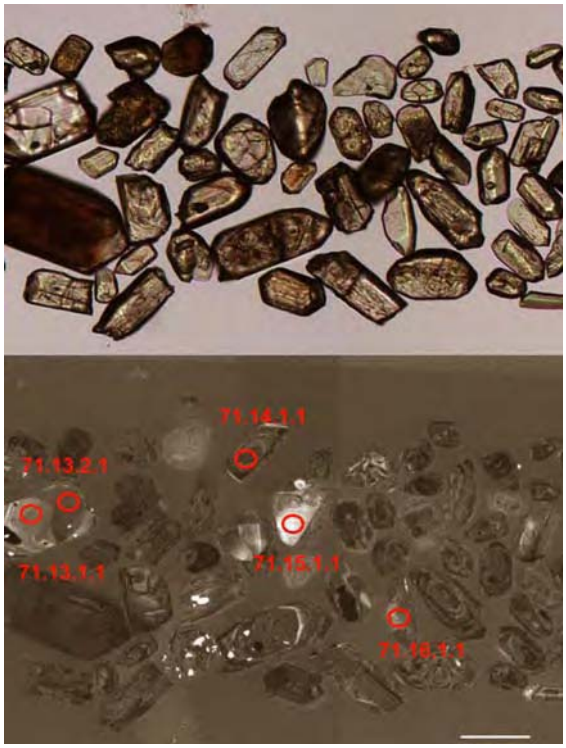

Figure 7.2. *Representative transmitted light and cathodoluminescence images of zircons from the Wertigo Granite (2008371071), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 38 zircon analyses were collected from 34 grains, with grains 13 and 36 each analysed twice, and grain 25 analysed three times. Nine analyses contain >1000 ppm U and are >10% discordant and, together with the more concordant analyses, define a scattered discordia trend (MSWD = 24) with intercepts at 1819 ± 32 Ma and 407 ± 59 Ma (Figure 7.3).

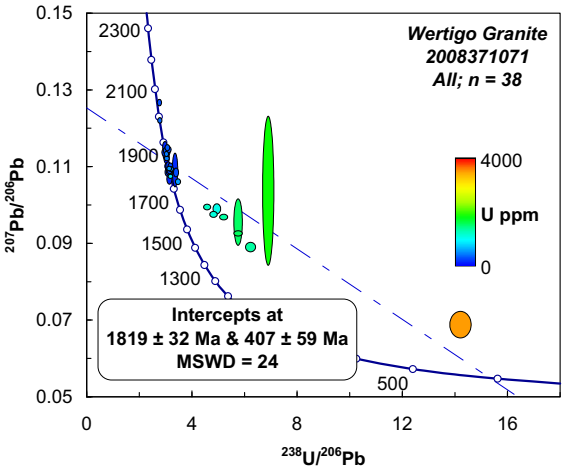

Figure 7.3. *Tera-Wasserburg concordia diagram showing results of zircon analyses from the Wertigo Granite (2008371071), coloured according to U content.*

Twenty-four analyses are less than 5% discordant and contain less than 0.1% common Pb. These 24 analyses do not define a single age population. Two analyses are significantly older than the others, with $^{207}Pb/^{206}Pb$ ages of 2053 ± 16 Ma (2σ) and 1988 ± 14 Ma (2σ), and are interpreted as inherited zircon. The remaining 22 analyses range in age between 1884 ± 26 Ma (2σ) and 1735 ± 16 Ma (2σ), and separate into two age populations, albeit with some statistical scatter within each (Figure 7.4). Ten analyses yield a weighted mean age of 1865 ± 9 Ma (95% confidence; MSWD = 1.5; probability of fit = 0.14; Figure 7.5). A single analysis (71.25.1.1) has an age of 1836 ± 14 Ma (2σ), just outside the younger limit of this age grouping. This analysis is interpreted to have been affected by ancient Pb-loss as two other analyses from this grain lie within the 1865 Ma population. Another 11 analyses define a weighted mean age of 1792 ± 6 Ma (95% confidence; MSWD = 0.76; probability of fit = 0.67; Figure 7.5).

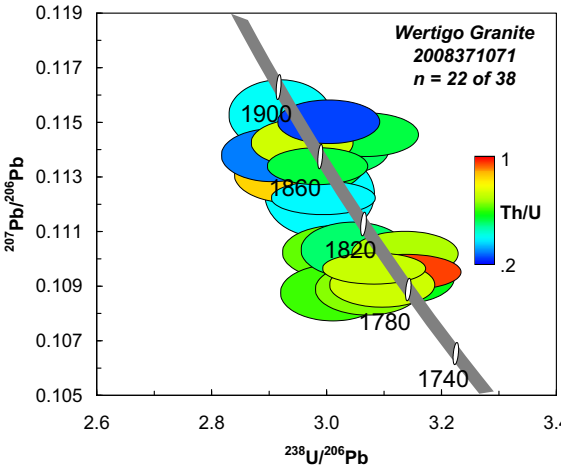

Figure 7.4. *Tera-Wasserburg concordia diagram showing results of concordant zircon analyses from the Wertigo Granite (2008371071), coloured according the Th/U ratio. Note the two age groupings.*

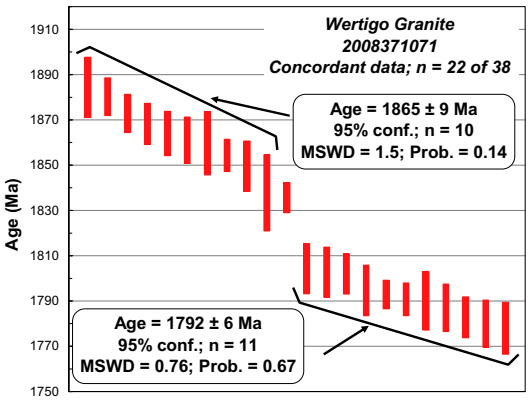

Figure 7.5. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of concordant zircon analyses from the Wertigo Granite (2008371071).*

Zircons from both the older and younger age populations exhibit oscillatory internal zoning, and there is no distinct difference between the age populations with respect to U content, although the younger age group tends to contain slightly higher Th and hence higher Th/U.

Geochronological Interpretation

The preferred interpretation of these data is that the crystallisation age of this granite is defined by the younger age population of 1792 ± 6 Ma. This age is indistinguishable from the age of the Myola Volcanics. The older zircon ages in this sample are interpreted as inherited grains and do not define a single age but suggest a source area that is dominated by igneous material with age of 1865 ± 9 Ma, with subordinate age components of ~1990 Ma and ~2050 Ma.

Table 7.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371071 (1958110), Wertigo Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Older inherited zircon (n = 2)											
71.2.1.1	0.04	274	119	0.45	2.71	2.0	.1268	0.5	2053	8	1
71.19.1.1	0.06	359	76	0.22	2.74	2.0	.1221	0.4	1988	7	-1
~1865 Ma inherited age component (n = 10)											
71.6.1.1	0.06	121	46	0.40	2.92	2.0	.1153	0.7	1884	13	-1
71.31.1.1	0.03	305	73	0.25	3.00	2.0	.1150	0.5	1880	8	2
71.25.2.1	0.01	275	140	0.53	3.07	2.0	.1145	0.5	1873	8	3
71.7.1.1	0.08	272	190	0.72	2.96	2.0	.1143	0.5	1868	9	0
71.25.3.1	0.04	239	118	0.51	3.02	2.0	.1140	0.5	1864	10	1
71.10.1.1	0.06	205	57	0.29	2.91	2.0	.1138	0.6	1861	10	-2
71.24.1.1	0.05	110	57	0.54	2.98	2.0	.1137	0.8	1860	14	0
71.32.1.1	0.09	430	220	0.53	2.98	1.9	.1134	0.4	1854	7	0
71.17.1.1	0.04	193	157	0.84	2.94	2.2	.1131	0.6	1849	11	-2
71.15.1.1	0.03	75	28	0.39	2.99	2.1	.1124	0.9	1838	17	-1
~1865 Ma inherited age component affected by ancient Pb-loss (n = 1)											
71.25.1.1	0.03	452	169	0.39	3.00	2.0	.1122	0.4	1836	7	-1
Igneous crystallisation age (n =11)											
71.13.1.1	0.03	187	91	0.50	3.05	2.0	.1103	0.6	1804	11	-1
71.33.1.1	0.02	184	111	0.62	3.02	2.1	.1102	0.6	1803	11	-2
71.13.2.1	0.01	271	179	0.68	3.14	2.0	.1102	0.5	1802	9	1
71.36.2.1	-0.05	177	121	0.71	3.11	2.1	.1097	0.6	1795	11	0
71.11.1.1	0.00	538	370	0.71	3.08	1.9	.1096	0.3	1793	6	-1
71.14.1.1	0.03	489	455	0.96	3.14	2.0	.1095	0.4	1791	7	0
71.36.1.1	0.02	129	72	0.57	3.07	2.1	.1095	0.7	1790	13	-1
71.5.1.1	0.03	201	108	0.55	3.13	2.0	.1093	0.6	1787	10	0
71.21.1.1	0.01	262	182	0.72	3.10	2.0	.1090	0.5	1783	9	-1
71.12.1.1	0.05	208	130	0.65	3.07	2.0	.1088	0.6	1780	10	-2
71.3.1.1	0.07	184	107	0.60	3.01	2.0	.1087	0.6	1778	11	-4
Analyses with $^{206}Pb_c$ > 0.1% (n = 5)											
71.23.1.1	0.27	260	167	0.66	3.34	2.0	.1086	0.7	1775	13	5
71.16.1.1	0.13	889	29	0.03	3.13	1.9	.1076	0.3	1759	6	-1
71.18.1.1	0.14	121	58	0.49	3.09	2.2	.1069	0.8	1747	15	-3
71.1.1.1	0.21	544	64	0.12	3.42	1.9	.1062	0.5	1735	8	5
71.28.1.1	2.09	147	99	0.69	3.31	2.0	.1092	2.7	1786	49	5
Analyses >10% discordant (n = 9)											
71.34.1.1	8.09	1846	90	0.05	6.87	2.1	.1038	12.3	1693	227	93
71.30.1.1	0.32	1216	62	0.05	4.53	1.9	.0996	0.5	1617	9	26
71.26.1.1	0.63	1051	79	0.08	4.90	1.9	.0991	0.9	1607	16	34
71.29.1.1	0.29	1107	25	0.02	4.77	1.9	.0977	0.5	1581	9	29
71.27.1.1	0.29	1346	63	0.05	5.15	2.0	.0970	0.5	1568	9	37
71.35.1.1	3.23	1541	50	0.03	5.71	1.9	.0957	4.1	1542	78	48
71.22.1.1	0.26	1559	41	0.03	5.71	1.9	.0927	0.5	1482	9	42
71.20.1.1	0.57	1346	83	0.06	6.20	2.0	.0892	0.9	1408	17	46
71.8.1.1	1.93	3540	254	0.07	14.20	1.9	.0690	3.3	899	68	105

8. WERTIGO GRANITE: 2009371031

GA Sample ID:	**2009371031**
GA Sample Number:	**1999467**
Other Sample ID:	
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**713099 6334898 Zone 53**
Collector:	**G. Fraser & N. Neumann**
Collection Date:	**5/7/2009**
Formal Name:	**Wertigo Granite**
Informal Name:	
Lithology:	**foliated biotite granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6098**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**29 – 31/8/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.59% (2σ) [67 of 71]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3468.1 ± 1.4 Ma [37 of 37]**
Interpreted Age:	**1768 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**
Interpreted Age:	**1858 ± 8 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Inherited zircon age**

Sample Description

This sample of Wertigo Granite was collected from the north side of the road to Kimba Gap, southwest of the city of Whyalla, eastern Eyre Peninsula, South Australia. The sample is an even-grained, medium-grained, light grey, orange-weathering, foliated biotite granite (Figure 8.1). The north-west-trending foliation is defined by aligned biotite and by anastamosing biotite-rich shear bands. This sample differs from sample 2008371071, also mapped as Wertigo Granite, as it lacks the prominent centimetre-scale gneissic banding defined by leucosome material that is present in 2008371071 (see above).

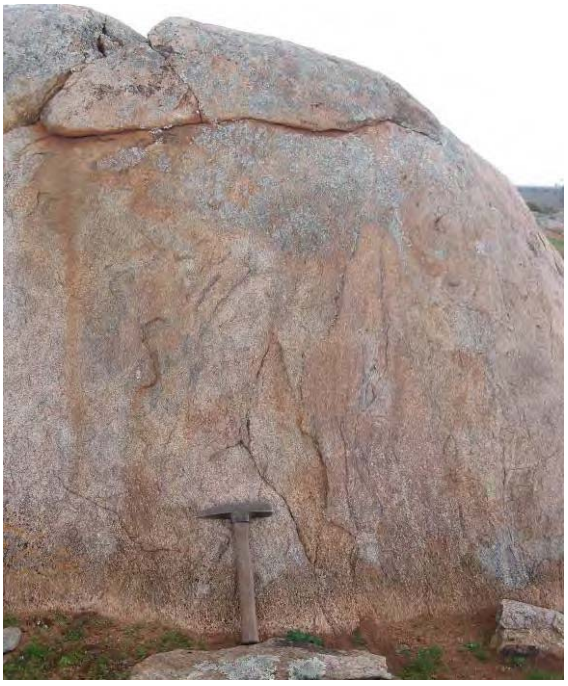

Figure 8.1 (right). *Outcrop photo of Wertigo Granite (sample 2009371031).*

Sample 2009371031was collected from the same site as the sample dated by Fanning *et al*. (2007). Fanning *et al*. (2007) reported 12 SHRIMP analyses from the Wertigo Granite, most of which were highly discordant. Nine analyses defined a discordia trend with an upper intercept age of 1845 ± 21 Ma. As noted by Fanning *et al*. (2007), this age, if interpreted to represent igneous crystallisation of the Wertigo Granite, is inconsistent with the field relationship suggesting the Wertigo Granite intrudes the Myola Volcanics, which have an age of ~1790 Ma (Fanning *et al*., 1988; this work). Hence this attempt to improve the age constraints on the Wertigo Granite.

Zircon Description

Zircon from this rock occurs as two distinct types. Approximately 80% of the separated grains occur as subhedral grains with aspect ratios of ~2, and a long dimension of ~100 µm. In cathodoluminescence (CL) images, these grains exhibit concentric, oscillatory zoning, commonly showing broadening of oscillatory zones that is characteristic of partial recrystallisation. The other ~20% of zircon grains from this sample occur as much larger, relatively equant, euhedral grains, typically ~200 µm across (Figure 8.2). These grains exhibit fine-scale oscillatory internal zoning, and in some cases also exhibit sector zoning. A characteristic feature of these grains is a prominent dark CL (high U) rim, interpreted as due to final crystallisation of a late-stage, high U melt fraction during granite crystallisation. This dark CL (high U) rim is typically lacking on the smaller, subhedral grains in this sample.

U-Pb Isotopic Results

A total of 66 analyses were collected, from 58 different zircon grains (Figure 8.3). The majority of near concordant analyses yield ages between ~1880 and ~1740 Ma. Ten near-concordant analyses are significantly older, and are interpreted as inherited zircon (Figure 8.4). These range in age between the oldest individual analysis at ~3400 Ma and the youngest at ~2085 Ma. Other inherited ages include two analyses at ~2790 Ma, two analyses at ~2520 Ma and one at ~2490 Ma. These ages are interpreted to

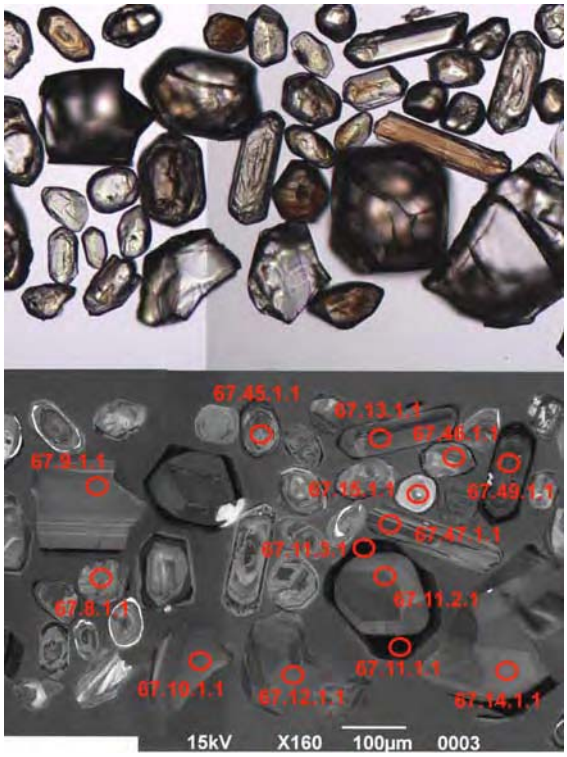

Figure 8.2. *Representative transmitted light and cathodoluminescence images of zircons from the Wertigo Granite (2009371031), with locations of some SHRIMP analyses.*

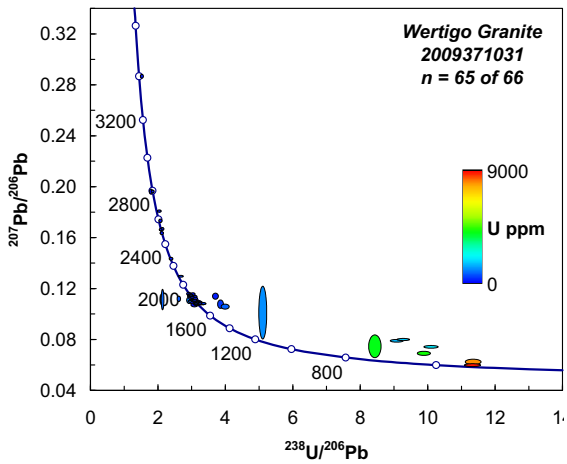

Figure 8.3. *Tera-Wasserburg concordia diagram showing results of zircon analyses from the Wertigo Granite (2009371031), coloured according to U content. A single, highly discordant, imprecise analysis (22.2.1) containing ~14 % common Pb has been omitted from this plot.*

represent the age of crustal components from which the Wertigo Granite was derived, or through which it passed during magma emplacement.

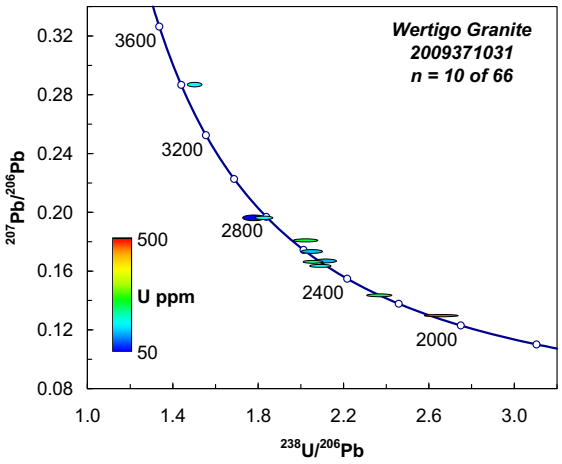

Figure 8.4. *Tera-Wasserburg concordia diagram showing results of pre-2000 Ma zircon analyses from the Wertigo Granite (2009371031), coloured according to U content.*

Of the 56 analyses younger than 2000 Ma, 15 contain >0.5% $^{206}Pb_c$ and/or are >10% discordant, and have been excluded from weighted mean age calculations. The remaining 41 analyses define two age populations (Figure 8.5).

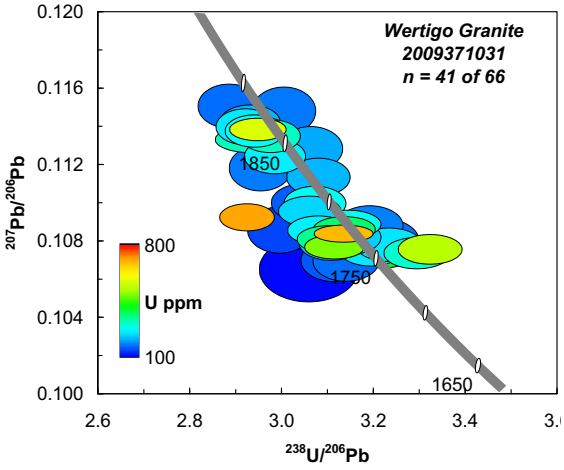

Figure 8.5. *Tera-Wasserburg concordia diagram showing results of ~1900 to ~1750 Ma zircon analyses from the Wertigo Granite (2009371031), coloured according to U content. Note the two age groupings.*

The oldest 11 analyses define a weighted mean $^{207}Pb/^{206}Pb$ age of 1858 ± 8 Ma (95% confidence; MSWD = 1.8; probability of fit = 0.06; Figure 8.6). Zircon grains in this group are all relatively small, equant to slightly elongate, euhedral, and most exhibit oscillatory zoning. The Th/U ratio of zircons in this group is typically in the range 0.4 to 0.6. The youngest 26 analyses define a weighted mean $^{207}Pb/^{206}Pb$ age of 1768 ± 4 Ma (95% confidence; MSWD = 1.06; probability of fit = 0.38, Figure 8.6). The Th/U ratio of zircons in this group is typically between 0.6 and 0.8, which is higher than for the ~1858 Ma group. Zircon grains in this ~1768 Ma group are dominated by large, relatively equant, euhedral grains and fragments, with relatively uniform CL response with subtle oscillatory zoning, and generally showing a very distinct, very dark CL response zircon rim. Seven analyses of these dark CL rims contain very high U, ranging between ~1500 and 9000 ppm, and yield discordant ages that lie towards the younger end of a scattered discordia (MSWD = 3.8) with a poorly defined upper intercept in the Paleoproterozoic and a lower intercept of 529 ± 67 Ma. This trend suggests an episode of significant Pb-loss in the late-Neoproterozoic or early Paleozoic, perhaps associated with the Delamarian Orogeny. This Pb-loss was largely restricted to high-U parts of grains that are susceptible to Pb-loss due to radiation damage to the crystal structure.

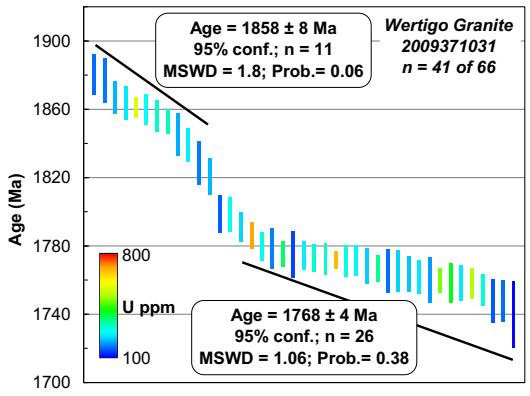

Figure 8.6. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of ~1750 to ~1900 Ma zircon analyses from the Wertigo Granite (2009371031), coloured according to U content, and showing the two age groupings and their mean ages.*

Four analyses yield near-concordant ages that lie between the ~1858 Ma age population and the ~1768 Ma age population. These analyses are interpreted to represent xenocrystic zircon subject to partial Pb-loss at ~1768 Ma.

Geochronological Interpretation

The preferred interpretation of these results is that the age population at 1768 ± 4 Ma represents the igneous crystallisation age of this granite. The 1858 ± 8 Ma age is interpreted as the dominant inherited zircon component, with additional inherited zircon components at ~2500 Ma, 2800 Ma and 3400 Ma.

Table 8.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371031 (1999467), Wertigo Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Pre-2000 Ma inherited zircon (n = 10)											
67.7.1.1	0.05	156	68	0.45	1.50	1.5	.2870	0.4	3402	6	3
67.42.1.1	0.19	50	53	1.08	1.77	1.9	.1960	0.7	2793	11	-3
67.52.1.1	0.09	159	66	0.43	1.82	1.5	.1960	0.4	2793	7	-1
67.45.1.1	0.17	229	155	0.70	2.02	1.8	.1805	0.3	2657	6	2
67.15.1.1	0.10	127	111	0.91	2.05	1.6	.1729	0.5	2586	8	1
67.4.1.1	0.07	124	95	0.79	2.11	1.6	.1664	0.5	2522	8	1
67.38.1.1	0.02	210	101	0.50	2.05	1.5	.1658	0.3	2516	6	-2
67.19.1.1	0.08	163	120	0.76	2.09	1.5	.1631	0.4	2488	7	-1
67.27.1.1	0.13	222	119	0.55	2.36	1.7	.1428	0.5	2262	8	-1
67.3.1.1	0.22	476	23	0.05	2.65	2.0	.1289	0.4	2084	7	1
~1865 Ma inherited zircon (n = 11)											
67.20.1.1	0.18	167	75	0.46	2.89	1.5	.1151	0.7	1881	12	-2
67.46.1.1	0.24	174	142	0.84	3.01	1.5	.1148	0.7	1877	13	1
67.5.1.1	0.09	214	92	0.45	2.93	1.5	.1142	0.5	1867	10	-1
67.43.1.1	0.19	250	100	0.41	2.92	1.5	.1140	0.5	1864	10	-2
67.6.1.1	0.11	571	211	0.38	2.95	1.4	.1138	0.3	1862	6	-1
67.25.1.1	0.11	270	89	0.34	2.94	1.5	.1138	0.5	1860	9	-1
67.31.1.1	0.19	314	143	0.47	2.98	1.4	.1135	0.5	1856	9	-1
67.33.1.1	0.06	317	87	0.28	2.93	1.7	.1133	0.4	1853	7	-2
67.8.1.1	0.25	206	104	0.52	3.06	1.5	.1128	0.7	1845	12	1
67.28.1.1	0.13	257	138	0.56	2.99	1.5	.1124	0.5	1839	10	-1
67.16.1.1	0.16	176	92	0.54	2.96	1.5	.1118	0.7	1829	13	-3
Inherited zircon affected by ancient Pb-loss? (n = 4)											
67.48.1.1	0.10	213	129	0.63	3.08	1.5	.1113	0.6	1821	11	0
67.54.1.1	0.10	157	109	0.72	3.05	1.5	.1100	0.6	1799	11	-2
67.26.1.1	0.16	278	204	0.76	3.07	1.5	.1099	0.5	1798	10	-1
67.50.1.1	0.06	235	166	0.73	3.06	1.5	.1095	0.5	1792	9	-2
Igneous crystallisation zircon											
67.47.1.1	0.27	713	544	0.79	2.93	1.4	.1092	0.4	1786	8	-6
67.11.2.1	0.03	280	235	0.87	3.15	1.5	.1088	0.5	1780	8	0
67.55.1.1	0.10	179	88	0.51	3.19	1.5	.1088	0.6	1779	12	1
67.22.1.1	0.05	364	329	0.93	3.14	1.4	.1086	0.4	1776	7	0
67.58.1.1	0.22	142	74	0.54	3.00	1.6	.1085	0.7	1775	14	-4
67.56.1.1	0.05	255	168	0.68	3.08	1.4	.1085	0.5	1775	8	-2
67.34.1.1	0.06	306	195	0.66	3.11	1.7	.1084	0.4	1773	8	-1
67.40.1.1	0.04	310	164	0.54	3.12	1.4	.1084	0.5	1772	9	-1
67.51.1.1	0.02	691	585	0.87	3.14	1.4	.1084	0.3	1772	5	-1
67.24.1.1	0.11	287	275	0.99	3.16	1.8	.1083	0.5	1772	9	0
67.57.1.1	0.08	262	187	0.74	3.10	1.5	.1083	0.5	1772	9	-2
67.44.2.1	0.16	228	149	0.67	3.15	1.5	.1082	0.6	1769	10	-1
67.39.2.1	0.04	344	312	0.94	3.10	1.4	.1081	0.4	1767	8	-2
67.14.1.1	0.15	170	133	0.81	3.22	1.5	.1080	0.7	1766	13	1
67.9.1.1	0.14	231	171	0.76	3.19	1.5	.1080	0.7	1766	12	1
67.2.1.1	0.01	221	164	0.77	3.11	1.5	.1079	0.6	1764	10	-2
67.10.1.1	0.09	248	158	0.66	3.23	1.5	.1078	0.5	1762	10	1
67.17.1.1	0.30	195	113	0.60	3.14	1.5	.1077	0.7	1760	13	-1
67.53.1.1	0.14	485	274	0.58	3.12	1.4	.1077	0.4	1760	7	-2
67.13.1.1	0.37	413	317	0.79	3.22	1.6	.1076	0.6	1759	12	1

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
67.21.1.1	0.16	250	185	0.76	3.19	1.5	.1076	0.6	1759	10	0
67.49.1.1	0.17	528	260	0.51	3.32	1.4	.1075	0.5	1758	9	4
67.12.1.1	0.12	304	223	0.76	3.30	1.4	.1073	0.5	1754	9	3
67.1.1.1	0.16	154	116	0.78	3.12	1.6	.1069	0.7	1748	13	-3
67.36.1.1	0.17	167	111	0.69	3.14	1.5	.1069	0.7	1748	12	-2
67.23.1.1	0.36	103	72	0.72	3.06	2.3	.1065	1.1	1740	20	-5
Analyses >10% discordant and/or with >0.5% $^{206}Pb_c$											
67.18.1.1	0.71	224	84	0.39	3.68	1.5	.1133	1.5	1853	27	19
67.35.1.1	1.08	680	376	0.57	2.60	1.4	.1113	1.2	1820	22	-13
67.37.1.1	4.21	780	270	0.36	2.12	1.4	.1105	4.8	1808	88	-27
67.30.1.1	1.40	977	259	0.27	2.89	1.7	.1102	1.5	1803	28	-6
67.32.2.1	1.77	416	85	0.21	3.83	1.4	.1070	2.1	1748	38	17
67.29.1.1	1.08	769	502	0.67	3.96	1.9	.1050	1.3	1715	24	18
67.41.1.1	10.83	1130	395	0.36	5.09	1.5	.1003	13.7	1629	255	41
67.22.2.1	14.15	8433	893	0.11	18.54	2.6	.0826	35.7	1260	698	272
67.24.2.1	0.42	1608	75	0.05	9.26	1.3	.0791	0.8	1175	16	78
67.24.3.1	0.47	1471	69	0.05	9.06	1.4	.0780	0.9	1146	17	70
67.32.1.1	5.07	3986	621	0.16	8.41	1.4	.0736	8.0	1032	162	42
67.44.1.1	0.49	1932	105	0.06	10.07	1.3	.0733	0.9	1022	19	68
67.39.1.1	0.93	4201	361	0.09	9.86	1.3	.0681	1.6	872	33	40
67.11.3.1	1.19	8040	1444	0.19	11.32	1.4	.0613	2.3	649	49	19
67.11.1.1	0.66	8870	956	0.11	11.30	1.4	.0588	1.3	561	28	3

9. UNNAMED GRANITE, NEAR MURNINNIE MINE: 2008371050

GA Sample ID:	**2008371050**
GA Sample Number:	**1958088**
Other Sample ID:	
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**711096 6315866 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**27/5/2008**
Formal Name:	
Informal Name:	
Lithology:	**foliated granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6063**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**18 – 22/9/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.79% (2σ) [38 of 40]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.9 ± 2.1 Ma [18 of 19]**
Interpreted Age:	**1790 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**
Interpreted Age:	**1764 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**High-grade metamorphic age**

Sample Description

This sample was collected from about 2 km SE of Moonabie Station and ~3 km west of the historical Murninnie copper mine, south of Whyalla on Eyre Peninsula, South Australia. The sampled rock is a strongly foliated, even-grained, medium-grained, red-purple K-feldspar-plagioclase-quartz granite with very minor biotite (Figure 9.1). A subvertical foliation trends NS.

Figure 9.1. *Sample site for sample 2008371050 – unnamed granite.*

Zircon Description

Zircons from this rock form stubby grains with aspect ratios of between ~1.3 to 2. Zircons are clear in transmitted light, apart from minor fracturing and some fine, needle-like inclusions, and exhibit euhedral outlines but with slightly rounded terminations. In cathodoluminescence (CL) images most grains are oscillatory zoned

across most of the grain, with many grains showing relatively narrow, discontinuous dark rims that overgrow the inner oscillatory zoning (Figure 9.2). The oscillatory zoned zircon is interpreted as igneous in origin and probably originates from the crystallisation of the granite, whereas the dark CL rims may represent a subsequent metamorphic event. Some grains with apparent euhedral igneous external morphology display relatively uniform but slightly patchy or sector zoned CL response, without any oscillatory zoning.

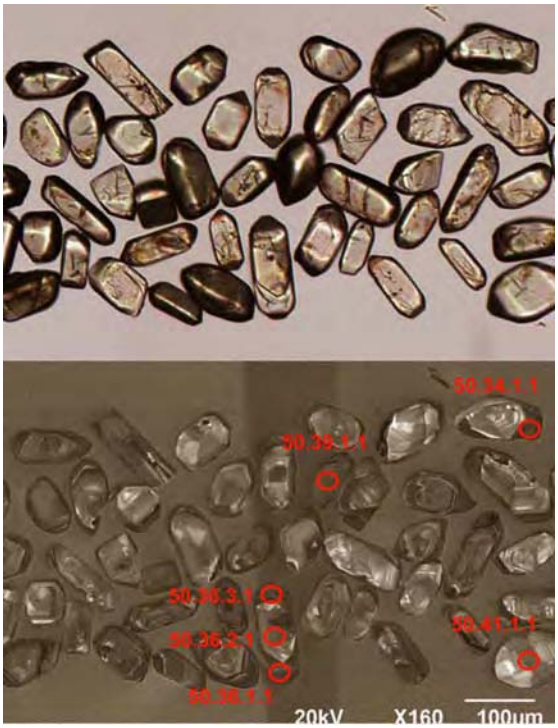

Figure 9.2. *Representative transmitted light and cathodoluminescence images of zircons from unnamed granite, near Murninnie Mine (2008371050), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 51 analyses were collected from 41 zircon grains. These can be divided into 36 analyses of zircon cores, and 15 analyses of zircon rims. All analyses contain <0.3% common Pb, and all but one are <7% discordant. Core and rim analyses are distinct in both chemistry and age (Figure 9.3). Zircon cores contain relatively low U, typically between 150 and 250 ppm, and Th/U between ~0.6 and 0.8. The weighted mean $^{207}Pb/^{206}Pb$ age of all 36 cores is 1790 ± 3 Ma (95% confidence; MSWD = 0.94; probability of fit = 0.58; Figure 9.4).

In contrast, zircon rims contain higher U, typically in the range 350 - 450 ppm, and Th/U between ~0.18 and 0.4. The weighted mean $^{207}Pb/^{206}Pb$ age of all 15 zircon rims is 1764 ± 5 Ma (95% confidence; MSWD = 1.4; probability of fit = 0.15; Figure 9.4).

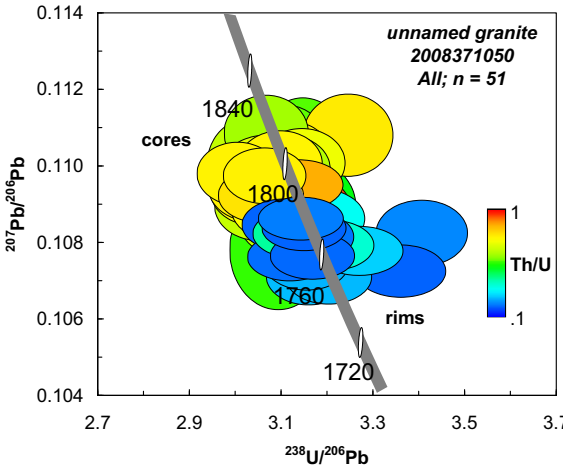

Figure 9.3. *Tera-Wasserburg concordia diagram showing results of zircon analyses from the unnamed granite (2008371050), coloured according the Th/U ratio. Note the difference in age and Th/U of cores versus rims.*

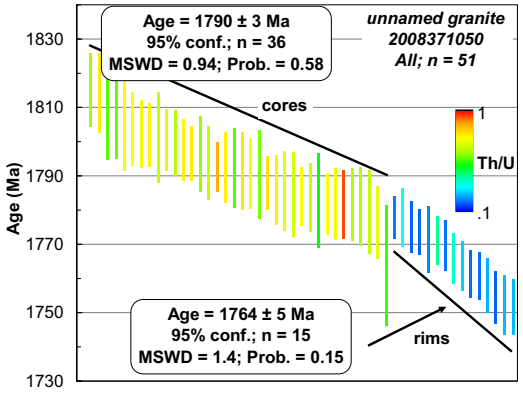

Figure 9.4. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of zircon analyses from the unnamed granite (2008371050), coloured according to Th/U ratio. Note the difference in age and Th/U of cores versus rims.*

Geochronological Interpretation

The data from this sample indicate two distinct periods of zircon growth, separated by ~25 Ma. Our preferred interpretation is that the age of 1790 ± 3 Ma from oscillatory zoned cores represents igneous crystallisation, and that the 1764 ± 5 Ma age from rims represents zircon growth during high-grade metamorphism of this granite.

Table 9.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371050 (1958088), unnamed granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Zircon cores; igneous crystallisation age (n = 36)											
50.21.1.1	-0.03	188	113	0.62	3.06	2.0	.1108	0.6	1813	11	0
50.16.1.1	0.03	159	121	0.79	3.24	2.0	.1108	0.6	1812	12	5
50.10.1.1	-0.07	118	65	0.57	3.14	2.0	.1105	0.8	1807	14	2
50.3.1.1	0.04	131	73	0.58	3.11	2.0	.1104	0.7	1806	13	0
50.9.1.1	-0.07	136	97	0.74	3.09	2.0	.1103	0.8	1804	15	0
50.25.1.1	0.00	176	130	0.76	3.12	2.0	.1102	0.6	1802	11	0
50.2.1.1	-0.01	190	135	0.73	3.14	2.0	.1101	0.5	1800	10	1
50.22.1.1	0.02	251	187	0.77	3.09	2.0	.1100	0.5	1800	9	0
50.27.2.1	0.12	234	151	0.67	3.02	2.0	.1100	0.7	1799	13	-2
50.39.1.1	-0.04	255	175	0.71	3.06	2.0	.1099	0.5	1799	9	-1
50.14.1.1	0.01	219	137	0.65	3.11	2.0	.1099	0.5	1798	10	0
50.31.1.1	0.00	238	178	0.77	3.00	2.0	.1098	0.5	1796	9	-3
50.15.1.1	0.00	325	244	0.78	3.06	2.0	.1097	0.4	1795	8	-2
50.17.1.1	0.08	177	105	0.61	3.12	2.0	.1097	0.6	1794	11	0
50.35.2.1	0.04	191	124	0.67	3.06	2.0	.1096	0.6	1792	11	-2
50.33.2.1	0.05	391	331	0.88	3.13	2.0	.1095	0.4	1791	7	0
50.41.1.1	0.06	197	148	0.78	3.03	2.0	.1095	0.6	1791	10	-3
50.23.1.1	0.09	184	102	0.57	3.12	2.0	.1095	0.6	1790	12	0
50.11.1.1	0.07	209	159	0.79	3.06	2.0	.1094	0.6	1790	11	-2
50.36.2.1	0.06	198	146	0.76	3.03	2.0	.1094	0.6	1789	10	-3
50.7.1.1	0.09	151	86	0.59	3.12	2.0	.1094	0.7	1789	13	0
50.4.1.1	0.00	321	248	0.80	3.05	2.0	.1092	0.4	1786	8	-2
50.38.2.1	0.01	254	192	0.78	3.08	2.0	.1091	0.6	1784	10	-2
50.30.1.1	0.04	171	118	0.72	3.06	2.3	.1091	0.6	1784	12	-2
50.1.1.1	0.05	156	105	0.69	3.11	2.0	.1090	0.7	1783	12	-1
50.26.1.1	0.03	283	208	0.76	3.10	2.0	.1090	0.5	1782	9	-1
50.19.1.1	0.07	219	142	0.67	3.05	2.1	.1089	0.6	1782	10	-3
50.18.1.1	0.01	110	53	0.50	3.16	2.2	.1089	0.8	1781	14	0
50.6.1.1	0.05	289	212	0.76	3.08	2.0	.1088	0.5	1780	9	-2
50.8.1.1	0.00	185	132	0.74	3.12	2.0	.1088	0.6	1780	10	-1
50.28.1.1	0.26	377	347	0.95	3.16	1.9	.1088	0.6	1780	10	0
50.24.1.1	0.03	221	138	0.64	3.08	2.1	.1088	0.6	1780	11	-2
50.5.1.1	0.08	225	139	0.64	3.12	2.0	.1088	0.6	1779	11	-1
50.32.2.1	0.00	133	86	0.67	3.10	2.2	.1087	0.7	1777	12	-1
50.13.1.1	0.02	181	127	0.73	3.13	2.0	.1085	0.6	1775	11	-1
50.20.1.1	0.16	95	50	0.54	3.09	2.3	.1078	1.0	1762	18	-3
Zircon rims; high-grade metamorphic age (n = 15)											
50.33.1.1	0.01	497	96	0.20	3.14	1.9	.1086	0.3	1776	6	0
50.27.1.1	0.12	376	118	0.33	3.19	2.0	.1086	0.5	1776	9	1
50.36.3.1	0.05	425	74	0.18	3.10	1.9	.1084	0.4	1773	8	-2
50.37.1.1	0.03	473	82	0.18	3.15	1.9	.1083	0.4	1772	7	0
50.32.1.1	0.20	375	75	0.21	3.41	1.9	.1082	0.5	1769	10	7
50.29.1.1	0.02	428	168	0.41	3.13	1.9	.1082	0.4	1769	7	-1
50.35.1.1	0.00	344	64	0.19	3.16	1.9	.1081	0.4	1768	7	0
50.29.2.1	-0.01	374	131	0.36	3.21	1.9	.1079	0.4	1764	7	1
50.12.1.1	0.02	408	105	0.27	3.27	1.9	.1077	0.4	1762	7	2
50.34.1.1	0.04	436	77	0.18	3.17	1.9	.1076	0.4	1759	7	-1
50.30.3.1	0.01	388	70	0.19	3.12	2.0	.1076	0.4	1759	7	-2
50.38.1.1	0.02	331	77	0.24	3.15	1.9	.1074	0.4	1756	8	-1
50.40.1.1	0.10	454	78	0.18	3.36	1.9	.1072	0.4	1752	8	4
50.30.2.1	0.03	354	86	0.25	3.16	1.9	.1071	0.5	1750	9	-1
50.36.1.1	0.08	366	88	0.25	3.20	1.9	.1071	0.4	1750	8	0

10. McGREGOR VOLCANICS: 2008371045

GA Sample ID:	**2008371045**
GA Sample Number:	**1958083**
Other Sample ID:	**R1721967 (PIRSA #)**
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**703392 6316263 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**25/5/2008**
Formal Name:	**McGregor Volcanics**
Informal Name:	
Lithology:	**porphyritic rhyolite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6063**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**18 – 22/9/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.79% (2σ) [38 of 40]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.9 ± 2.1 Ma [18 of 19]**
Interpreted Age:	**1754 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

This sample was collected ~200 m north of the Lincoln Highway, immediately west of where the highway cuts through the Moonabie Range (see page 71 of Parker *et al*., 1988), Eyre Peninsula, South Australia. According to the mapping of Parker *et al*. (1988) the sample comes from the upper part of the McGregor Volcanic stratigraphy and lies stratigraphically immediately below the Moonabie Formation. The sampled rock is a medium-grained, purple-grey, plagioclase-phyric, porphyritic rhyolite (Figure 10.1). The McGregor Volcanics do not display a tectonic fabric at this locality.

Figure 10.1. *Photo of hand sample of McGregor Volcanics (2008371045), showing undeformed volcanic texture. Bars on scale are 1 cm.*

The McGregor Volcanics have previously been dated via zircon U-Pb TIMS analyses (Fanning *et al*., 1988). Six multigrain zircon fractions yield a poorly defined discordia (MSWD = 20) with upper intercept of 1761 ± 10 Ma. A single fraction of six clear zircons yields more concordant data with a $^{207}Pb/^{206}Pb$ age of ~1740 Ma, interpreted by Fanning *et al*. (1988) as the best estimate of the crystallisation age of this volcanic rock.

Zircon Description

Zircons from sample 2008371045 are predominantly clear and euhedral grains, with many grains preserving sharp pointed terminations. In cathodoluminescence (CL) images, all grains exhibit fine-scale oscillatory zoning parallel with crystal faces. Some grains exhibit sector zoning as well as oscillatory zoning. Most zircons display oscillatory zoning that is continuous throughout the crystal, but some grains contain a zircon core in which zonation is truncated against the oscillatory-zoned outer part of the crystal, suggestive of episodic igneous zircon growth (Figure 10.2). All zircon from this rock is interpreted as igneous in origin, and there is no clear morphological evidence for any inherited zircon.

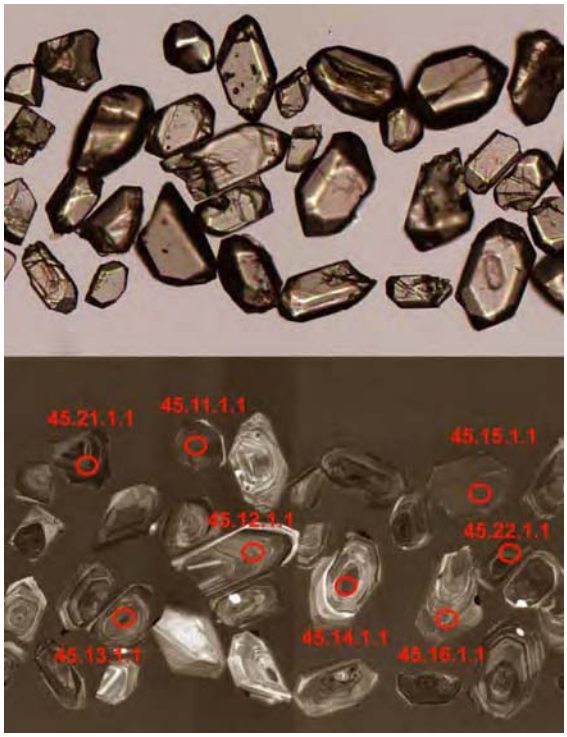

Figure 10.2. *Representative transmitted light and cathodoluminescence images of zircons from McGregor Volcanics (2008371045), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Twenty-eight zircon analyses were collected from this rock. All analyses are <5% discordant and contain <0.2% common Pb. A single analysis yields an age of 1956 ± 16 Ma (2σ), interpreted to represent inheritance (Figure 10.3). The other 27 analyses define a single age population with a weighted mean $^{207}Pb/^{206}Pb$ age of 1754 ± 5 Ma (95% confidence; MSWD = 1.01; probability of fit = 0.45; Figure 10.4). Zircons in this age population typically contain between ~80 and 300 ppm U, and Th/U between 0.6 and 1.0. The euhedral zircon morphologies, oscillatory internal zonation, and unimodal age population are all consistent with the age of 1754 ± 5 Ma representing the igneous age of the McGregor Volcanics.

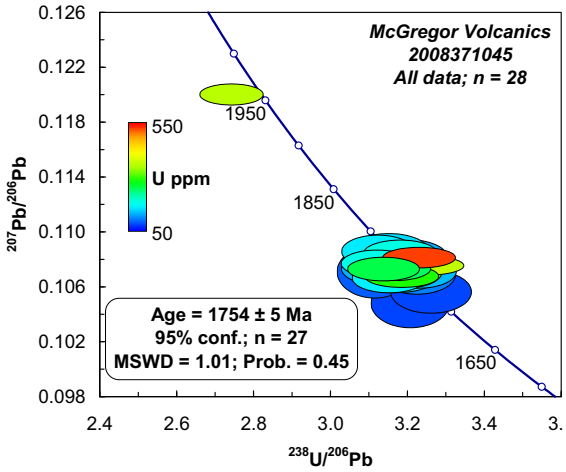

Figure 10.3. *Tera-Wasserburg concordia diagram showing results of zircon analyses from the McGregor Volcanics (2008371045), coloured according to U content.*

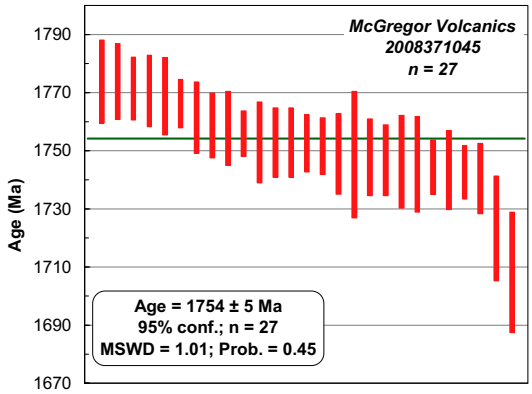

Figure 10.4. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of zircon analyses from the McGregor Volcanics (2008371045).*

Geochronological Interpretation

The weighted mean age of 1754 ± 5 Ma is interpreted as the igneous extrusive age of this sample of the McGregor Volcanics.

Table 10.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371045 (1958083), McGregor Volcanics.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited zircon											
45.17.1.1	0.03	358	58	0.17	2.74	2.0	.1200	0.4	1956	8	-3
Igneous crystallisation age (n = 27)											
45.20.1.1	0.08	149	68	0.47	3.15	2.2	.1085	0.8	1774	14	0
45.13.1.1	0.02	159	111	0.73	3.12	2.0	.1085	0.7	1774	13	-1
45.6.1.1	-0.01	185	125	0.70	3.18	2.0	.1083	0.6	1771	11	0
45.28.1.1	-0.03	155	109	0.73	3.15	2.0	.1083	0.7	1771	12	0
45.12.1.1	-0.03	126	71	0.58	3.19	2.2	.1082	0.7	1769	13	1
45.5.1.1	0.17	528	373	0.73	3.23	1.9	.1080	0.5	1766	8	2
45.25.1.1	0.00	207	176	0.88	3.20	2.0	.1077	0.7	1761	12	0
45.11.1.1	0.05	183	149	0.84	3.12	2.0	.1076	0.6	1759	11	-2
45.27.1.1	0.03	142	96	0.70	3.17	2.1	.1075	0.7	1758	13	-1
45.2.1.1	0.00	364	415	1.18	3.25	2.0	.1074	0.4	1756	8	1
45.3.1.1	0.03	128	91	0.73	3.12	2.0	.1072	0.8	1753	14	-2
45.26.1.1	0.01	168	121	0.74	3.19	2.0	.1072	0.7	1753	12	0
45.14.1.1	0.01	158	173	1.13	3.20	2.4	.1072	0.7	1753	12	0
45.7.1.1	0.03	243	200	0.85	3.16	2.0	.1072	0.5	1753	10	-1
45.21.1.1	0.03	252	166	0.68	3.13	2.0	.1072	0.5	1752	10	-2
45.16.1.1	0.03	133	96	0.74	3.23	2.0	.1070	0.8	1749	14	1
45.9.1.1	0.09	91	60	0.68	3.11	2.1	.1070	1.2	1749	22	-3
45.22.1.1	0.03	318	304	0.99	3.19	2.0	.1069	0.7	1748	13	-1
45.24.1.1	0.04	160	111	0.72	3.17	2.2	.1069	0.7	1747	12	-1
45.8.1.1	0.00	99	80	0.84	3.16	2.1	.1068	0.9	1746	16	-2
45.4.1.1	0.09	107	72	0.70	3.22	2.1	.1068	0.9	1745	16	0
45.18.1.1	0.05	293	170	0.60	3.18	2.1	.1067	0.5	1744	9	-1
45.15.1.1	0.09	154	163	1.09	3.18	2.1	.1067	0.7	1743	14	-1
45.19.1.1	0.04	288	366	1.31	3.18	2.0	.1066	0.5	1743	9	-1
45.23.1.1	-0.03	161	109	0.70	3.15	2.0	.1065	0.7	1741	12	-2
45.10.1.1	0.08	80	51	0.66	3.26	2.1	.1055	1.0	1723	18	0
45.1.1.1	0.18	80	61	0.79	3.21	2.1	.1046	1.1	1708	21	-2

11. MOONABIE FORMATION, MOONABIE RANGE: 2008371046

GA Sample ID:	**2008371046**
GA Sample Number:	**1958084**
Other Sample ID:	**R1721970 (PIRSA #)**
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**704270 6316461 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**25/5/2008**
Formal Name:	**Moonabie Formation**
Informal Name:	
Lithology:	**volcaniclastic gritstone**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6062**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**2 – 8/8/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.21% (2σ) [55 of 59]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.1 ± 1.9 Ma [30 of 30]**
Interpreted Age:	**1750 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum deposition age**

Sample Description

This sample was collected from the quarry on the SE side of the Lincoln Highway where it passes through the Moonabie Range, Eyre Peninsula, South Australia. This is described as Stop 28 in Parker *et al*. (1988). The rock is a poorly sorted gritstone, containing angular clasts of quartzite and probable volcanic rock up to 8 cm long (Figure 11.1). Here the Moonabie Formation is mapped as overlying the McGregor Volcanics and appears to be an immature volcaniclastic rock that may have been substantially derived from reworking of the McGregor Volcanics.

Figure 11.1. *Outcrop photo of Moonabie Formation at the site of sample 2008371046. Note the coarse clasts. Coin for scale.*

Zircon Description

This sample contains abundant, good quality zircon. Most grains are euhedral and preserve well-defined crystal faces and pointed terminations, suggestive of an igneous origin and very limited sedimentary transport. In cathodoluminescence (CL) images most grains show well-preserved oscillatory zoning (Figure 11.2).

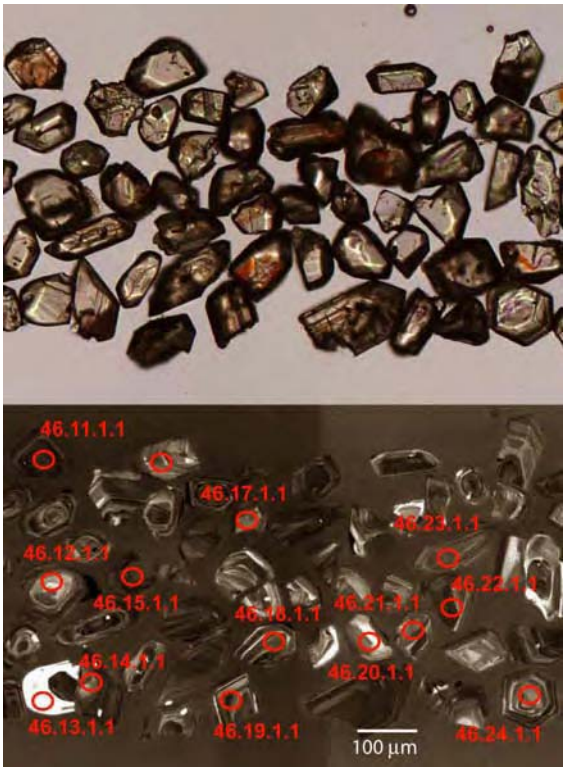

Figure 11.2. *Representative transmitted light and cathodoluminescence images of zircons from Moonabie Formation, Moonabie Range (2008371046), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Thirty analyses were collected from 29 different zircon grains (Figure 11.3). Three analyses have been rejected on the basis of either >10% discordance or >0.5% $^{206}Pb_c$. The remaining 27 analyses define a single age population with a weighted mean $^{207}Pb/^{206}Pb$ age of 1750 ± 5 Ma (95% confidence; MSWD = 0.36; probability of fit = 0.99; Figure 11.4).

Geochronological Interpretation

These data are interpreted to indicate that this coarse-grained, immature sedimentary rock was predominantly derived from a unimodal igneous source with an age of 1750 ± 5 Ma. This age, therefore, also represents a maximum depositional age for this sedimentary rock.

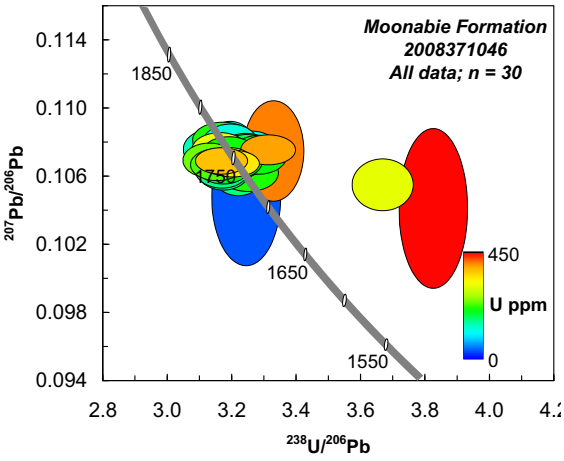

Figure 11.3. *Tera-Wasserburg concordia diagram showing results of zircon analyses from the Moonabie Formation (2008371046), coloured according to U content.*

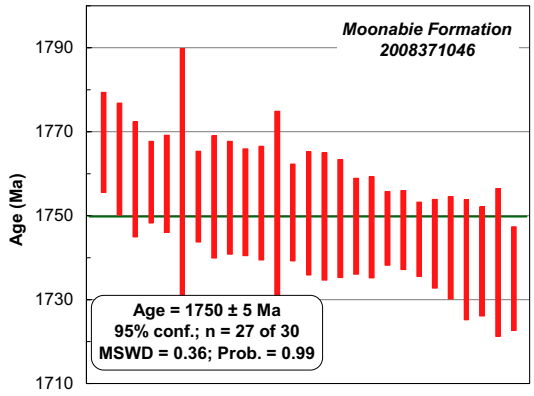

Figure 11.4. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of zircon analyses from the Moonabie Formation (2008371046).*

Table 11.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371046 (1958084), Moonabie Formation, Moonabie Range.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Coherent ~1750 Ma detrital component (n = 27)											
46.10.1.1	0.06	215	130	0.63	3.17	1.9	.1081	0.7	1767	12	0
46.12.1.1	0.02	125	77	0.64	3.20	1.8	.1079	0.7	1764	13	1
46.1.1.1	0.11	146	68	0.49	3.15	2.0	.1076	0.8	1759	14	-1
46.5.2.1	0.30	396	233	0.61	3.31	1.7	.1075	0.5	1758	10	3
46.19.1.1	0.11	313	268	0.88	3.17	1.8	.1075	0.6	1758	12	-1
46.11.1.1	0.26	408	318	0.81	3.33	1.8	.1075	1.8	1757	33	4
46.29.1.1	0.00	210	121	0.60	3.19	1.7	.1073	0.6	1755	11	0
46.20.1.1	0.02	113	102	0.93	3.26	1.8	.1073	0.8	1754	15	2
46.8.1.1	0.11	180	113	0.65	3.25	1.7	.1073	0.7	1754	13	1
46.24.1.1	0.05	203	120	0.61	3.29	1.7	.1072	0.7	1753	13	2
46.7.1.1	0.11	176	111	0.65	3.25	1.7	.1072	0.7	1753	14	1
46.9.1.1	0.16	133	106	0.83	3.20	1.8	.1072	1.2	1752	23	0
46.5.1.1	0.08	229	239	1.08	3.20	1.7	.1071	0.6	1751	12	0
46.16.1.1	0.10	183	123	0.69	3.17	1.7	.1071	0.8	1751	15	-1
46.4.1.1	0.08	127	88	0.72	3.17	1.8	.1071	0.8	1750	15	-1
46.21.1.1	0.13	163	104	0.66	3.21	1.8	.1070	0.8	1749	14	0
46.2.1.1	0.13	242	137	0.58	3.13	1.7	.1069	0.6	1747	11	-2
46.18.1.1	0.08	199	157	0.81	3.21	1.7	.1069	0.7	1747	12	0
46.3.1.1	0.08	374	234	0.65	3.17	1.7	.1069	0.5	1747	9	-1
46.26.1.1	0.02	310	164	0.55	3.19	1.7	.1069	0.5	1747	9	-1
46.6.1.1	0.09	344	192	0.58	3.20	1.7	.1067	0.5	1744	9	0
46.28.1.1	0.00	231	130	0.58	3.16	1.7	.1067	0.6	1743	11	-2
46.23.1.1	0.05	202	113	0.58	3.18	1.7	.1066	0.7	1742	12	-1
46.17.1.1	0.12	154	99	0.66	3.18	1.8	.1064	0.8	1739	14	-1
46.25.1.1	0.07	160	80	0.52	3.17	1.8	.1064	0.7	1739	13	-2
46.14.1.1	0.10	163	109	0.69	3.22	1.8	.1064	1.0	1739	18	0
46.27.1.1	0.08	215	131	0.63	3.25	1.9	.1062	0.7	1735	12	0
Analyses >10% discordant and/or >0.5% $^{206}Pb_c$											
46.22.1.1	1.31	310	214	0.71	3.67	1.7	.1055	0.9	1723	17	11
46.13.1.1	0.73	33	18	0.57	3.25	2.2	.1048	2.5	1711	47	-1
46.15.1.1	1.92	449	215	0.49	3.82	1.8	.1041	3.0	1698	55	13

12. COOYERDOO GRANITE: 2008371067

GA Sample ID:	**2008371067**
GA Sample Number:	**1958105**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**702571 6361851 Zone 53**
Collector:	**G. Fraser, S. McAvaney, N. Neumann, M. Szpunar**
Collection Date:	**31/5/2008**
Formal Name:	**Cooyerdoo Granite**
Informal Name:	
Lithology:	**foliated granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6062**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**2 – 8/8/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.21% (2σ) [55 of 59]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.1 ± 1.9 Ma [30 of 30]**
Interpreted Age:	**3149 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

The Cooyerdoo Granite crops out on the eastern side of the Middleback Ranges, Eyre Peninsula, South Australia. This sample was collected ~10 km south of Iron Knob, on Katunga Station. The outcrop occurs as low tors of orange-weathering granite (Figure 12.1). This rock consists of medium- to coarse-grained, quartz-plagioclase-K-feldspar and biotite, and has a steeply-dipping foliation defined by aligned biotite that trends north-northeast. Results presented here have also been reported in Fraser *et al*., (2010).

Figure 12.1. *Outcrop photo of Cooyerdoo Granite.*

Zircon Description

Zircon from this rock is not particularly abundant, and exhibits a range in morphology and quality. Most common are relatively large, cloudy grains, with less common clear zircon grains and fragments. Due to the relative paucity of high-quality zircons from this rock, two fractions have been mounted – the 5° non-magnetic (NM) fraction and the 5° magnetic (M) fraction.

The 5° NM fraction contains a wider range of grain sizes and morphologies than the 5° M fraction. Grains include; (i) subhedral grains with aspect ratios of ~1:2 to 1:3 and size of ~70 x 140 µm with indistinct internal zonation and generally rather dark CL response (expected high

U), (ii) relatively equant, euhedral grains, with oscillatory internal zonation, and (iii) relatively large (100 x 150 µm) fragments with well-preserved oscillatory zoning. Most zircon, particularly the larger grains, is dark honey-coloured in transmitted light, and many grains are almost opaque.

The 5° M fraction consists only of elongate, relatively euhedral grains, typically ~50 x 140 µm with oscillatory zoning, in some cases with a rather mottled internal zonation suggestive of post-crystallisation modification of original igneous zoning. Most grains are significantly cracked (Figure 12.2).

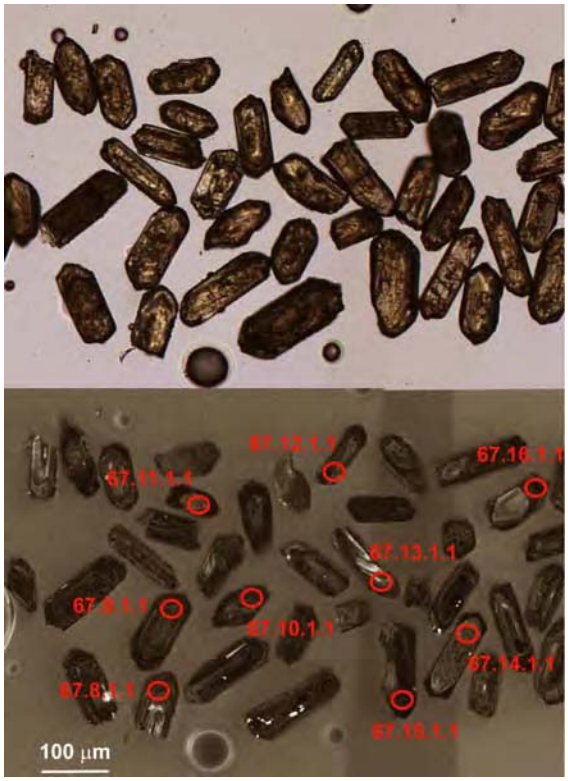

Figure 12.2. *Representative transmitted light and cathodoluminescence images of zircons from the Cooyerdoo Granite (2008371067), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Thirty-nine U-Pb analyses were collected from 39 different zircon grains (Figure 12.3). Of these, 19 analyses are from the 5°M fraction, and 20 are from the 5°NM fraction. The U and Th contents of the 5°M fraction are distinctly higher than in the 5°NM fraction, and Th/U ratio is slightly higher in the 5°NM fraction, typically being in the range 0.6 to 1.2. Of the 20 analyses of the NM fraction, 15 define a weighted mean $^{207}Pb/^{206}Pb$ age of 3149 ± 3 Ma (95% confidence; MSWD = 0.9; probability of fit = 0.56; Figure 12.4). The five analyses excluded from this age grouping consist of one near-concordant young outlier, two analyses with >0.5 % common Pb ($^{206}Pb_c$) and analyses that are 8% and 4% discordant.

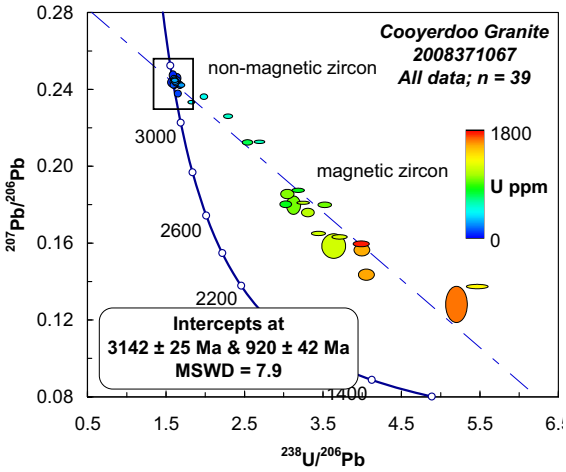

Figure 12.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Cooyerdoo Granite (2008371067), coloured according to U content.*

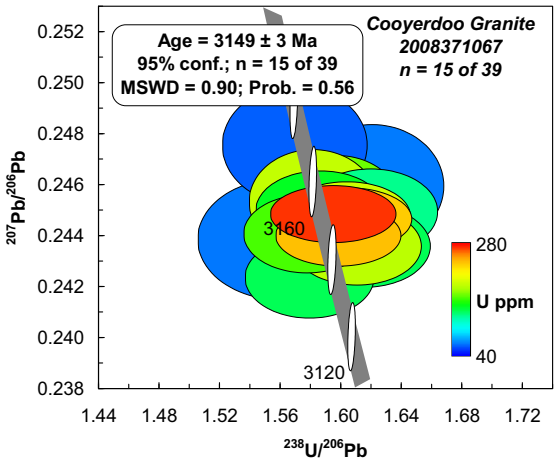

Figure 12.4. *Tera-Wasserburg concordia diagram showing results of near-concordant zircon analyses from the Cooyerdoo Granite (2008371067), coloured according to U content.*

All 19 analyses from the more magnetic zircon fraction are >>10% discordant and together with the nonmagnetic zircon fraction they define a discordia trend with upper and lower intercepts of 3142 ± 25 Ma and 920 ± 42 Ma, with significant scatter indicated by the MSWD of 7.9. Although the data are scattered and result in relatively imprecise discordia intercepts, these data are consistent with an igneous age of ~3149 Ma, as defined by the more concordant analyses from this sample, and having lost variable amounts of Pb, largely in a single event between ~1000 and 800 Ma.

Geochronological Interpretation

Zircon from this sample suggests a single period of zircon growth at 3149 ± 3 Ma, interpreted as the igneous crystallisation age for this granite. Discordant analyses suggest an episode of Pb-loss in the Neoproterozoic.

Table 12.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371067 (1958105), Cooyerdoo Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
5° Nonmagnetic: Igneous crystallisation age (n = 15)											
067.34.1.1	0.00	60	73	1.26	1.57	2.0	.2476	0.6	3169	10	0
067.3.1.1	0.12	66	73	1.14	1.62	1.9	.2459	0.7	3159	10	2
067.5.1.1	0.09	192	244	1.31	1.58	1.8	.2453	0.6	3155	9	0
067.31.1.1	0.09	144	188	1.35	1.59	1.8	.2450	0.4	3153	7	0
067.36.1.1	0.15	169	175	1.07	1.60	1.8	.2450	0.6	3152	9	1
067.30.1.1	0.02	124	127	1.05	1.62	1.8	.2449	0.5	3152	7	2
067.32.1.1	0.05	271	419	1.60	1.59	1.7	.2448	0.3	3152	5	0
067.33.1.1	0.04	196	143	0.75	1.60	1.7	.2448	0.4	3151	6	1
067.38.1.1	0.03	235	365	1.60	1.60	1.7	.2446	0.3	3150	5	1
067.2.1.1	0.03	162	109	0.70	1.58	1.8	.2441	0.4	3147	7	-1
067.35.1.1	0.05	240	138	0.60	1.60	1.7	.2440	0.3	3146	5	0
067.7.1.1	0.14	65	73	1.16	1.56	2.4	.2438	0.6	3145	10	-1
067.27.1.1	0.06	135	144	1.10	1.62	1.8	.2436	0.4	3143	7	1
067.29.1.1	0.21	189	204	1.12	1.61	1.7	.2436	0.4	3143	7	1
067.37.1.1	0.05	135	82	0.63	1.58	1.8	.2423	0.4	3135	7	-1
5°Nonmagnetic: affected by minor ancient Pb-loss (n = 5)											
067.6.1.1	0.09	251	388	1.60	1.68	1.7	.2424	0.3	3136	5	4
067.28.1.1	0.70	131	153	1.21	1.66	1.8	.2424	0.5	3135	8	3
067.39.1.1	0.88	139	160	1.19	1.59	1.8	.2424	0.5	3134	8	0
067.1.1.1	0.12	107	107	1.03	1.63	1.8	.2381	0.5	3107	8	1
067.40.1.1	0.05	433	314	0.75	1.81	1.7	.2336	0.3	3077	4	8
5° Magnetic: affected by significant Neoproterozoic Pb-loss (n = 19)											
067.14.1.1	0.35	459	321	0.72	1.97	1.7	.2364	0.4	3095	6	17
067.19.1.1	1.64	541	270	0.51	2.28	1.7	.2263	0.3	3023	6	29
067.11.1.1	0.32	572	347	0.63	2.68	1.8	.2130	0.3	2928	5	43
067.13.1.1	0.31	726	252	0.36	2.52	1.7	.2127	0.4	2925	7	36
067.8.1.1	1.41	795	573	0.75	3.18	1.7	.1877	0.4	2720	6	54
067.17.1.1	1.04	1003	527	0.54	3.04	1.9	.1859	0.9	2704	14	48
067.16.1.1	0.55	1121	573	0.53	3.24	1.7	.1814	0.3	2664	5	54
067.18.1.1	1.00	795	183	0.24	3.02	1.7	.1805	0.6	2656	11	44
067.9.1.1	0.69	969	440	0.47	3.51	1.7	.1802	0.5	2654	9	64
067.10.1.1	1.24	979	579	0.61	3.11	1.9	.1800	1.8	2651	29	48
067.12.1.1	0.83	1113	769	0.71	3.30	1.7	.1762	0.8	2617	13	53
067.21.1.1	0.41	1169	245	0.22	3.43	1.7	.1654	0.4	2511	7	52
067.22.1.1	0.69	1199	663	0.57	3.70	1.7	.1635	0.4	2491	8	62
067.23.1.1	0.31	1768	233	0.14	3.98	1.7	.1599	0.6	2454	10	70
067.24.1.1	1.61	1178	279	0.24	3.63	2.8	.1588	2.7	2441	46	56
067.20.1.1	1.73	1555	264	0.18	3.99	1.6	.1568	1.3	2419	22	68
067.26.1.1	1.38	1572	637	0.42	4.04	1.6	.1440	1.3	2274	23	60
067.25.1.1	1.90	1330	791	0.61	5.46	1.7	.1378	0.5	2198	9	103
067.15.1.1	2.26	1648	844	0.53	5.20	1.8	.1285	4.8	2077	85	83

13. COOYERDOO GRANITE: 2008371080

GA Sample ID:	**2008371080**
GA Sample Number:	**1976794**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**701117 6364429 Zone 53**
Collector:	**G. Fraser, C. Foudoulis, S. McAvaney, A. Reid**
Collection Date:	**8/9/2008**
Formal Name:	**Cooyerdoo Granite**
Informal Name:	
Lithology:	**foliated granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6070**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**31/10-2008 – 7/11/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.90% (2σ) [68 of 70]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.4 ± 1.2 Ma [35 of 35]**
Interpreted Age:	**3158 ± 2 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

The Cooyerdoo Granite crops out on the eastern side of the Middleback Ranges, Eyre Peninsula, South Australia. This sample was collected near the northern extent of the Cooyerdoo Granite, a few tens of metres east (i.e. on the Katunga Station side) of the Cooyerdoo-Katunga Station boundary fence. The Cooyerdoo Granite at this locality forms subhorizontal pavements and low tors (Figure 13.1). It is dominantly composed of even-grained, medium-grained, grey quartz-plagioclase granite, with a foliation trending 030°. The granite contains discontinuous, folded, white, quartz-rich leucocratic bands and lenses up to ~15 cm wide. Also present are aplitic veins with relatively sharp margins that cross-cut the dominant foliation at low angle, and sigmoidal-shaped quartz veins. Sample 2008371080 was collected via drilling and feathers and wedges, and is a large, fresh sample. The sampled rock does not contain obvious aplitic or quartz veins and is not obviously foliated in hand specimen.

Figure 13.1. *Outcrop photo of Cooyerdoo Granite at site of sample 2008371080.*

Results presented here have also been reported in Fraser *et al*. (2010).

Zircon Description

Zircons from sample 2008371080 occur as euhedral grains and fragments with aspect ratios of ~2, and long axis dimensions between 100 and 200 µm (Figure 13.2). Three groups of zircons were separated and mounted, according to their magnetic properties as revealed by Frantz magnetic separation. The three groups are: 5° magnetic, 4° magnetic, and 4° non-magnetic. No morphological differences are evident between these groupings, although in cathodoluminescence (CL) images the non-magnetic fraction contains a higher proportion of clearer and brighter grains, corresponding to lower U content.

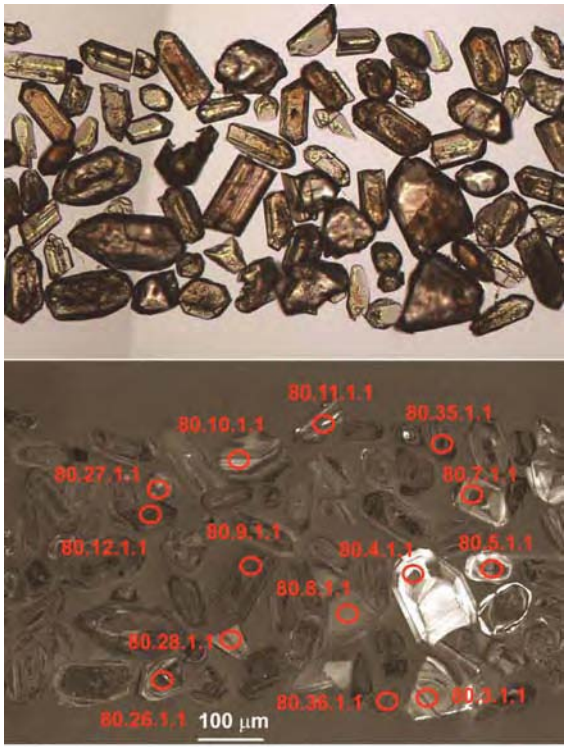

Figure 13.2. *Representative transmitted light and cathodoluminescence images of zircons from the Cooyerdoo Granite (2008371080), with locations of some SHRIMP analyses.*

All grains exhibit variably-preserved, concentric, oscillatory zoning that is concordant with grain boundaries. In darker CL grains, with higher U content, this concentric zoning generally appears broader and more mottled than in bright CL, low U grains, suggesting some post-crystallisation internal modification, interpreted as most likely due to incipient metamictisation. The euhedral grain morphologies and oscillatory internal zoning suggest that these zircons are of igneous origin.

U-Pb Isotopic Results

Thirty-nine analyses were collected from 36 different zircon grains. Of these, 21 analyses are >10% discordant, and/or contain >0.5% $^{206}Pb_c$ and have not been considered in age calculations (Figure 13.3). Of the remaining 18 analyses, all but two cluster at ~3150 Ma. The two outlying analyses (80.8.1.1 and 80.14.1.1) yield $^{207}Pb/^{206}Pb$ ages of 3294 ± 4 Ma and 3297 ± 3 Ma. Both these old grains are interpreted as inherited zircons, consistent with these grains exhibiting atypical grain shapes compared with the dominant zircon population, and rather uniform CL response in contrast to the oscillatory zoning typical of most grains from this sample.

The 16 remaining analyses combine to yield a weighted mean $^{207}Pb/^{206}Pb$ age of 3157 ± 4 Ma with slight excess scatter indicated by MSWD of 2.3. If the four most discordant grains from this group are excluded, three of which contain relatively high $^{206}Pb_c$, the remaining 12 analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 3158 ± 2 Ma (95% confidence; MSWD = 1.1; probability of fit =0.35; Figure 13.4).

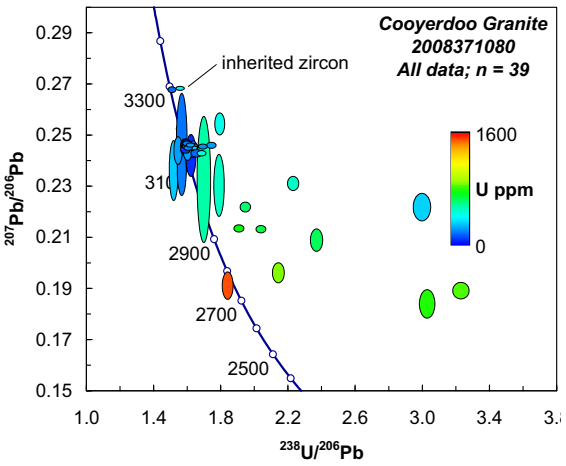

Figure 13.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Cooyerdoo Granite (2008371080), coloured according to U content.*

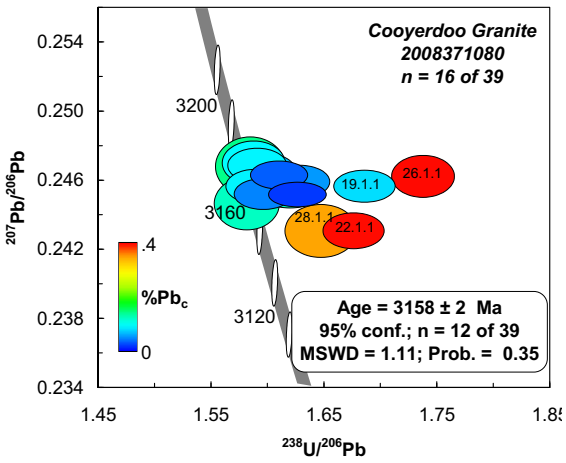

Figure 13.4. *Tera-Wasserburg concordia diagram showing results of near-concordant zircon analyses from the Cooyerdoo Granite (2008371080), coloured according to* $\%^{206}Pb_c$. *The four analyses that are individually labelled with spot numbers have not been included in the mean age calculation.*

Geochronological Interpretation

The weighted mean $^{207}Pb/^{206}Pb$ age of 3158 ± 2 Ma is interpreted as the best estimate for the igneous crystallisation age of this sample.

Table 13.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371080 (1976794), Cooyerdoo Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited zircons (n = 2)											
80.14.1.1	0.06	361	147	0.42	1.55	1.1	0.2684	0.18	3297	3	3
80.8.1.1	0.02	145	54	0.38	1.501	1.1	0.2679	0.27	3294	4	0
Igneous crystallisation age (n = 12)											
80.4.1.1	0.09	101	78	0.80	1.59	1.1	.2470	0.3	3166	5	1
80.24.1.1	0.09	180	84	0.48	1.59	1.1	.2468	0.3	3165	4	1
80.15.1.1	0.14	61	20	0.34	1.58	1.3	.2468	0.5	3164	7	0
80.2.1.1	0.07	143	91	0.66	1.60	1.1	.2465	0.3	3163	4	1
80.16.2.1	0.03	231	99	0.45	1.61	1.0	.2463	0.2	3161	3	2
80.20.1.1	0.05	185	88	0.49	1.63	1.1	.2459	0.3	3159	4	2
80.18.1.1	0.07	197	144	0.75	1.62	1.2	.2457	0.3	3157	4	2
80.1.1.1	0.09	158	79	0.52	1.59	1.1	.2456	0.3	3157	4	0
80.5.1.1	0.12	194	153	0.82	1.62	1.1	.2453	0.2	3155	4	2
80.23.1.1	0.05	196	101	0.53	1.60	1.1	.2452	0.2	3154	4	1
80.16.1.1	0.02	298	119	0.41	1.63	1.0	.2452	0.2	3154	3	2
80.17.1.1	0.12	77	39	0.53	1.58	1.2	.2446	0.4	3150	7	0
Slightly discordant and/or high $^{206}Pb_c$ (n = 4)											
80.26.1.1	0.40	218	46	0.22	1.74	1.0	.2462	0.3	3161	5	8
80.19.1.1	0.08	205	141	0.71	1.69	1.1	.2456	0.3	3157	4	5
80.22.1.1	0.40	438	284	0.67	1.68	1.1	.2430	0.3	3140	5	4
80.28.1.1	0.35	148	104	0.73	1.65	1.3	.2430	0.4	3140	7	3
Analyses >10% discordant and/or containing >0.5% $^{206}Pb_c$ (n = 21)											
80.32.1.1	1.97	421	184	0.45	1.79	1.1	.2545	1.1	3213	18	12
80.3.1.1	5.23	162	73	0.46	1.56	1.4	.2473	5.1	3167	81	-1
80.27.1.1	1.63	168	114	0.71	1.58	1.1	.2455	0.9	3156	14	0
80.7.1.1	1.59	182	79	0.45	1.63	1.1	.2446	0.9	3150	14	2
80.11.1.1	2.35	224	193	0.89	1.54	1.1	.2441	1.5	3147	23	-3
80.20.2.1	1.63	227	106	0.48	1.60	1.1	.2435	0.9	3143	14	0
80.17.2.1	3.69	64	36	0.57	1.61	1.3	.2422	2.2	3134	36	1
80.6.1.1	5.17	177	126	0.73	1.56	1.1	.2369	2.9	3099	46	-3
80.21.1.1	5.53	287	201	0.72	1.51	1.2	.2363	3.3	3095	52	-5
80.12.1.1	11.67	531	208	0.40	1.69	1.6	.2328	7.0	3072	112	3
80.9.1.1	1.27	480	356	0.77	2.23	1.0	.2312	0.8	3060	13	28
80.33.1.1	5.27	487	154	0.33	1.78	1.2	.2305	3.5	3055	55	6
80.29.1.1	0.64	598	242	0.42	1.94	1.0	.2221	0.6	2996	9	12
80.10.1.1	2.71	300	105	0.36	2.99	1.2	.2220	1.6	2996	26	61
80.30.1.1	0.66	722	248	0.36	1.90	1.0	.2138	0.4	2934	7	8
80.34.1.1	0.67	650	233	0.37	2.03	1.0	.2134	0.4	2932	7	14
80.25.1.1	2.28	626	81	0.13	2.36	1.0	.2091	1.4	2899	22	28
80.36.1.1	1.99	887	285	0.33	2.14	1.1	.1964	1.3	2797	22	13
80.13.1.1	2.73	1511	919	0.63	1.83	1.1	.1913	1.8	2754	30	-2
80.35.1.1	1.33	825	321	0.40	3.23	1.0	.1894	1.1	2737	18	57
80.31.1.1	2.90	769	220	0.30	3.03	1.0	.1843	2.0	2692	33	46

14. COOYERDOO GRANITE: 2008371086

GA Sample ID:	**2008371086**
GA Sample Number:	**1976800**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**700742 6360000 Zone 53**
Collector:	**G. Fraser, C. Foudoulis**
Collection Date:	**11/9/2008**
Formal Name:	**Cooyerdoo Granite**
Informal Name:	
Lithology:	**foliated granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6070**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**31/10-2008 – 7/11/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.90% (2σ) [68 of 70]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.4 ± 1.2 Ma [35 of 35]**
Interpreted Age:	**3155 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

The Cooyerdoo Granite crops out on the eastern side of the Middleback Ranges, Eyre Peninsula, South Australia. This sample was collected from near the centre of the mapped outcrop of Cooyerdoo Granite, about 40 metres west of the Cooyerdoo-Katunga Station boundary fence. The Cooyerdoo Granite at this locality is an even-grained, grey to slightly orange rock, with a weak foliation defined by preferred orientation of flattened quartz and feldspar grains, and narrow, discontinuous trails of biotite (Figure 14.1). The foliation trend varies between N and NNW, and dips steeply west.

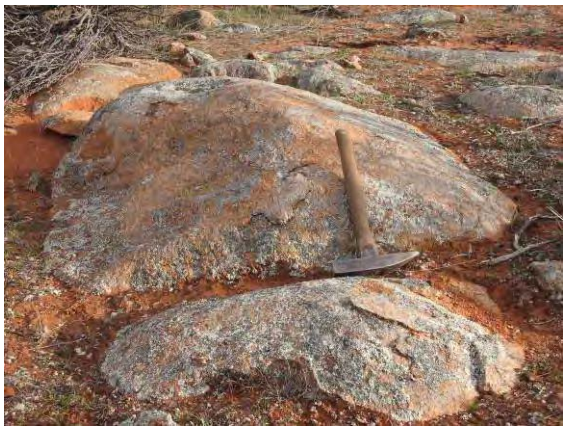

Figure 14.1. *Outcrop photo of Cooyerdoo Granite at site of sample 2008371086.*

Zircon Description

Zircons from 2008371086 form euhedral and subhedral grains and fragments ranging in long dimension from ~50 to ~200 μm, with aspect ratios typically between 1 and 2, plus a few more elongate fragments. Zircons have been separated into 4° M, and 4° NM fractions via Frantz magnetic separation. Grains range from clear to brown in transmitted light. In cathodoluminescence (CL) images most grains exhibit concentric oscillatory zonation in at least parts of the grain. Some grains also exhibit sector zoning overlain on oscillatory zoning. A small number of grains display narrow, dark CL

outermost zones, generally concordant with oscillatory zoning in the interior of the grain. Many of the larger grains are brown in transmitted light and exhibit either broad, mottled relic oscillatory zoning in CL, or are uniformly dark in CL, interpreted as due to radiation damage (Figure 14.2).

Figure 14.2. *Representative transmitted light and cathodoluminescence images of zircons from the Cooyerdoo Granite (2008371086), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Fifty five U-Pb analyses were collected from 54 zircon grains. Thirty one analyses are either >10% discordant and/or contain >0.5 %$^{206}Pb_c$, leaving 24 near-concordant, low common Pb analyses. Most of these analyses cluster around ~3150 Ma, with four older analyses and four younger analyses (Figure 14.3). The four older analyses (86.8.1.1, 86.38.1.1, 86.39.1.1, 86.41.1.1) yield $^{207}Pb/^{206}Pb$ ages of ~3310, 3250, 3240 and 3215 Ma. Each of these grains are atypical compared with the dominant zircon population, exhibiting a combination of large grain size, equant morphology, and uniform rather than oscillatory-zoned CL response. On the basis of these characteristics, and their ages, these grains are interpreted as inherited zircons.

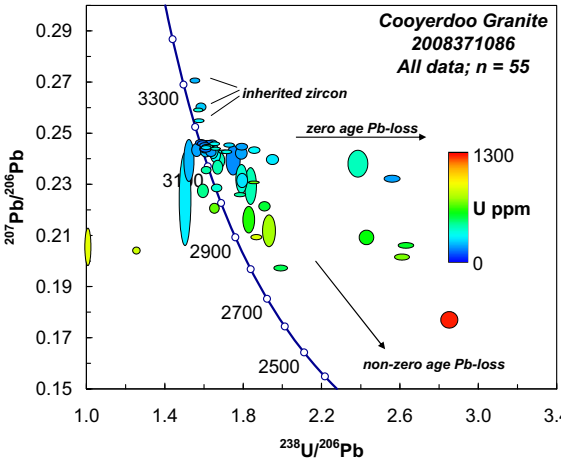

Figure 14.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Cooyerdoo Granite (2008371086), coloured according to U content.*

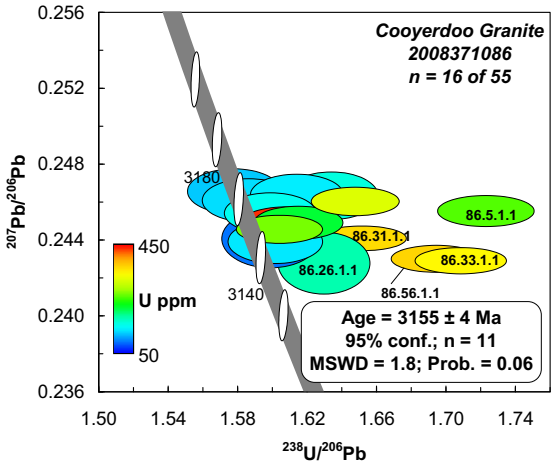

Figure 14.4. *Tera-Wasserburg concordia diagram showing results of near-concordant zircon analyses from the Cooyerdoo Granite (2008371086), coloured according to U content The five analyses that are individually labelled with spot numbers have not been included in the mean age calculation.*

The four analyses younger than ~3150 Ma are 86.1.1.1, 86.25.1.1. 86.40.1.1 and 86.44.1.1. Each of these analyses contains >400 ppm U, and >0.3% $^{206}Pb_c$, and is at least 4 % discordant. The $^{207}Pb/^{206}Pb$ ages of these grains scatter between ~2800 and 3100 Ma, and are attributed to non-

zero age Pb-loss and are not regarded as having geological meaning. The remaining 16 analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 3150 ± 4 Ma, with excess scatter as indicated by MSWD of 4.3. The youngest of these analyses (86.26.1.1) contains the highest abundance of common Pb in this group (0.42 % $^{206}Pb_c$) and is rejected on this basis. A further four of these analyses (86.5.1.1, 86.31.1.1, 86.33.1.1, 86.56.1.1) are rejected as being the most discordant of this group, probably as a result of Pb-loss related to metamictisation as these four analyses all contain relatively high U (>250 ppm). This leaves a relatively concordant group of 11 analyses with a weighted mean $^{207}Pb/^{206}Pb$ age of 3155 ± 4 Ma (95% confidence; MSWD = 1.8; probability of fit = 0.06; Figure 14.4).

Geochronological Interpretation

The weighted mean $^{207}Pb/^{206}Pb$ age of 3155 ± 4 Ma is taken as the best estimate for the igneous crystallisation age of this sample. Inherited zircon includes components as old as ~3310 Ma.

Table 14.1. SHRIMP U-Pb isotopic data for zircons from sample 2008381086 (1976800), Cooyerdoo Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± (Ma) (1σ)	Disc (%)
Inherited zircons (n = 4)											
86.8.1.1	0.20	207	244	1.22	1.55	1.0	.2707	0.2	3310	4	3
86.38.1.1	0.13	235	51	0.22	1.58	1.0	.2603	0.4	3249	6	3
86.39.1.1	0.07	355	140	0.41	1.56	1.0	.2592	0.2	3242	3	2
86.41.1.1	0.04	294	160	0.56	1.57	1.0	.2550	0.2	3216	3	1
Analyses used in mean age calculations (n = 11)											
86.22.1.1	0.07	121	199	1.70	1.58	1.1	.2465	0.3	3163	5	0
86.6.1.1	0.08	137	178	1.34	1.61	1.1	.2463	0.3	3161	5	2
86.12.1.1	0.05	160	194	1.25	1.63	1.1	.2463	0.3	3161	5	3
86.24.1.1	0.10	130	68	0.54	1.59	1.1	.2461	0.3	3160	5	0
86.42.1.1	0.11	320	142	0.46	1.65	1.0	.2460	0.2	3159	3	3
86.18.1.1	0.10	152	127	0.86	1.60	1.1	.2454	0.3	3155	5	1
86.19.1.1	0.22	438	323	0.76	1.61	1.1	.2450	0.2	3152	3	1
86.4.1.1	0.06	218	156	0.74	1.62	1.1	.2449	0.2	3152	4	1
86.2.1.1	0.06	268	160	0.62	1.60	1.0	.2445	0.2	3150	3	1
86.22.2.1	0.08	91	99	1.13	1.60	1.2	.2440	0.4	3146	7	0
86.45.1.1	0.05	135	68	0.52	1.60	1.1	.2439	0.3	3145	5	1
Slightly discordant or elevated $^{206}Pb_c$ (n = 5)											
86.5.1.1	0.07	257	106	0.43	1.72	1.1	.2455	0.2	3156	3	7
86.31.1.1	0.02	365	160	0.45	1.65	1.0	.2441	0.2	3147	3	3
86.56.1.1	0.06	369	169	0.47	1.69	1.0	.2430	0.2	3140	3	5
86.33.1.1	0.04	346	142	0.42	1.71	1.0	.2429	0.2	3139	3	6
86.26.1.1	0.42	181	71	0.41	1.63	1.1	.2427	0.4	3138	7	2
Non-zero age Pb-loss (n = 4)											
86.40.1.1	0.17	432	141	0.34	1.60	1.0	.2358	0.4	3092	6	-1
86.44.1.1	0.33	437	174	0.41	1.78	1.1	.2262	0.3	3025	4	5
86.25.1.1	0.47	875	606	0.72	1.86	1.0	.2096	0.3	2902	5	5
86.1.1.1	0.46	516	453	0.91	1.99	1.1	.1976	0.4	2806	6	7
>10% discordant (n = 11)											
86.27.1.1	0.32	184	202	1.13	1.79	1.1	.2449	0.3	3152	5	10
86.9.1.1	0.41	304	258	0.88	1.85	1.0	.2435	0.3	3143	5	13
86.10.1.1	0.88	277	225	0.84	1.94	1.1	.2399	0.5	3119	8	17
86.30.1.1	2.59	409	124	0.31	2.38	1.4	.2382	1.5	3108	23	38
86.3.1.1	0.07	185	149	0.83	2.56	1.1	.2324	0.4	3068	6	44
86.48.1.1	0.16	694	480	0.71	1.85	1.0	.2310	0.2	3059	3	10
86.7.1.1	0.94	545	195	0.37	1.90	1.0	.2216	0.6	2992	9	10
86.52.1.1	1.19	589	442	0.77	2.43	1.0	.2095	0.9	2901	15	30
86.34.1.1	0.37	558	286	0.53	2.63	1.0	.2064	0.4	2877	6	38
86.28.1.1	0.37	711	382	0.56	2.61	1.0	.2018	0.4	2841	6	36
86.54.1.1	1.52	1273	590	0.48	2.85	1.0	.1774	1.2	2628	20	36
>0.5% $^{206}Pb_c$ (n = 18)											
86.13.1.1	1.24	188	164	0.90	1.56	1.1	.2437	0.7	3144	11	-2
86.21.1.1	1.22	311	231	0.77	1.64	1.0	.2433	0.8	3142	13	2
86.46.1.1	0.65	224	215	0.99	1.60	1.1	.2429	0.6	3139	9	0
86.14.1.1	1.09	188	154	0.85	1.78	1.1	.2424	0.6	3136	10	9
86.32.1.1	1.50	318	115	0.37	1.65	1.0	.2418	0.8	3132	13	3
86.36.1.1	2.16	162	65	0.41	1.74	1.4	.2396	1.6	3117	25	7
86.37.1.1	1.57	411	170	0.43	1.67	1.0	.2395	0.9	3117	14	3
86.35.1.1	4.12	211	97	0.47	1.52	1.2	.2395	2.2	3117	36	-5
86.23.1.1	1.36	424	207	0.50	1.66	1.1	.2369	0.7	3099	12	2
86.51.1.1	2.42	380	126	0.34	1.79	1.1	.2323	1.6	3068	25	7
86.49.1.1	1.39	273	188	0.71	1.79	1.0	.2317	0.8	3064	13	7
86.53.1.1	3.62	421	174	0.43	1.83	1.1	.2296	2.1	3049	33	9
86.11.1.1	0.67	372	91	0.25	1.66	1.0	.2288	0.4	3043	7	0
86.55.1.1	1.34	458	176	0.40	1.59	1.1	.2276	0.8	3036	12	-4
86.29.1.1	8.95	285	131	0.48	1.50	1.3	.2245	5.3	3013	86	-9
86.50.1.1	0.98	687	465	0.70	1.65	1.0	.2209	0.6	2987	9	-2
86.20.1.1	2.39	620	385	0.64	1.82	1.0	.2164	1.6	2954	25	5
86.47.1.1	3.26	755	375	0.51	1.93	1.1	.2121	1.9	2922	31	8
Very reversely discordant (n = 2)											
86.43.1.1	3.24	891	711	0.82	1.00	1.0	.2058	2.3	2873	38	-36
86.16.1.1	0.70	838	249	0.31	1.25	1.0	.2044	0.4	2861	7	-25

15. COOYERDOO GRANITE: 2008371087

GA Sample ID:	**2008371087**
GA Sample Number:	**1976801**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**700760 6355849 Zone 53**
Collector:	**G. Fraser, C. Foudoulis**
Collection Date:	**12/9/2008**
Formal Name:	**Cooyerdoo Granite**
Informal Name:	
Lithology:	**foliated granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6070**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**31/10-2008 – 7/11/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.90% (2σ) [68 of 70]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.4 ± 1.2 Ma [35 of 35]**
Interpreted Age:	**3152 ± 19 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

The Cooyerdoo Granite crops out on the eastern side of the Middleback Ranges, Eyre Peninsula, South Australia. This sample was collected ~4.5 km south of 2008371086, and about 150 metres east of the Cooyerdoo-Katunga Station boundary fence (i.e. on Katunga side). In this vicinity the Cooyerdoo Granite exhibits more prominent compositional banding than seen at other sampled localities. Specifically, wispy, discontinuous biotite-rich bands up to a few centimetres wide define a subhorizontal compositional layering. This compositional fabric is cross-cut by a subvertical to steeply east-dipping (~55°) foliation defined by alignment of biotite and flattened quartz and feldspar. This foliation trends 010 – 020. Sample 2008371087 was collected from a small, horizontal pavement on the slope of a low ridge (Figure 15.1). The sampled rock is a medium-grained, even-grained granite, compositionally banded on the scale of a few millimetres to about a centimetre giving the rock a subtle blue-grey to orange banded appearance.

Figure 15.1. *Photo of sampling in progress for sample 2008371087, Cooyerdoo Granite.*

Zircon Description

Zircons from this sample occur as euhedral to subhedral grains and fragments, with aspect ratios between 1.5 and 3, and size ranging up to ~200 µm in the long dimension. Grains range from optically clear to extremely metamict. Most grains exhibit concentric oscillatory internal zoning in CL images (Figure 15.2). A small number of grains contain rounded cores in which internal zonation is truncated by euhedral rims, suggesting the presence of some zircon inheritance.

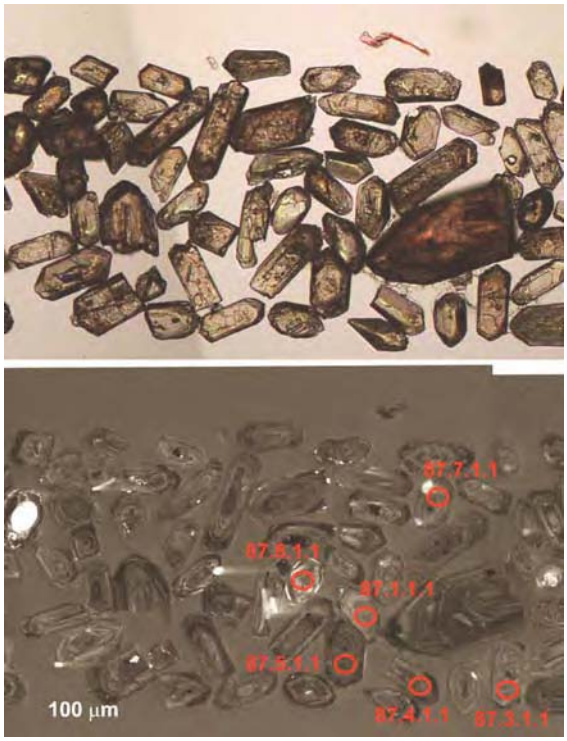

Figure 15.2. *Representative transmitted light and cathodoluminescence images of zircons from the Cooyerdoo Granite (2008371087), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Fifty four analyses were collected from 54 different zircon grains. Twenty two of these analyses are >10% discordant, and range up to 77% discordant. There is a clear positive correlation between discordance and U content, with all but one of the analyses containing >500 ppm U being >10% discordant (Figure 15.3). Of the near-concordant analyses, 12 yield $^{207}Pb/^{206}Pb$ ages significantly older than ~3150 Ma, and are interpreted as inherited zircon. One of these analyses is very imprecise due to relatively high common Pb content. Three of the interpreted inherited grains cluster at ~3210 Ma, and another 8 range in age between ~3260 and ~3315 Ma.

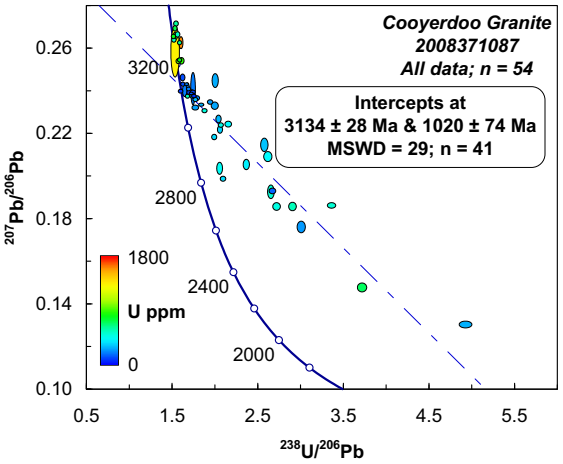

Figure 15.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Cooyerdoo Granite (2008371087), coloured according to U content.*

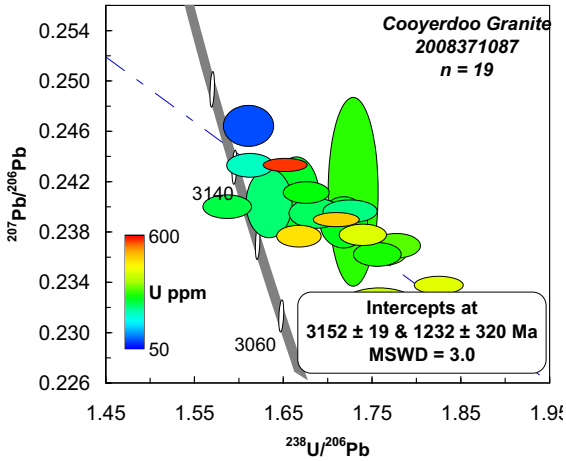

Figure 15.4. *Tera-Wasserburg concordia diagram showing results of near-concordant zircon analyses from the Cooyerdoo Granite (2008371087), coloured according to U content.*

Omitting the analyses interpreted to be inherited zircon, and a single reversely discordant analysis (87.3.1.1), forty-one analyses define a scattered (MSWD = 29) discordia with upper and lower concordia intercepts of 3134 ± 28 Ma and 1020 ± 74 Ma, respectively. Most of the discordia scatter

is attributable to analyses >10% discordant, which suggests these sites have undergone multiple Pb-loss events. If only the 19 analyses less than 10% discordant are included, the scatter in the resulting discordia is greatly reduced (MSWD = 3.0) and yields upper and lower intercepts of 3152 ± 19 Ma and 1232 ± 320 Ma, respectively (Figure 15.4).

Geochronological Interpretation

The upper intercept age of 3152 ± 19 Ma, although relatively imprecise, is consistent with ages derived from three other samples of the Cooyerdoo Granite, and is regarded as the best estimate of the time of crystallisation of this rock.

Table 15.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371087 (1976801), Cooyerdoo Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited zircons (n = 9)											
87.53.1.1	0.08	120	27	0.23	1.53	1.1	.2716	0.3	3316	5	2
87.8.1.1	0.04	204	49	0.25	1.52	1.1	.2693	0.3	3302	5	1
87.15.1.1	0.03	116	57	0.51	1.55	1.1	.2665	0.3	3286	5	2
87.9.1.1	0.06	196	126	0.66	1.50	1.1	.2656	0.3	3280	4	0
87.25.1.1	0.24	206	121	0.61	1.51	1.1	.2640	0.3	3271	4	0
87.1.1.1	0.05	204	122	0.62	1.57	1.0	.2627	0.2	3263	4	3
87.10.1.1	0.05	199	95	0.49	1.57	1.1	.2545	0.3	3213	4	1
87.41.1.1	0.14	90	38	0.44	1.59	1.3	.2542	0.4	3211	6	2
87.32.1.1	0.06	106	43	0.42	1.56	1.1	.2540	0.3	3210	5	0
Inherited zircon with >0.5% $^{206}Pb_c$ (n = 3)											
87.18.1.1	0.57	104	53	0.53	1.52	1.1	.2658	0.5	3281	7	1
87.13.1.1	1.27	139	66	0.49	1.59	1.1	.2627	0.7	3263	11	4
87.19.2.1	1.46	317	175	0.57	1.52	2.1	.2586	3.1	3238	48	-1
Igneous zircons, <10% discordant (n = 19)											
87.35.1.1	0.13	86	55	0.66	1.61	1.2	.2463	0.4	3161	7	1
87.36.1.1	0.02	579	145	0.26	1.65	1.0	.2432	0.1	3141	2	3
87.26.1.1	0.17	219	99	0.47	1.61	1.1	.2432	0.3	3141	4	1
87.19.1.1	2.23	318	114	0.37	1.73	1.1	.2411	2.1	3127	33	6
87.44.1.1	0.21	299	117	0.41	1.67	1.0	.2410	0.2	3127	4	4
87.50.1.1	1.50	286	159	0.57	1.66	1.0	.2405	0.9	3123	15	3
87.40.1.1	0.72	256	124	0.50	1.63	1.1	.2401	0.8	3121	12	1
87.29.1.1	0.28	273	132	0.50	1.59	1.1	.2399	0.3	3119	4	-1
87.52.1.1	0.13	248	121	0.51	1.72	1.2	.2395	0.2	3117	4	6
87.51.1.1	0.42	263	130	0.51	1.69	1.2	.2393	0.3	3116	5	4
87.54.1.1	0.05	495	127	0.27	1.71	1.0	.2389	0.2	3112	3	5
87.17.1.1	0.79	292	154	0.55	1.72	1.0	.2386	0.6	3111	9	5
87.37.1.1	0.25	422	107	0.26	1.74	1.0	.2376	0.2	3104	4	6
87.31.1.1	0.34	478	280	0.61	1.67	1.0	.2375	0.2	3104	4	2
87.39.1.1	0.35	336	331	1.02	1.78	1.0	.2368	0.3	3098	4	8
87.49.1.1	0.39	354	129	0.38	1.76	1.0	.2363	0.3	3095	5	7
87.11.1.1	0.24	310	133	0.45	1.76	1.0	.2361	0.3	3094	4	6
87.48.1.1	0.16	425	252	0.61	1.83	1.0	.2336	0.2	3077	3	9
87.30.1.1	0.42	403	204	0.52	1.76	1.5	.2323	0.3	3068	5	6
Igneous zircons, >10% discordant (n = 22)											
87.16.1.1	1.65	444	234	0.54	1.99	1.1	.2449	0.9	3152	14	20
87.24.1.1	0.41	357	177	0.51	1.93	1.0	.2348	0.3	3085	5	15
87.28.1.1	0.11	152	60	0.41	1.98	1.3	.2332	0.5	3074	8	17
87.20.1.1	0.31	513	224	0.45	1.86	1.0	.2308	0.3	3058	5	10
87.22.1.1	0.22	516	252	0.50	2.03	1.0	.2269	0.5	3031	8	17
87.21.1.1	0.25	573	430	0.78	2.14	1.2	.2245	0.4	3013	6	22
87.47.1.1	0.26	487	253	0.54	2.05	1.0	.2241	0.3	3010	5	18
87.2.1.1	0.76	243	113	0.48	2.05	1.0	.2220	0.5	2995	8	17
87.27.1.1	0.36	698	402	0.60	1.98	1.0	.2185	0.4	2969	6	13
87.38.1.1	1.41	282	44	0.16	2.56	1.2	.2149	1.0	2942	15	39
87.33.1.1	1.21	610	227	0.38	2.60	1.2	.2094	0.8	2901	12	38
87.46.1.1	0.64	730	350	0.50	2.36	1.0	.2055	0.8	2871	13	26
87.6.1.1	1.47	558	301	0.56	2.04	1.0	.2038	0.9	2857	15	11
87.34.1.1	0.56	805	200	0.26	2.08	1.0	.1990	0.4	2818	6	11
87.12.1.1	0.55	551	152	0.29	2.66	1.0	.1932	0.5	2770	8	35
87.4.1.1	1.67	634	539	0.88	2.64	1.0	.1929	1.1	2767	18	34
87.45.1.1	0.62	813	198	0.25	3.35	1.0	.1865	0.5	2712	8	61
87.5.1.1	1.02	882	503	0.59	2.90	1.0	.1860	0.7	2707	12	42
87.14.1.1	0.42	947	598	0.65	2.71	1.1	.1859	0.6	2706	10	34
87.7.1.1	1.43	944	456	0.50	3.00	1.0	.1764	1.0	2619	17	41
87.23.1.1	1.02	1616	133	0.09	3.71	1.0	.1480	0.9	2323	16	51
87.42.1.1	0.77	1356	361	0.27	4.93	1.0	.1308	0.8	2109	14	77
Reversely discordant (n = 1)											
87.3.1.1	0.36	945	572	0.63	1.70	1.0	.2041	0.2	2859	4	-4

16. UNNAMED GNEISSIC GRANITE, WEST OF IRON KNOB: 2008371085

GA Sample ID:	**2008371085**
GA Sample Number:	**1976799**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**692206 6376788 Zone 53**
Collector:	**G. Fraser, C. Foudoulis, S. McAvaney, A. Reid**
Collection Date:	**11/9/2008**
Formal Name:	
Informal Name:	
Lithology:	**gneissic granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6070**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**31/10-2008 – 7/11/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.90% (2σ) [68 of 70]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.4 ± 1.2 Ma [35 of 35]**
Interpreted Age:	**3151 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**
Interpreted Age:	**2510 ± 24 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**High-grade metamorphic age**

Sample Description

This sample was collected approximately 8 km WNW of Iron Knob, Eyre Peninsula, South Australia, from a region mapped as "Lincoln Complex" gneissic granite and granite gneiss between Iron Knob and the Burkitt Granite. The sample is a medium-grained, quartz-K-feldspar-plagioclase-biotite granite. Distinct banding is defined by red leucocratic bands up to ~3 cm wide and blue-grey, biotite-bearing bands (Figure 16.1). This rock differs from the Burkitt Granite to the west due to (i) the absence of hornblende, (ii) the absence of elongate, tabular feldspar phenocrysts (iii) the presence of distinct gneissic banding, and (iv) a lower radiation reading of ~0.045 mS/hr in this rock versus ~0.06 to 0.1mS/hr in the Burkitt Granite. This gneissic granite also contains numerous highly weathered, coarse-grained amphibolites up to several metres wide trending NNE.

Figure 16.1. *Freshly broken and wet surface of sample 2008371085, unnamed granitic gneiss.*

Zircon Description

Zircons from this sample can be grouped into two types. Honey-coloured, subhedral grains exhibiting oscillatory internal zoning and relatively bright CL response make up approximately 30% of the zircon population. Relatively clear, euhedral to subhedral, slightly elongate grains make up approximately 70% of the zircon population. Zircon of this type has relatively dark CL response, with mottled internal zoning. In some cases, zircons with bright CL forms cores of grains with darker CL overgrowths (Figure 16.2). These textures are suggestive of an igneous zircon component forming the bright CL, oscillatory zoned grains, followed by a later episode of zircon growth that formed both overgrowths on existing grains as well as new grains.

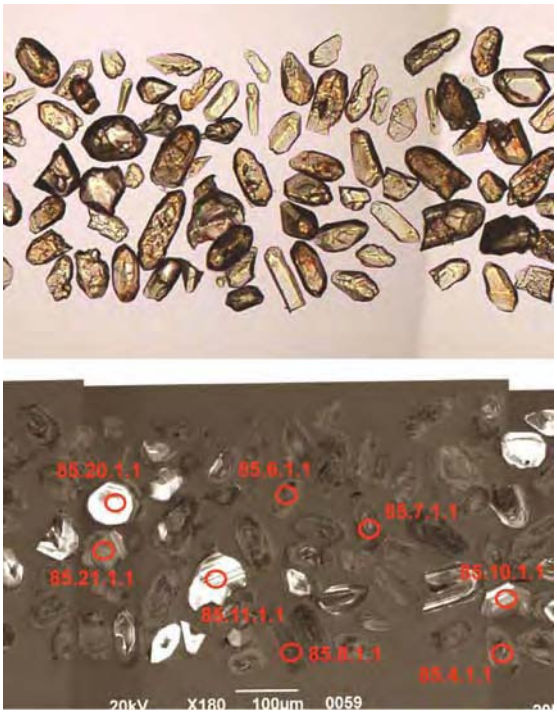

Figure 16.2. *Representative transmitted light and cathodoluminescence images of zircons from the unnamed gneissic granite (2008371085), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Forty eight analyses were collected from 48 different zircon grains. On a concordia diagram these analyses may visually be subdivided into (i) a near concordant group at ~3150 Ma, (ii) a much smaller, near concordant group at ~2500 Ma, and (iii) discordia trends leading away from each of the above age groups (Figure 16.3).

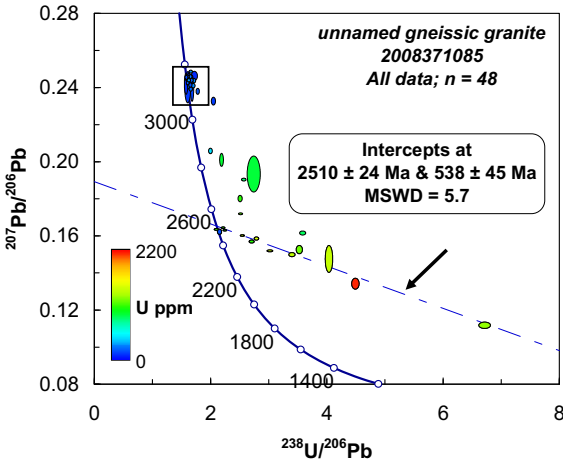

Figure 16.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the unnamed gneissic granite (2008371085), coloured according to U content. The box indicates the region displayed in Figure 16.4.*

The cluster of analyses at ~3150 Ma is represented by 20 analyses with a weighted mean $^{207}Pb/^{206}Pb$ age of 3151 ± 3 Ma (95% confidence; MSWD = 1.4; probability of fit = 0.12; Figure 16.4). All analyses in this group contain relatively low U content (mostly less than 250 ppm), with Th/U ratios typically in the range 0.5 to 1.0, and come from relatively bright CL zircons. A single analysis (85.27.1.1) is statistically older than this group, with an age of 3176 ± 6 Ma (2σ), and may represent slightly older, inherited zircon. Six analyses form a young tail on this statistical grouping and are interpreted to have experienced minor, non-zero age, Pb-loss. A further five analyses are 10 to 40 % discordant and form a very scattered discordia trend leading towards a poorly defined lower intercept in the late Mesoproterozoic.

The age grouping at ~2500 Ma is represented by four near-concordant analyses which scatter in age between 2505 and 2483 Ma. The two most concordant of these analyses (85.8.1.1 and 85.10.1.1) yield a mean age of 2495 ± 7 Ma. Three of these four analyses contain >1000 ppm

U, and Th/U of 0.06 – 0.07, an order of magnitude lower than the Th/U ratio typical of the ~3150 Ma zircon in this sample. An additional eight analyses lie on a slightly scattered (MSWD 5.7) discordia trend with upper intercept of 2510 ± 24 Ma and lower intercept of 538 ± 45 Ma (Figure 16.3). All eight of these analyses also have low Th/U ratios, in the range 0.02 to 0.06, and contain more than 1000 ppm U. Three analyses have Th/U ratios intermediate between the typical ranges of ~3150 Ma and ~2500 Ma zircon, and yield discordant ages. These are interpreted as likely to be mixed analyses incorporating both ~3150 Ma and ~2500 Ma zircon components, and are not assigned any geological meaning.

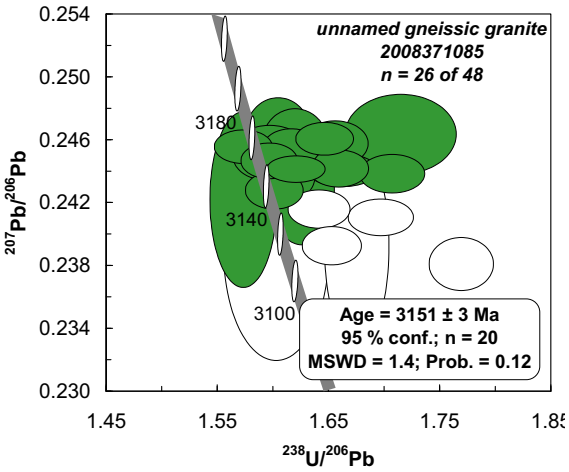

Figure 16.4. *Tera-Wasserburg concordia diagram showing results of near-concordant Mesoarchean zircon analyses from the unnamed gneissic granite (2008371085). Unfilled ellipses represent analyses that have not been included in the mean age calculation.*

The two distinct zircon ages from this sample correlate with distinctly different chemical and morphological features in the zircons, indicating distinct periods of zircon growth at ~3150 Ma and ~2500 Ma. Differing interpretations of these zircon growth episodes are possible. The simplest interpretation is that the ~3150 Ma zircon represents the igneous protolith age of this sample, equivalent in age to the nearby Cooyerdoo Granite. The relatively low Th/U of ~2500 Ma zircon may indicate zircon growth during high-grade metamorphism and partial melting. This may represent the time at which this rock developed its prominent gneissic banding. Alternatively, the ~2500 Ma zircon could be interpreted as the igneous age of this sample, in which case the ~3150 Ma zircon could be interpreted as inherited zircon, consistent with ~3150 Ma crust in the melt source area. Both these possible interpretations imply the local presence of ~3150 Ma crust.

The lower intercept of the discordia leading away from ~2500 Ma suggests a period of Pb-loss in approximately the Cambrian. The higher U content of the ~2500 Ma zircon, and the consequent greater radiation damage, provides a likely explanation for the observation that the ~2500 Ma zircon has been more strongly affected by Pb-loss than the ~3150 Ma zircon.

Geochronological Interpretation

Our preferred interpretation is that the age of 3151 ± 3 Ma represents the time of igneous crystallisation of this granitic rock, and the age of 2510 ± 24 Ma represents high-grade metamorphic reworking and partial melting.

Table 16.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371085 (1976799), unnamed gneissic granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Possible inherited grain (n = 1)											
85.27.1.1	0.11	300	165	0.57	1.65	1.0	.2487	0.2	3176	3	4
~3150 Ma zircon (n = 20)											
85.24.1.1	0.58	82	76	0.96	1.71	1.9	.2463	0.7	3161	11	7
85.5.1.1	0.06	77	69	0.92	1.60	1.2	.2463	0.6	3161	10	1
85.38.1.1	0.06	241	324	1.39	1.65	1.0	.2460	0.3	3159	4	3
85.43.1.1	0.07	168	98	0.60	1.60	1.1	.2459	0.3	3159	4	1
85.35.1.1	0.08	99	77	0.81	1.62	1.2	.2458	0.6	3158	9	2
85.41.1.1	0.06	82	63	0.80	1.66	1.2	.2458	0.4	3158	6	4
85.45.1.1	0.09	138	90	0.67	1.57	1.1	.2456	0.3	3156	5	-1
85.32.1.1	0.44	266	99	0.39	1.62	1.0	.2454	0.3	3156	5	2
85.17.1.1	0.20	87	57	0.68	1.59	1.2	.2450	0.4	3153	6	0
85.36.1.1	0.17	134	76	0.58	1.65	1.3	.2448	0.3	3151	5	3
85.1.1.1	0.04	200	153	0.79	1.60	1.1	.2447	0.3	3151	5	0
85.48.1.1	0.04	175	107	0.63	1.66	1.1	.2442	0.3	3147	5	3
85.34.1.1	0.17	316	193	0.63	1.62	1.1	.2441	0.2	3147	4	2
85.19.1.1	0.09	179	153	0.88	1.66	1.2	.2440	0.3	3147	4	4
85.22.1.1	0.40	268	58	0.22	1.71	1.1	.2438	0.3	3145	5	6
85.29.1.1	0.05	181	93	0.53	1.61	1.1	.2438	0.5	3145	8	1
85.12.1.1	0.01	218	217	1.03	1.61	1.1	.2437	0.3	3144	5	1
85.44.1.1	1.16	228	101	0.46	1.63	1.2	.2428	0.9	3139	15	2
85.3.1.1	0.30	173	119	0.71	1.60	1.1	.2428	0.3	3138	5	0
85.9.1.1	0.10	80	68	0.88	1.57	1.3	.2422	1.5	3134	24	-1
~3150 Ma zircon subject to variable non-zero age Pb-loss (n = 11)											
85.11.1.1	0.12	134	94	0.72	1.64	1.1	.2416	0.3	3130	5	2
85.16.1.1	0.30	276	189	0.71	1.70	1.1	.2411	0.3	3127	5	5
85.21.1.1	0.04	211	110	0.54	1.65	1.1	.2393	0.3	3115	5	2
85.33.1.1	3.23	127	86	0.70	1.68	1.2	.2392	1.8	3115	29	3
85.20.1.1	0.11	107	91	0.88	1.60	1.9	.2390	1.9	3113	31	0
85.31.1.1	0.63	164	100	0.63	1.77	1.1	.2381	0.5	3107	7	8
85.18.1.1	0.14	112	58	0.54	2.04	1.1	.2328	0.6	3071	9	20
85.39.1.1	0.11	446	184	0.43	1.99	1.0	.2061	0.5	2875	8	10
85.15.1.1	0.06	924	198	0.22	2.18	1.0	.2013	1.2	2836	19	17
85.46.1.1	0.07	915	206	0.23	2.74	2.7	.1937	3.3	2773	54	38
85.2.1.1	0.22	838	303	0.37	2.57	1.0	.1907	0.2	2748	4	30
Possible mixing between ~3150 and 2500 Ma zircon (n = 3)											
85.4.1.1	0.31	1069	88	0.09	2.50	1.0	.1805	0.6	2657	10	22
85.13.1.1	0.10	1146	112	0.10	2.51	1.0	.1723	0.2	2581	3	19
85.6.1.1	2.35	1393	179	0.13	4.03	1.1	.1481	3.2	2325	55	63
Near concordant metamorphic zircon ~2500 Ma (n = 4)											
85.25.1.1	0.03	1069	63	0.06	2.21	1.0	.1648	0.2	2505	3	4
85.8.1.1	0.21	1115	73	0.07	2.09	1.1	.1640	0.2	2497	4	-1
85.10.1.1	0.14	150	115	0.80	2.15	1.1	.1626	0.6	2483	9	1
85.26.1.1	0.06	1048	67	0.07	2.24	1.0	.1634	0.2	2491	3	5
Discordant metamorphic zircon ~2500 Ma (n = 8)											
85.40.1.1	0.04	1390	84	0.06	2.54	1.0	.1606	0.1	2462	2	15
85.28.1.1	0.09	1448	71	0.05	2.78	1.0	.1590	0.3	2445	6	24
85.42.1.1	0.10	1059	61	0.06	2.70	1.1	.1575	0.3	2429	5	20
85.14.1.1	1.12	1185	61	0.05	3.52	1.0	.1530	0.9	2380	16	48
85.30.1.1	0.11	1437	120	0.09	3.01	1.0	.1524	0.2	2373	4	28
85.47.1.1	0.50	1371	27	0.02	3.39	1.0	.1504	0.5	2351	8	41
85.37.1.1	1.56	2142	57	0.03	4.48	1.0	.1347	1.4	2160	25	66
85.23.1.1	0.76	1246	47	0.04	6.71	1.0	.1124	1.0	1839	18	105
Unassigned discordant analysis (n = 1)											
85.7.1.1	0.41	855	117	0.14	3.58	1.0	.1618	0.5	2475	8	56

17. BURKITT GRANITE: 2008371065

GA Sample ID:	**2008371065**
GA Sample Number:	**1958103**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**688865 63785472 Zone 53**
Collector:	**G. Fraser, N. Neumann, S. McAvaney, M. Szpunar**
Collection Date:	**31/5/2008**
Formal Name:	**Burkitt Granite**
Informal Name:	
Lithology:	**hornblende granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6062**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**28 – 29/8/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.43% (2σ) [10 of 11]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.1 ± 3.1 Ma [6 of 6]**
Interpreted Age:	**1742 ± 42 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

This sample was collected from an outcrop of large tors near the side of the road leading west from Corunna Station, northern Eyre Peninsula, South Australia (Figure 17.1). This outcrop contains an old blast site. At this locality the Burkitt Granite is an undeformed, orange, slightly porphyritic, hornblende-bearing granite, containing fine-grained mafic enclaves up to several centimetres in size. Webb *et al*. (1986) reported a Rb-Sr isochron age of 1655 ± 61 Ma for the Burkitt Granite. The SHRIMP U-Pb zircon results presented here are also reported in Fraser *et al*., (2010).

Figure 17.1. *Outcrop of Burkitt Granite at the site of sample 2008371065.*

Zircon Description

Zircons from this sample are not particularly abundant and the analysed zircons were retrieved from the 2° non-magnetic fraction. The zircons are relatively uniform in size and morphology, and are typically ~40 x 150 µm i.e. aspect ratios of ~1:3 or 1:4. Grains vary from clear to honey brown in colour. The overwhelming majority of grains are euhedral, preserving well-defined crystal faces and pointed terminations, and exhibit oscillatory internal zoning visible in both transmitted light and CL images (Figure 17.2). Contrast between oscillatory zones in CL images

is unusually marked in these grains, and some zones appear to have thickened, suggesting the possibility of post-crystallisation modification of internal structure (Hoskin and Black, 2000). There are no clear cores to these euhedral grains, and they are interpreted to be entirely of igneous origin.

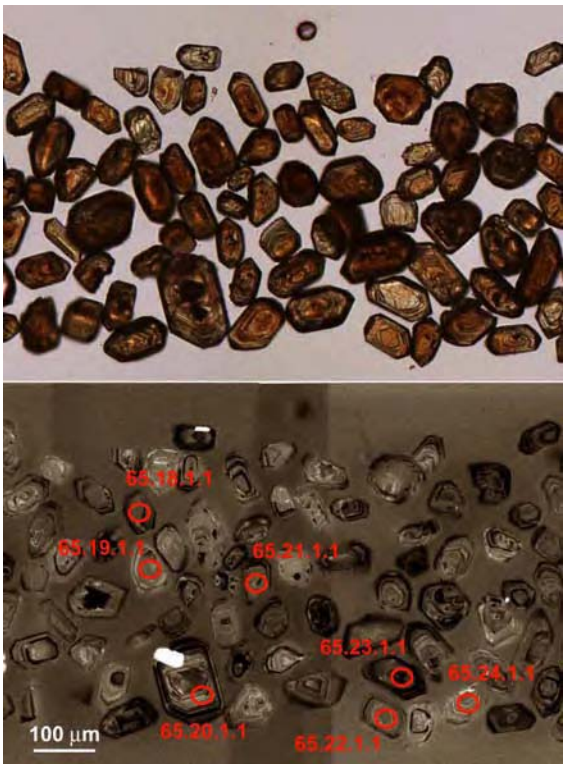

Figure 17.2. *Representative transmitted light and cathodoluminescence images of zircons from the Burkitt Granite (2008371065), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 29 analyses from 29 different zircons were acquired. All of these analyses contain >1% ^{206} Pb$_c$, and more than half contain >5% ^{206} Pb$_c$. The high common-Pb content of most analyses leads to large uncertainties in ^{207}Pb/^{206}Pb ages. In addition, most data are significantly discordant, with only 6 analyses being less than 10% discordant (Figure 17.3). The discordance of these zircons, and the high common-Pb content, is likely to be related to their relatively high U-content (typically >900 ppm), and consequent radiation damage. If the data are filtered to accept only analyses with <5% ^{206} Pb$_c$, 13 analyses define a discordia trend with upper intercept of 1742 ± 42 Ma, and lower intercept of 512 ± 120 Ma (MSWD = 0.60). Further attempts to date the Burkitt Granite with higher precision are warranted, but are likely to require samples in which the zircons contain lower U, and much less common Pb.

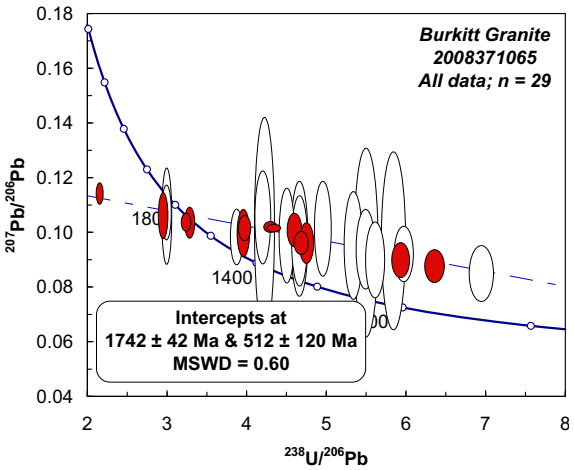

Figure 17.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Burkitt Granite (2008371065). Red ellipses represent analyses included in the calculation of the discordia line shown.*

Geochronological Interpretation

The upper intercept age of 1742 ± 42 Ma is interpreted as the best estimate for the timing of igneous intrusion of the Burkitt Granite, based on these data. The lower intercept age of 512 ± 120 Ma, while imprecise, may indicate an episode of partial isotopic resetting at approximately Cambrian time.

Table 17.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371065 (1958103), Burkitt Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Analyses containing <5% $^{206}Pb_c$ (n = 13)											
65.16.1.1	2.17	1017	889	0.90	2.14	1.3	.1141	2.3	1866	47	-24
65.12.1.1	4.59	699	613	0.91	2.94	1.3	.1060	5.3	1731	109	-7
65.22.1.1	1.84	938	898	0.99	3.23	1.3	.1036	2.1	1689	43	-3
65.31.1.1	3.12	905	738	0.84	3.27	1.3	.1034	3.6	1685	74	-1
65.15.1.1	1.04	789	676	0.89	4.29	1.3	.1018	1.3	1656	26	23
65.35.1.1	0.81	2412	1985	0.85	4.34	1.3	.1014	1.0	1650	20	23
65.28.1.1	2.57	1535	1293	0.87	3.97	1.3	.1014	3.0	1649	62	14
65.13.1.1	3.37	830	702	0.87	4.59	1.3	.1007	4.0	1636	83	30
65.11.1.1	4.74	1039	859	0.85	3.95	1.3	.0996	5.7	1616	119	12
65.37.1.1	2.32	1127	744	0.68	4.68	1.3	.0959	2.9	1545	60	24
65.34.1.1	4.13	1630	1659	1.05	4.74	1.3	.0959	5.2	1545	108	26
65.18.1.1	3.59	1698	1141	0.69	5.93	1.3	.0897	4.7	1418	100	42
65.14.1.1	3.35	1596	1450	0.94	6.36	1.3	.0874	4.5	1370	96	46
Analyses containing >5% $^{206}Pb_c$ (n = 16)											
65.10.1.1	5.46	1312	1312	1.03	2.99	1.3	.1072	6.2	1752	128	-5
65.33.1.1	5.56	917	847	0.95	3.87	1.3	.0982	6.9	1727	231	8
65.23.1.1	5.57	1340	1190	0.92	5.97	1.3	.0919	7.4	1719	213	48
65.36.1.1	5.60	2321	2236	1.00	6.94	1.5	.0846	8.0	1663	553	52
65.9.1.1	6.74	674	438	0.67	4.19	1.6	.1053	10.7	1645	239	26
65.17.1.1	7.45	1296	1199	0.96	5.61	1.4	.0897	10.2	1597	245	36
65.19.1.1	7.73	1175	1183	1.04	5.49	1.4	.0936	10.3	1589	144	41
65.20.1.1	8.76	1851	1293	0.72	4.66	1.4	.0967	11.3	1575	302	26
65.27.1.1	9.12	975	815	0.86	4.95	1.4	.1012	11.4	1560	238	41
65.21.1.1	9.14	929	714	0.79	4.50	1.4	.0986	11.7	1560	477	25
65.32.1.1	9.24	815	695	0.88	2.99	1.4	.1057	11.1	1547	511	-6
65.30.1.1	10.23	795	771	1.00	5.33	1.5	.0950	13.7	1528	290	40
65.29.1.1	10.77	940	705	0.78	4.65	1.5	.0975	14.3	1499	217	28
65.24.1.1	15.92	1124	1117	1.03	5.84	1.7	.0967	22.3	1464	155	58
65.26.1.1	16.73	1119	880	0.81	5.49	1.8	.0961	23.8	1418	216	48
65.25.1.1	18.57	1039	952	0.95	4.22	2.0	.1022	25.8	1307	169	26

18. BURKITT GRANITE: 2008371084

GA Sample ID:	**2008371084**
GA Sample Number:	**1976798**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**691326 6382933 Zone 53**
Collector:	**G. Fraser, C. Foudoulis, S. McAvaney, A. Reid**
Collection Date:	**10/9/2008**
Formal Name:	**Burkitt Granite**
Informal Name:	
Lithology:	**hornblende granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6098**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**13-14/8/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.22% (2σ) [17 of 17]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3469.2 ± 3.3 Ma [7 of 7]**
Interpreted Age:	**1755 ± 19 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

The Burkitt Granite crops out south of the road leading west from Corunna Station, northern Eyre Peninsula, South Australia. This sample was collected in an attempt to improve the relatively imprecise age constraint derived from sample 2008371065 (see above). The Burkitt Granite is highly radiogenic, yielding a heat production value of ~17 μWm^{-3}, and a whole-rock uranium abundance of 37 ppm (Neumann, 2001). The high U abundance is consistent with the high U content of zircons derived from sample 2008371065, and is regarded as a cause of zircon age discordance. In an effort to reduce this problem, a radiation meter was used to select a sample that yielded a significantly lower radiation dose than sample 2008371065. Sample 2008371084 was collected from the southeastern side of Burkitt Hill (Figure 18.1). In outcrop this sample is very similar to sample 2008371065, being an unfoliated, medium-grained, hornblende-bearing granite with large tabular feldspar phenocrysts. It contains rare fine-grained enclaves.

Figure 18.1. *Sampling 2008371084, Burkitt Granite.*

Zircon Description

Zircons from this sample are euhedral grains, typically ~100 µm long with aspect ratio of ~2. Cathodoluminescence (CL) images reveal concentric, oscillatory zoning in most grains. Many grains exhibit very dark CL response in the innermost part of the grain. In some cases fine-scale oscillatory zoning appears to have become broader in selected zones, interpreted as due to radiation damage (Figure 18.2). On morphological grounds, zircon from this sample appears to be igneous in origin.

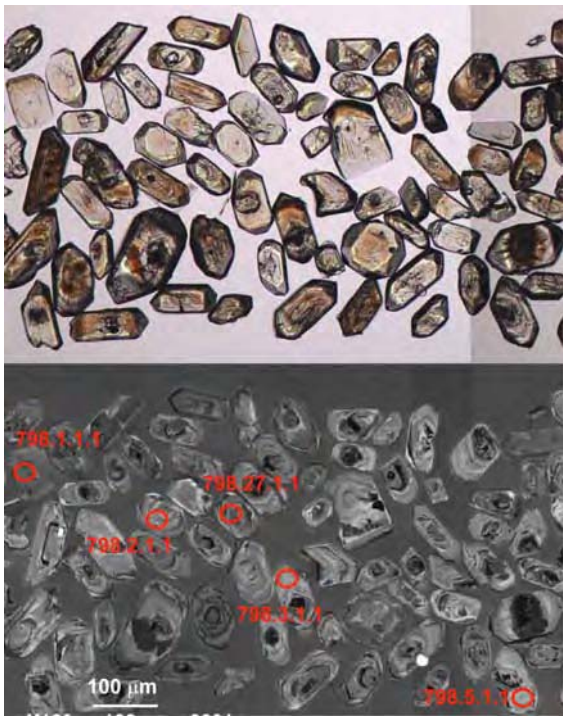

Figure 18.2. *Representative transmitted light and cathodoluminescence images of zircons from the Burkitt Granite (2008371084), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 27 analyses were collected, from 27 different zircon grains. All but one of these analyses contains >1% common Pb ($^{206}Pb_c$), resulting in very large uncertainties on individual analyses. The analysis with the lowest common Pb (798.6.1.1) also contains the lowest U abundance (354 ppm), and yields a near concordant $^{207}Pb/^{206}Pb$ age of 1747 ± 16 Ma (2σ). This single analysis represents the most reliable age constraint from this rock. Most grains contain >800 ppm U, and 20 of the 27 analyses are >10% discordant. A discordia trend fitted through all 27 analyses yields upper and lower intercepts of 1755 ± 19 Ma and 421 ± 150 Ma (MSWD = 0.25; Figure 18.3). The upper intercept age is consistent with the upper intercept age derived from sample 2008371065 (see above).

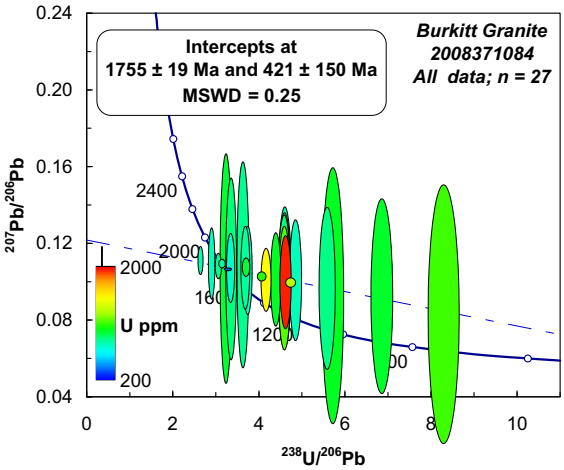

Figure 18.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Burkitt Granite (2008371084), coloured according to U content.*

Geochronological Interpretation

The upper intercept age of 1755 ± 19 Ma is interpreted to represent the time of igneous crystallisation of this granite. More precise age constraints for this granite will probably require sampling of zircon with lower uranium abundance, or alternative dating methods.

Table 18.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371084 (1976798), Burkitt Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Magmatic zircon, subject to variable ancient Pb-loss (n = 27)											
798.3.1.1	3.99	781	488	0.65	2.61	1.6	.1113	4.3	1821	79	-13
798.13.1.1	9.58	773	511	0.68	2.88	1.8	.1098	11.1	1796	202	-7
798.22.1.1	1.15	806	519	0.67	3.11	1.6	.1098	1.3	1796	24	0
798.12.1.1	23.50	830	498	0.62	3.61	2.6	.1091	32.4	1784	591	13
798.7.1.1	3.64	834	565	0.70	3.03	1.6	.1085	4.0	1775	74	-3
798.20.1.1	2.58	947	586	0.64	3.68	1.6	.1079	2.9	1764	52	14
798.17.1.1	11.02	812	619	0.79	3.66	1.8	.1076	13.2	1759	242	13
798.9.1.1	9.25	736	457	0.64	3.32	1.8	.1075	11.0	1757	202	4
798.5.1.1	25.59	958	670	0.72	3.21	2.7	.1072	36.7	1752	672	0
798.23.1.1	21.41	862	550	0.66	3.33	2.4	.1070	29.2	1749	534	3
798.6.1.1	0.02	354	250	0.73	3.25	1.6	.1069	0.4	1747	8	1
798.21.1.1	6.63	1136	781	0.71	0.31	1.7	.1064	7.6	1739	140	-81
798.2.1.1	11.63	761	536	0.73	3.72	1.8	.1062	14.3	1735	262	13
798.10.1.1	1.29	1065	489	0.47	4.04	1.6	.1031	1.5	1681	28	18
798.18.1.1	17.41	789	548	0.72	4.59	2.1	.1028	23.5	1675	433	32
798.16.1.1	12.31	978	760	0.80	4.37	1.9	.1016	15.8	1653	293	25
798.11.1.1	8.62	1526	1298	0.88	4.15	1.8	.1012	10.7	1647	199	18
798.4.1.1	15.27	768	461	0.62	4.84	2.0	.1011	20.5	1645	380	36
798.24.1.1	16.83	934	566	0.63	4.58	2.1	.1011	22.9	1645	425	29
798.25.1.1	16.44	863	615	0.74	4.57	2.1	.1007	22.5	1637	418	28
798.1.1.1	12.21	1961	2549	1.34	4.61	1.9	.1002	15.9	1627	297	28
798.19.1.1	1.28	1304	686	0.54	4.72	1.6	.0998	1.6	1621	30	31
798.8.1.1	19.63	848	538	0.66	5.57	2.2	.0970	28.7	1567	538	47
798.27.1.1	15.65	1130	720	0.66	4.58	2.0	.0970	21.9	1567	410	23
798.14.1.1	27.85	983	582	0.61	5.70	2.9	.0931	47.3	1489	895	43
798.15.1.1	22.75	968	770	0.82	6.85	2.5	.0928	36.0	1485	683	69
798.26.1.1	28.25	1105	789	0.74	8.29	2.9	.0834	53.2	1279	1037	74

19. LEUCOGRANITE, NORTH OF LAKE GILLES: 2008371081

GA Sample ID:	**2008371081**
GA Sample Number:	**1976795**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**675870 6384467 Zone 53**
Collector:	**G. Fraser, S. McAvaney, A. Reid, C. Foudoulis**
Collection Date:	**9/9/2008**
Formal Name:	
Informal Name:	
Lithology:	**foliated leucogranite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6070**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**31/10-2008 – 7/11/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.90% (2σ) [68 of 70]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.4 ± 1.2 Ma [35 of 35]**
Interpreted Age:	**2529 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

This sample was collected from the northern shore of Lake Gilles, east of the Uno Range, and east of the prominent magnetic boundary in this region of northern Eyre Peninsula, South Australia. The basement geology is mapped as undifferentiated Lincoln Complex gneissic granite and granitic gneiss. Field observations show the basement in this region to consist of a sequence of interlayered orthogneisses, amphibolites and minor paragneisses. These gneisses are tight to isoclinally folded about subhorizontal fold axes trending NNW. Within the gneissic sequence leucogranites in places form dykes ~30 cm wide that appear to intrude into biotite-bearing banded grey-green gneisses. The leucogranite dykes are folded into the gneissic fabric and are strongly foliated and incipiently boudinaged parallel to their margins and to the fabric in the host gneisses. Elsewhere, similar foliated leucogranites form layers several metres wide within the gneissic sequence. It is one of these broad leucogranite layers that was sampled as 2008371081 (Figure 19.1). The sample is an even-grained, orange to pink rock dominantly composed of quartz and K-feldspar with grey quartz ribbons defining the foliation.

Figure 19.1. *Outcrop of sample 2008371081, Lake Gilles leucogranite.*

Zircon Description

Zircons from this sample form subhedral grains ranging from equant to slightly elongate with aspect ratios up to ~3. Cathodoluminescence images show very similar internal zonation and CL response for nearly all zircons from this sample. The CL patterns are characterised by concentric oscillatory zoning that, in many cases, appears to have been subsequently modified to a rather mottled appearance, with some fine-scale oscillatory zones having become darker and broader (Figure 19.2). This texture is suggestive of secondary fluid alteration of metamict portions of the zircons, as documented by Rayner *et al*. (2005). On morphological and textural grounds, the majority of zircons from this rock are interpreted to represent a single igneous population, possibly affected by variable secondary fluid alteration.

Figure 19.2. *Representative transmitted light and cathodoluminescence images of zircons from leucogranite north of Lake Gilles (2008371081), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Thirty six analyses were collected on 35 different zircon grains (Figure 19.3). Zircons from this sample divide into two distinct age populations. The first group comprises the three oldest analyses each of which yield ages of ~3150 Ma (81.8.1.1; 81.10.1.1; 81.29.1.1). Of these, 81.10.1.1 and 81.29.1.1 are both from anhedral zircon fragments with relatively uniform CL response. These zircons are not typical of the dominant population from this sample and are most simply interpreted to represent inherited zircon xenocrysts within this leucogranite. Analysis 81.8.1.1 is from an equant, euhedral zircon that is difficult to distinguish from the typical zircons in this sample on morphological grounds. This analysis contains relatively high $^{206}Pb_c$ (0.96%), high U (667 ppm), and is 9 % discordant. The $^{207}Pb/^{206}Pb$ age of 3125 ± 16 Ma (2σ) and its discordance is suggestive of an original age of ~3150 Ma subject to minor Pb-loss. This grain is, therefore, also interpreted as inherited.

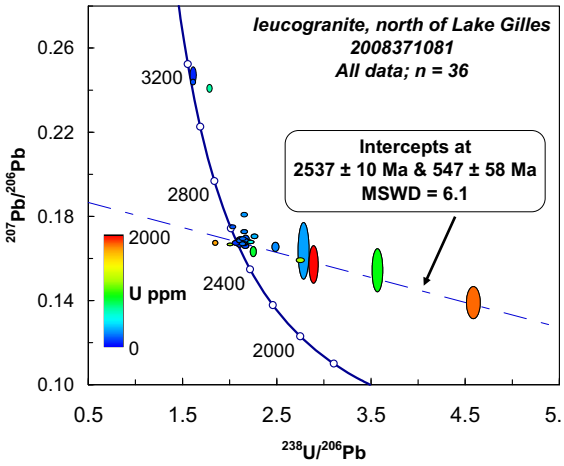

Figure 19.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the leucogranite north of Lake Gilles (2008371081), coloured according to U content.*

The second age grouping consists of the remaining 33 analyses, and these define a scattered discordia (MSWD = 6.1) with upper and lower concordia intercepts of 2537 ± 10 Ma and 547 ± 58 Ma, respectively. Six of these 33 analyses are >10% discordant and two are significantly reversely discordant. An additional four analyses contain >0.5% $^{206}Pb_c$, leaving 21 near-concordant, low common-Pb analyses. Sixteen of these analyses define a weighted mean $^{207}Pb/^{206}Pb$ age of 2529 ± 4 Ma (95% confidence; MSWD = 1.4; probability of fit = 0.12; Figure 19.4).

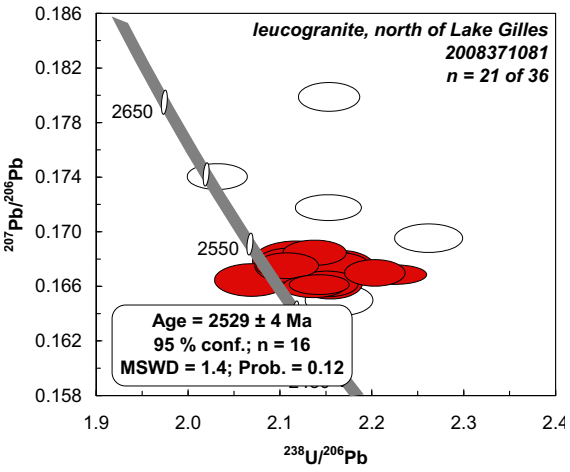

Figure 19.4. *Tera-Wasserburg concordia diagram showing results of near-concordant, Neoarchean zircon analyses from the leucogranite north of Lake Gilles (2008371081). Unfilled ellipses represent analyses not included in the mean age calculation.*

Geochronological Interpretation

The weighted mean age of 2529 ± 4 Ma is interpreted as the best estimate for the time of crystallisation of this leucogranite. A lower intercept age defined by discordant analyses is suggestive of isotopic disturbance during the latest Proterozoic or Cambrian.

Table 19.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371081 (1976795), Lake Gilles leucogranite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Mesoarchean inherited zircon (n = 3)											
81.29.1.1	0.28	62	54	0.90	1.60	1.3	.2471	1.1	3166	17	1
81.10.1.1	0.02	131	74	0.59	1.60	1.1	.2438	0.3	3145	6	1
81.8.1.1	0.96	667	370	0.57	1.78	1.0	.2407	0.5	3125	8	9
Late Archean inherited zircon (n = 4)											
81.25.1.1	0.31	264	250	0.98	2.15	1.0	.1801	0.4	2654	7	8
81.19.1.1	0.07	152	149	1.02	2.03	1.1	.1742	0.4	2599	6	0
81.24.1.1	0.24	215	119	0.57	2.15	1.1	.1719	0.4	2576	6	5
81.26.1.1	0.15	317	249	0.81	2.26	1.1	.1697	0.4	2554	7	8
~2530 Ma igneous zircon (n = 16)											
81.1.1.1	0.06	184	187	1.05	2.06	1.3	.1666	0.5	2544	6	-1
81.28.1.1	0.05	131	158	1.24	2.10	1.1	.1676	0.4	2538	7	1
81.31.1.1	0.04	58	91	1.61	2.10	1.2	.1677	0.5	2537	10	1
81.9.1.1	0.07	196	261	1.38	2.11	1.5	.1679	0.6	2535	6	2
81.35.1.1	0.11	90	108	1.23	2.13	1.1	.1661	0.3	2534	8	2
81.3.1.1	0.07	185	185	1.03	2.12	1.1	.1675	0.4	2534	6	2
81.2.1.1	0.07	156	161	1.07	2.14	1.0	.1662	0.3	2533	7	2
81.6.1.1	0.18	168	175	1.08	2.15	1.1	.1663	0.4	2531	7	2
81.14.1.1	0.12	84	62	0.76	2.15	1.1	.1663	0.5	2531	9	2
81.30.1.1	0.36	490	982	2.07	2.13	1.1	.1686	0.4	2529	6	3
81.15.1.1	0.24	507	809	1.65	2.14	1.1	.1680	0.4	2528	5	3
81.20.1.1	0.08	86	92	1.11	2.16	1.1	.1674	0.4	2524	8	3
81.27.1.1	0.26	173	275	1.64	2.16	1.1	.1677	0.4	2521	8	3
81.32.1.1	0.22	201	282	1.45	2.16	1.2	.1673	0.6	2521	6	3
81.16.2.1	0.17	324	96	0.31	2.20	1.0	.1671	0.4	2520	5	5
81.17.1.1	0.04	205	285	1.44	2.22	1.0	.1670	0.3	2519	5	5
Young outlier, possible minor Pb-loss (n = 1)											
81.5.1.1	0.15	129	151	1.21	2.16	1.1	.1651	0.5	2509	8	2
Reversely discordant (n = 2)											
81.33.1.1	0.59	1763	170	0.10	1.84	1.0	.1666	0.4	2523	8	-10
81.16.1.1	0.33	1188	118	0.10	2.00	1.0	.1658	0.3	2516	5	-4
>10% discordant (n = 6)											
81.23.1.1	0.99	245	271	1.14	2.48	1.1	.1646	0.9	2503	15	15
81.13.1.1	5.42	285	243	0.88	2.78	1.4	.1627	5.5	2484	93	25
81.7.1.1	0.58	1187	331	0.29	2.74	1.0	.1583	0.5	2437	8	22
81.12.1.1	4.77	1997	1399	0.72	2.89	1.0	.1562	3.8	2415	64	26
81.22.1.1	4.95	902	464	0.53	3.57	1.1	.1534	4.5	2384	76	50
81.4.1.1	4.15	1849	1407	0.79	4.59	1.0	.1379	3.7	2201	64	73
>0.5% $^{206}Pb_c$ (n = 4)											
81.34.1.1	0.56	71	48	0.69	2.10	1.2	.1664	0.8	2522	13	0
81.21.1.1	0.65	262	299	1.18	2.14	1.0	.1666	0.6	2524	10	2
81.11.1.1	0.83	151	231	1.58	2.17	1.1	.1683	0.8	2541	13	4
81.18.1.1	1.31	847	682	0.83	2.25	1.0	.1624	1.0	2480	17	5

20. CORUNNA CONGLOMERATE, BAXTER HILLS: 2008371062

GA Sample ID:	**2008371062**
GA Sample Number:	**1958100**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**697039 6385920 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**30/5/2008**
Formal Name:	**Corunna Conglomerate**
Informal Name:	**Lower green sandstone**
Lithology:	**Purple sandstone**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6093**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**15 – 22/07/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.33% (2σ) [43 of 44]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.3 ± 1.5 Ma [42 of 42]**
Interpreted Age:	**1752 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample is from the Tassie Creek Reservoir section of the Corunna Conglomerate, in the Baxter Hills, northern Eyre Peninsula, South Australia. The sample was collected from the base of the spillway, from a unit informally termed the Lower green sandstone, which is the lowest known unit within the Corunna Conglomerate (Morgan, 2007). The sample is a purple, thick-bedded sandstone, which is interbedded with thinner siltstones and contains siltstone clasts (Figure 20.1).

Figure 20.1. *Corunna Conglomerate (lower green sandstone) from the Tassie Creek Reservoir, Baxter Hills (sample 2008371062).*

Zircon Description

Zircons from this sample range from ~80 µm to ~170 µm in length, and are colourless to light brown in colour (Figure 20.2). Most grains have a rounded morphology with minor pitting on some surfaces. Cathodoluminescence images record oscillatory zoning within most grains, while some grains have a homogeneous bright cathodoluminescence character.

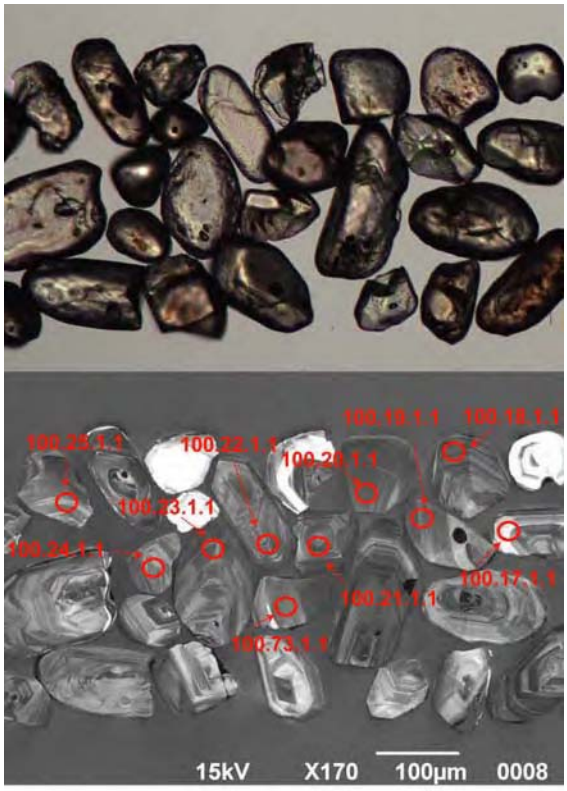

Figure 20.2. *Representative transmitted light and cathodoluminescence images of zircons from the lower green sandstone of the Corunna Conglomerate (2008371062), with locations of some SHRIMP analyses.*

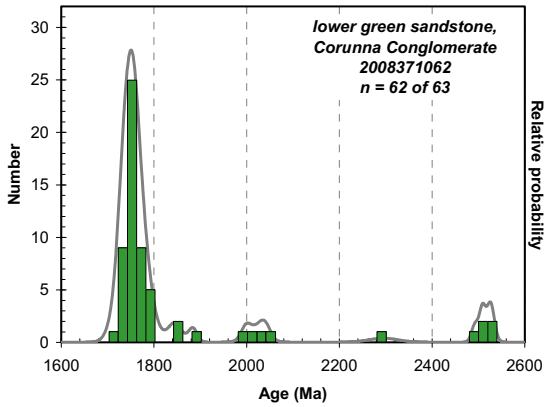

Figure 20.3. *Probability density diagram of zircon analyses from the lower green sandstone of the Corunna Conglomerate (2008371062).*

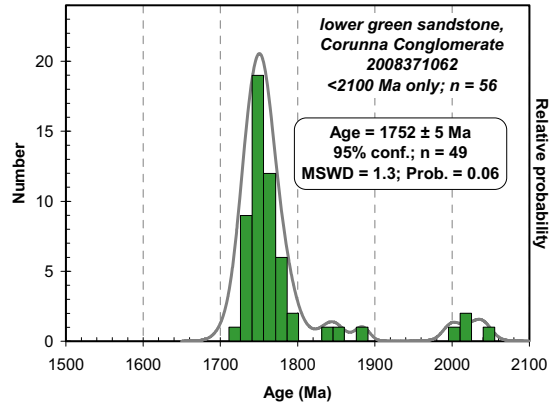

Figure 20.4. *Probability density diagram of zircon analyses from the lower green sandstone of the Corunna Conglomerate (2008371062) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

U-Pb Isotopic Results

Sixty-three zircons were analysed, and one analysis containing a common Pb content greater than an arbitrary value of 0.5% was excluded from further consideration. The remaining 62 analyses record a range of ages between ~2528 Ma and ~1712 Ma, and includes 5 ages between ~2528 Ma and ~2493 Ma, one age at ~2295 Ma, four ages between ~2041 Ma and ~1999 Ma, and three ages between ~1884 Ma and ~1841 Ma (Figure 20.3). The remaining ages, which include the youngest individual age of ~1712 Ma, form a large cluster (~80% of the total analyses) and combine to yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1752 ± 5 Ma (95% confidence; n = 49; MSWD = 1.3; probability of fit = 0.06; Figure 20.4).

Geochronological Interpretation

The weighted mean age of 1752 ± 5 Ma (95% confidence; n = 49) for the youngest cluster can be used to define a maximum depositional age for this sample from the Corunna Conglomerate.

Table 20.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371062 (1958100), Corunna Conglomerate, Baxter Hills.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircon (n = 62)											
100.65.1.1	0.04	108	44	0.42	2.15	1.9	.1670	0.5	2528	9	3
100.1.1.1	0.01	181	73	0.42	2.12	1.8	.1669	0.4	2527	7	1
100.37.1.1	0.10	120	55	0.47	2.14	1.9	.1656	0.6	2514	10	2
100.46.1.1	0.00	287	191	0.69	2.18	1.8	.1651	0.4	2509	6	3
100.26.1.1	0.03	173	218	1.30	2.13	1.8	.1636	0.5	2493	8	0
100.68.1.1	0.02	75	64	0.88	2.24	3.7	.1456	1.9	2295	33	-4
100.31.1.1	0.09	153	73	0.49	2.72	1.8	.1258	0.6	2041	11	1
100.25.1.1	0.05	86	55	0.66	2.82	1.9	.1247	0.8	2025	14	3
100.45.1.1	0.31	47	27	0.58	2.77	2.5	.1243	1.4	2019	25	1
100.57.1.1	0.07	137	56	0.42	2.81	1.8	.1229	0.6	1999	10	2
100.33.1.1	0.02	222	115	0.54	3.04	1.8	.1152	0.5	1884	9	3
100.40.1.1	0.07	131	64	0.50	3.06	1.9	.1131	0.8	1850	14	2
100.11.1.1	0.05	126	58	0.47	3.06	1.9	.1126	0.7	1841	13	1
100.14.1.1	-0.01	80	53	0.68	3.31	2.0	.1099	1.2	1797	22	5
100.70.1.1	0.05	80	99	1.29	3.31	2.2	.1096	1.0	1793	19	5
100.7.1.1	-0.09	186	148	0.82	3.28	1.8	.1091	0.7	1784	12	4
100.41.1.1	0.19	94	53	0.58	3.25	1.9	.1090	1.1	1782	20	3
100.64.1.1	0.09	116	67	0.59	3.19	1.8	.1088	0.8	1780	14	1
100.60.1.1	0.07	108	67	0.64	3.22	1.8	.1087	0.8	1778	14	2
100.42.1.1	0.08	98	60	0.63	3.12	1.9	.1086	1.0	1776	18	-1
100.58.1.1	0.03	161	79	0.51	3.29	1.8	.1083	0.6	1771	11	3
100.36.1.1	0.08	88	84	0.99	3.24	1.9	.1080	1.1	1766	20	2
100.39.1.1	0.14	131	95	0.75	3.22	1.9	.1079	0.9	1764	16	1
100.32.1.1	0.00	87	88	1.05	3.17	1.9	.1078	0.9	1763	16	0
100.23.1.1	0.10	191	118	0.64	3.22	1.9	.1078	0.7	1762	13	1
100.18.1.1	0.05	167	120	0.74	3.27	1.8	.1077	0.7	1761	14	2
100.59.1.1	0.06	115	120	1.08	3.55	1.9	.1077	0.7	1761	14	9
100.2.1.1	0.02	177	132	0.77	3.23	1.8	.1076	0.6	1760	12	1
100.17.1.1	0.01	58	33	0.58	3.40	2.1	.1076	1.2	1759	22	5
100.28.1.1	0.03	133	73	0.57	3.24	1.8	.1075	0.8	1757	14	1
100.19.1.1	0.02	199	122	0.63	3.24	1.8	.1075	0.6	1757	11	1
100.5.1.1	0.01	149	69	0.48	3.23	1.8	.1074	0.7	1757	14	1
100.67.1.1	0.08	200	132	0.68	3.24	1.8	.1074	0.6	1756	11	1
100.35.1.1	0.17	49	28	0.60	3.32	2.1	.1073	1.6	1755	29	3
100.30.1.1	0.25	69	139	2.08	3.34	2.0	.1072	1.3	1753	24	4
100.9.1.1	0.35	128	137	1.11	3.51	1.8	.1071	1.1	1751	21	8
100.16.1.1	0.17	118	83	0.73	3.33	1.9	.1071	1.1	1751	21	3
100.22.1.1	0.11	180	96	0.55	3.23	1.8	.1071	0.7	1750	13	1
100.12.1.1	0.04	150	97	0.67	3.35	2.4	.1071	0.7	1750	13	4
100.8.1.1	-0.05	142	135	0.98	3.23	1.8	.1070	0.7	1750	13	1
100.62.1.1	0.07	161	231	1.49	3.27	1.9	.1070	0.7	1749	12	2
100.43.1.1	0.21	133	96	0.74	3.32	1.9	.1069	1.0	1747	19	3
100.38.1.1	0.10	148	92	0.64	3.29	1.8	.1069	0.8	1747	14	2
100.73.1.1	0.07	130	91	0.72	3.27	1.8	.1068	0.8	1746	14	2
100.34.1.1	0.16	127	58	0.47	3.29	1.9	.1068	1.0	1746	18	2
100.44.1.1	0.06	170	90	0.55	3.28	1.8	.1068	0.7	1745	13	2
100.72.1.1	0.21	121	87	0.74	3.23	1.9	.1067	1.0	1745	18	0
100.29.1.1	0.03	114	65	0.59	3.25	1.9	.1067	1.0	1743	18	1
100.10.1.1	0.15	98	56	0.59	3.27	1.9	.1066	1.0	1742	18	1
100.71.1.1	0.03	201	117	0.60	3.26	1.8	.1066	0.5	1742	10	1
100.69.1.1	0.16	170	79	0.48	3.27	1.8	.1066	0.9	1741	17	1
100.21.1.1	0.09	119	85	0.74	3.27	1.9	.1065	0.8	1740	15	1
100.15.1.1	0.13	65	118	1.89	3.35	2.0	.1065	1.2	1740	22	3
100.3.1.1	0.06	203	82	0.42	3.23	1.8	.1064	0.7	1739	14	0
100.63.1.1	0.14	115	64	0.57	3.27	1.9	.1063	0.8	1736	15	1
100.13.1.1	0.15	57	86	1.58	3.26	2.7	.1062	1.5	1736	27	1
100.6.1.1	0.09	194	118	0.63	3.21	1.8	.1061	0.7	1733	12	-1
100.20.1.1	0.01	239	317	1.37	3.27	1.8	.1060	0.5	1732	10	1
100.24.1.1	0.16	115	68	0.61	3.15	1.9	.1060	0.9	1732	17	-3
100.4.1.1	0.08	174	115	0.68	3.31	1.8	.1060	0.7	1731	13	2
100.66.1.1	0.05	188	158	0.87	3.22	1.8	.1057	0.6	1727	11	-1
100.61.1.1	0.15	151	89	0.61	3.29	1.8	.1049	0.8	1712	14	0
Analysis >0.5% $^{206}Pb_c$ (n = 1)											
100.27.1.1	1.02	124	115	0.96	3.36	1.9	.1088	1.7	1780	31	6

21. CORUNNA CONGLOMERATE, BAXTER HILLS: 2008371063

GA Sample ID:	**2008371063**
GA Sample Number:	**1958101**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**697194 6385847 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**30/5/2008**
Formal Name:	**Corunna Conglomerate**
Informal Name:	**Massive Conglomerate**
Lithology:	**Clasts of pink fine-grained rock**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6093**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**13 – 15/07/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 4.26% (2σ) [16 of 20]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3464.5 ± 3.9 Ma [13 of 14]**
Acquisition Date:	**15 – 22/07/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.33% (2σ) [43 of 44]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.3 ± 1.5 Ma [42 of 42]**
Interpreted Age:	**1718 ± 12 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample is from the Tassie Creek Reservoir section of the Corunna Conglomerate, in the Baxter Hills, northern Eyre Peninsula, South Australia. The sample consists of clasts of pink, fine-grained rock which are up to 30 cm in diameter and are preserved along some bedded surfaces within the lithostratigraphic unit termed the Massive conglomerate (Morgan, 2007) within the Corunna Conglomerate (Figure 21.1).

Figure 21.1. *A pink clast (sample 2008371063) within the Corunna Conglomerate (massive conglomerate) from Tassie Creek Reservoir, Baxter Hills.*

Zircon Description

Zircons from this sample range from ~60 - 110 µm in length, with some large grains up to ~140 µm in length. Most grains are clear and colourless to light brown, although some are very metamict (Figure 21.2). Grains have a range of morphologies from glassy euhedral shapes with preserved prismatic terminations to grains with a

rounded morphology and minor pitting on some surfaces. Cathodoluminescence images also record a range of characteristics, from oscillatory zoning to grains with a homogeneous bright or dark cathodoluminescence character. Due to the large range in morphology and cathodoluminescence of zircons, this sample is interpreted to be sedimentary rather than igneous in origin.

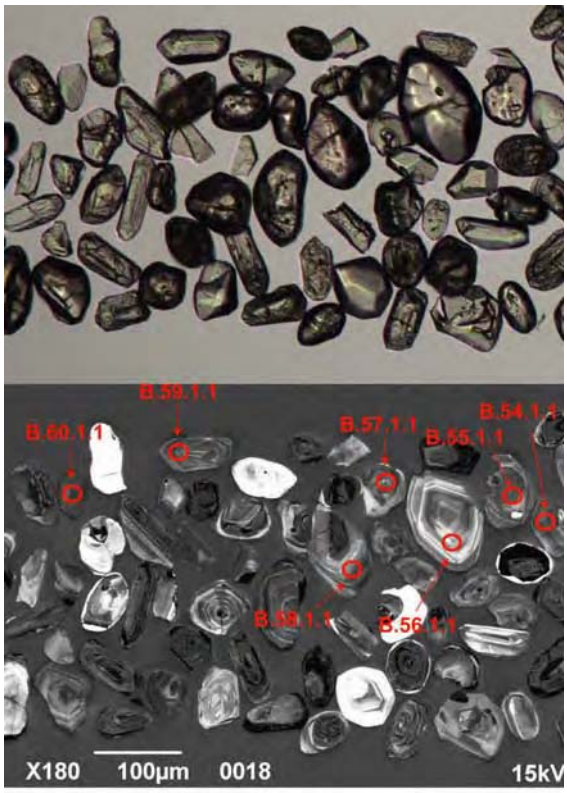

Figure 21.2. *Representative transmitted light and cathodoluminescence images of zircons from pink clasts of the Corunna Conglomerate (2008371063), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Seventy-eight zircons were analysed over two sessions, and were combined with no isotopic corrections. Seven analyses containing common Pb contents greater than an arbitrary value of 0.5% and one discordant analysis were excluded from further consideration. The remaining 70 analyses range in age from ~3149 Ma to ~1663 Ma, and include one age at ~3149 Ma, nine ages between ~2594 Ma and ~2363 Ma, one age at ~1936 Ma and a large number of ages (n = 59) between ~1875 Ma and the youngest individual at ~1663 Ma (Figure 21.3).

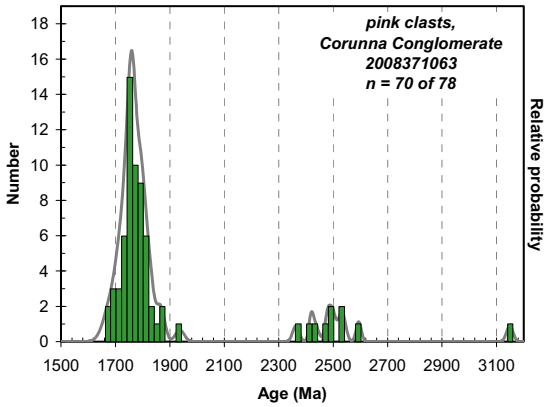

Figure 21.3. *Probability density diagram of zircon analyses from pink clasts of the Corunna Conglomerate (2008371063).*

As the large MSWD value for the weighted mean age of this youngest cluster indicates that it is not a single population, mixture modelling was used to interpret possible age groups within this cluster. The maximum number of possible age groups that can be modelled is 4, which gives a youngest age group at 1699 ± 19 Ma, with the other age groups at ~1757 Ma, ~1803 Ma and ~1857 Ma. Alternatively, using the MSWD and probability of fit as a guide for the youngest statistically coherent age grouping provides a weighted mean $^{207}Pb/^{206}Pb$ age of 1718 ± 12 Ma (95% conf; MSWD = 1.5; probability of fit = 0.07; Figure 21.4) for the youngest 18 ages.

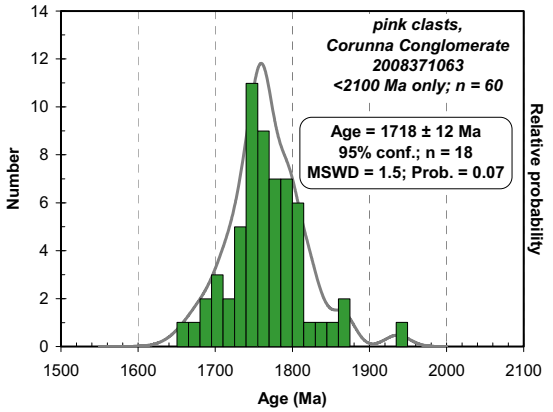

Figure 21.4. *Probability density diagram of zircon analyses from pink clasts of the Corunna Conglomerate (2008371063) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

Geochronological Interpretation

Given the rounded morphology of the zircons and the range of ages within this sample, the clasts sampled within the conglomerate are interpreted to be sedimentary rather than volcanic in origin. Determining a maximum depositional age for the sample is difficult due to the large range of ages within the youngest cluster. The youngest age from the mixture modelling is ~20 Ma younger than the youngest statistically coherent age grouping, but the two calculated ages are within uncertainty of each other. Due to its smaller uncertainty and more conservative estimate, the age of 1718 ± 12 Ma (95% conf; n = 18) is the preferred interpretation for a maximum depositional age of this sample. Given that this sample occurs as clasts within the massive conglomerate unit, it also provides a maximum age constraint for the deposition of this part of the Corunna Conglomerate.

Table 21.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371063 (1958101), Corunna Conglomerate, Baxter Hills.

Spot Name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircon (n = 70)											
B.74.1.1	0.04	73	23	0.32	1.63	1.9	.2444	0.7	3149	12	2
B.27.1.1	0.03	199	60	0.31	2.10	2.4	.1737	0.6	2594	10	3
B.20.1.1	0.08	150	43	0.30	2.16	2.3	.1678	0.7	2536	12	3
B.63.1.1	0.07	125	67	0.55	2.12	2.8	.1670	0.7	2528	12	2
B.14.1.1	0.18	183	78	0.44	2.12	2.3	.1641	0.7	2498	11	0
B.16.1.1	-0.02	157	92	0.60	2.15	2.3	.1636	0.8	2493	13	1
B.26.1.1	0.05	239	36	0.16	2.16	2.5	.1622	0.5	2478	9	1
B.10.1.1	0.23	266	73	0.28	2.24	2.5	.1581	0.7	2435	13	2
B.22.1.1	0.08	292	50	0.18	2.17	2.3	.1566	0.5	2419	8	-1
B.13.1.1	0.19	180	65	0.37	2.30	2.3	.1515	0.7	2363	12	2
B.8.1.1	0.17	138	112	0.84	2.88	2.4	.1187	0.9	1936	16	1
B.76.1.1	-0.03	130	113	0.90	3.13	1.8	.1147	0.7	1875	12	5
B.45.1.1	0.10	377	231	0.63	2.94	2.2	.1138	0.6	1861	11	-2
B.21.1.1	0.14	166	83	0.52	3.19	2.4	.1131	1.2	1849	21	5
B.71.1.1	0.00	155	54	0.36	3.18	1.8	.1123	0.6	1837	11	4
B.72.1.1	0.00	198	103	0.54	3.16	2.1	.1114	0.5	1822	10	3
B.28.1.1	0.13	134	85	0.65	3.13	2.4	.1109	1.2	1814	21	2
B.43.1.1	0.25	146	77	0.55	3.01	2.4	.1107	1.1	1811	20	-2
B.29.1.1	0.27	173	56	0.33	3.03	2.3	.1107	1.1	1811	20	-2
B.75.1.1	0.01	121	73	0.62	3.27	1.8	.1106	0.9	1810	16	5
B.25.1.1	0.18	148	64	0.45	3.07	2.5	.1105	1.2	1808	22	-1
B.60.1.1	0.04	376	177	0.49	3.12	2.2	.1101	0.6	1801	11	0
B.41.1.1	0.21	169	75	0.46	3.11	2.3	.1100	1.0	1799	19	0
B.12.1.1	0.12	193	99	0.53	3.21	2.3	.1099	0.9	1798	16	3
B.19.1.1	0.10	245	90	0.38	3.16	2.3	.1099	0.8	1798	15	2
B.11.1.1	0.14	146	77	0.55	3.19	2.6	.1098	1.1	1796	20	2
B.66.1.1	0.45	201	104	0.54	2.99	2.3	.1098	1.1	1796	21	-4
B.48.1.1	0.00	254	69	0.28	3.15	2.3	.1093	0.7	1788	12	1
B.77.1.1	0.08	137	80	0.60	3.31	1.8	.1093	0.8	1787	14	5
B.34.1.1	0.25	181	79	0.45	3.04	2.5	.1089	1.1	1782	20	-3
B.57.1.1	0.42	154	92	0.62	3.18	2.4	.1088	1.4	1780	25	1
B.5.1.1	0.15	189	41	0.22	3.17	2.3	.1085	0.9	1775	17	0
B.3.1.1	0.06	309	27	0.09	3.16	2.2	.1084	1.0	1773	19	0
B.52.1.1	0.14	141	107	0.79	3.05	2.4	.1084	1.0	1772	19	-3
B.67.1.1	0.15	167	81	0.50	3.03	2.4	.1083	1.1	1770	20	-4
B.7.1.1	0.12	212	74	0.36	3.10	2.3	.1083	0.8	1770	15	-2
B.54.1.1	0.04	226	42	0.19	3.18	2.4	.1080	0.8	1766	14	0
B.73.1.1	-0.01	141	99	0.73	3.23	1.8	.1079	0.6	1764	12	1
B.17.1.1	-0.01	188	60	0.33	3.24	2.5	.1078	1.0	1763	18	2
B.39.1.1	0.20	270	136	0.52	3.20	2.3	.1078	0.9	1763	16	1
B.70.1.1	0.10	244	151	0.64	3.30	1.8	.1077	0.5	1761	10	3
B.35.1.1	0.04	176	83	0.49	3.18	2.3	.1076	0.8	1759	15	0
B.24.1.1	0.03	128	95	0.76	3.28	2.4	.1075	1.1	1758	20	2
B.64.1.1	0.13	306	95	0.32	3.13	2.3	.1075	0.7	1757	14	-2
B.33.1.1	0.40	157	69	0.45	3.19	2.3	.1074	1.2	1756	22	0
B.56.1.1	0.46	123	54	0.45	3.23	2.4	.1072	1.6	1752	29	1
B.18.1.1	0.19	221	120	0.56	3.26	2.3	.1072	0.9	1752	17	2
B.62.1.1	0.34	180	68	0.39	3.06	2.3	.1072	1.1	1752	21	-4
B.23.1.1	0.11	158	104	0.68	3.20	2.4	.1071	1.1	1751	19	0
B.69.1.1	0.14	181	79	0.45	3.16	2.3	.1070	1.0	1750	18	-1
B.36.1.1	0.14	210	55	0.27	3.04	2.8	.1070	0.9	1749	17	-5
B.78.1.1	0.10	175	108	0.64	3.22	1.8	.1070	0.7	1748	13	0
B.44.1.1	0.08	170	123	0.74	3.03	2.4	.1069	1.1	1748	21	-5
B.15.1.1	0.21	161	93	0.60	3.11	2.3	.1068	1.1	1746	20	-3
B.6.1.1	0.21	148	205	1.43	3.24	2.4	.1067	1.1	1743	21	1
B.61.1.1	0.18	175	55	0.33	3.09	2.4	.1066	1.0	1743	18	-4
B.65.1.1	0.33	201	102	0.52	3.03	2.3	.1064	1.1	1739	19	-6
B.40.1.1	0.31	124	65	0.54	3.18	2.7	.1062	1.4	1735	25	-2
B.4.1.1	0.33	105	85	0.84	3.19	2.5	.1058	1.4	1728	26	-2
B.30.1.1	0.14	192	131	0.71	3.26	2.5	.1058	1.1	1728	20	0
B.37.1.1	0.15	245	154	0.65	3.13	2.3	.1057	0.9	1726	16	-4
B.51.1.1	0.22	145	105	0.75	3.19	2.4	.1056	1.1	1725	20	-2
B.47.1.1	0.33	89	65	0.75	3.21	2.5	.1052	1.5	1718	28	-2
B.31.1.1	0.18	144	67	0.48	3.28	2.4	.1047	1.2	1709	22	0

Spot Name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
B.53.1.1	0.13	291	114	0.41	3.29	2.3	.1047	0.7	1708	13	0
B.58.1.1	0.25	136	66	0.50	3.35	2.4	.1042	1.2	1700	22	1
B.68.1.1	0.27	115	85	0.77	3.20	2.4	.1037	1.3	1691	24	-4
B.55.1.1	0.12	169	142	0.87	3.30	2.3	.1032	0.9	1683	17	-1
B.42.1.1	0.16	173	129	0.77	3.25	2.3	.1028	1.6	1675	30	-3
B.32.1.1	0.13	148	127	0.89	3.22	2.4	.1021	1.1	1663	21	-5
Analyses >0.5% $^{206}Pb_c$ (n = 7)											
B.50.1.1	1.25	202	101	0.51	3.33	2.3	.1097	2.5	1794	45	6
B.2.1.1	1.19	1083	250	0.24	8.14	2.6	.1062	1.8	1736	33	57
B.49.1.1	1.18	39	28	0.75	2.74	2.8	.1199	2.8	1955	50	-3
B.38.1.1	1.03	352	153	0.45	4.45	2.3	.1024	1.9	1667	35	22
B.9.1.1	0.86	229	306	1.39	4.89	2.3	.1003	1.7	1630	31	26
B.46.1.1	0.61	67	67	1.03	2.74	2.6	.1192	2.1	1944	37	-3
B.59.1.1	0.60	212	85	0.41	3.18	2.3	.1073	1.3	1754	23	0
Analysis >10% discordant (n = 1)											
B.1.1.1	0.21	189	232	1.27	4.16	2.6	.1084	1.2	1773	21	22

22. CORUNNA CONGLOMERATE, BAXTER HILLS: 2008371064

GA Sample ID:	**2008371064**
GA Sample Number:	**1958102**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**695532 6389027 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**30/5/2008**
Formal Name:	**Corunna Conglomerate**
Informal Name:	**Upper green sandstone**
Lithology:	**Cross-bedded white sandstone**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6093**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**15 – 22/07/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.33% (2σ) [43 of 44]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.3 ± 1 .5 Ma [42 of 42]**
Interpreted Age:	**1680 ± 7 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample was collected ~10 km north of the Tassie Creek Reservoir section of the Corunna Conglomerate, in the Baxter Hills, northern Eyre Peninsula, South Australia. The sample is a thick-bedded, cross-bedded, crystalline, white quartzite (Figure 22.1), and is correlated with the informal upper green sandstone unit of Morgan (2007).

Figure 22.1. *White sandstone of the Corunna Conglomerate (upper green sandstone) from north of the Tassie Creek Reservoir, Baxter Hills (sample 2008371064).*

Zircon Description

Zircons from this sample range from ~70 µm to ~150 µm in length, and are clear and colourless to light brown in colour (Figure 22.2). Most grains have a rounded morphology and are pitted, while a small number of grains preserve prismatic terminations. Cathodoluminescence images record predominantly oscillatory zoning, with some grains recording a homogeneous bright or dark response.

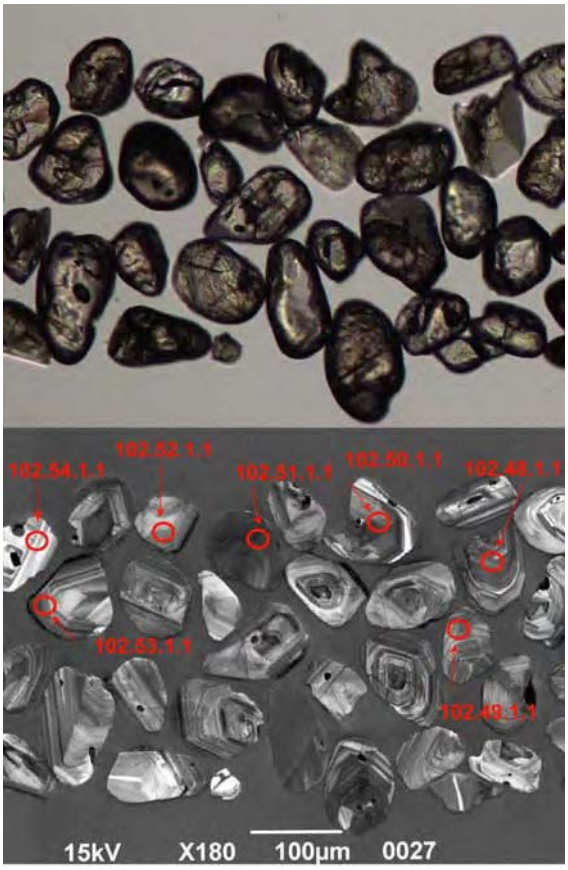

Figure 22.2. *Representative transmitted light and cathodoluminescence images of zircons from the upper green sandstone of the Corunna Conglomerate (2008371064), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Eighty zircons were analysed, and 12 analyses which contain common Pb contents greater than an arbitrary value of 0.5%, and two analyses greater than 10% discordant were excluded from further consideration. The remaining 66 analyses range in age between ~3268 Ma and ~1638 Ma, and includes one age at ~3268 Ma, eleven ages ranging between ~2834 Ma and ~2461 Ma, and a large cluster of ages between ~1766 Ma and the youngest individual age of ~1638 Ma (Figure 22.3). Using mixture modelling to interpret this youngest cluster suggests ages at 1677 ± 7 Ma (52% of the group) and 1740 ± 7 Ma (48% of the group). Alternatively, using the MSWD and probability of fit as a statistical guide to calculating weighted mean $^{207}Pb/^{206}Pb$ ages for this cluster provides ages at 1680 ± 7 Ma (95% confidence; n = 31; MSWD = 1.4; probability of fit = 0.08) and 1742 ± 6 Ma (95% confidence; n = 23; MSWD = 1.09; probability of fit = 0.34; Figure 22.4).

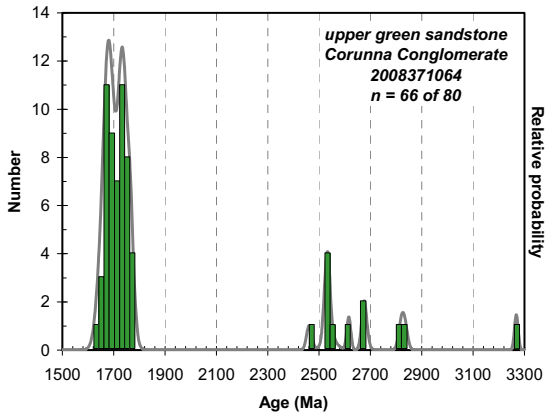

Figure 22.3. *Probability density diagram of zircon analyses from the upper green sandstone of the Corunna Conglomerate (2008371064).*

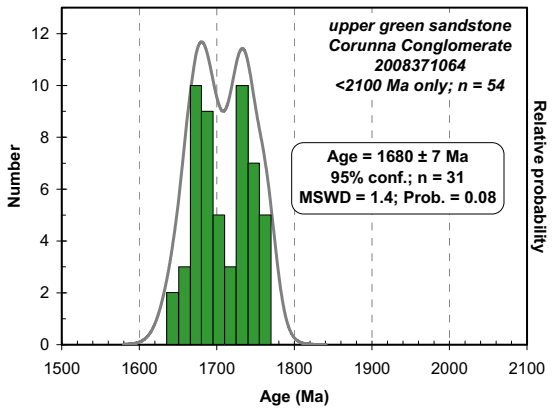

Figure 22.4. *Probability density diagram of zircon analyses from the upper green sandstone of the Corunna Conglomerate (2008371064) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

Geochronological Interpretation

The weighted mean age of 1680 ± 7 Ma (95% confidence; n = 31) calculated from part of the youngest cluster within this age spectra can be used to define a maximum depositional age for this sample.

Table 22.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371064 (1958102), Corunna Conglomerate, Baxter Hills.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detritial zircon (n = 66)											
102.3.1.1	0.07	106	121	1.18	1.55	1.9	.2636	0.5	3268	7	2
102.40.1.1	0.12	62	1	0.01	1.84	2.3	.2009	0.7	2834	11	
102.56.1.1	0.10	65	52	0.83	1.87	2.0	.1992	0.7	2820	11	2
102.61.1.1	0.21	79	57	0.75	1.98	1.9	.1828	0.7	2678	12	1
102.14.1.1	0.21	138	115	0.87	2.04	1.8	.1824	0.5	2675	9	4
102.13.1.1	0.04	145	91	0.65	2.05	1.8	.1760	0.5	2616	8	2
102.4.1.1	-0.01	122	71	0.60	2.09	1.9	.1684	1.7	2541	28	1
102.70.1.1	0.06	174	130	0.77	2.18	1.8	.1680	0.4	2538	7	4
102.45.1.1	0.21	64	25	0.41	2.06	2.0	.1679	0.9	2537	15	-1
102.44.1.1	0.04	159	71	0.46	2.13	1.8	.1673	0.5	2531	8	2
102.62.1.1	0.01	127	79	0.64	2.09	1.8	.1665	0.5	2523	8	0
102.10.1.1	0.06	135	48	0.37	2.17	1.8	.1605	0.6	2461	10	1
102.67.1.1	0.21	95	38	0.42	3.16	1.9	.1080	1.0	1766	19	0
102.28.1.1	0.07	179	229	1.32	3.26	2.0	.1080	0.6	1765	12	2
102.27.1.1	0.09	205	135	0.68	3.28	1.9	.1079	0.7	1765	12	3
102.15.1.1	0.02	150	87	0.60	3.33	2.0	.1079	0.7	1763	13	4
102.17.1.1	0.33	135	80	0.62	3.58	1.8	.1076	1.0	1759	19	10
102.74.1.1	-0.16	93	103	1.14	3.37	1.9	.1072	1.1	1752	19	4
102.32.1.1	0.07	105	54	0.53	3.24	1.9	.1072	0.8	1752	14	1
102.1.1.1	0.29	154	89	0.60	3.44	1.8	.1071	1.0	1751	18	6
102.71.1.1	0.23	121	80	0.69	3.17	1.9	.1071	0.9	1751	17	-1
102.65.1.1	0.13	124	68	0.57	3.17	1.9	.1070	0.9	1749	16	-1
102.42.1.1	0.20	95	69	0.75	3.32	1.9	.1070	1.0	1748	19	3
102.64.1.1	0.08	146	85	0.60	3.25	1.8	.1065	0.8	1740	15	1
102.20.1.1	0.05	318	81	0.26	3.25	1.8	.1065	0.5	1740	10	1
102.24.1.1	0.03	231	103	0.46	3.35	1.8	.1064	0.6	1738	10	3
102.69.1.1	0.10	110	72	0.68	3.24	1.9	.1063	0.9	1737	17	0
102.80.1.1	0.03	121	81	0.69	3.39	1.9	.1063	0.9	1736	17	4
102.77.1.1	0.07	189	105	0.58	3.28	1.8	.1059	0.7	1730	12	1
102.38.1.1	0.13	283	200	0.73	3.36	1.8	.1057	0.6	1727	10	3
102.12.1.1	0.13	112	71	0.65	3.32	1.9	.1057	0.9	1726	17	2
102.25.1.1	0.01	209	86	0.43	3.34	1.8	.1057	0.6	1726	11	2
102.72.1.1	0.08	212	186	0.91	3.37	1.8	.1056	0.7	1725	12	3
102.34.1.1	0.17	75	81	1.11	3.45	1.9	.1056	1.3	1725	23	5
102.33.1.1	0.26	105	203	1.99	3.39	1.9	.1055	1.2	1724	23	3
102.60.1.1	0.41	160	66	0.43	3.48	1.8	.1051	1.0	1716	19	5
102.37.1.1	0.12	164	58	0.37	3.38	1.8	.1048	0.9	1711	16	2
102.68.1.1	0.23	76	120	1.63	3.50	2.0	.1047	1.3	1709	25	5
102.16.1.1	0.01	179	162	0.94	3.47	1.8	.1045	0.7	1706	13	4
102.30.1.1	0.08	197	101	0.53	3.36	1.8	.1045	1.0	1705	18	1
102.22.1.1	0.09	76	95	1.29	3.54	3.0	.1045	1.0	1705	19	6
102.48.1.1	0.05	156	167	1.10	3.45	1.8	.1044	0.8	1703	15	4
102.75.1.1	0.02	90	111	1.29	3.32	2.6	.1037	1.0	1691	19	0
102.26.1.1	0.04	113	83	0.75	3.40	1.9	.1036	0.8	1690	15	2
102.31.1.1	0.01	206	225	1.13	3.43	1.8	.1034	0.6	1686	11	2
102.41.1.1	0.16	70	44	0.66	3.35	2.0	.1033	1.5	1685	27	0
102.23.1.1	0.15	117	145	1.28	3.35	1.9	.1033	1.0	1684	18	0
102.78.1.1	0.08	136	98	0.74	3.49	1.8	.1033	0.8	1684	15	4
102.43.1.1	0.15	67	144	2.23	3.46	2.0	.1032	1.4	1683	25	3
102.36.1.1	0.21	113	220	2.01	3.49	1.9	.1031	1.1	1681	19	3
102.58.1.1	0.05	158	109	0.71	3.35	1.8	.1031	0.8	1680	14	0
102.59.1.1	0.22	113	83	0.76	3.39	2.1	.1029	1.1	1678	21	1
102.52.1.1	0.10	120	67	0.58	3.40	1.9	.1028	1.1	1676	19	1
102.8.1.1	0.27	133	101	0.78	3.48	1.8	.1028	1.0	1675	19	3
102.18.1.1	0.05	114	78	0.71	3.27	1.9	.1027	0.8	1674	15	-3
102.2.1.1	0.50	74	82	1.14	3.59	2.0	.1027	1.7	1673	31	5
102.21.1.1	0.43	272	150	0.57	3.71	1.8	.1026	0.9	1672	17	8
102.49.1.1	0.02	188	132	0.73	3.43	1.8	.1026	0.7	1672	13	1
102.53.1.1	0.08	131	87	0.68	3.44	1.8	.1026	0.9	1672	17	2
102.66.1.1	0.10	195	67	0.35	3.36	1.8	.1026	0.7	1672	12	0
102.63.1.1	0.42	161	143	0.91	3.70	1.8	.1023	1.1	1667	21	8
102.39.1.1	0.27	191	280	1.52	3.78	1.9	.1021	0.9	1663	17	9
102.47.1.1	0.17	112	107	0.98	3.37	1.9	.1019	0.9	1659	17	-1
102.76.1.1	0.07	188	128	0.70	3.41	1.8	.1019	0.7	1658	12	0

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
102.73.1.1	0.06	157	117	0.77	3.40	1.8	.1009	0.7	1640	13	-1
102.79.1.1	0.23	128	166	1.34	3.44	1.9	.1008	1.0	1638	19	0
Analyses >0.5% $^{206}Pb_c$ (n = 12)											
102.29.1.1	5.87	433	152	0.36	6.60	1.8	.1102	6.4	1803	117	50
102.19.1.1	4.11	153	104	0.70	3.59	1.9	.0994	7.7	1612	143	2
102.6.1.1	3.28	193	127	0.68	5.31	7.2	.0977	7.6	1582	142	30
102.57.1.1	2.05	84	95	1.16	3.41	1.9	.1027	3.1	1673	57	1
102.9.1.1	1.69	123	176	1.48	3.51	1.9	.1028	2.6	1674	49	3
102.11.1.1	1.46	258	134	0.53	4.30	1.9	.1027	2.0	1674	36	19
102.55.1.1	1.38	267	112	0.43	3.99	1.8	.1070	1.8	1748	32	17
102.54.1.1	1.14	67	43	0.66	3.65	2.2	.1035	2.3	1687	43	8
102.7.1.1	0.99	55	81	1.50	3.37	2.1	.1040	2.4	1697	44	1
102.50.1.1	0.96	162	211	1.35	3.54	1.8	.1037	1.6	1691	29	5
102.35.1.1	0.69	132	92	0.72	2.26	1.8	.1674	0.9	2532	15	7
102.46.1.1	0.57	136	161	1.22	3.52	2.0	.1026	1.3	1671	23	4
Analyses >10% discordant (n = 2)											
102.51.1.1	0.31	305	109	0.37	1.78	1.7	.2639	0.4	3270	7	12
102.5.1.1	0.01	127	109	0.89	2.33	1.9	.1730	1.6	2587	27	11

Southern Gawler Craton

CLEVE DOMAIN

The Cleve Domain lies to the west of the Spencer Domain, across the Kalinjala Mylonite Zone, and is characterised by a uniformly low magnetic signature (Figure vi). Geology of the Cleve Domain is dominated by Paleoproterozoic metasedimentary rocks of the Hutchison Group, as well as felsic gneisses, including the Minbrie Gneiss. The western part of the Cleve Domain is intruded by granites of the ~1590 Ma Hiltaba Suite. The northern Cleve Domain also contains outcrop of the Corunna Conglomerate, near the boundary with the overlying Gawler Range Volcanics.

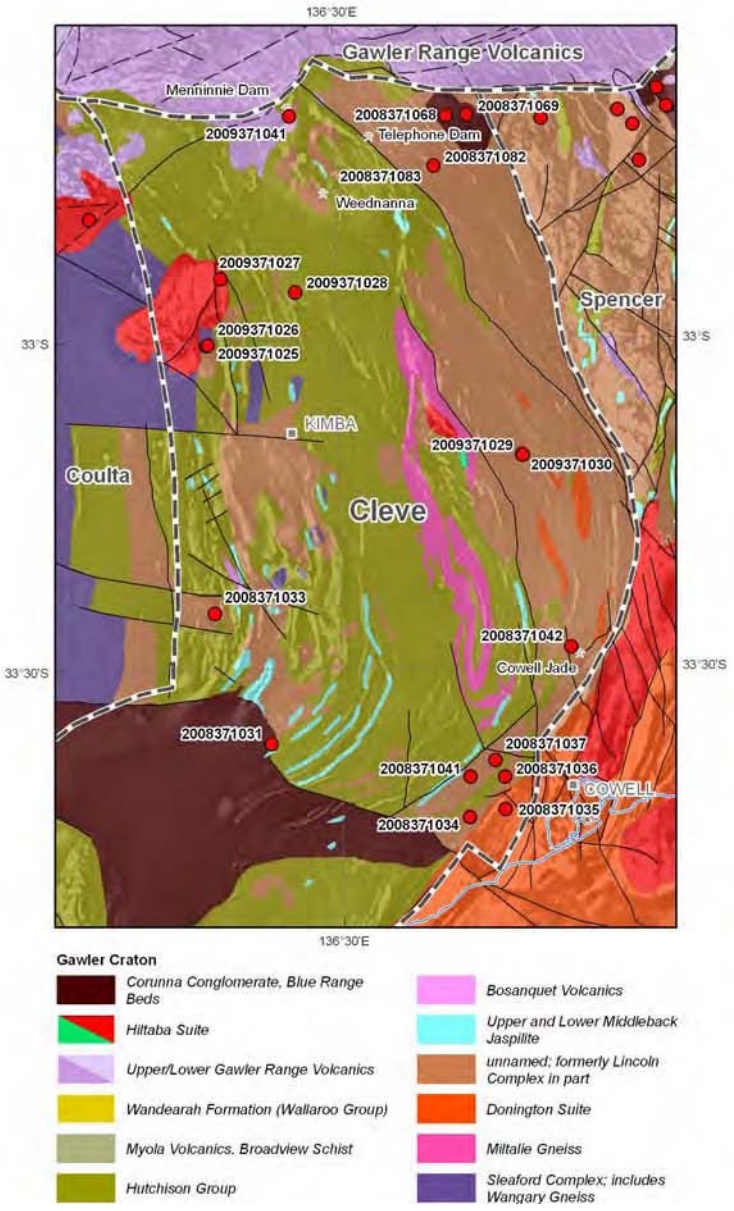

Figure vi. *Locations of new samples analysed for SHRIMP U-Pb zircon geochronology from the Cleve Domain, Gawler Craton, South Australia, displayed on a partially transparent solid geology map (Cowley, 2006) laid over a magnetic intensity image.*

23. CORUNNA CONGLOMERATE, UNO RANGE: 2008371068

GA Sample ID:	**2008371068**
GA Sample Number:	**1958106**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**659745 6385190 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**1/6/2008**
Formal Name:	**Corunna Conglomerate**
Informal Name:	**Upper green sandstone**
Lithology:	**Coarse-grained white sandstone**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6093**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**15 – 22/07/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.33% (2σ) [43 of 44]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.3 ± 1.5 Ma [42 of 42]**
Interpreted Age:	**1690 ± 7 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample was collected from the Uno Range, northern Eyre Peninsula, South Australia, from a lithostratigraphic unit informally termed the upper green sandstone (Morgan, 2007). The sample is a white, coarse-grained cross-bedded quartzite (Figure 23.1)

Figure 23.1. *Cross-bedded, white sandstone of the upper green sandstone of the Corunna Conglomerate from Uno Range (sample 2008371068).*

Zircon Description

Zircons from this sample range from ~70 µm to ~150 µm in length, with some large grains up to ~190 µm in length (Figure 23.2). The grains are colourless to light brown in colour and most have a rounded morphology and are pitted, while a small number of grains preserve prismatic terminations. Cathodoluminescence images record oscillatory zoning within most grains.

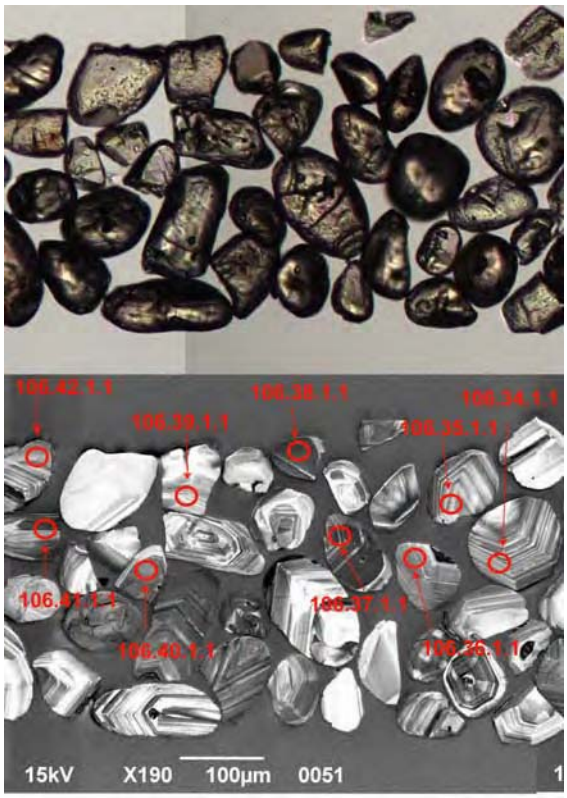

Figure 23.2. *Representative transmitted light and cathodoluminescence images of zircons from the upper green sandstone of the Corunna Conglomerate (2008371068), with locations of some SHRIMP analyses.*

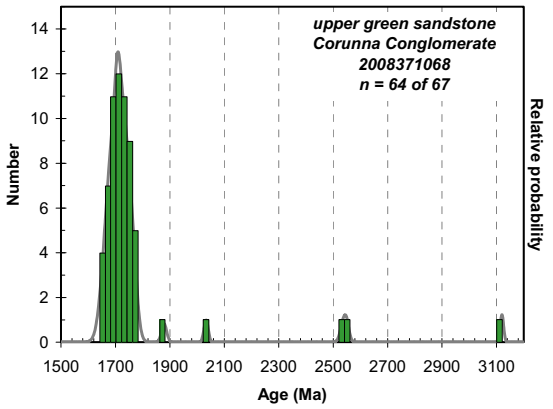

Figure 23.3. *Probability density diagram of zircon analyse from the upper green sandstone of the Corunna Conglomerate (2008371068).*

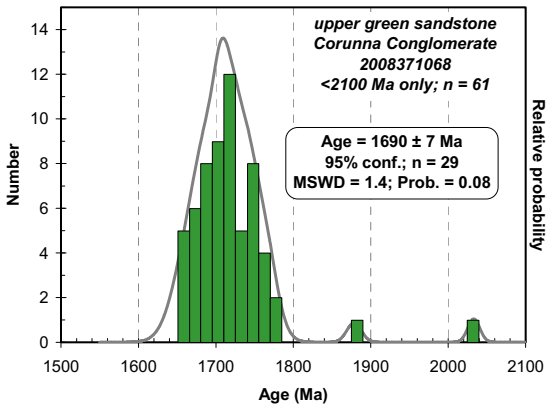

Figure 23.4. *Probability density diagram of zircon analyses from the upper green sandstone of the Corunna Conglomerate (2008371068) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

U-Pb Isotopic Results

Sixty-seven zircons were analysed from this sample, with three discordant analyses excluded from further consideration. The remaining 64 analyses range in age from ~3120 Ma to ~1653 Ma, and include individual ages at ~3120 Ma, ~2549 Ma, ~2535 Ma, ~2033 Ma, and ~1878 Ma, and a large number of ages ranging between ~1772 Ma and the youngest individual age at 1653 Ma (Figure 23.3). The large MSWD for this large cluster (n = 59) indicates that it is not a single population. Mixture modelling of two components provides ages at 1696 ± 6 Ma (60% of the cluster) and 1743 ± 7 Ma (40% of the cluster). Alternatively, using the MSWD as a guide for the youngest statistically coherent age group provides a weighted mean $^{207}Pb/^{206}Pb$ age 1690 ± 7 Ma (95% confidence; MSWD = 1.4; probability of fit = 0.08; Figure 23.4) for the youngest 29 individuals.

Geochronological Interpretation

Interpreting a maximum depositional age for this sample is difficult due to the large range of ages within the youngest cluster. However, given that the youngest weighted mean age calculated using the MSWD value as a guide is within error of the age determined from mixture modelling of 2 components, the weighted mean age of 1690 ± 7 Ma (95% confidence; n = 29) is the preferred interpretation for a maximum depositional age of this sample.

Table 23.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371068 (1958106), Corunna Conglomerate, Uno Range.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircon (n = 64)											
106.49.1.1	0.05	143	70	0.51	1.62	1.8	.2400	0.4	3120	6	0
106.55.1.1	0.10	103	95	0.96	2.07	1.9	.1691	0.6	2549	9	0
106.52.1.1	0.26	119	41	0.35	2.05	1.9	.1677	0.6	2535	11	-1
106.33.1.1	0.01	252	216	0.88	2.64	1.8	.1253	0.4	2033	8	-2
106.56.1.1	-0.01	201	109	0.56	2.95	1.8	.1149	0.5	1878	9	0
106.7.1.1	-0.07	101	72	0.74	3.22	1.9	.1084	0.9	1772	16	2
106.8.1.1	0.19	189	145	0.79	3.36	1.8	.1084	0.8	1772	14	5
106.40.1.1	0.04	191	117	0.63	3.18	1.8	.1082	0.6	1770	11	0
106.17.1.1	0.20	209	434	2.15	3.35	1.8	.1078	0.7	1762	12	4
106.21.1.1	0.02	172	103	0.62	3.23	1.8	.1077	0.7	1760	12	1
106.23.1.1	0.15	108	128	1.22	3.37	1.9	.1074	1.0	1755	18	5
106.47.1.1	0.15	120	91	0.79	3.16	1.9	.1073	0.9	1753	17	-1
106.62.1.1	0.03	163	155	0.99	3.24	1.8	.1071	0.7	1751	13	1
106.19.1.1	0.04	235	248	1.09	3.31	1.8	.1070	0.5	1749	10	3
106.59.1.1	0.09	175	147	0.87	3.25	1.8	.1069	0.7	1747	12	1
106.65.1.1	0.13	159	93	0.61	3.13	2.0	.1068	0.8	1746	14	-2
106.44.1.1	0.22	115	69	0.62	3.24	1.9	.1068	1.0	1746	18	1
106.20.1.1	-0.01	291	134	0.48	3.29	1.7	.1066	0.5	1742	8	2
106.9.1.1	0.11	138	73	0.54	3.31	1.9	.1065	1.0	1740	19	2
106.67.1.1	0.03	142	212	1.54	3.36	1.8	.1061	0.8	1733	15	3
106.35.1.1	0.09	124	102	0.85	3.28	1.8	.1060	0.9	1732	16	1
106.14.1.1	0.09	207	157	0.78	3.33	1.8	.1060	0.7	1732	12	2
106.57.1.1	0.00	224	160	0.74	3.18	1.8	.1059	0.5	1729	10	-2
106.46.1.1	0.06	283	172	0.63	3.24	1.8	.1058	0.6	1729	11	0
106.42.1.1	0.01	172	103	0.62	3.32	1.8	.1056	0.8	1724	15	1
106.15.1.1	0.03	177	75	0.44	3.35	2.2	.1056	0.6	1724	12	2
106.68.1.1	0.23	116	90	0.80	3.25	1.9	.1055	1.0	1722	18	0
106.48.1.1	0.31	138	114	0.86	3.20	1.8	.1054	1.0	1722	17	-2
106.18.1.1	0.05	229	117	0.53	3.30	1.8	.1054	0.6	1722	11	1
106.6.1.1	0.08	211	81	0.39	3.41	1.8	.1054	0.7	1721	13	4
106.36.1.1	0.08	186	82	0.45	3.25	1.8	.1052	0.7	1717	13	-1
106.58.1.1	0.06	150	125	0.86	3.27	1.8	.1052	0.8	1717	15	0
106.38.1.1	0.05	244	228	0.97	3.31	1.8	.1048	0.6	1712	11	1
106.63.1.1	0.41	151	111	0.76	3.33	1.8	.1048	1.0	1711	19	1
106.3.1.1	0.01	264	173	0.68	3.36	1.8	.1048	0.6	1711	10	2
106.45.1.1	0.11	245	113	0.48	3.27	1.8	.1048	0.6	1711	12	-1
106.1.1.1	0.22	104	75	0.74	3.36	2.5	.1046	1.1	1708	20	2
106.25.1.1	-0.01	205	122	0.61	3.35	1.8	.1046	0.6	1707	10	1
106.50.1.1	0.09	451	412	0.94	3.39	1.8	.1045	0.4	1706	8	2
106.64.1.1	0.16	116	61	0.55	3.25	1.9	.1045	0.9	1705	17	-1
106.27.1.1	0.09	158	163	1.06	3.38	1.8	.1043	0.7	1703	13	2
106.5.1.1	0.13	182	98	0.56	3.67	1.8	.1043	0.9	1701	17	9
106.39.1.1	0.16	111	84	0.78	3.21	1.9	.1042	1.0	1700	19	-3
106.2.1.1	0.06	262	238	0.94	3.44	1.8	.1042	0.6	1700	11	3
106.34.1.1	0.05	173	164	0.98	3.32	1.8	.1041	0.7	1698	13	0
106.16.1.1	0.08	207	217	1.08	3.28	1.8	.1038	0.6	1694	11	-1
106.22.1.1	0.12	99	82	0.86	3.37	1.9	.1038	1.0	1693	18	1
106.66.1.1	0.21	169	217	1.33	3.25	1.9	.1037	0.9	1691	16	-2
106.4.1.1	0.05	139	121	0.90	3.44	1.9	.1036	0.8	1690	15	3
106.60.1.1	0.22	147	104	0.73	3.35	1.8	.1035	0.9	1688	17	0
106.13.1.1	0.00	179	148	0.85	3.51	1.8	.1033	0.6	1685	11	4
106.26.1.1	0.32	153	223	1.51	3.39	2.1	.1033	1.0	1685	18	1
106.24.1.1	0.13	114	131	1.19	3.42	1.9	.1032	0.9	1683	17	2
106.37.1.1	0.13	193	191	1.02	3.34	1.8	.1029	0.7	1678	14	-1
106.43.1.1	0.11	152	106	0.72	3.39	1.8	.1028	0.8	1676	16	1
106.12.1.1	0.14	166	167	1.04	3.45	1.8	.1027	0.9	1673	16	2
106.41.1.1	0.03	169	157	0.96	3.40	1.8	.1027	0.7	1673	13	1
106.61.1.1	0.20	106	86	0.84	3.33	1.9	.1025	1.1	1669	20	-1
106.29.1.1	0.15	147	194	1.36	3.35	1.8	.1023	1.1	1667	20	-1
106.28.1.1	0.04	126	93	0.77	3.39	1.8	.1020	0.8	1660	16	0
106.32.1.1	0.09	82	35	0.44	3.31	1.9	.1018	1.1	1658	21	-3
106.54.1.1	0.24	158	112	0.73	3.35	1.8	.1018	1.1	1657	21	-2
106.11.1.1	0.13	191	302	1.63	3.42	1.8	.1017	0.8	1655	15	0
106.10.1.1	0.21	115	91	0.82	3.40	1.9	.1016	1.1	1653	20	0

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Analyses >10% discordant (n = 3)											
106.31.1.1	0.15	233	250	1.11	4.24	1.8	.1037	0.7	1691	14	19
106.30.1.1	0.20	177	277	1.62	2.45	1.8	.1818	0.5	2670	8	17
106.51.1.1	0.39	227	279	1.27	4.03	1.8	.1049	1.3	1712	24	17

24. CORUNNA CONGLOMERATE, UNO RANGE: 2008371069

GA Sample ID:	**2008371069**
GA Sample Number:	**1958107**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**663284 6385354 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**1/6/2008**
Formal Name:	**Corunna Conglomerate**
Informal Name:	**White sandstone**
Lithology:	**Pink massive sandstone**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6093**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**15 – 22/07/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.33% (2σ) [43 of 44]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.3 ± 1.5 Ma [42 of 42]**
Interpreted Age:	**1659 ± 7 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample is from the Uno Range, northern Eyre Peninsula, South Australia, and was collected from the unit informally named the white sandstone, which is the uppermost unit within the Corunna Conglomerate (Morgan, 2007). The sample is a massive to thick-bedded, gritty sandstone with cross beds (Figure 24.1).

Figure 24.1. *Thick-bedded sandstone of the Corunna Conglomerate (white sandstone) from Uno Range (sample 2008371069).*

Zircon Description

Zircons from this sample range from ~100 µm to ~170 µm in length, with some large grains up to ~270 µm in length (Figure 24.2). The grains are colourless to light brown in colour and most have a rounded morphology and are pitted, while a small number of grains preserve prismatic terminations. Cathodoluminescence images record oscillatory zoning within most grains.

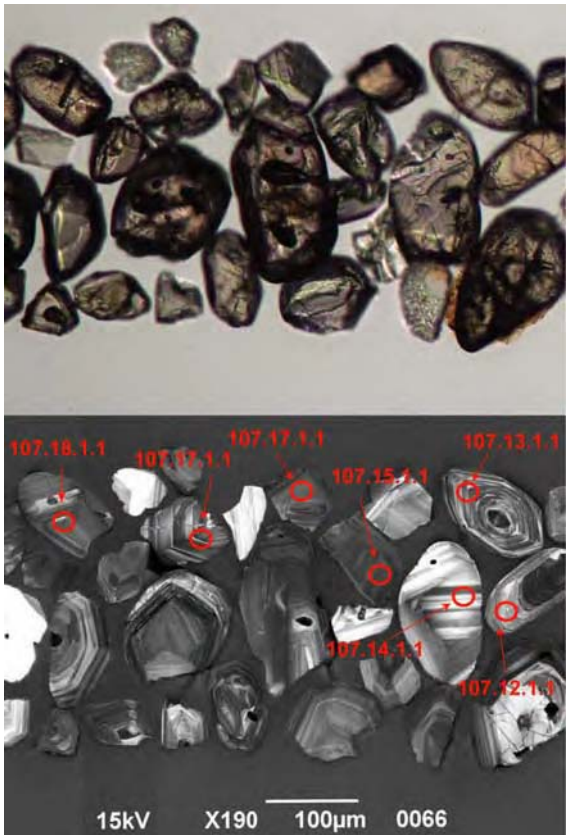

Figure 24.2. *Representative transmitted light and cathodoluminescence images of zircons from the white sandstone of the Corunna Conglomerate (2008371069), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Sixty-nine zircons were analysed, with three analyses containing common Pb contents greater than an arbitrary value of 0.5% excluded from further consideration. The remaining 66 analyses range in age from ~2809 Ma to ~1615 Ma (Figure 24.3). The age spectrum includes individual ages at ~2809 Ma and ~2680 Ma, three ages between ~2539 Ma and ~2460 Ma, ages at ~1912 Ma, ~1860 Ma and ~1833 Ma and a large range of ages (~88% of the spectra) between ~1741 Ma and the youngest individual at ~1615 Ma (Figure 24.4). The MSWD value of 4.5 for this youngest group (n = 58) indicates that it is not a single population. Using mixture modelling to interpret this cluster provides ages at 1654 ± 8 Ma (60% of the group) and 1714 ± 7 Ma (40% of the group).

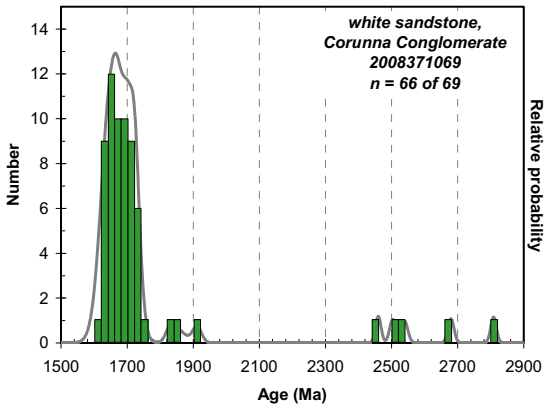

Figure 24.3. *Probability density diagram of zircon analyses from the white sandstone of the Corunna Conglomerate (2008371069).*

Alternatively, using the MSWD and probability of fit as a guide for the youngest statistically coherent age group provides a weighted mean $^{207}Pb/^{206}Pb$ age of 1659 ± 7 Ma (95% confidence; MSWD = 1.3; Probability of fit = 0.10; Figure 24.4) for the youngest 38 ages, with the remaining analyses combining to give a weighted mean age of 1717 ± 6 Ma (95% confidence; n = 20: MSWD = 0.98; probability of fit = 0.48).

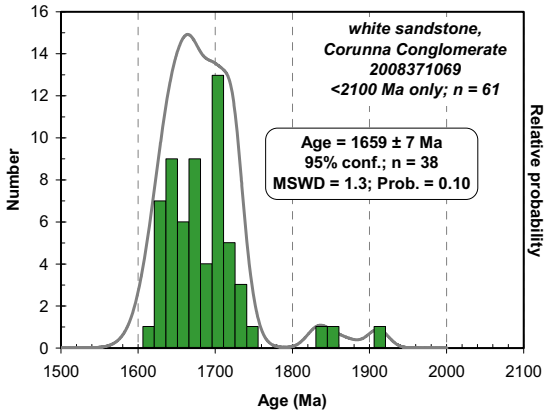

Figure 24.4. *Probability density diagram of zircon analyses from the white sandstone of the Corunna Conglomerate (2008371069) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

Geochronological Interpretation

The weighted mean age of 1659 ± 7 Ma (95% confidence) for the youngest 38 ages from this sample is within error of the age calculated from mixture modelling, and can be used to define a maximum depositional age for this sample from the Corunna Conglomerate.

Table 24.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371069 (1958107), Corunna Conglomerate, Uno Range.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircon (n = 66)											
107.32.1.1	0.04	95	145	1.57	1.83	1.9	.1979	0.5	2809	9	0
107.69.1.1	0.08	101	41	0.42	1.99	1.9	.1829	0.6	2680	9	2
107.40.1.1	0.08	102	115	1.17	2.11	1.9	.1681	0.6	2539	10	2
107.55.1.1	0.02	108	64	0.61	2.11	1.9	.1646	0.6	2504	10	0
107.44.1.1	0.03	167	82	0.51	2.17	1.8	.1604	0.5	2460	8	1
107.39.1.1	0.09	146	82	0.58	2.86	1.8	.1170	0.8	1912	14	-1
107.27.1.1	0.29	82	35	0.44	2.96	2.0	.1137	1.2	1860	21	-1
107.16.1.1	0.16	136	64	0.49	3.02	1.8	.1120	0.8	1833	14	-1
107.38.1.1	-0.02	211	112	0.55	3.23	1.8	.1065	0.6	1741	12	0
107.21.1.1	0.04	201	123	0.63	3.36	1.8	.1064	0.8	1739	15	3
107.15.1.1	0.00	191	78	0.42	3.18	1.8	.1059	0.6	1729	11	-2
107.59.1.1	0.02	292	187	0.66	3.20	1.8	.1058	0.6	1728	10	-1
107.58.1.1	0.02	251	97	0.40	3.22	1.8	.1055	0.6	1723	10	-1
107.49.1.1	0.02	241	90	0.39	3.31	1.8	.1054	0.6	1722	10	1
107.11.1.1	0.03	171	72	0.44	3.28	1.8	.1053	0.6	1720	12	0
107.5.1.1	-0.01	164	197	1.24	3.44	1.8	.1049	0.6	1713	12	4
107.29.1.1	0.24	139	146	1.08	3.27	1.8	.1048	0.9	1711	17	-1
107.28.1.1	0.04	123	71	0.60	3.28	1.9	.1047	0.8	1710	15	0
107.31.1.1	0.04	239	120	0.52	3.17	1.8	.1047	0.6	1708	11	-3
107.57.1.1	0.17	177	105	0.61	3.26	1.8	.1047	0.8	1708	15	-1
107.30.1.1	0.09	46	52	1.16	3.38	2.2	.1046	1.7	1708	30	2
107.61.1.1	0.26	101	92	0.94	3.29	1.9	.1046	1.1	1707	20	0
107.53.1.1	0.34	65	34	0.55	3.21	2.0	.1044	1.6	1703	30	-3
107.2.1.1	0.07	140	53	0.39	3.30	1.8	.1044	0.8	1703	14	0
107.25.1.1	0.21	110	85	0.80	3.20	1.9	.1041	1.2	1698	22	-3
107.14.1.1	0.10	39	48	1.26	3.23	2.3	.1041	1.4	1698	26	-2
107.66.1.1	0.02	103	118	1.19	3.39	1.9	.1041	1.0	1698	19	2
107.60.1.1	0.10	290	96	0.34	3.24	1.8	.1040	0.6	1697	10	-2
107.1.1.1	0.09	101	74	0.75	3.46	1.9	.1040	1.0	1696	18	3
107.54.1.1	0.13	63	66	1.07	3.32	2.0	.1039	1.8	1695	32	0
107.4.1.1	0.03	51	51	1.02	3.56	2.2	.1038	1.2	1694	23	6
107.51.1.1	0.31	106	118	1.15	3.24	1.9	.1036	1.1	1689	21	-3
107.45.1.1	0.10	236	96	0.42	3.22	1.8	.1035	0.7	1688	12	-3
107.6.1.1	-0.07	145	102	0.73	3.44	1.8	.1031	0.7	1681	13	2
107.9.1.1	0.00	96	80	0.85	3.47	1.9	.1029	1.0	1677	19	3
107.52.1.1	0.12	82	65	0.82	3.36	2.0	.1029	1.2	1677	21	0
107.46.1.1	0.14	141	101	0.74	3.38	1.8	.1028	0.9	1674	17	0
107.63.1.1	0.04	81	69	0.88	3.35	2.0	.1027	1.2	1673	23	-1
107.68.1.1	0.07	109	88	0.84	3.43	1.9	.1026	1.0	1671	18	1
107.34.1.1	0.12	147	106	0.74	3.34	1.8	.1025	0.9	1669	16	-1
107.43.1.1	0.19	192	214	1.15	3.42	1.8	.1025	0.8	1669	15	1
107.3.1.1	0.01	128	104	0.84	3.21	1.9	.1023	0.8	1667	14	-5
107.33.1.1	0.11	221	252	1.18	3.45	1.8	.1023	0.7	1666	13	1
107.41.1.1	0.24	56	71	1.30	3.47	2.2	.1021	1.9	1662	36	2
107.23.1.1	0.05	101	101	1.03	3.43	1.9	.1019	0.9	1659	17	1
107.13.1.1	0.13	130	110	0.87	3.49	1.8	.1018	0.9	1657	16	2
107.64.1.1	0.07	141	94	0.69	3.39	2.0	.1016	0.8	1654	15	-1
107.35.1.1	0.14	159	139	0.91	3.27	2.2	.1016	0.8	1654	15	-4
107.8.1.1	0.38	46	158	3.56	3.44	2.2	.1016	1.9	1653	36	0
107.67.1.1	0.28	75	110	1.51	3.41	2.0	.1014	1.4	1649	27	-1
107.56.1.1	0.47	75	109	1.50	3.32	2.0	.1013	1.6	1647	29	-3
107.19.1.1	0.02	115	53	0.48	3.58	1.9	.1012	0.8	1647	16	4
107.65.1.1	0.19	64	79	1.28	3.32	2.1	.1012	1.6	1647	29	-3
107.37.1.1	0.07	94	127	1.40	3.36	1.9	.1012	1.3	1645	24	-2
107.22.1.1	0.16	106	135	1.32	3.43	1.9	.1010	1.1	1643	20	0
107.42.1.1	0.09	133	158	1.23	3.43	1.9	.1010	1.0	1642	19	0
107.26.1.1	0.07	158	76	0.49	3.44	1.8	.1008	0.7	1639	13	0
107.17.1.1	0.27	148	208	1.45	3.39	1.8	.1008	0.9	1639	17	-2
107.50.1.1	0.53	157	79	0.52	3.46	1.8	.1005	1.3	1633	24	0
107.62.1.1	0.12	118	86	0.76	3.40	1.9	.1004	1.0	1632	19	-2
107.7.1.1	0.15	108	78	0.74	3.40	1.9	.1003	1.1	1629	20	-2
107.47.1.1	0.19	75	56	0.78	3.30	2.0	.1002	1.3	1628	25	-5
107.24.1.1	0.20	89	96	1.12	3.45	1.9	.1002	1.3	1628	23	-1
107.20.1.1	-0.04	109	132	1.25	3.60	1.9	.1001	0.9	1626	17	3

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
107.10.1.1	0.18	117	73	0.64	3.49	1.9	.1000	1.1	1624	20	0
107.48.1.1	0.26	91	61	0.70	3.30	1.9	.0995	1.4	1615	25	-6
Analyses >0.5% $^{206}Pb_c$ (n = 3)											
107.36.1.1	0.83	39	50	1.33	3.42	2.2	.0976	2.7	1578	50	-5
107.12.1.1	0.68	61	59	1.00	3.49	2.4	.1015	2.1	1652	39	2
107.18.1.1	0.54	112	81	0.74	3.65	2.1	.1047	1.3	1709	24	9

25. GREY GRANITIC GNEISS, REFUGE ROCKS: 2009371030

GA Sample ID:	**2009371030**
GA Sample Number:	**1999466**
Other Sample ID:	
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**671138 6327451 Zone 53**
Collector:	**G. Fraser, N. Neumann**
Collection Date:	**5/7/2009**
Formal Name:	**Minbrie Gneiss**
Informal Name:	
Lithology:	**grey granitic gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6098**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**24 - 31/8/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.59% (2σ) [67 of 71]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3468.1 ± 1.4 Ma [37 of 37]**
Interpreted Age:	**2446 ± 31 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous protolith age**
Interpreted Age:	**1738 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**High-grade metamorphic age**

Sample Description

Refuge Rocks is located ~30 km west of the Middleback Ranges, Eyre Peninsula, South Australia. At this locality, extensive outcrop of quartzofeldspathic gneiss and granitic gneiss is present and is collectively mapped as Minbrie Gneiss (Parker *et al*., 1988). This sample consists of even-grained, medium-grained, strongly-foliated, grey granitic, biotite gneiss (Figure 25.1). This sample was collected from the same locality and same lithology as sample R445506 reported in Fanning *et al*. (2007). Fanning *et al*. (2007) reported a magmatic crystallisation age of 1740 ± 4 Ma, with inherited zircon in the age range 2500 Ma to 2400 Ma.

Figure 25.1. *Outcrop of sample 20098371030, grey granitic gneiss, Refuge Rocks.*

Zircon Description

Zircons from this sample are typically subhedral and slightly elongate, with aspect ratios of ~2 and long dimension of ~150 – 200 µm. In cathodoluminescence (CL) images, the grains display a variety of internal zonation features (Figure 25.2). Some grains exhibit concentric, oscillatory zoning throughout the grain, others show a dark (high U), rounded core surrounded by a dark CL, euhedral, oscillatory-zoned rim. In several such grains the boundary between core and rim is marked by a narrow zone of bright CL response that appears to represent a region of recrystallisation of the core. A few grains show bright CL (low U) cores overgrown by dark CL oscillatory-zoned rims. In many cases the oscillatory zoning in the rims appears to have been modified post-crystallisation, with fine-scale zoning having become broader and mottled in CL.

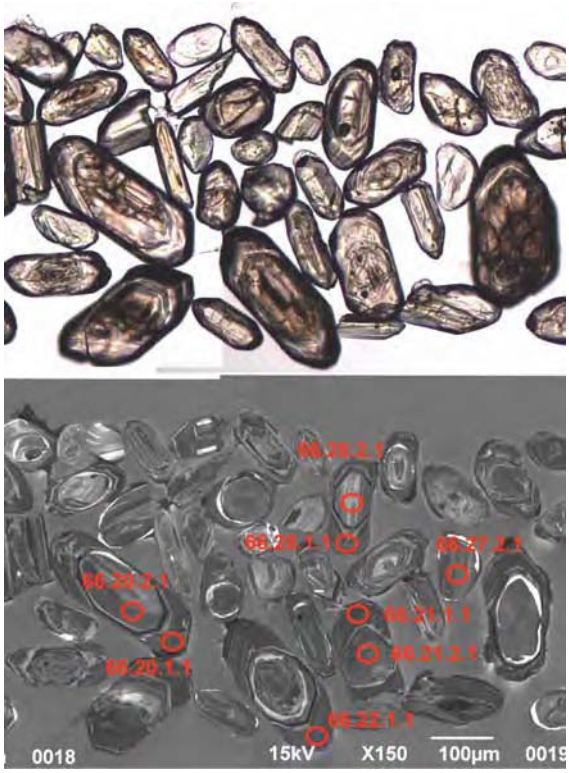

Figure 25.2. *Representative transmitted light and cathodoluminescence images of zircons from grey granitic gneiss, Refuge Rocks (2009371030), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 50 analyses were collected from 40 different zircon grains (Figure 25.3). Two analyses are older than 2600 Ma; both these are from the interior of grain 29 and are interpreted as inherited.

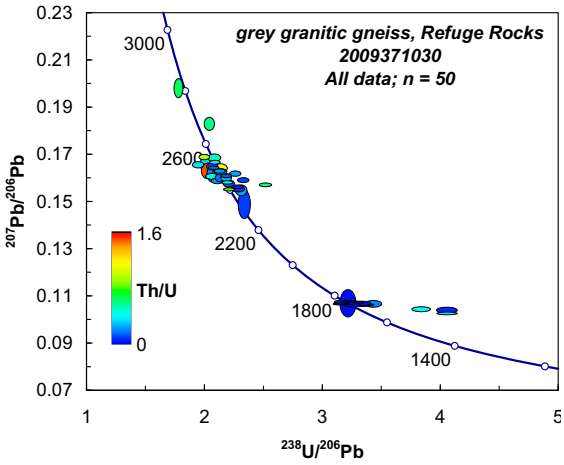

Figure 25.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the grey granitic gneiss at Refuge Rocks (2009371030), coloured according to Th/U ratio.*

A group of 31 analyses ranges in age between ~2550 Ma and 2330 Ma, and scatter well beyond expectation for a single age population (MSWD = 27). Six of these analyses are either >5% discordant or contain >0.5% $^{206}Pb_c$, although excluding these analyses does not significantly improve the scatter. When plotted on concordia and coloured according to U-content there is a clear trend in which higher U analyses form a young tail within this group, suggesting that at least some of the scatter is due to ancient Pb-loss that has been more significant in higher U zircon in which more radiation damage has accumulated (Figure 25.4). A discordia regression through 25 analyses produces an upper intercept age of 2446 ± 31 Ma (MSWD = 1.3; Figure 25.4). Although imprecise, this is regarded as the best estimate for the age of the igneous protolith to this gneiss.

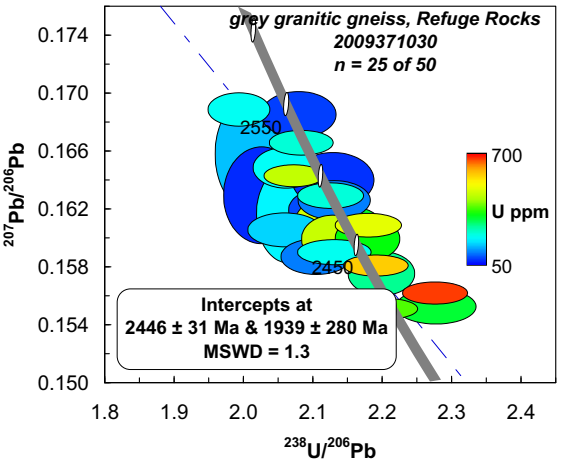

Figure 25.4. *Tera-Wasserburg concordia diagram showing results of near-concordant ~2450 Ma zircon from the grey granitic gneiss at Refuge Rocks (2009371030), coloured according to U content.*

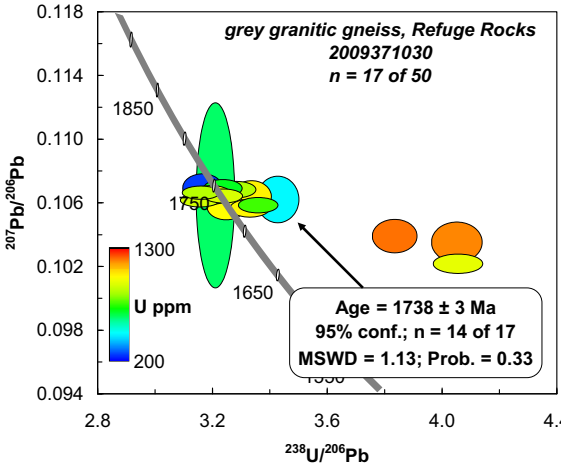

Figure 25.5. *Tera-Wasserburg concordia diagram showing results of ~1740 Ma zircon analyses from the grey granitic gneiss at Refuge Rocks (2009371030), coloured according to U content.*

Another group of 17 analyses ranges in age between ~1750 and 1660 Ma. The three youngest analyses in this group are all >10% discordant, and if these are disregarded the remaining 14 analyses define a weighted mean $^{207}Pb/^{206}Pb$ age of 1738 ± 3 Ma (95% confidence; MSWD = 1.13; probability of fit = 0.33; Figures 25.5 & 25.6). Analyses in this group come from dark CL zircon, generally forming broad, oscillatory-zoned rims around rounded cores. All but two of the analyses in this group have Th/U between 0.01 and 0.03, which is typical of high-grade metamorphic zircon. The morphology and oscillatory zoning of these rims is suggestive of crystallisation from a melt.

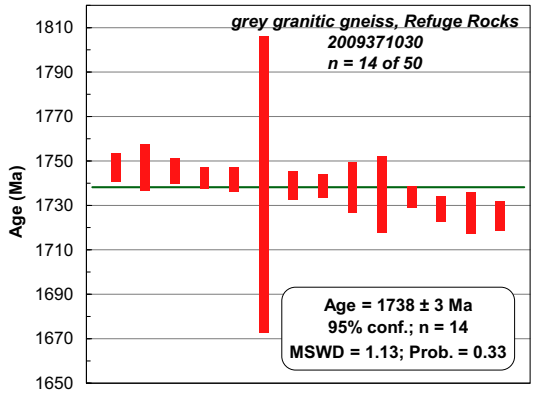

Figure 25.6. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of ~1740 Ma zircon analyses from the grey granitic gneiss at Refuge Rocks (2009371030).*

Geochronological Interpretation

The upper intercept age defined by zircon cores of 2446 ± 31 Ma is interpreted to represent the age of igneous crystallisation of this granitic gneiss. The age of 1738 ± 3 Ma derived from low Th/U zircon rims is interpreted as the time of high-grade metamorphism, probably resulting in local melting.

Table 25.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371030 (1999466), Refuge Rocks grey granitic gneiss.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited zircon (n = 2)											
66.29.1.1	0.67	268	162	0.62	1.77	1.5	.1982	1.4	2811	22	-2
66.29.2.1	0.15	291	161	0.57	2.04	1.4	.1830	1.0	2680	17	4
~2446 Ma zircon (n = 25)											
66.26.1.1	0.07	214	205	0.99	1.99	1.5	.1688	0.5	2546	8	-3
66.8.1.1	0.15	85	41	0.50	2.08	1.7	.1685	0.6	2543	10	0
66.6.1.1	0.03	235	79	0.35	2.08	1.5	.1666	0.3	2523	6	0
66.28.2.1	0.17	161	51	0.33	2.01	1.7	.1658	1.6	2516	26	-3
66.5.1.1	0.09	210	21	0.11	2.06	1.5	.1648	0.6	2506	10	-2
66.21.2.1	0.20	460	67	0.15	2.07	1.4	.1643	0.3	2500	5	-2
66.15.1.1	0.36	77	89	1.19	2.13	1.8	.1640	0.8	2497	13	1
66.23.1.1	0.18	73	107	1.51	2.03	1.8	.1629	1.4	2486	23	-4
66.11.1.1	0.05	233	49	0.22	2.13	1.5	.1629	0.4	2486	6	0
66.19.1.1	0.16	123	46	0.38	2.13	1.6	.1626	0.5	2483	9	0
66.24.1.1	0.21	92	88	0.98	2.12	1.7	.1619	0.6	2475	11	-1
66.36.1.1	0.13	199	36	0.19	2.06	1.5	.1616	1.4	2472	23	-3
66.14.1.1	0.06	496	56	0.12	2.18	1.5	.1608	0.3	2464	6	1
66.12.2.1	0.04	479	33	0.07	2.12	1.4	.1605	0.9	2461	15	-1
66.35.1.1	0.27	174	72	0.43	2.06	1.7	.1605	0.5	2461	8	-4
66.3.1.1	0.02	331	17	0.05	2.16	1.4	.1601	0.8	2456	14	0
66.7.1.1	0.14	343	86	0.26	2.18	1.4	.1599	0.6	2455	11	1
66.20.2.1	0.36	466	73	0.16	2.13	1.4	.1599	0.7	2454	12	-1
66.39.1.1	0.04	215	147	0.71	2.13	1.7	.1590	0.4	2445	6	-1
66.34.1.1	0.11	122	26	0.22	2.10	1.6	.1587	0.5	2441	9	-3
66.30.1.1	0.05	578	230	0.41	2.19	1.4	.1581	0.3	2435	5	0
66.2.1.1	0.07	276	35	0.13	2.20	1.4	.1575	0.6	2429	11	1
66.32.1.1	0.03	672	24	0.04	2.28	1.4	.1561	0.3	2414	5	3
66.12.1.1	0.10	323	19	0.06	2.28	1.7	.1552	0.5	2404	9	2
66.37.1.1	0.08	385	315	0.85	2.20	1.4	.1551	0.3	2402	5	0
~2446 Ma zircon >5% discordant and/or containing >0.5% $^{206}Pb_c$ (n = 6)											
66.40.1.1	0.22	150	48	0.33	1.94	1.7	.1655	0.5	2513	9	-6
66.38.1.1	0.27	266	60	0.23	2.26	1.4	.1617	0.5	2474	8	5
66.27.1.1	0.04	707	60	0.09	2.32	1.4	.1590	0.4	2445	7	6
66.25.1.1	0.18	736	416	0.58	2.51	1.4	.1570	0.4	2423	6	12
66.16.2.1	0.91	498	111	0.23	2.31	1.4	.1546	1.0	2397	17	3
66.13.2.1	1.81	359	29	0.08	2.33	1.4	.1487	2.7	2331	46	1
~1738 Ma zircon (n = 14)											
66.22.1.1	0.08	678	11	0.02	3.24	1.4	.1069	0.3	1747	6	1
66.18.1.1	0.16	257	34	0.14	3.17	1.5	.1069	0.6	1747	10	-1
66.13.1.1	0.09	857	21	0.03	3.28	1.4	.1068	0.3	1746	6	2
66.31.1.1	0.03	874	9	0.01	3.16	1.4	.1066	0.3	1743	5	-2
66.1.1.1	0.01	967	6	0.01	3.20	1.4	.1066	0.3	1742	5	-1
66.28.1.1	2.15	620	11	0.02	3.21	1.4	.1065	3.6	1740	67	0
66.14.2.1	0.08	695	14	0.02	3.20	1.4	.1064	0.3	1739	6	-1
66.4.1.1	0.09	932	12	0.01	3.24	1.3	.1064	0.3	1739	5	0
66.11.2.1	0.47	1024	12	0.01	3.34	1.4	.1064	0.6	1738	11	3
66.33.1.1	0.39	456	82	0.19	3.43	1.4	.1062	0.9	1735	17	5
66.21.1.1	0.04	922	13	0.01	3.16	1.4	.1061	0.3	1734	5	-2
66.20.1.1	0.06	754	17	0.02	3.36	1.4	.1058	0.3	1729	6	3
66.14.3.1	0.37	1004	16	0.02	3.25	1.3	.1057	0.5	1727	9	0
66.17.1.1	0.05	1018	21	0.02	3.33	1.4	.1056	0.4	1726	7	2
~1738 Ma zircon >10% discordant (n = 3)											
66.10.1.1	0.53	1210	454	0.39	3.83	1.3	.1039	0.7	1695	12	13
66.16.1.1	0.56	1192	56	0.05	4.05	1.4	.1035	0.8	1688	15	19
66.9.1.1	0.20	960	316	0.34	4.06	1.4	.1021	0.4	1663	7	17

26. MEGACRYSTIC GNEISS, REFUGE ROCKS: 2009371029

GA Sample ID:	**2009371029**
GA Sample Number:	**1999465**
Other Sample ID:	
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS84):	**671037 6327590 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**5/7/2009**
Formal Name:	**Minbrie Gneiss**
Informal Name:	
Lithology:	**K-feldspar-megacrystic gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6098**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**24 - 31/8/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.59% (2σ) [67 of 71]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3468.1 ± 1.4 Ma [37 of 37]**
Interpreted Age:	**2418 ± 7 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

Refuge Rocks is located ~30 km west of the Middleback Ranges, Eyre Peninsula, South Australia. At this locality, extensive outcrop of quartzofeldspathic gneiss and granitic gneiss is present and is collectively mapped as Minbrie Gneiss (Parker *et al*., 1988). This sample is a strongly-foliated, megacrystic gneiss composed of flattened feldspar augen wrapped by a biotite-rich foliation (Figure 26.1). This megacrystic gneiss is interlayered and folded with a medium-grained, grey granitic gneiss that has also been dated (sample 2009371030). Sample 2009371029 was collected from the same locality and same lithology as sample R445507 in Fanning *et al*. (2007). The data of Fanning *et al*. (2007) yield a best age estimate of 2413 ± 7 Ma, derived from the upper intercept of a discordia trend.

Figure 26.1. *Megacrystic gneiss, Refuge Rocks, sample 2009371029.*

Zircon Description

Zircons from this sample are morphologically uniform, forming relatively euhedral grains with aspect ratios between 1 and 2, and long dimension typically ~130 µm. Cathodoluminescence (CL) images display concentric, oscillatory zoning that conforms to the grain shape (Figure 26.2).

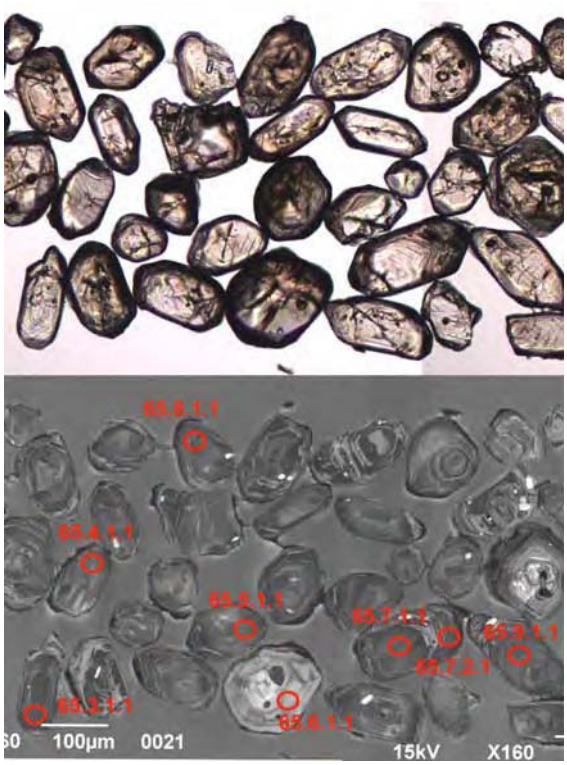

Figure 26.2. *Representative transmitted light and cathodoluminescence images of zircons from megacrystic gneiss, Refuge Rocks (2009371029), with locations of some SHRIMP analyses.*

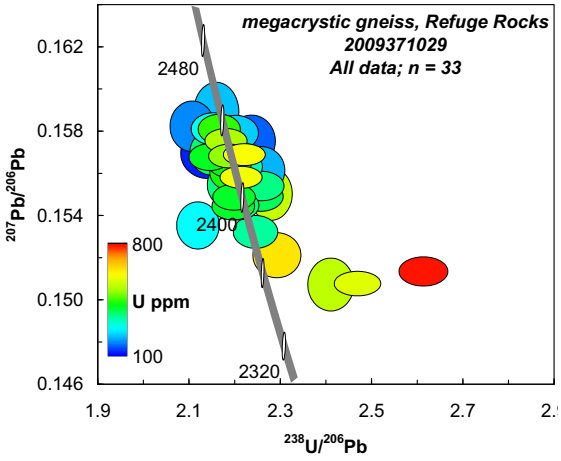

Figure 26.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the megacrystic gneiss at Refuge Rocks (2009371029).*

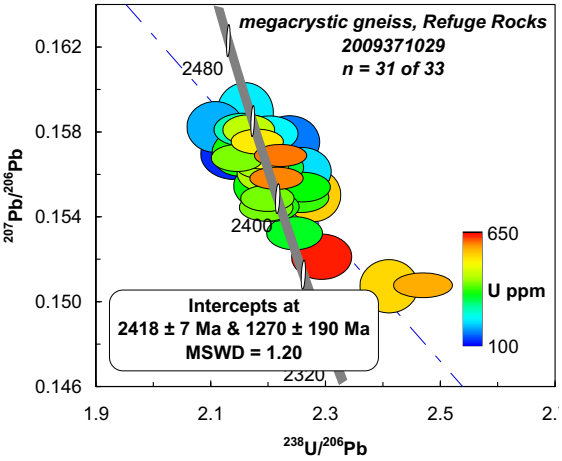

Figure 26.4. *Tera-Wasserburg concordia diagram showing discordia trend through 31 of the 33 zircon analyses from the megacrystic gneiss at Refuge Rocks (2009371029).*

Morphologically, these zircons are typical of igneous zircon. There is no evidence of zircon overgrowths on these grains, nor is there evidence for morphologically-distinct zircon cores. Many of the zircons contain small, optically clear, slightly elongate, euhedral inclusions that are very bright in CL images.

U-Pb Isotopic Results

A total of 33 analyses were collected from 31 different zircon grains (Figure 26.3). All analyses contain <0.5% $^{206}Pb_c$, and only one analysis is >10% discordant. The U content of these zircons ranges between ~120 and ~800 ppm, and Th/U between 0.50 and 1.0. Ignoring the single most discordant analysis (65.7.2.1) yields a weighted mean $^{207}Pb/^{206}Pb$ age of 2412 ± 8 Ma (95% confidence) but with very significant excess scatter, indicated by the MSWD of 15. When plotted on a concordia diagram, and coloured according to U content, it is evident that higher U grains tend to be slightly more discordant and have slightly younger $^{207}Pb/^{206}Pb$ ages (Figure 26.3). This trend is consistent with higher U zircon being more susceptible to non-zero age Pb-loss, and thus yielding ages slightly younger than the original zircon crystallisation age. If the four youngest ages are rejected, each of which come from analyses with >500 ppm U, the remaining 29 analyses yield a weighted mean age of 2416 ± 6 Ma, but still with significant excess scatter (MSWD = 7.2). Rejecting the most discordant analysis (65.7.2.1) and the most negatively discordant analysis (65.23.1.1) leaves 31 analyses through which a discordia line can be

fitted with MSWD of 1.20, defining an upper intercept age of 2418 ± 7 Ma (95% confidence) and lower intercept age of 1270 ± 190 Ma (Figure 26.4). Given the evidence for subtle Pb-loss in this dataset, this upper intercept age is interpreted as the best estimate for the igneous crystallisation age of this gneiss.

Geochronological Interpretation

The upper intercept age of 2418 ± 7 Ma is interpreted as the igneous crystallisation age of this gneiss. This age is consistent with the upper intercept age of 2413 ± 7 Ma reported by Fanning *et al*. (2007) from the same rock.

Table 26.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371029 (1999465), megacrystic gneiss, Refuge Rocks.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Igneous zircon (n = 32)											
65.11.1.1	0.10	219	127	0.60	2.16	1.5	.1589	0.6	2444	10	0
65.13.1.1	0.05	185	116	0.65	2.11	1.5	.1582	0.5	2437	9	-3
65.21.1.1	0.01	289	217	0.78	2.16	1.6	.1581	0.3	2436	5	-1
65.27.1.1	0.03	277	201	0.75	2.16	1.5	.1581	0.3	2436	5	-1
65.5.1.1	0.02	444	304	0.71	2.17	1.4	.1581	0.3	2435	5	0
65.1.1.1	0.02	228	174	0.79	2.20	1.5	.1579	0.4	2433	6	1
65.15.1.1	0.03	521	480	0.95	2.18	1.4	.1575	0.2	2429	4	0
65.6.1.1	0.23	159	148	0.97	2.24	1.5	.1575	0.5	2429	9	2
65.29.2.1	0.02	360	286	0.82	2.15	1.4	.1570	0.5	2423	8	-2
65.17.1.1	0.07	119	86	0.75	2.14	1.8	.1570	0.5	2423	9	-2
65.3.1.1	0.01	602	401	0.69	2.22	1.4	.1569	0.2	2422	4	1
65.24.1.1	0.00	497	302	0.63	2.19	1.4	.1568	0.2	2422	4	0
65.26.1.1	0.05	367	259	0.73	2.21	1.6	.1568	0.3	2421	5	0
65.20.1.1	0.05	403	397	1.02	2.15	1.4	.1568	0.3	2421	5	-2
65.16.1.1	0.08	421	315	0.77	2.19	1.4	.1564	0.3	2417	5	0
65.2.1.1	0.03	329	254	0.80	2.21	1.4	.1563	0.3	2416	5	1
65.19.1.1	0.00	212	135	0.66	2.26	1.5	.1561	0.5	2414	8	2
65.18.1.1	0.02	430	423	1.02	2.19	1.4	.1561	0.4	2413	6	0
65.12.1.1	0.01	596	545	0.94	2.21	1.4	.1558	0.2	2411	4	0
65.14.1.1	0.00	255	165	0.67	2.22	1.5	.1556	0.7	2408	12	1
65.30.1.1	0.05	352	276	0.81	2.19	1.6	.1554	0.5	2407	8	-1
65.31.1.1	0.03	351	228	0.67	2.26	1.4	.1554	0.3	2406	5	2
65.10.1.1	0.07	545	375	0.71	2.28	1.4	.1550	0.5	2402	9	2
65.9.1.1	0.06	373	277	0.77	2.26	1.4	.1549	0.3	2401	5	2
65.28.1.1	0.03	400	341	0.88	2.20	1.4	.1549	0.3	2400	5	-1
65.25.1.1	0.07	364	221	0.63	2.21	1.4	.1545	0.3	2396	5	-1
65.7.1.1	0.03	400	276	0.71	2.20	1.4	.1544	0.3	2395	5	-1
65.23.1.1	0.40	268	230	0.89	2.12	1.5	.1535	0.5	2385	8	-4
65.4.1.1	0.05	338	245	0.75	2.25	1.4	.1532	0.3	2382	6	0
65.29.1.1	0.02	639	309	0.50	2.29	1.5	.1521	0.5	2369	8	2
65.8.1.1	0.07	574	323	0.58	2.47	1.4	.1507	0.3	2354	4	7
65.22.1.1	0.04	536	359	0.69	2.41	1.4	.1507	0.6	2354	9	5
>10% discordant (n = 1)											
65.7.2.1	0.16	790	353	0.46	2.61	1.4	.1513	0.3	2361	5	13

27. MINBRIE GNEISS, NEAR MT GHEARTHY: 2008371042

GA Sample ID:	**2008371042**
GA Sample Number:	**1958080**
Other Sample ID:	
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS):	**678415 6294871 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**24/5/2008**
Formal Name:	**Minbrie Gneiss**
Informal Name:	
Lithology:	**biotite-rich, migmatitic gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6098**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**24-31/8/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.59% (2σ) [67 of 71]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3468.1 ± 1.4 Ma [37 of 37]**
Interpreted Age:	**2521 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**
Interpreted Age:	**1762 ± 43 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**High-grade metamorphic age**

Sample Description

This sample of Minbrie Gneiss was collected from a road-side outcrop west of Mt Ghearthy, approximately 30 km north of Elbow Hill, Eyre Peninsula, South Australia. The lithologies at this locality are very similar to those at Elbow Hill (sample 2008371035). The dominant rock type is a banded gneiss, with centimetre-scale leucocratic K-feldspar-rich layers and melanocratic biotite-rich layers (Figure 27.1). Also present are dismembered amphibolite layers. Gneissic layering is offset along spaced shear bands with a sinistral shear sense (Figure 27.1).

Figure 27.1. *Minbrie Gneiss, near Mt Ghearthy (sample 2008371042).*

Zircon Description

Abundant zircon grains were retrieved from this sample. The zircons are typically ~100 µm in long dimension with aspect ratios between 1 and 2. Grain outlines are slightly rounded. In cathodoluminesence (CL) images, most zircon exhibits oscillatory internal zonation. In contrast with the sample from Elbow Hill, there is very little evidence for zircon overgrowths on oscillatory-zoned grains. Some grains are mantled by dark CL rims and by narrow, bright CL outer rims (Figure 27.2).

A small number of grains show relatively bright CL (low U) overgrowths, most of which are too narrow to place a SHRIMP spot on (typically <5 µm wide). There is handful of large grains with homogeneous or mottled internal zoning that may represent zircon inheritance.

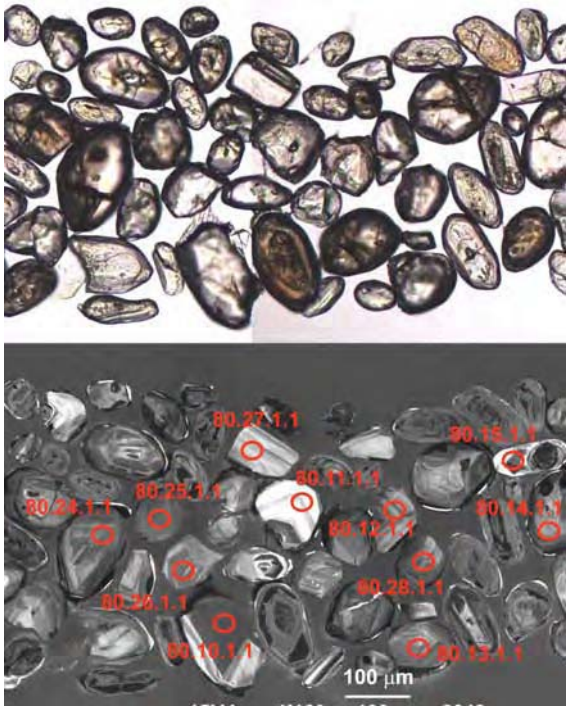

Figure 27.2. *Representative transmitted light and cathodoluminescence images of zircons from Minbrie Gneiss, near Mt Ghearthy (2008371042), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 48 analyses were collected from 47 different zircon grains. The majority of the data fall into two age groupings; a predominant group at ~2520 Ma, and a smaller group at ~1750 Ma (Figure 27.3). In addition, ten analyses are older than ~2550 Ma grouping, one of which is highly discordant and is not assigned any geological meaning. The other 9 analyses older than ~2550 Ma include two ages at ~2550 Ma, two at ~2590 Ma, two at ~2700 Ma, and single analyses with ages of ~2635, 2810 and 2995 Ma (Figure 27.3). These are all interpreted as inherited zircon.

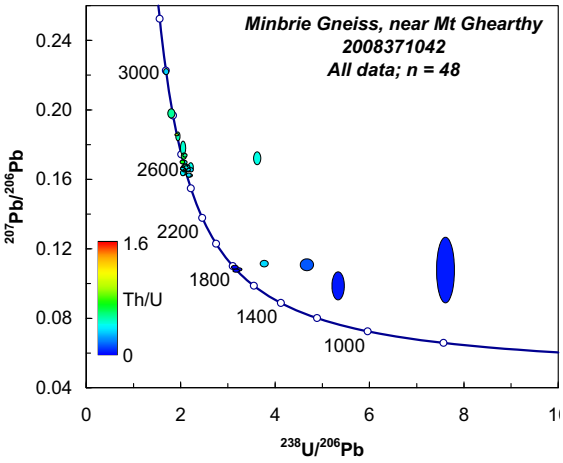

Figure 27.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Minbrie Gneiss near Mt Ghearthy (2008371042), coloured according to Th/U ratio.*

~2520 Ma grouping

Thirty-one analyses range in $^{207}Pb/^{206}Pb$ age from 2535 Ma to 2478 Ma. All of these analyses are <5% discordant and contain <0.3% $^{206}Pb_c$. All 31 analyses yield a weighted mean age of 2518 ± 5 Ma, but with significant excess scatter, as indicated by the MSWD of 2.9. The two youngest analyses of this group (80.7.1.1, 80.12.1.1) plot as younger outliers with ages of ~2480 Ma (Figure 27.4). The remaining 29 analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2521 ± 3 Ma (95% confidence; MSWD = 1.17; probability of fit = 0.24; Figure 27.5). Zircon in this group is dominated by oscillatory zoned grain interiors, with U content ranging between ~60 and 330 ppm, with Th/U typically between 0.3 and 0.5. The oscillatory zoned zircon making up the ~2520 Ma population is interpreted to be of igneous origin, and most likely represents the age of an igneous protolith to this migmatitic gneiss. The two analyses with

ages at ~2480 Ma may represent a subsequent period of igneous activity, although it is also possible that these zircons have been affected by partial ancient Pb-loss from the ~2520 Ma group.

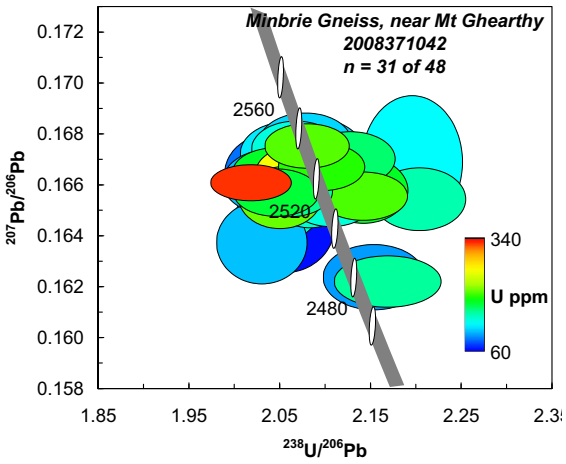

Figure 27.4. *Tera-Wasserburg concordia diagram showing results of ~2500 Ma zircon analyses from the Minbrie Gneiss near Mt Ghearthy (2008371042), coloured according to U content.*

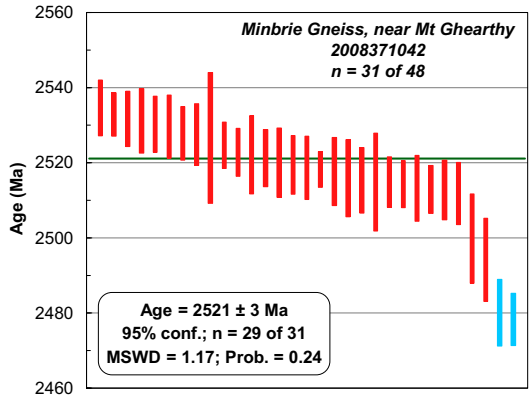

Figure 27.5. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of ~2500 Ma zircon analyses from the Minbrie Gneiss near Mt Ghearthy (2008371042). Blue bars indicate analyses not included in mean age calculation.*

~1750 Ma grouping

Seven analyses yield $^{207}Pb/^{206}Pb$ ages in the range 1816 to 1590 Ma. Six of these seven analyses come from a zircon rim. Five of the seven analyses have Th/U <0.03, as is typical of high-grade metamorphic zircon. Four of these analyses are highly discordant and their ages have not been assigned geological significance, although they lie along a vector consistent with modern day Pb-loss from zircon with an age of ~1750 Ma. Three analyses are near-concordant, with a weighted mean $^{207}Pb/^{206}Pb$ age of 1762 ± 43 Ma (95% confidence; MSWD = 2.8; probability of fit = 0.06; Figure 27.6). These analyses are interpreted to indicate a period of Paleoproterozoic high-grade metamorphism.

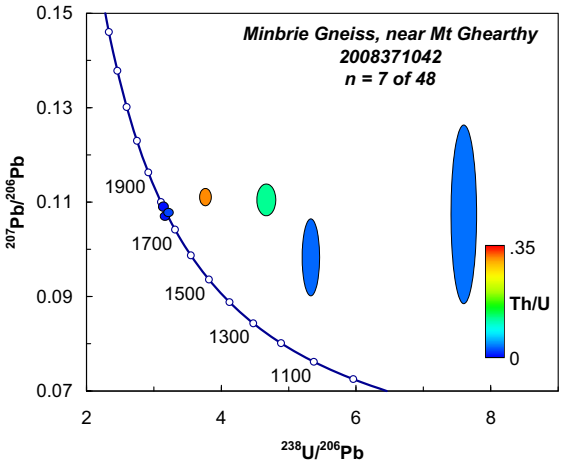

Figure 27.6. *Tera-Wasserburg concordia diagram showing results of ~1750 Ma zircon analyses from the Minbrie Gneiss near Mt Ghearthy (2008371042), coloured according to Th/U ratio.*

Geochronological Interpretation

The age of 1762 ± 43 Ma, although imprecise due to the small number of near concordant analyses, is regarded as representing the time of high-grade metamorphism and migmatisation. The significance of the older data can be interpreted in different ways depending on whether this rock represents an ortho- or paragneiss. The preferred interpretation is that the ~2520 Ma and smaller ~2480 Ma populations represent age components within an igneous protolith. In this interpretation, the older zircon spanning back to almost 3000 Ma represents inherited zircon within the igneous protolith. Alternatively, all the pre-~1750 Ma zircon could be regarded as detrital zircon in a metasediment, in which case ~2520 Ma represents a maximum depositional age for the metasedimentary protolith.

Table 27.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371042 (1958080), Minbrie Gneiss, near Mt Ghearthy.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited zircon (n = 9)											
80.11.1.1	0.13	65	18	0.29	1.67	2.2	.2222	0.5	2997	9	-1
80.3.1.1	0.02	126	67	0.55	1.79	2.6	.1981	0.9	2810	14	-2
80.10.1.1	0.01	332	311	0.97	1.90	1.4	.1858	0.2	2705	4	-1
80.16.1.1	0.13	93	46	0.51	1.92	1.7	.1848	0.9	2696	15	0
80.40.1.1	0.11	64	29	0.47	2.03	1.8	.1780	1.5	2634	25	2
80.26.1.1	0.08	186	101	0.56	2.07	1.5	.1737	0.4	2593	6	2
80.17.1.1	0.06	114	74	0.67	2.05	1.6	.1733	0.7	2589	12	1
80.31.1.1	*0.07*	*143*	*100*	*0.72*	*2.02*	*1.6*	*.1699*	*0.4*	*2557*	*7*	*-2*
80.39.1.1	0.04	134	49	0.38	2.06	1.6	.1697	0.5	2554	8	0
Inherited zircon >10% discordant (n = 1)											
80.32.1.1	1.91	373	154	0.43	3.60	1.4	.1721	1.4	2578	23	63
~2520 Ma igneous zircon (n = 29)											
80.1.1.1	0.02	114	41	0.37	2.08	1.6	.1677	0.4	2535	7	0
80.21.1.1	0.02	206	104	0.52	2.08	1.5	.1675	0.3	2533	6	0
80.5.1.1	0.08	137	49	0.37	2.07	1.6	.1674	0.4	2532	7	0
80.33.1.1	0.11	111	37	0.34	2.08	1.8	.1673	0.5	2531	9	0
80.4.1.1	0.04	130	45	0.36	2.08	1.6	.1673	0.4	2530	8	0
80.38.1.1	0.14	120	38	0.33	2.06	1.6	.1672	0.5	2530	8	-1
80.30.1.1	0.05	166	58	0.36	2.13	1.5	.1670	0.4	2528	7	2
80.2.1.1	0.09	112	169	1.56	2.08	1.7	.1670	0.5	2528	8	0
80.46.1.1	0.27	126	51	0.42	2.20	1.7	.1669	1.0	2527	17	4
80.28.1.1	0.03	195	76	0.40	2.10	1.5	.1667	0.4	2525	6	0
80.6.1.1	0.04	180	65	0.37	2.05	1.6	.1665	0.4	2523	6	-2
80.27.1.1	0.19	88	28	0.32	2.04	1.7	.1665	0.6	2522	10	-2
80.34.1.1	-0.01	260	44	0.17	2.07	1.4	.1664	0.5	2521	8	-1
80.23.1.1	0.06	109	39	0.38	2.12	1.6	.1662	0.6	2520	9	1
80.8.1.1	0.01	131	45	0.36	2.08	1.6	.1662	0.5	2520	8	0
80.9.1.1	0.11	108	38	0.36	2.04	1.6	.1661	0.5	2519	8	-2
80.35.1.1	0.06	330	106	0.33	2.02	1.4	.1661	0.3	2518	5	-3
80.19.1.1	0.04	180	61	0.35	2.07	1.5	.1660	0.5	2518	9	-1
80.24.1.1	0.11	142	53	0.38	2.08	1.6	.1658	0.6	2516	10	0
80.18.1.1	0.01	181	66	0.38	2.14	1.5	.1658	0.5	2515	9	2
80.29.1.1	0.05	145	53	0.38	2.05	1.5	.1657	0.8	2515	13	-2
80.13.1.1	0.05	157	61	0.40	2.06	1.5	.1657	0.4	2515	7	-1
80.37.1.1	0.00	177	93	0.55	2.05	1.5	.1657	0.4	2514	6	-2
80.22.1.1	0.06	210	64	0.32	2.05	1.5	.1656	0.5	2513	9	-2
80.25.1.1	0.07	203	62	0.32	2.14	1.5	.1655	0.4	2513	6	2
80.36.1.1	0.12	139	50	0.37	2.11	1.6	.1655	0.5	2513	8	0
80.14.1.1	0.20	151	45	0.31	2.20	1.5	.1654	0.5	2512	8	4
80.20.1.1	0.17	63	57	0.93	2.05	1.8	.1643	0.7	2500	12	-2
80.42.1.1	0.24	108	37	0.35	2.03	1.6	.1637	0.7	2494	11	-3
~2480 Ma zircon (n = 2)											
80.7.1.1	0.05	99	31	0.32	2.15	1.7	.1623	0.5	2480	9	1
80.12.1.1	0.01	155	46	0.31	2.17	1.8	.1622	0.4	2478	7	1
~1760 Ma zircon (n = 3)											
80.45.1.1	0.07	187	1	0.00	3.13	1.5	.1090	0.6	1782	11	0
80.43.1.1	0.27	359	7	0.02	3.20	1.5	.1077	0.6	1761	10	1
80.15.1.1	0.12	226	1	0.01	3.16	1.5	.1069	0.5	1747	10	-1
~1760 Ma zircon >10% discordant (n = 4)											
80.41.1.1	0.40	163	50	0.31	3.76	1.5	.1110	1.1	1816	20	19
80.47.1.1	0.44	51	6	0.12	4.66	2.0	.1104	2.0	1806	37	44
80.1.2.1	10.17	1438	48	0.03	7.59	1.6	.1073	11.7	1754	214	120
80.44.1.1	3.99	146	4	0.03	5.32	1.6	.0982	5.5	1589	103	43

28. MINBRIE GNEISS, ELBOW HILL: 2008371035

GA Sample ID:	**2008371035**
GA Sample Number:	**1958073**
Other Sample ID:	
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS84):	**666542 6267713 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**22/5/2008**
Formal Name:	**Minbrie Gneiss**
Informal Name:	
Lithology:	**biotite-rich, migmatitic gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6098**
Instrument:	**SHRIMP-IIe Geoscience Australia**
Acquisition Date:	**24 – 31/8/2009**
U-Pb Standard & reproducibility::	**TEMORA-2; 2.59% (2σ) [67 of 71]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3468.1 ± 1.4 Ma [37 of 37]**
Interpreted Age:	**~2450 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**
Interpreted Age:	**1733 ± 7 Ma**
IMF correction applied?	**Yes**
Interpreted Age Type:	**Migmatite-grade metamorphism**

Sample Description

Elbow Hill is located a few kilometres west of Franklin Harbour, eastern Eyre Peninsula, South Australia. This sample was collected from the top of Elbow Hill adjacent to the communications tower. The sample is a fine- to medium-grained, even-grained, biotite-rich foliated rock composed of biotite, quartz and plagioclase. Gneissic banding is defined by abundant medium- to coarse-grained K-feldspar rich leucosomes that range from a millimetre to several centimetres in width (Figure 28.1). These leucosomes also form massive, irregularly-shaped segregations. The gneiss has been strongly sheared and shows regularly-spaced shear-bands which deflect the leucosomes and gneissic banding. Also present in this outcrop are boudinaged and dismembered amphibolites, although these were not sampled.

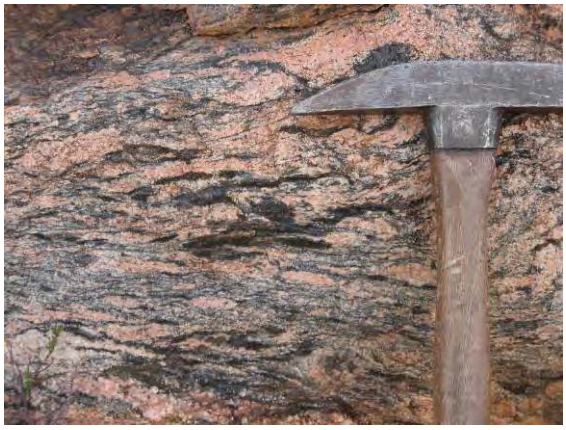

Figure 28.1. *Minbrie Gneiss, Elbow Hill (sample 2008371035).*

Zircon Description

Abundant zircon was retrieved from this rock, typically occurring as equant to slightly elongate grains, with aspect ratios between 1 and 3 and a long dimension of 100 to 200 µm. Most grains show slightly rounded outlines. In CL images, most grains show complex internal zoning suggestive of multi-stage growth.

Figure 28.2. *Representative transmitted light and cathodoluminescence images of zircons from Minbrie Gneiss, Elbow Hill (2008371035), with locations of some SHRIMP analyses.*

Zircon types include the following:

(i) Oscillatory zoned, medium CL response. This zircon type is volumetrically the major component in this rock. It forms the inner portions of most grains, and is usually rimmed by an apparently later generation of zircon growth (see B below). In a few grains, oscillatory zoned zircon contains a central core of relatively homogeneous, dark CL response that may represent an older zircon component (see iv below).

(ii) Relatively homogeneous, medium- to bright-CL response overgrowths on oscillatory-zoned zircon. In several cases these overgrowths are broad and form pointed, euhedral terminations on rounded oscillatory-zoned cores.

(iii) Discrete, clear euhedral grains with medium- to bright-CL response. These grains may be the same zircon generation as type ii, but simply forming discrete grains rather than overgrowths.

(iv) Dark CL response inner cores to oscillatory zoned zircon. These may represent inherited components, or perhaps represent initial igneous zircon growth during the same episode that produced type i oscillatory zoned zircon.

U-Pb Isotopic Results

A total of 62 analyses were collected, on 52 different zircon grains. When plotted on a concordia diagram the majority of the data fall into two distinct groups; a grouping near concordia at ~2450 Ma, and a second grouping near concordia at ~1700 Ma (Figure 28.3).

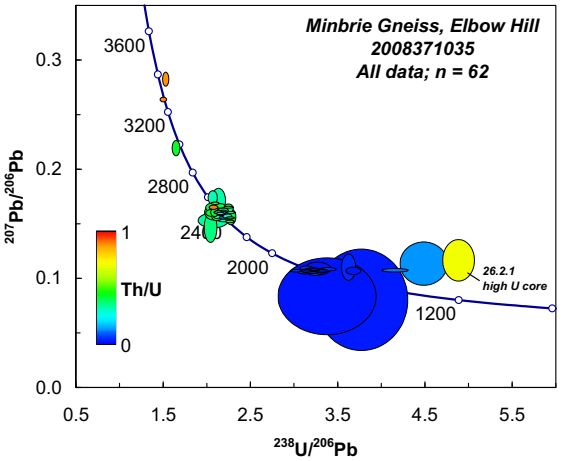

Figure 28.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Minbrie Gneiss at Elbow Hill (2008371035).*

Three analyses from two zircon grains yield ages significantly older than ~2500 Ma. Two of these analyses come from grain 21, with ages from the core of 3379 ± 48 Ma (2σ) and 3271 ± 16 Ma (2σ). Grain 46 yields an age of 2975 ± 68 Ma (2σ). These are interpreted as inherited zircon within a predominantly ~2450 Ma protolith. The presence of these Paleo- to Mesoarchean zircons in this sample is of interest as crust of this age has not been identified on the western side of the Kalinjala Mylonite Zone.

Thirty-two analyses plot in a grouping at ~2450 Ma, two of which are rejected on the basis of being more than 5% negatively discordant. The remaining 30 analyses are all <5% discordant, and all contain <0.3% $^{206}Pb_c$ (Figure 28.4). These 30 analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2450 ± 17 Ma, but are very scattered (MSWD = 18). The overwhelming majority of these analyses come from oscillatory zoned zircon (type (i) above). Two exceptions are analyses 73.39.2.1 and 73.52.2.1, which both come from broad, uniformly-dark CL zones that appear to overgrow oscillatory-zoned cores.

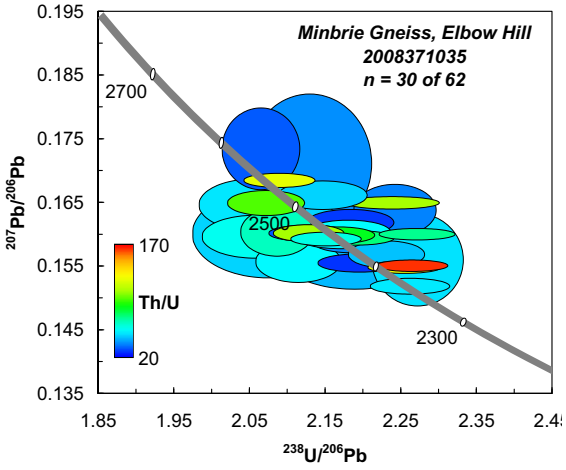

Figure 28.4. *Tera-Wasserburg concordia diagram showing results of ~2500 Ma zircon analyses from the Minbrie Gneiss at Elbow Hill (2008371035).*

The U content of these zircons ranges between ~90 and ~425 ppm, and Th/U ratio is mostly between ~0.3 and 0.5. A probability density plot of these 32 analyses exhibits three major age peaks (Figure 28.5). The dominant peak is at ~2455 Ma, with subsidiary peaks on either side at ~2405 Ma and ~2510 Ma. These peaks in the probability density plot essentially match results from the Unmix algorithm in Isoplot, which identifies age populations at 2452 Ma, 2403 Ma, and 2507 Ma, in descending order of abundance.

The geological significance of these various age populations is not obvious. The major peak at ~2455 Ma is broadly consistent with intrusive ages from the Dutton Suite of southern Eyre Peninsula e.g. Kiana Granite (Fanning *et al*., 2007).

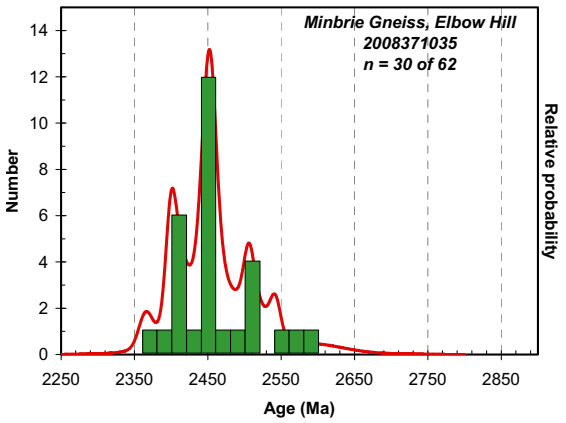

Figure 28.5. *Probability distribution diagram showing $^{207}Pb/^{206}Pb$ ages from ~2450 Ma zircon from the Minbrie Gneiss at Elbow Hill (2008371035).*

The age peak at ~2405 Ma may represent metamorphism during the latter stages of the Sleaford Orogeny, although only one of the constituent analyses in this age group (73.52.2.1) is morphologically suggestive of metamorphic new growth or modification of older zircon. The older age peak at ~2510 Ma is similar in age to the Hall Bay Volcanics (Fanning *et al*., 2007).

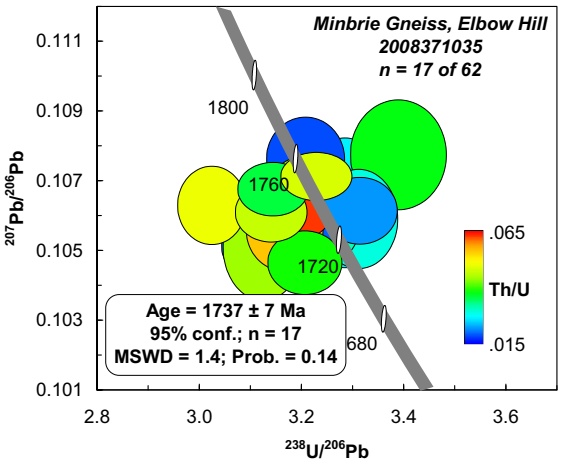

Figure 28.6. *Tera-Wasserburg concordia diagram showing results of ~1730 Ma zircon analyses from the Minbrie Gneiss at Elbow Hill (2008371035).*

Twenty-seven analyses plot in a group around ~1740 Ma, including 10 analyses that are >10% discordant and/or contain >0.5% $^{206}Pb_c$. If these ten analyses are excluded, the remaining 17

analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1737 ± 7 Ma (95 % confidence; MSWD = 1.4; probability of fit = 0.14; Figure 28.6). When corrected for instrumental mass fractionation (IMF), this age becomes 1733 ± 7 Ma. These analyses contain U contents between ~50 and 300 ppm, and exhibit Th/U between 0.02 and 0.06. Such low Th/U values are commonly observed in high-grade metamorphic zircon, and consequently the age of 1733 ± 7 Ma is interpreted as the timing of high-grade metamorphism and partial melting in this gneiss.

Geochronological Interpretation

Contrasting interpretations of these data are possible, depending on whether this rock represents an ortho- or paragneiss. The preferred interpretation is that the dominant zircon age peak at ~2455 Ma reflects the age of an igneous protolith of this gneiss, with minor older inherited zircon components. In this case the age peak at ~2405 Ma may represent a metamorphic effect, during the latter stages of the Sleaford Orogeny. Alternatively, all the ~2550 – 2400 Ma zircon could be interpreted as detrital zircon in a post-2400 Ma sedimentary rock.

Irrespective of which of these two interpretations is preferred, this sample is interpreted to have been subject to migmatite-grade metamorphism and deformation at ~1735 Ma, during the Kimban Orogeny.

Table 28.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371035 (1958073), Minbrie Gneiss, Elbow Hill.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited zircon (n = 3)											
73.21.1.1	0.02	122	106	0.89	1.52	1.6	.2829	1.5	3379	24	4
73.21.2.1	0.03	119	104	0.90	1.50	1.5	.2640	0.5	3271	8	-1
73.46.1.1	0.10	91	38	0.43	1.64	1.8	.2192	2.1	2975	34	-3
~2450 Ma zircon (n = 30)											
73.37.1.1	0.01	102	32	0.32	2.07	1.6	.1734	2.5	2591	41	2
73.39.1.1	0.04	122	39	0.33	2.13	2.5	.1711	4.2	2569	71	4
73.34.1.1	0.00	250	123	0.51	2.09	1.5	.1684	0.4	2542	7	1
73.35.2.1	0.06	123	48	0.40	2.15	1.8	.1661	0.9	2518	15	2
73.38.1.1	0.06	207	108	0.54	2.24	1.8	.1649	0.4	2506	7	5
73.17.1.1	0.10	111	97	0.91	2.07	1.6	.1648	0.8	2506	13	-1
73.65.1.1	0.05	134	52	0.40	2.05	2.3	.1646	1.6	2503	28	-2
73.50.2.1	0.08	106	37	0.36	2.24	1.6	.1637	1.6	2494	28	5
73.14.1.1	-0.01	88	27	0.32	2.18	1.7	.1618	0.8	2474	14	2
73.44.1.1	0.05	172	67	0.40	2.09	1.5	.1603	1.6	2459	27	-3
73.27.1.1	0.04	143	56	0.40	2.18	1.7	.1603	0.8	2458	13	1
73.28.1.1	0.10	107	32	0.31	2.13	1.6	.1601	0.5	2457	9	-1
73.52.1.1	0.07	231	108	0.48	2.13	1.4	.1601	0.6	2457	9	-1
73.13.2.1	0.05	127	48	0.39	2.07	3.2	.1600	2.9	2456	49	-3
73.22.1.1	0.04	237	73	0.32	2.27	1.5	.1599	0.4	2455	6	4
73.42.1.1	0.04	319	85	0.28	2.17	1.4	.1598	0.5	2453	9	0
73.25.1.1	0.08	141	58	0.43	2.06	2.3	.1595	1.4	2451	24	-4
73.29.1.1	0.15	149	75	0.52	2.19	1.6	.1593	0.5	2448	8	1
73.39.2.1	0.03	303	60	0.21	2.15	1.4	.1592	0.4	2447	8	-1
73.48.1.1	0.03	140	54	0.40	2.17	1.6	.1591	0.6	2446	10	0
73.41.1.1	0.05	136	38	0.29	2.19	1.6	.1588	0.8	2443	13	1
73.54.1.1	0.06	158	46	0.30	2.23	1.5	.1567	0.9	2421	15	1
73.16.1.1	0.02	127	51	0.41	2.27	1.8	.1559	3.1	2411	52	3
73.23.1.1	0.08	129	44	0.36	2.14	2.0	.1558	0.7	2411	11	-2
73.19.1.1	0.07	151	55	0.38	2.11	1.8	.1556	1.4	2408	24	-4

73.36.1.1	0.04	127	44	0.36	2.19	2.7	.1554	1.8	2406	30	-1
73.40.1.1	0.01	303	27	0.09	2.20	1.7	.1554	0.6	2406	10	-1
73.52.2.1	0.05	426	165	0.40	2.26	1.4	.1549	0.4	2401	7	2
73.45.1.1	0.21	322	125	0.40	2.25	1.4	.1547	0.4	2398	7	1
73.49.2.1	0.26	137	52	0.39	2.26	1.5	.1517	0.5	2365	9	0
~2450 Ma zircon, >5% reversely discordant (n = 2)											
73.47.1.1	0.01	89	29	0.34	2.07	5.5	.1525	3.0	2374	51	-7
73.20.1.1	0.02	112	40	0.36	2.04	2.4	.1459	6.1	2298	104	-11
~1730 Ma zircon (n = 17)											
73.53.1.1	0.05	58	2	0.04	3.39	1.8	.1078	1.0	1762	18	6
73.62.1.1	0.07	134	2	0.02	3.20	1.6	.1076	0.7	1760	13	1
73.24.1.1	0.04	289	13	0.05	3.23	1.4	.1071	0.4	1751	8	1
73.61.1.1	0.00	234	8	0.04	3.14	1.5	.1068	0.5	1745	9	-2
73.49.1.1	0.01	132	6	0.04	3.21	1.6	.1067	0.6	1744	12	0
73.26.1.1	0.09	112	3	0.03	3.28	1.6	.1064	1.2	1738	21	1
73.18.1.1	0.30	236	11	0.05	3.02	1.5	.1063	0.7	1737	13	-6
73.60.1.1	0.08	173	11	0.06	3.19	1.5	.1063	0.6	1737	11	-1
73.32.1.1	0.11	140	3	0.02	3.21	1.6	.1063	0.7	1737	13	-1
73.30.1.1	0.04	234	5	0.02	3.31	1.5	.1062	0.6	1734	11	2
73.59.1.1	0.10	267	12	0.05	3.14	1.5	.1061	0.5	1734	10	-3
73.31.1.1	0.24	164	5	0.03	3.31	1.5	.1059	0.9	1730	16	2
73.35.1.1	0.06	153	5	0.03	3.23	1.7	.1056	0.7	1725	12	-1
73.15.1.1	0.13	159	9	0.06	3.16	1.6	.1056	0.7	1725	13	-3
73.33.1.1	0.13	146	3	0.02	3.15	2.2	.1052	0.8	1717	14	-3
73.43.1.1	0.20	106	4	0.04	3.12	1.7	.1051	1.0	1717	18	-4
73.52.3.1	1.09	94	4	0.05	3.23	1.7	.1049	1.9	1713	34	-1
~1730 Ma zircon, >10% discordant and/or containing >0.5% $^{206}Pb_c$ (n =10)											
73.26.2.1	10.11	1013	694	0.71	4.89	2.5	.1158	10.9	1892	196	58
73.63.1.1	3.65	8	1	0.13	4.48	4.0	.1128	11.6	1845	210	42
73.57.1.1	6.28	664	23	0.04	3.62	1.4	.1096	7.4	1792	134	14
73.58.1.1	0.59	177	8	0.05	3.14	1.5	.1085	1.3	1775	23	0
73.50.1.1	0.83	14	0	0.02	3.27	3.0	.1082	3.6	1770	66	3
73.64.1.1	0.31	155	15	0.10	4.16	2.4	.1068	0.9	1745	17	26
73.22.2.1	1.83	499	9	0.02	3.68	1.5	.1062	2.1	1736	39	12
73.13.1.1	0.06	212	8	0.04	3.20	1.5	.1047	0.6	1708	11	-2
73.55.1.1	6.44	3	0	0.02	3.38	11.0	.0828	28.2	1264	550	-24
73.56.1.1	12.54	4	0	0.02	3.77	9.3	.0795	38.8	1184	766	-22

29. MIDDLECAMP GRANITE: 2008371036

GA Sample ID:	**2008371036**
GA Sample Number:	**1958074**
Other Sample ID:	
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**666602 6273209 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**23/5/2009**
Formal Name:	**Middlecamp Granite**
Informal Name:	
Lithology:	**gneissic granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6066**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**18/10/2008 (Subsession A)**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.15% (2σ) [21 of 21]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3458.1 ± 2.6 Ma [11 of 11]**
Acquisition Date:	**19/10/2008 (Subsession B)**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.49% (2σ) [26 of 27]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.2 ± 2.4 Ma [14 of 14]**
Interpreted Age:	**1736 ± 6 Ma**
IMF correction applied?	**Yes**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

The Middlecamp Granite is located in the hills east of the town of Cleve, Eyre Peninsula, South Australia. This sample was collected from the hill immediately north of Middlecamp ruins. It is a fine- to medium-grained, even-grained granite, composed of quartz, plagioclase, K-feldspar and minor biotite. It is strongly banded with irregularly distributed, planar, K-feldspar-rich leucosomes (Figure 29.1).

Two samples of Middlecamp Granite have been previously dated via SHRIMP (Fanning *et al.*, 2007), both yielding dominantly discordant data with upper intercept ages of 1737 ± 7 Ma and 1726 ± 7 Ma.

Figure 29.1. *Middlecamp Granite at the site of sample 2008371036.*

Zircon Description

Zircons from this sample are subhedral and range from relatively equant to elongate with aspect ratios of up to ~4. Most grains are clear in transmitted light, but many are cracked. In cathodoluminescence (CL) images, the zircons are dominated by rather mottled internal zoning. Some grains exhibit relic oscillatory zoning, but in many cases such zoning appears to have been modified by internal recrystallisation (Figure 29.2). Zircons from this sample are interpreted to be of primary igneous origin but appear to have undergone some solid state modification.

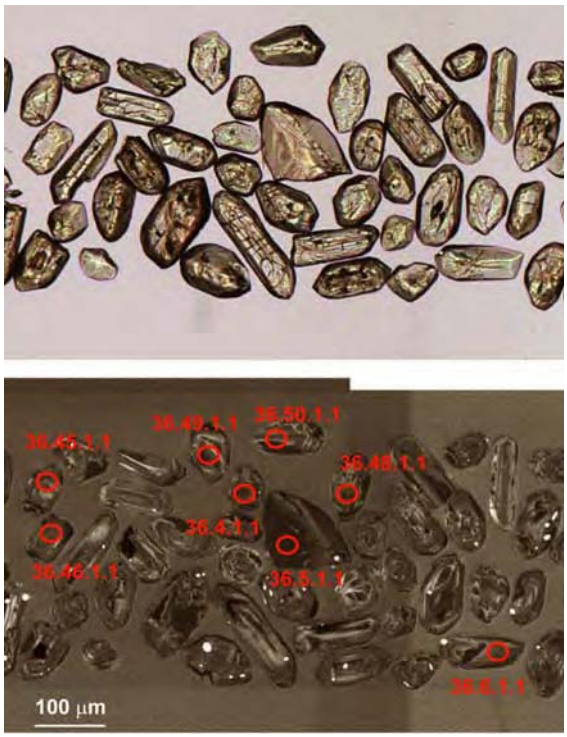

Figure 29.2. *Representative transmitted light and cathodoluminescence images of zircons from the Middlecamp Granite (2008371036), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Zircon isotopic analyses from this sample were collected across two subsessions. Magnet settings were changed between these two subsessions, resulting in slightly different fractionation of ^{207}Pb versus ^{206}Pb, as recorded by different ages from the OG1 reference zircon. Results from these two subsessions are described separately below.

Subsession A

Analyses labelled from 36.1.1.1 up to, and including, 36.33.1.1 were collected in this subsession. Of these 33 analyses on 33 different zircon grains, two analyses are distinctly older than the rest, with ages of ~2500 Ma and ~2450 Ma, interpreted as representing inherited zircon (Figure 29.3). Of the remaining 31 analyses, 6 are >10% discordant, and another 6 contain >0.5% $^{206}Pb_c$. Disregarding these 12 analyses leaves 19 analyses that define a single age population with weighted mean $^{207}Pb/^{206}Pb$ age of 1727 ± 4 Ma (95% confidence; MSWD = 1.5; probability of fit = 0.09; Figure 29.4). As the measured age for the OG1 reference zircon was significantly younger than the reference age (Stern *et al.*, 2009) in this analytical session, correction for instrumental mass fractionation (IMF) is required. Correction for IMF shifts the age from 1727 ± 4 Ma to 1736 ± 6 Ma.

Subsession B

In this subsession, 43 analyses were collected from this sample. All of these analyses appear to define a single, Paleoproterozoic age population, albeit with variable discordance (Figure 29.50. Five analyses are >10% discordant and have not been included in further age calculations. Of the remaining 38 analyses, 11 contain >0.5%$^{206}Pb_c$ and have been excluded from age calculations on that basis. This leaves 27 analyses with a weighted mean $^{207}Pb/^{206}Pb$ age of 1725 ± 6 Ma, but with significant excess scatter (MSWD = 4.9). Five analyses in this group contain >1000 ppm U and low Th/U – generally below 0.1. These analyses come from grains that do not appear morphologically different from the more typical, lower U grains, but exhibit evidence in CL images for solid-state recrystallisation. This evidence includes irregular shaped patches of very dark CL response, and broadening of relict oscillatory zonation. All the data from this subsession define a discordia trend with upper and lower intercepts of 1740 ± 8 Ma and 490 ± 41 Ma, respectively (MSWD = 1.7). Lead loss during the early Paleozoic, as indicated by the lower intercept of the discordia trend, is regarded as responsible for the excess scatter in $^{207}Pb/^{206}Pb$ ages, and thus the mean $^{207}Pb/^{206}Pb$ age of 1725 ± 6 Ma is regarded as an underestimate of the true

age. The upper intercept age of 1740 ± 8 Ma from this subsession is consistent with the weighted mean $^{207}Pb/^{206}Pb$ age of 1736 ± 6 Ma from Subsession A reported above.

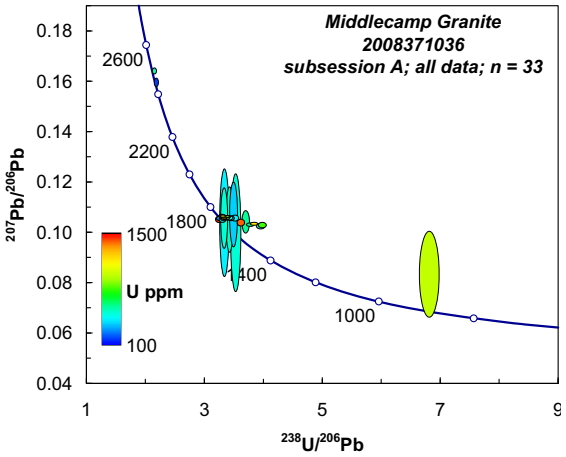

Figure 29.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses collected during subsession A from the Middlecamp Granite (2008371036), coloured according to U content.*

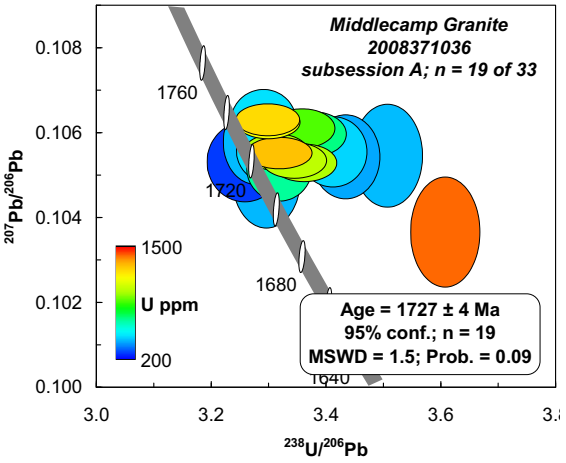

Figure 29.4. *Tera-Wasserburg concordia diagram showing results of near-concordant ~1730 Ma zircon analyses collected during subsession A from the Middlecamp Granite (2008371036, coloured according to U content. Note the mean age of 1727 ± 4 Ma is uncorrected for instrumental mass fractionation (IMF) – correction for IMF shifts the mean age to 1736 ± 6 Ma.*

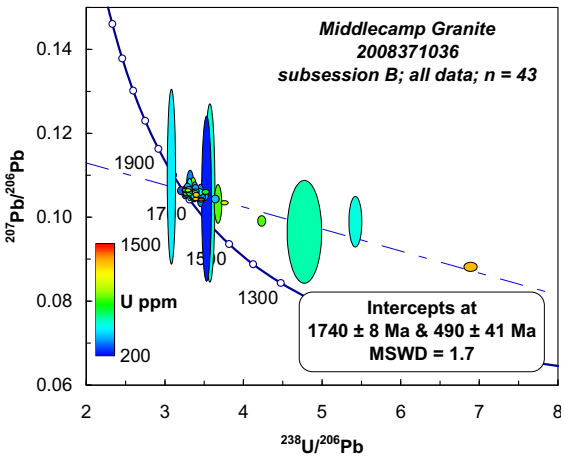

Figure 29.5. *Tera-Wasserburg concordia diagram showing results of all zircon analyses collected during subsession B from the Middlecamp Granite (2008371036), coloured according to U content.*

Geochronological Interpretation

Given the evidence for Pb-loss within the data from Subsession B, the more concordant data from Subsession A are considered more reliable. The preferred age from this sample is, therefore, 1736 ± 6 Ma, interpreted to represent igneous crystallisation of the Middlecamp Granite. There is evidence for an inherited zircon component of broadly Sleaford Complex age, and also evidence for variable Pb-loss in the early Paleozoic, perhaps related to the Delamarian Orogeny.

Table 29.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371036 (1958074), Middlecamp Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Subsession A											
Inherited zircon (n = 2)											
36.19.1.1	0.10	176	65	0.38	2.17	1.2	.1598	0.7	2500	8	0
36.33.1.1	0.05	551	357	0.67	2.14	1.2	.1643	0.5	2453	12	1
~1730 Ma igneous zircon (n = 19)											
36.15.1.1	0.02	1225	124	0.10	3.30	1.1	.1063	0.2	1737	4	2
36.14.1.1	0.02	1125	47	0.04	3.30	1.1	.1062	0.2	1736	4	2
36.13.1.1	0.05	466	1000	2.22	3.29	1.1	.1062	0.5	1736	9	2
36.25.1.1	0.04	870	295	0.35	3.36	1.1	.1061	0.3	1734	5	3
36.30.1.1	0.03	668	259	0.40	3.38	1.1	.1060	0.3	1731	6	4
36.21.1.1	0.08	468	1060	2.34	3.32	1.5	.1058	0.4	1728	8	2
36.32.1.1	0.34	416	735	1.83	3.28	1.2	.1058	0.6	1728	12	1
36.20.1.1	0.21	464	855	1.90	3.30	1.1	.1056	0.5	1725	9	1
36.18.1.1	0.15	448	1007	2.32	3.41	1.1	.1055	0.5	1724	10	4
36.26.1.1	0.05	982	71	0.07	3.31	1.1	.1055	0.3	1724	5	1
36.29.1.1	0.03	1278	56	0.05	3.32	1.1	.1055	0.2	1723	4	2
36.8.1.1	0.40	416	524	1.30	3.51	1.1	.1055	0.8	1722	14	7
36.6.1.1	0.33	393	615	1.62	3.43	1.1	.1054	0.6	1722	11	5
36.5.1.1	0.05	1010	71	0.07	3.35	1.1	.1053	0.3	1720	5	2
36.9.1.1	0.14	266	132	0.51	3.26	1.3	.1053	0.6	1720	11	0
36.24.1.1	0.05	984	140	0.15	3.36	1.1	.1053	0.3	1719	5	2
36.4.1.1	0.28	645	1534	2.46	3.32	1.1	.1052	0.5	1717	9	1
36.22.1.1	0.38	411	595	1.50	3.30	1.2	.1049	0.7	1713	14	0
36.3.1.1	0.27	1402	222	0.16	3.61	1.1	.1036	0.8	1690	15	7
Analyses >10% discordant and/or >0.5% $^{206}Pb_c$ (n = 12)											
36.28.1.1	6.00	358	541	1.56	3.48	1.3	.1069	8.0	1747	146	7
36.16.1.1	6.43	505	853	1.74	3.32	1.2	.1055	7.6	1723	140	2
36.27.1.1	0.58	1445	102	0.07	3.23	1.2	.1049	0.8	1712	14	-1
36.17.1.1	6.52	520	723	1.44	3.42	1.3	.1049	8.3	1712	152	4
36.7.1.1	2.43	580	533	0.95	3.69	1.1	.1040	2.9	1696	53	10
36.23.1.1	9.97	414	508	1.27	3.33	1.6	.1035	13.7	1689	253	0
36.31.1.1	0.14	1167	323	0.29	3.83	1.1	.1031	0.4	1681	7	12
36.1.1.1	0.15	579	942	1.68	3.76	1.1	.1029	0.4	1677	8	10
36.2.1.1	0.08	800	1763	2.28	3.97	1.1	.1027	0.7	1673	13	16
36.10.1.1	0.47	529	1094	2.14	3.95	1.2	.1022	0.7	1665	14	14
36.12.1.1	6.26	498	1159	2.41	3.52	1.7	.0996	15.6	1617	291	0
36.11.1.1	4.38	980	2878	3.03	6.81	1.7	.0830	13.7	1269	267	44
Subsession B											
~1730 Ma zircon (n = 22)											
36.61.1.1	0.21	396	953	2.49	3.38	0.9	.1069	0.5	1747	10	5
36.43.1.1	0.46	415	555	1.38	3.28	0.9	.1069	0.7	1747	14	2
36.51.1.1	0.08	421	932	2.29	3.30	0.8	.1067	0.4	1743	7	2
36.50.1.1	0.01	795	482	0.63	3.25	0.8	.1064	0.3	1739	5	1
36.70.1.1	0.05	680	256	0.39	3.25	0.8	.1064	0.3	1739	6	1
36.64.1.1	0.26	311	494	1.64	3.20	0.9	.1063	0.6	1737	11	-1
36.54.1.1	0.06	564	1315	2.41	3.38	0.9	.1061	0.4	1734	6	4
36.40.1.1	0.08	630	717	1.18	3.35	0.8	.1061	0.4	1734	7	3
36.68.1.1	0.10	761	758	1.03	3.51	0.8	.1060	0.4	1732	7	7
36.47.1.1	0.39	727	1314	1.87	3.26	0.8	.1060	0.6	1731	10	0
36.72.1.1	0.24	506	346	0.71	3.43	0.8	.1059	0.5	1731	10	5
36.44.1.1	0.30	702	694	1.02	3.31	0.8	.1058	0.5	1728	9	1
36.62.1.1	0.05	556	945	1.76	3.38	0.8	.1057	0.4	1726	6	3
36.55.1.1	0.16	821	962	1.21	3.33	0.8	.1057	0.6	1726	10	2
36.71.1.1	0.10	299	466	1.61	3.26	0.9	.1056	0.5	1725	10	0
36.45.1.1	0.48	271	388	1.48	3.34	0.9	.1055	0.8	1723	15	2
36.67.1.1	0.11	450	785	1.80	3.36	1.1	.1051	0.5	1716	9	2
36.73.1.1	0.08	558	205	0.38	3.36	0.8	.1050	0.4	1715	8	2
36.46.1.1	0.19	423	1035	2.53	3.46	0.8	.1049	0.7	1713	13	5
36.41.1.1	0.18	357	784	2.27	3.46	0.9	.1047	0.6	1709	10	4
36.76.1.1	0.21	430	580	1.39	3.63	0.9	.1043	0.6	1701	11	8
36.57.1.1	0.13	581	757	1.35	3.45	0.8	.1041	0.4	1699	7	4
High U and low Th/U zircon (n = 5)											
36.39.1.1	0.05	1052	76	0.07	3.29	0.8	.1064	0.3	1738	5	2
36.37.1.1	0.12	1144	58	0.05	3.26	0.8	.1062	0.3	1735	5	1

36.74.1.1	0.18	1269	202	0.16	3.39	0.8	.1053	0.4	1720	7	3
36.35.1.1	0.10	1271	112	0.09	3.38	0.8	.1043	0.3	1701	5	2
36.48.1.1	0.09	1454	73	0.05	3.45	0.8	.1042	0.2	1700	4	4
Analyses >10% discordant and/or containing >0.5% $^{206}Pb_c$ (n = 16)											
36.56.1.1	10.72	487	1267	2.69	3.07	1.2	.1096	12.6	1793	230	-1
36.75.1.1	1.61	352	432	1.27	3.31	0.9	.1078	2.1	1763	37	4
36.60.1.1	1.50	905	455	0.52	3.35	0.8	.1065	1.8	1741	33	3
36.63.1.1	1.35	512	1261	2.54	3.30	0.8	.1065	1.7	1741	30	2
36.58.1.1	1.16	417	683	1.69	3.37	0.9	.1060	1.5	1732	27	3
36.38.1.1	0.71	382	839	2.27	3.25	0.9	.1059	1.0	1730	18	0
36.65.1.1	10.84	581	307	0.55	3.56	1.1	.1057	13.4	1727	245	8
36.42.1.1	0.54	426	851	2.06	3.50	0.9	.1051	0.8	1717	15	6
36.69.1.1	1.30	358	464	1.34	3.45	0.9	.1051	1.7	1716	31	4
36.34.1.1	10.01	230	203	0.91	3.52	1.2	.1043	12.5	1703	231	6
36.66.1.1	0.11	1020	567	0.57	3.75	0.8	.1034	0.3	1686	6	11
36.59.1.1	1.09	873	562	0.67	3.67	0.8	.1031	3.0	1681	55	8
36.53.1.1	0.43	868	1718	2.04	4.22	0.8	.0990	0.8	1605	16	17
36.36.1.1	3.17	559	796	1.47	5.42	1.0	.0989	4.0	1603	75	47
36.52.1.1	3.02	628	1034	1.70	4.77	3.0	.0964	8.5	1556	159	27
36.49.1.1	0.48	1299	3693	2.94	6.88	0.8	.0880	0.8	1383	15	58

30. CARPA GRANITE: 2008371037

GA Sample ID:	**2008371037**
GA Sample Number:	**1958075**
Other Sample ID:	
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**665116 6276011 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**23/5/2008**
Formal Name:	**Carpa Granite**
Informal Name:	
Lithology:	**foliated granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6066**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**28 – 30/10/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.0% [16 of 19]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.5 ± 2.8 Ma [9 of 9]**
Interpreted Age:	**2517 ± 7 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

The Carpa Granite crops out in the hills east of the town of Cleve, Eyre Peninsula, South Australia. This sample was collected adjacent to the southern boundary of the Middlecamp Hills Conservation Park. It is a medium-grained, foliated, pink-orange granite, composed of K-feldspar-quartz-plagioclase-biotite with the foliation defined by trails of oriented biotite (Figure 30.1).

Previous geochronology on the Carpa Granite includes a Rb-Sr whole rock isochron age of 1677 ± 125 Ma (Webb *et al*., 1986). SHRIMP dating reported by Fanning *et al*., (2007) found all zircons to contain high levels of U, generally >2000 ppm, and to be variably metamict and discordant. The scattered and discordant data did not allow any crystallisation age for the Carpa Granite to be estimated, hence the need for further analyses of the Carpa Granite.

Figure 30.1. *Carpa Granite (sample 2008371037).*

Zircon Description

Zircons from this sample are generally poor quality, being cracked and metamict. Many grains, or parts of grains, are completely opaque, and are uniformly black in cathodoluminescence (CL) images, interpreted to indicate destruction of the zircon crystal structure via radiation

damage. Where internal zonation is preserved in CL images it occurs as euhedral, oscillatory zoning, consistent with these zircons being of igneous origin (Figure 30.2).

Figure 30.2. *Representative transmitted light and cathodoluminescence images of zircons from the Carpa Granite (2008371037), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 16 analyses were collected from this sample. The majority of data from this sample yield late Archean to early Paleoproterozoic ages (Figure 30.3). A single analysis (37.1.1.1) yields a much older age of ~3400 Ma. This analysis comes from a broken zircon fragment that is morphologically and chemically indistinguishable from the ~2520 Ma population, but its age suggests it is an inherited zircon.

Five analyses are >10% discordant and/or contain >0.5% $^{206}Pb_c$ and have not been included in geological interpretation.

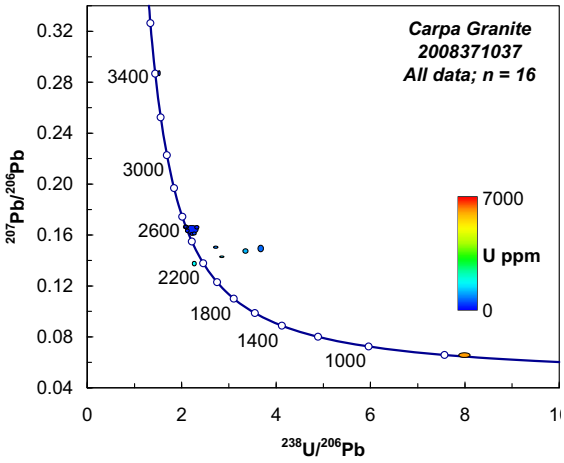

Figure 30.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Carpa Granite (2008371037).*

Four near-concordant analyses and one analysis that is 8% discordant, yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2517 ± 7 Ma (95% confidence; MSWD = 0.11; probability of fit = 0.98; Figure 30.4). These analyses each come from internal portions of zircons, exhibiting relatively bright CL response and concentric, oscillatory zoning. The age is, therefore, interpreted to indicate the timing of igneous crystallisation of this sample of the Carpa Granite.

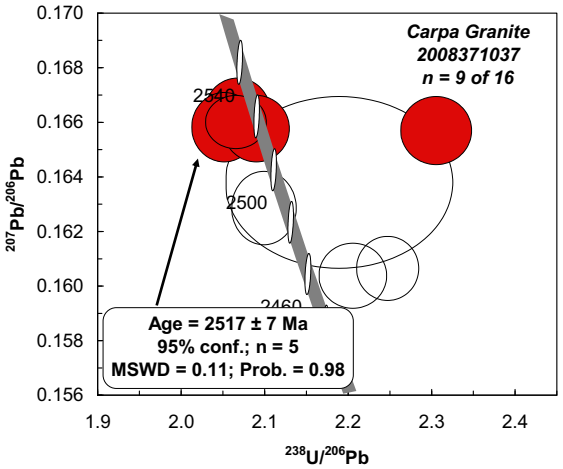

Figure 30.4. *Tera-Wasserburg concordia diagram showing results of near-concordant, ~2500 Ma zircon analyses from the Carpa Granite (2008371037). Open ellipses indicate analyses not included in mean age calculation.*

Four analyses spread to slightly younger ages from this ~2520 Ma age population. Each of these zircons is morphologically and chemically similar to those that define the ~2520 Ma population, and is interpreted as part of that age population that has been affected by variable Pb-loss.

A single analysis (37.14.1.1) is concordant with an age of 765 ± 76 Ma (2σ) (Figure 30.3). This analysis is from a very dark CL region near the tip of a zircon that contains a brighter CL core. The core of this grain (37.14.2.1) yields a $^{207}Pb/^{206}Pb$ age of ~2260 but is 16% discordant. This analysis is most easily interpreted as part of the major age population from this sample of ~2520 Ma, hence the age of ~765 Ma cannot be disregarded as a distinctly different aged grain that might have arisen from laboratory contamination. Instead, the age of 765 Ma may represent complete Pb-loss during the Neoproterozoic, broadly coeval with early stages of Adelaidean rifting.

Geochronological Interpretation

The interpreted age of igneous crystallisation of this rock is 2517 ± 7 Ma, although this is defined by only five~ analyses due to the poor quality of zircon from this sample. A single analysis with an age of ~3400 Ma suggests the presence of Paleoarchean material at depth beneath this granite. A single concordant analysis at 765 Ma suggests an episode of zircon recrystallisation and Pb-loss during the Neoproterozoic.

Table 30.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371037 (1958075), Carpa Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited zircon (n = 1)											
37.1.1.1	0.21	153	81	0.54	1.51	1.2	.2875	0.4	3404	7	4
~2520 Ma zircon (n = 5)											
37.13.1.1	0.06	122	36	0.30	2.07	1.3	.1664	0.5	2521	8	-1
37.12.1.1	0.04	196	77	0.41	2.07	1.2	.1660	0.4	2518	7	-1
37.6.1.1	0.08	132	42	0.33	2.05	1.2	.1658	0.5	2516	9	-2
37.2.1.1	0.04	132	46	0.36	2.09	1.2	.1658	0.5	2515	8	0
37.8.1.1	0.13	156	54	0.36	2.31	1.2	.1657	0.5	2515	8	8
~2520 Ma zircon, subject to ancient Pb-loss (n = 4)											
37.3.1.1	0.11	212	67	0.33	2.19	4.1	.1638	1.3	2495	22	3
37.3.2.1	0.11	152	53	0.36	2.10	1.2	.1628	0.6	2485	9	-1
37.7.1.1	0.09	364	112	0.32	2.25	1.1	.1606	0.5	2462	8	4
37.5.1.1	0.11	154	124	0.83	2.21	1.2	.1604	0.5	2459	8	2
discordant and/or high $^{206}Pb_c$ (n = 5)											
37.9.1.1	0.36	752	104	0.14	2.70	1.0	.1499	0.4	2345	7	16
37.11.1.1	1.28	642	684	1.10	3.66	1.1	.1488	1.1	2332	22	50
37.10.1.1	0.88	1129	1092	1.00	3.33	1.1	.1468	0.8	2309	15	37
37.14.2.1	0.24	1395	166	0.12	2.83	1.0	.1424	0.3	2257	5	16
37.4.1.1	1.03	1682	122	0.07	2.25	1.0	.1370	0.9	2189	18	-8
Neoproterozoic Pb-loss (n = 1)											
37.14.1.1	1.00	6195	243	0.04	7.97	1.0	.0647	1.8	765	38	0

31. CARPA GRANITE: 2008371034

GA Sample ID:	**2008371034**
GA Sample Number:	**1958072**
Other Sample ID:	
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**660513 6266473 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**22/5/2008**
Formal Name:	**Carpa Granite**
Informal Name:	
Lithology:	**foliated granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6066**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**28 – 30/10/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.0% [16 of 19]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.5 ± 2.8 Ma [9 of 9]**
Interpreted Age:	**2513 ± 47 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous protolith age**
Interpreted Age:	**1724 ± 11 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**High-grade metamorphic age**

Sample Description

The Carpa Granite crops out in the hills east of the town of Cleve, Eyre Peninsula, South Australia. This sample is an even-grained, grey, foliated granite composed of biotite, plagioclase, quartz and minor K-feldspar (Figure 31.1). It was sampled from bouldery outcrop on the side of the road leading east from Sunny Brae farm.

Previous geochronology on the Carpa Granite includes a Rb-Sr whole rock isochron age of 1677 ± 125 Ma (Webb *et al*., 1986). SHRIMP dating reported by Fanning *et al*., (2007) found all zircons to contain high levels of U, generally >2000 ppm, and to be variably metamict and discordant. The scattered and discordant data did not allow any crystallisation age for the Carpa Granite to be estimated.

Figure 31.1. *Carpa Granite (sample 2008371034).*

Zircon Description

Zircons from this sample are typically ~100 x 200 μm. All grains are cracked and variably metamict, ranging from slightly milky to light

brown, through to some grains that are opaque (Figure 31.2). Grains with relatively clear, uncracked areas in transmitted light are rare, and limited the placement of SHRIMP analytical spots.

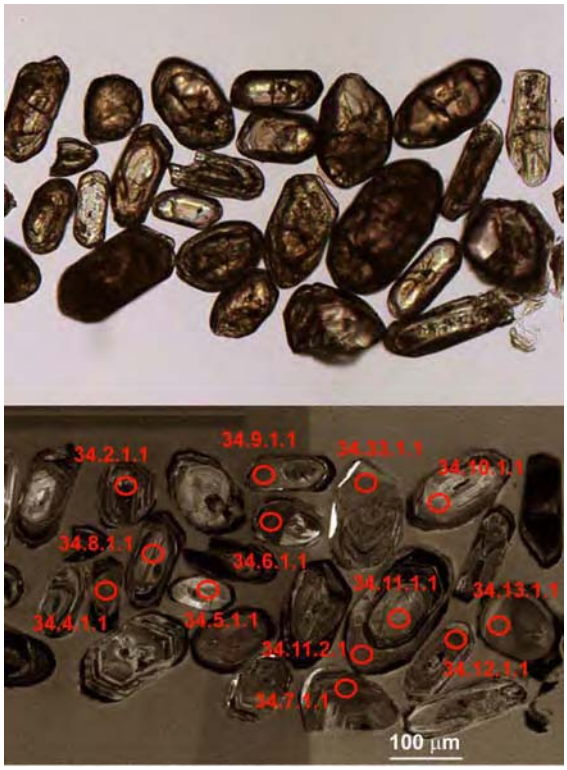

Figure 31.2. *Representative transmitted light and cathodoluminescence images of zircons from the Carpa Granite (2008371034), with locations of some SHRIMP analyses.*

In cathodoluminescence (CL) images, the zircons show a range of internal zonation. Many grains preserve oscillatory zoning. Some grains with a dark CL response, and interpreted high U content, appear almost homogenously black in CL, or have relatively broad, black bands within oscillatory zoning. Other grains exhibit mottled zonation that appears to be a result of modification of oscillatory zoning (Figure 31.2). Zircon from this sample is interpreted to be igneous in origin and subject to post-crystallisation radiation damage. Numerous grains have a narrow, dark CL (high U) outer rim. In general this outer rim appears concordant with inner zoning, and is interpreted as a final stage of igneous crystallisation of fractionated, high U melt.

U-Pb Isotopic Results

A total of 51 analyses were collected from this sample. The complete dataset, when plotted on a concordia diagram, appears to define two general trends (Figure 31.3). The first trend is defined by a group of near-concordant data with latest Archean ages (~2500 Ma) and an associated spread of discordant data trending away from this late Archean group towards the late Neoproterozoic. The second trend is defined by a smaller group of near-concordant data with Paleoproterozoic (~1725 Ma) ages, and some discordant data trending away from the Paleoproterozoic group towards a poorly defined lower intercept in the Neoproterozoic to Phanerozoic. In addition to these two main trends, there are also two near-concordant analyses at ~2000 Ma.

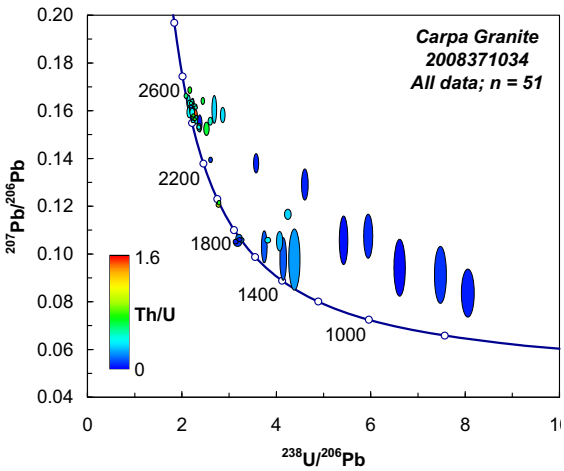

Figure 31.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Carpa Granite (2008371034).*

Within the late-Archean group, the two oldest analyses (34.5.1.1, 34.47.1.1) come from grain interiors with bright CL response, and yield near-concordant ages of 2546 ± 18 Ma (2σ) and 2521 ± 14 Ma (2σ). A group of nine analyses yield near-concordant ages with a weighted mean $^{207}Pb/^{206}Pb$ age of 2480 ± 6 Ma (95% confidence; MSWD = 1.4; probability of fit = 0.19; Figure 31.4). Another group of six analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2439 ± 8 Ma (95% confidence; MSWD = 0.78; probability of fit = 0.56; Figure 31.4). Another group of five analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age

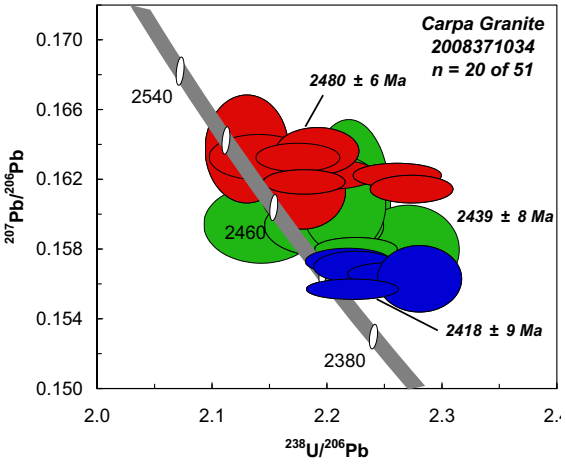

Figure 31.4. *Tera-Wasserburg concordia diagram showing results of near-concordant, late Archean to earliest Paleoproterozoic zircon analyses from the Carpa Granite (2008371034), coloured to illustrate possible age groupings.*

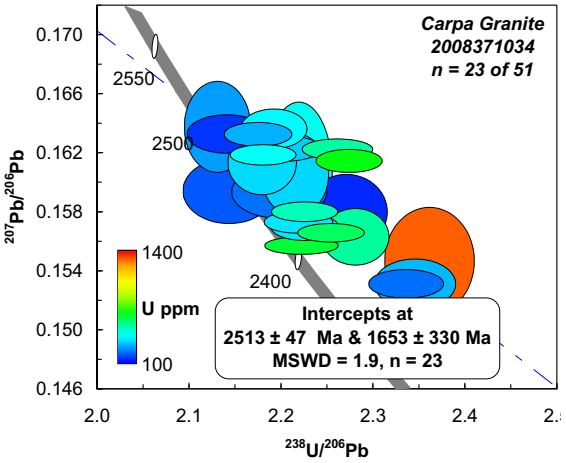

Figure 31.5. *Tera-Wasserburg concordia diagram showing discordia trend fitted through near-concordant, late Archean to earliest Paleoproterozoic zircon analyses from the Carpa Granite (2008371034). Ellipses are coloured according to U content.*

of 2418 ± 9 Ma (95% confidence; MSWD = 1.8, probability of fit = 0.12; Figure 31.4). The geological significance of these three ages is uncertain – it is possible they are all artefacts of variable ancient Pb-loss. For example, a discordia can be fitted through 23 analyses that encompass the three age groups, yielding upper and lower intercept ages of 2513 ± 47 Ma and 1653 ± 330 Ma (MSWD = 1.9; Figure 31.5). This more conservative approach yields much less precise ages, but the upper intercept age is consistent with the age derived from sample 2008371037, also from the Carpa Granite.

The Paleoproterozoic trend in this dataset is defined by 10 analyses, five of which are near-concordant, and five are at least 9% discordant. A discordia fitted through these data yields an upper intercept age of 1724 ± 10 Ma (MSWD = 0.72) and lower intercept within uncertainty of zero, suggesting these zircons have predominantly been affected by modern-day Pb-loss. A weighted mean $^{207}Pb/^{206}Pb$ age of the five near-concordant analyses is 1724 ± 10 Ma (95% confidence; MSWD = 0.71; probability of fit = 0.58; Figure 31.6). These analyses contain significantly lower Th/U than the older zircon in the sample, with three of the five analyses having Th/U < 0.1, consistent with high-grade metamorphic zircon growth.

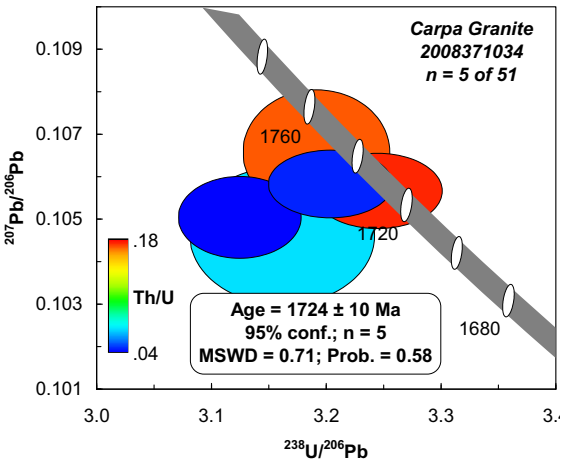

Figure 31.6. *Tera-Wasserburg concordia diagram showing results of near-concordant, ~1730 Ma zircon analyses from the Carpa Granite (2008371034).*

Geochronological Interpretation

The preferred interpretation of these data is that they represent an igneous protolith age of 2513 ± 47 Ma. This protolith may have been subject to high-grade metamorphism during the Sleaford Orogeny and during the Kimban Orogeny, which could account for the dispersion of the data. New zircon growth occurred at 1724 ± 10 Ma, possibly related to partial melting or melt injection from regional granites during the Kimban Orogeny.

Table 31.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371034 (1958072), Carpa Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Pre-2500 Ma analyses (n = 2)											
34.5.1.1	0.19	258	186	0.75	2.15	1.1	.1688	0.6	2546	9	3
34.47.1.1	0.03	173	98	0.59	2.07	1.2	.1664	0.4	2521	7	-1
~2495 Ma grouping (n = 9)											
34.22.1.1	0.01	281	96	0.35	2.13	1.1	.1638	1.2	2495	21	1
34.15.1.1	0.52	402	160	0.41	2.19	1.1	.1636	0.5	2494	9	3
34.25.1.1	0.07	160	63	0.41	2.14	1.3	.1633	0.5	2490	9	1
34.21.1.1	0.04	303	148	0.50	2.17	1.1	.1633	0.3	2490	6	2
34.8.1.1	0.08	336	131	0.40	2.20	1.2	.1623	0.3	2480	6	3
34.12.1.1	0.16	538	238	0.46	2.26	1.1	.1623	0.3	2479	5	5
34.17.1.1	0.07	424	83	0.20	2.18	1.1	.1619	0.3	2475	5	2
34.24.1.1	0.29	681	334	0.51	2.27	1.0	.1615	0.3	2471	5	5
34.9.1.1	0.01	357	123	0.36	2.18	1.1	.1614	0.9	2470	15	1
~2440 Ma grouping (n = 6)											
34.35.1.1	0.02	430	348	0.84	2.22	1.1	.1607	1.9	2464	33	3
34.1.1.1	0.20	352	62	0.18	2.21	1.1	.1605	1.1	2461	19	2
34.42.1.1	0.03	201	74	0.38	2.14	1.5	.1594	0.9	2450	15	-1
34.10.1.1	0.08	230	85	0.38	2.20	1.6	.1594	0.7	2449	12	1
34.39.1.1	0.01	512	373	0.75	2.22	1.1	.1580	0.3	2435	5	2
34.27.1.1	0.09	145	212	1.51	2.27	1.3	.1580	1.1	2434	18	3
~2420 Ma grouping (n = 5)											
34.46.1.1	0.06	375	178	0.49	2.22	1.1	.1573	0.3	2427	5	1
34.43.1.1	0.02	377	274	0.75	2.22	1.1	.1570	0.4	2424	6	1
34.7.1.1	0.08	603	438	0.75	2.25	1.1	.1566	0.3	2419	5	2
34.19.2.1	0.02	541	252	0.48	2.28	1.1	.1563	0.8	2416	14	3
34.6.1.1	0.06	643	185	0.30	2.22	1.2	.1557	0.2	2410	4	1
slightly discordant analyses (n = 3)											
34.2.1.1	0.33	1310	37	0.03	2.36	1.4	.1547	1.5	2399	26	5
34.33.1.1	0.22	312	106	0.35	2.34	1.2	.1532	0.7	2382	12	4
34.11.1.1	0.06	227	93	0.42	2.33	1.2	.1532	0.4	2381	7	4
Analyses >5% discordant and/or containing high $^{206}Pb_c$ (n = 9)											
34.41.1.1	0.67	680	431	0.66	2.42	1.0	.1643	0.6	2500	10	12
34.29.1.1	0.39	248	73	0.30	2.67	1.2	.1606	2.4	2462	41	20
34.36.1.1	1.28	257	79	0.32	2.85	1.1	.1583	1.4	2438	23	26
34.13.1.1	0.55	262	125	0.49	2.59	1.1	.1557	0.7	2410	12	14
34.31.1.1	0.20	99	65	0.67	2.50	1.3	.1525	1.2	2374	21	10
34.26.1.1	0.21	844	74	0.09	2.59	1.0	.1394	0.5	2220	9	6
34.4.1.1	2.23	2910	126	0.04	3.56	1.0	.1380	2.0	2202	34	38
34.44.1.1	3.59	2592	109	0.04	4.59	1.0	.1290	3.4	2085	59	64
34.19.1.1	0.87	1096	317	0.30	4.23	1.0	.1165	1.2	1903	22	39
~2000 Ma zircon (n = 2)											
34.23.1.1	0.45	1252	863	0.71	2.77	1.0	.1214	0.5	1977	9	-1
34.32.1.1	0.05	183	185	1.05	2.76	1.2	.1205	0.6	1964	10	-2
Analyses >50% discordant (n = 5)											
34.20.1.1	5.05	2251	115	0.05	5.93	1.1	.1073	5.8	1753	105	75
34.38.1.1	5.54	1930	35	0.02	5.41	1.1	.1056	6.4	1724	118	58
34.37.1.1	6.47	2244	21	0.01	6.60	1.2	.0940	8.4	1507	159	66
34.3.1.1	6.46	2343	153	0.07	7.46	1.1	.0909	8.7	1445	165	78
34.3.2.1	5.49	2567	92	0.04	8.04	1.1	.0832	8.0	1274	156	69
~1725 Ma zircon (n = 5)											
34.18.1.1	0.13	103	17	0.17	3.19	1.3	.1066	0.9	1742	17	-1
34.25.2.1	0.08	330	14	0.04	3.20	1.1	.1058	0.5	1729	9	-1
34.45.1.1	0.09	255	43	0.18	3.25	1.1	.1057	0.6	1726	10	0
34.25.3.1	0.09	279	11	0.04	3.12	1.1	.1050	0.6	1715	11	-4
34.28.1.1	0.15	118	8	0.07	3.16	1.7	.1046	1.0	1707	19	-4
discordant ~1725 Ma zircon (n = 5)											
34.11.2.1	0.47	540	186	0.36	3.80	1.1	.1056	0.7	1724	13	9
34.34.1.1	2.13	772	189	0.25	4.05	1.1	.1051	2.6	1716	48	13
34.40.1.1	3.02	1734	207	0.12	3.73	1.1	.1029	4.3	1676	80	14
34.14.1.1	4.84	1670	202	0.12	4.13	1.1	.0977	6.0	1581	113	19
34.30.1.1	5.52	43	9	0.22	4.37	1.9	.0974	8.7	1575	163	21

32. COOLANIE GNEISS, AT PINEROW: 2008371041

GA Sample ID:	**2008371041**
GA Sample Number:	**1958079**
Other Sample ID:	
1:250,000 Sheet:	**WHYALLA SI 53-8**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS84):	**660807 6273383 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**24/5/2008**
Formal Name:	**Coolanie Gneiss**
Informal Name:	
Lithology:	**K-feldspar megacrystic, mylonitic gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6066**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**20 - 21/10/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.49% (2σ) [26 of 27]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.2 ± 2.4 Ma [14 of 14]**
Interpreted Age:	**2823 ± 37 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**
Interpreted Age:	**2427 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**High-grade metamorphic age**

Sample Description

This sample was collected from Pinerow farm, ~20 km east of the town of Cleve, Eyre Peninsula, South Australia. In this region the Coolanie Gneiss is mapped as a ~3 km wide northeast-trending zone of mylonitic augen gneisses. This is Stop 24 in the field guide of Parker *et al*. (1988). Parker *et al*. (1988) interpret the Coolanie Gneiss to have been deformed during shearing synchronous with development of the Kalinjala Shear Zone to the east. Parker *et al*. (1988) interpret the Coolanie Gneiss to be a deformed equivalent of the Carpa Granite. This sample is a K-feldspar augen gneiss, with individual augen up to ~2 cm long (Figure 32.1) wrapped by a fine-grained mylonitic fabric that dips steeply east.

Figure 32.1. *Coolanie Gneiss at Pinerow farm; sample 2008371041.*

Zircon Description

Zircons from this sample are generally of poor quality. Grains are typically subhedral with aspect ratios of ~3 and often with a ragged, partially resorbed outer surface. Most grains are cracked and apparently metamict, being partially opaque. In cathodoluminescence (CL) images, most grains exhibit bright inner regions, typically with oscillatory zoning, mantled by very dark rims. It is not clear whether the dark rims represent a discrete period of younger zircon growth, or result from chemical modification and recrystallisation of zircon cores. Morphological evidence for both of these scenarios can be found. Examples can be found in which the zircon core appears rounded and is surrounded by a dark rim with relatively euhedral outline, suggesting the rim represents a discrete period of younger zircon growth. Also present are examples where oscillatory zoning in the zircon core can be traced into the dark CL rim, suggesting the rim represents modification of pre-existing zircon rather than new growth.

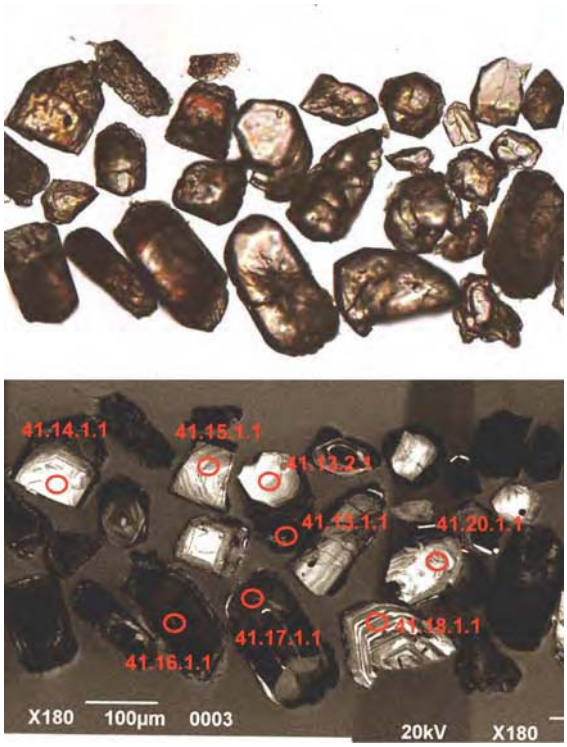

Figure 32.2. *Representative transmitted light and cathodoluminescence images of zircons from the Coolanie Gneiss (2008371041), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 44 zircon analyses were collected from this sample. Fourteen analyses are >10% discordant and/or contain >0.5% $^{206}Pb_c$, and have not been included in age calculations. The remaining 30 analyses form two distinct age clusters; one at ~2830 Ma and one at ~2430 Ma (Figure 32.3).

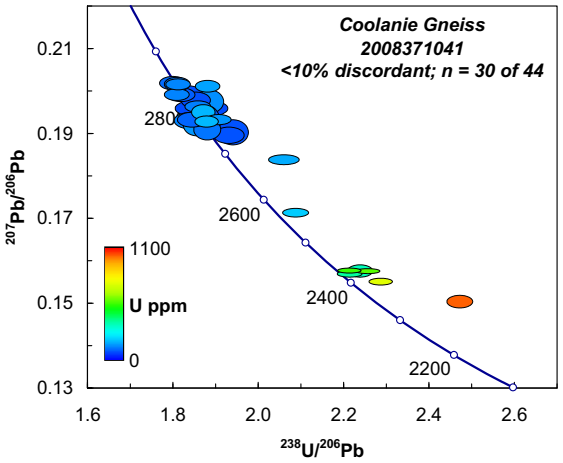

Figure 32.3. *Tera-Wasserburg concordia diagram showing results of zircon analyses <10% discordant, from the Coolanie Gneiss (2008371041), coloured according to U content.*

Twenty-one analyses range in $^{207}Pb/^{206}Pb$ between ~2840 Ma and ~2740 Ma. These 21 analyses do not form a single statistically coherent age population, but scatter along concordia (weighted mean age 2801 ± 15 Ma; MSWD = 12). There is no apparent correlation of age with U content or Th/U within this scattered grouping. A plausible interpretation of this scatter is that it arises from subtle Pb-loss during a ~2430 Ma event, and thus the older ages in this grouping are likely a closer approximation to the original crystallisation age. The oldest seven analyses define an age of 2832 ± 6 Ma (95% confidence; MSWD = 1.6; probability of fit = 0.14).

Alternatively, a discordia fitted through the 23 analyses that are <10% discordant and older than ~2500 Ma yields an upper intercept age of 2823 ± 37 Ma (MSWD = 1.8; Figure 32.4). This upper intercept age is within uncertainty of the weighted mean age of the seven oldest analyses,

and is regarded as the best estimate for the age of this generation of zircon growth.

Two analyses plot between the ~2800 Ma group and the cluster at ~2430 Ma (Figure 32.4). Each of these contain slightly elevated U-content relative to the main ~2830 Ma cluster, and are interpreted to have crystallised contemporaneously with the ~2830 Ma group and experienced a larger degree of Pb-loss during a ~2430 Ma event.

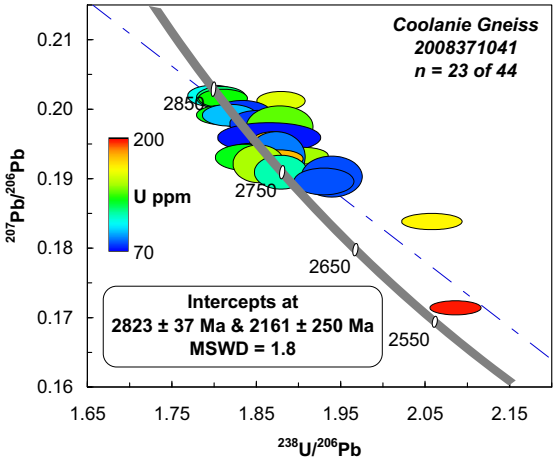

Figure 32.4. *Tera-Wasserburg concordia diagram showing results of near-concordant, pre-2500 Ma zircon analyses from the Coolanie Gneiss (2008371041), coloured according to U content.*

Five analyses cluster near concordia with a weighted mean $^{207}Pb/^{206}Pb$ age of 2427 ± 4 Ma (95% confidence; MSWD = 0.47; probability of fit = 0.76; Figure 32.5). Each of these analyses comes from very dark CL regions, and contains between ~350 and 570 ppm U, significantly higher than the U-content of the ~2830 Ma zircon component from this sample. Th/U ratios for this group of 5 analyses range between 0.3 to 0.6, overlapping with, but at the low end of, the range of Th/U ratios found in the ~2800 Ma zircon component. An additional two analyses from dark CL zircon rims are slightly discordant and are consistent with partial Pb-loss from an age of ~2430 Ma.

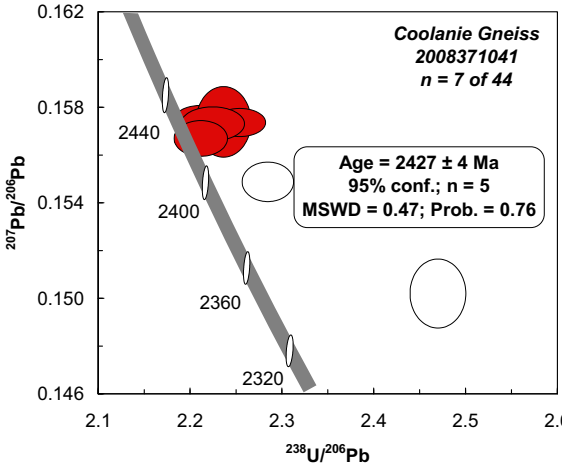

Figure 32.5. *Tera-Wasserburg concordia diagram showing results of near-concordant, ~2430 Ma zircon analyses from the Coolanie Gneiss (2008371041). Unfilled ellipses represent analyses not included in the age calculation.*

Geochronological Interpretation

There are two distinct zircon age populations in this rock. The preferred age estimates for the two age populations are 2823 ± 37 Ma, and 2427 ± 5 Ma. The geological significance of the two ages is subject to interpretation. Oscillatory zoned zircon interiors yield the older age of 2823 ± 37 Ma, and are interpreted to represent igneous zircon growth. Morphological evidence in the CL images is interpreted to indicate that at least some of the dark CL zircon rims and grains that yield the 2427 ± 5 Ma age have resulted from solid-state recrystallisation of pre-existing ~2830 Ma zircon. This recrystallisation episode may have been accompanied by some new zircon growth.

The simplest explanation is that this sample represents an igneous rock with a crystallisation age of 2823 ± 37 Ma, which was subject to high-grade metamorphism at 2427 ± 4 Ma, inducing partial zircon recrystallisation. Metamorphic recrystallisation of zircon at 2427 ± 4 Ma may represent the time of mylonitic deformation of this rock, although further evidence is required to substantiate this.

Table 32.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371041 (1958079), Coolanie Gneiss.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
~2830 Ma zircon (n = 21)											
41.35.1.1	0.13	103	75	0.76	1.80	1.1	.2019	0.5	2842	8	0
41.6.1.1	0.10	118	59	0.52	1.81	1.1	.2017	0.5	2840	9	0
41.23.1.1	0.04	130	71	0.57	1.81	1.1	.2016	0.4	2839	7	0
41.5.1.1	0.09	158	89	0.58	1.88	1.0	.2012	0.5	2836	7	3
41.14.1.1	0.12	76	42	0.57	1.83	1.2	.1993	0.7	2821	11	0
41.13.2.1	0.08	129	76	0.61	1.81	1.1	.1992	0.5	2820	7	-1
41.2.1.1	0.06	92	70	0.79	1.82	1.2	.1992	0.5	2819	9	0
41.32.1.1	0.23	76	49	0.66	1.85	1.2	.1979	0.6	2809	11	1
41.15.1.1	0.00	138	85	0.64	1.88	1.4	.1975	1.0	2806	16	2
41.26.1.1	0.05	124	76	0.63	1.86	1.1	.1964	0.4	2796	7	1
41.4.1.1	0.02	72	38	0.55	1.86	2.2	.1959	0.7	2792	12	1
41.28.1.1	0.06	177	106	0.62	1.87	1.0	.1950	0.6	2785	10	1
41.40.1.1	0.13	97	57	0.61	1.84	1.2	.1933	0.6	2771	10	-1
41.24.1.1	0.05	146	71	0.51	1.91	1.0	.1933	0.4	2770	7	2
41.30.1.1	0.07	84	52	0.63	1.87	1.2	.1931	1.2	2769	20	0
41.20.1.1	0.03	128	96	0.77	1.84	1.3	.1930	0.6	2768	11	-1
41.3.1.1	0.08	179	110	0.63	1.88	1.0	.1928	0.4	2766	7	0
41.7.1.1	0.08	147	82	0.58	1.85	1.1	.1921	0.9	2761	15	-1
41.21.1.1	0.06	112	67	0.61	1.88	1.1	.1909	0.8	2750	14	0
41.39.1.1	0.39	78	45	0.59	1.94	1.2	.1903	1.0	2744	17	2
41.31.1.1	0.16	79	54	0.71	1.93	1.2	.1896	0.7	2738	11	2
~2830 Ma zircon subject to partial ancient Pb loss (n = 2)											
41.34.2.1	0.04	167	101	0.62	2.06	1.2	.1838	0.4	2687	7	5
41.18.1.1	0.07	198	136	0.71	2.09	1.0	.1712	0.4	2570	7	2
~2430 Ma zircon (n = 5)											
41.33.1.1	0.00	546	165	0.31	2.21	0.8	.1575	0.2	2429	4	1
41.9.2.1	0.04	349	176	0.52	2.24	0.9	.1574	0.6	2428	11	2
41.19.1.1	0.02	573	167	0.30	2.25	0.8	.1574	0.2	2428	4	3
41.17.1.1	0.00	379	153	0.42	2.22	1.0	.1573	0.3	2427	5	1
41.16.1.1	0.05	373	230	0.64	2.21	0.9	.1567	0.3	2420	5	1
slightly discordant, ~2430 Ma zircon (n = 2)											
41.34.1.1	0.03	750	40	0.06	2.28	0.8	.1549	0.4	2400	6	3
41.28.2.1	0.15	1023	22	0.02	2.47	0.8	.1502	0.6	2348	11	7
Analyses >10% discordant (n = 5)											
41.37.1.1	0.06	319	221	0.71	2.47	0.9	.1552	0.3	2404	6	10
41.29.1.1	0.13	301	276	0.95	2.33	0.9	.1713	0.4	2570	6	12
41.38.1.1	0.26	159	71	0.46	2.14	1.0	.1919	0.5	2758	8	12
41.1.1.1	0.33	2304	44	0.02	2.99	0.8	.1336	0.4	2146	7	15
41.22.1.1	0.21	185	93	0.52	2.50	1.0	.1815	0.5	2666	8	23
Analyses >40% discordant and/or containing >0.5% $^{206}Pb_c$ (n = 9)											
41.25.1.1	0.27	2017	452	0.23	1.13	0.8	.1463	0.3	2303	5	-44
41.11.1.1	0.18	368	167	0.47	3.30	0.9	.1572	0.5	2426	9	42
41.10.1.1	0.86	1435	207	0.15	3.35	0.8	.1535	1.1	2385	18	42
41.36.1.1	0.57	2156	819	0.39	4.12	0.8	.1224	0.7	1991	13	42
41.27.1.1	1.25	1892	377	0.21	4.71	0.8	.1189	1.3	1940	23	56
41.8.1.1	0.53	264	108	0.42	3.54	1.0	.1942	0.8	2778	14	73
41.12.1.1	0.34	155	108	0.72	4.77	1.2	.1901	0.8	2743	13	124
41.9.1.1	3.55	5645	1494	0.27	31.15	0.8	.0897	4.9	1420	93	597
41.13.1.1	0.97	4695	326	0.07	19.49	1.5	.1662	0.8	2520	13	681

33. GARNET-BEARING LEUCOGRANITE, WEST OF LAKE GILLES: 2008371082

GA Sample ID:	**2008371082**
GA Sample Number:	**1976796**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**657514 6376815 Zone 53**
Collector:	**G. Fraser, C. Foudoulis, A. Reid, S. McAvaney**
Collection Date:	**10/9/2008**
Formal Name:	
Informal Name:	
Lithology:	**garnet-bearing leucogranite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6070**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**31/10-2008 – 7/11/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.90% (2σ) [68 of 70]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.4 ± 1.2 Ma [35 of 35]**
Interpreted Age:	**1738 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

Lake Gilles is located ~20 km west of the town of Iron Knob, northern Eyre Peninsula, South Australia. This sample was collected near the western shore of Lake Gilles north of Eurilla Hill. Basement outcrop in this region is sparse, and where present is typically deeply weathered. It consists of quartz-rich, iron-rich and carbonate-bearing gneisses, interlayered and boudinaged at the metre scale, and folded about tight to isoclinal folds. The gneisses are intruded by garnet-bearing leucogranite that contains rafts of the surrounding gneisses and is itself weakly foliated. Sample 2008371082 is a garnet-bearing leucogranite (Figure 33.1) collected from an isolated bouldery outcrop that does not show contact relationships, but is interpreted to be an equivalent to the garnet-bearing leucogranites that are locally seen to intrude the surrounding gneisses.

Figure 33.1. *Garnet-bearing leucogranite, west of Lake Gilles; sample 2008371082.*

Zircon Description

Zircons from this sample occur as euhedral grains and fragments, typically with aspect ratios between 2 and 5. Cathodoluminescence (CL) imaging shows concentric, oscillatory internal

zonation. In many cases, oscillatory zoning in these grains appears to have broadened and the zone boundaries become more diffuse, suggesting secondary fluid alteration of primary igneous grains (Figure 33.2).

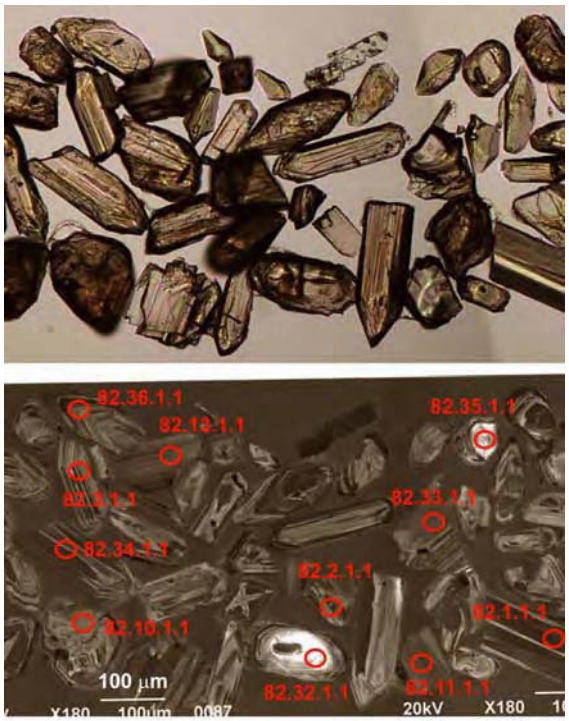

Figure 33.2. *Representative transmitted light and cathodoluminescence images of zircons from garnet-bearing leucogranite, west of Lake Gilles (2008371082), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Forty three analyses were collected from 42 different zircons (Figure 33.3). A large majority of these analyses yield $^{207}Pb/^{206}Pb$ ages of ~1735 Ma. The exceptions are a single near concordant analysis (82.32.1.1) with an age of 3227 ± 14 Ma (2σ), and slightly discordant analyses at 2321 ± 68 Ma (2σ; 82.17.1.1) and 1952 ± 34 Ma (2σ; 82.35.1.1). Each of these three analyses comes from a distinct zircon core with higher CL response than the typical zircon from this sample. These three older ages are, therefore, interpreted as inherited zircon. Of the remaining 40 analyses, 11 are >10% discordant and a further 9 contain >0.5% $^{206}Pb_c$. Nineteen of the remaining 20 analyses define a weighted mean $^{207}Pb/^{206}Pb$ age of 1738 ± 4 Ma (95% confidence; MSWD = 1.3; probability of fit = 0.2; Figure 33.4).

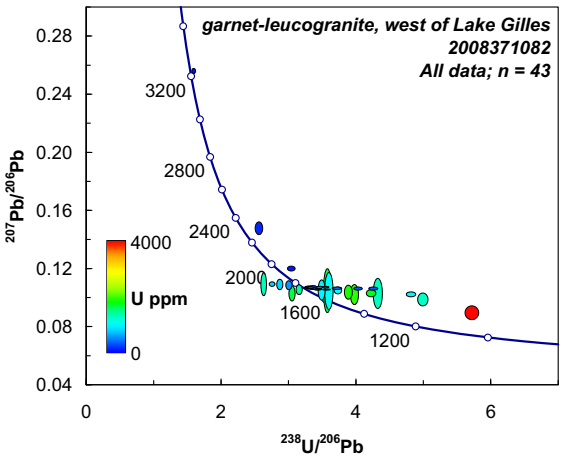

Figure 33.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the garnet-bearing leucogranite, west of Lake Gilles (2008371082), coloured according to U content.*

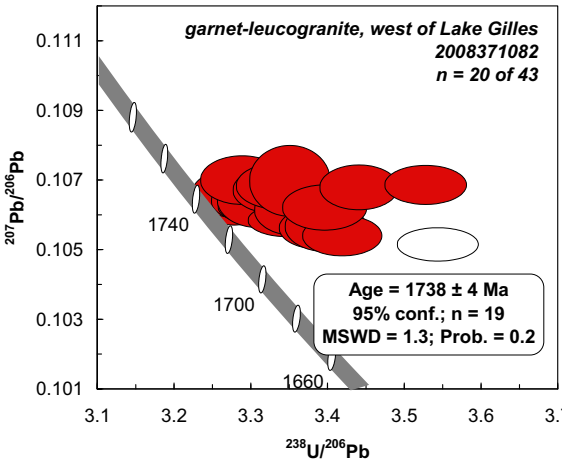

Figure 33.4. *Tera-Wasserburg concordia diagram showing results of near-concordant zircon analyses from the garnet-bearing leucogranite, west of Lake Gilles (2008371082). The unfilled ellipse was not included in the mean age calculation.*

Geochronological Interpretation

The weighted mean $^{207}Pb/^{206}Pb$ age of 1738 ± 4 Ma is interpreted as the best estimate for the time of crystallisation of this garnet-bearing leucogranite.

Table 33.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371082 (1976796) garnet-bearing leucogranite, west of Lake Gilles.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited zircon (n = 3)											
82.32.1.1	0.15	65	31	0.49	1.57	1.2	.2567	0.4	3227	7	2
82.17.1.1	0.06	125	72	0.59	2.54	1.4	.1478	2.0	2321	34	8
82.35.1.1	0.24	79	82	1.06	3.02	1.2	.1197	1.0	1952	17	6
Analyses included in mean age calculation (n =19)											
82.39.1.1	0.06	376	160	0.44	3.29	1.1	.1070	0.4	1750	8	2
82.28.1.1	0.04	284	100	0.36	3.35	1.0	.1070	0.6	1749	11	4
82.24.1.1	0.08	487	180	0.38	3.53	1.0	.1069	0.3	1747	6	9
82.4.2.1	0.02	285	106	0.39	3.34	1.1	.1069	0.4	1747	8	3
82.19.1.1	0.14	904	430	0.49	3.44	1.0	.1068	0.4	1746	7	6
82.18.1.1	0.03	319	144	0.47	3.33	1.0	.1067	0.4	1744	8	3
82.15.1.1	0.05	276	122	0.46	3.28	1.1	.1067	0.4	1743	8	2
82.26.1.1	0.04	237	79	0.35	3.31	1.1	.1065	0.5	1740	9	2
82.11.1.1	0.06	343	129	0.39	3.31	1.0	.1065	0.4	1740	7	2
82.33.1.1	0.03	331	133	0.41	3.30	1.0	.1064	0.4	1739	7	2
82.4.1.1	0.09	304	125	0.43	3.28	1.0	.1064	0.4	1739	8	1
82.1.1.1	0.03	644	321	0.51	3.31	1.0	.1064	0.3	1739	5	2
82.5.1.1	0.02	436	144	0.34	3.31	1.0	.1063	0.3	1737	6	2
82.16.1.1	0.05	352	156	0.46	3.40	1.1	.1063	0.4	1736	7	4
82.40.1.1	0.08	252	107	0.44	3.36	1.0	.1062	0.5	1735	8	3
82.21.1.1	0.07	597	220	0.38	3.35	1.0	.1059	0.3	1730	5	3
82.25.1.1	0.13	318	132	0.43	3.40	1.0	.1057	0.4	1726	8	4
82.14.1.1	0.13	460	164	0.37	3.39	1.0	.1057	0.4	1726	7	4
82.12.1.1	0.12	480	184	0.40	3.42	1.0	.1054	0.4	1722	7	4
Young age outlier, possible minor Pb-loss (n = 1)											
82.23.1.1	0.09	693	289	0.43	3.54	1.0	.1052	0.3	1718	6	7
Analyses >10% discordant (n = 11)											
82.6.1.1	0.20	406	154	0.39	3.70	1.2	.1061	0.5	1734	8	12
82.13.1.1	0.15	298	87	0.30	4.02	1.0	.1060	0.7	1732	12	21
82.27.1.1	0.34	326	109	0.35	4.24	1.0	.1059	0.7	1730	12	27
82.3.1.1	1.31	952	370	0.40	3.71	1.0	.1045	1.5	1705	28	11
82.41.1.1	2.68	1889	1385	0.76	3.87	1.0	.1033	3.1	1684	57	14
82.38.1.1	1.31	1745	1070	0.63	4.21	1.0	.1027	1.5	1673	28	22
82.29.1.1	5.59	1263	730	0.60	4.31	1.1	.1025	6.7	1671	124	24
82.7.1.1	0.90	919	364	0.41	4.81	1.0	.1019	1.1	1659	20	36
82.10.1.1	3.85	1956	37	0.02	3.96	1.0	.1017	4.5	1655	84	14
82.34.1.1	2.48	1206	756	0.65	4.98	1.0	.0984	3.0	1594	56	35
82.22.1.1	2.43	3993	330	0.09	5.71	1.2	.0892	3.5	1408	67	35
Analyses >0.5% $^{206}Pb_c$ (n = 9)											
82.36.1.1	4.26	1258	521	0.43	2.61	1.1	.1088	4.8	1781	17	-15
82.31.1.1	0.83	765	353	0.48	2.73	1.0	.1089	1.0	1779	88	-11
82.20.1.1	2.87	1630	710	0.45	3.03	1.0	.1026	3.3	1778	40	-9
82.2.1.1	1.98	777	386	0.51	2.85	1.0	.1087	2.2	1769	34	-8
82.37.1.1	1.68	530	238	0.46	2.98	1.0	.1082	1.9	1715	40	-5
82.42.1.1	1.88	1360	628	0.48	3.14	1.0	.1050	2.2	1710	81	-4
82.9.1.1	3.83	910	566	0.64	3.48	1.0	.1048	4.4	1705	177	5
82.30.1.1	8.05	1626	823	0.52	3.56	1.1	.1045	9.6	1699	149	7
82.8.1.1	6.09	984	585	0.61	3.58	1.2	.1042	8.1	1671	61	7

34. WARROW QUARTZITE, WEST OF LAKE GILLES: 2008371083

GA Sample ID:	**2008371083**
GA Sample Number:	**1976797**
Other Sample ID:	
1:250,000 Sheet:	**PORT AUGUSTA SI 53-4**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**656816 6375168 Zone 53**
Collector:	**A. J. Reid, G. L. Fraser, C. Foudoulis, S. McAvaney**
Collection Date:	**10/9/2008**
Formal Name:	**Warrow Quartzite**
Informal Name:	
Lithology:	**massive quartzite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6111**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**22 - 23/12/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.24% (2σ) [31 of 31]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.5 ± 2.1 Ma [15 of 15]**
Interpreted Age:	**2019 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

Lake Gilles is located ~20 km west of the town of Iron Knob, northern Eyre Peninsula, South Australia. This sample was collected from a low ridge of highly fractured, recrystallised clean quartzite near the western shore of Lake Gilles, near Eurilla Hill (Figure 34.1). This quartzite ridge trends ~070.

Figure 34.1. *Quartzite, west of Lake Gilles; sample 2008371083. The western shore of Lake Gilles can be seen in the background.*

Zircon Description

Zircons from this sample occur as rounded grains and fragments ranging in size from ~100 to 300 μm in long dimension. Most grains show pitted outer surfaces. In cathodoluminesence (CL) images, some grains exhibit oscillatory internal zonation while others, particularly the larger grains, exhibit uniformly low CL response (Figure 34.2). All grains are interpreted to be of detrital origin in this sedimentary rock.

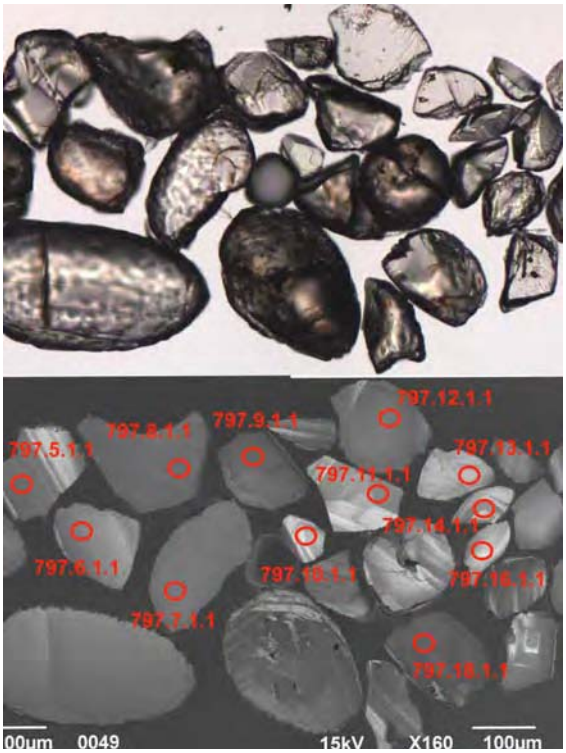

Figure 34.2. *Representative transmitted light and cathodoluminescence images of zircons from quartzite, west of Lake Gilles (2008371083), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 71 analyses were collected from 71 different zircon grains (Figure 34.3). One analysis is 30% discordant and has not been included in the geological interpretation. The remaining 70 analyses are all less than 10% discordant and all contain less than 0.5% common Pb ($^{206}Pb_c$). The oldest age is concordant at 2760 Ma and the two next-youngest grains have ages of ~2620 and 2580 Ma. A group of 6 analyses cluster with ages between 2537 and 2507 Ma, and together define a statistically coherent grouping with weighted mean $^{207}Pb/^{206}Pb$ age of 2522 ± 7 Ma (95% confidence; MSWD = 1.5; probability of fit = 0.17). The other 61 analyses cluster near concordia at ~2020 Ma with very slight excess scatter. If the oldest and youngest analyses in this age cluster are rejected, the remaining 59 analyses yield a weighted mean age of 2019 ± 3 Ma (95% confidence; MSWD = 1.3; probability of fit 0.08; Figure 34.4).

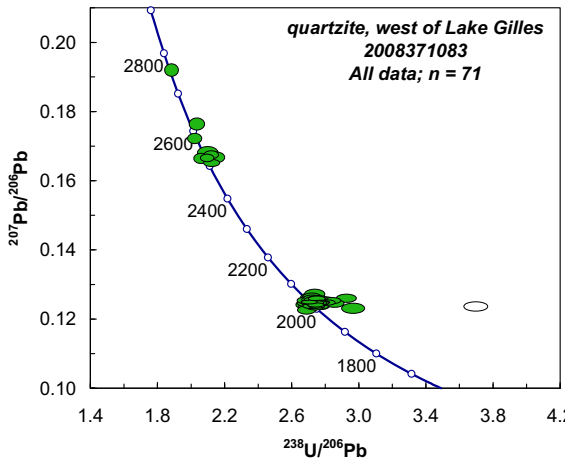

Figure 34.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the quartzite on the western short of Lake Gilles (2008371083). The discordant analysis shown by the unfilled ellipse has not been included in geological interpretation.*

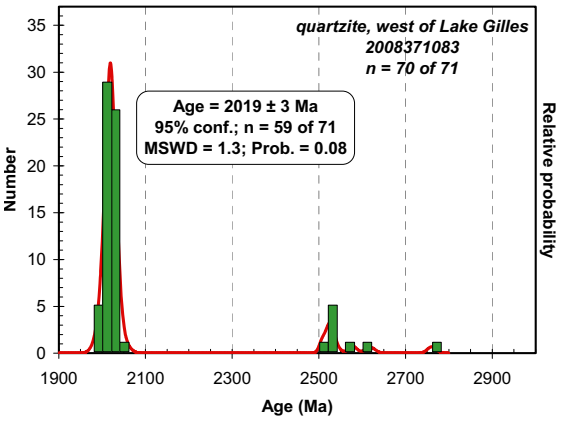

Figure 34.4. *Probability density diagram for zircon analyses from quartzite on the western shore of Lake Gilles (2008371083).*

Geochronological Interpretation

The youngest statistically coherent group of analyses, with a weighted mean age of 2019 ± 3 Ma, is interpreted to represent a maximum age for the deposition of this sedimentary rock.

Table 34.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371083 (1976797), quartzite, west of Lake Gilles.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircon (n = 70)											
797.70.1.1	0.11	66	75	1.17	1.88	1.5	.1921	0.6	2760	10	0
797.3.1.1	0.00	213	126	0.61	2.03	1.5	.1763	0.7	2619	11	1
797.25.1.1	0.06	80	68	0.88	2.02	1.4	.1721	0.6	2579	10	-1
797.38.1.1	-0.09	57	20	0.36	2.10	1.9	.1679	0.7	2537	12	1
797.51.1.1	-0.02	115	60	0.54	2.12	1.3	.1674	0.5	2532	8	2
797.10.1.1	0.03	69	79	1.18	2.14	1.6	.1667	0.6	2524	11	2
797.11.1.1	-0.02	129	85	0.68	2.09	1.3	.1665	0.4	2523	7	0
797.62.1.1	-0.04	148	57	0.40	2.06	1.4	.1663	0.6	2521	10	-1
797.23.1.1	0.00	151	63	0.43	2.12	1.4	.1649	0.4	2507	7	1
797.21.1.1	0.04	74	36	0.50	2.74	1.4	.1267	0.8	2053	13	2
797.16.1.1	0.00	81	46	0.59	2.72	1.4	.1257	0.7	2038	13	1
797.47.1.1	-0.04	66	38	0.61	2.71	1.5	.1256	0.8	2038	14	1
797.39.1.1	-0.14	65	40	0.63	2.73	1.7	.1256	0.9	2037	15	1
797.7.1.1	0.02	191	201	1.09	2.72	1.3	.1255	0.5	2036	8	1
797.59.1.1	0.03	116	62	0.55	2.93	1.3	.1255	0.6	2036	11	7
797.31.1.1	0.00	104	57	0.57	2.74	1.6	.1254	0.6	2035	11	1
797.35.1.1	0.00	240	170	0.73	2.75	1.2	.1253	0.4	2034	7	2
797.8.1.1	0.02	197	198	1.04	2.76	1.2	.1253	0.5	2033	8	2
797.4.1.1	0.01	183	168	0.95	2.74	1.3	.1252	0.5	2032	8	1
797.56.1.1	0.00	138	129	0.96	2.71	1.3	.1251	0.5	2030	10	0
797.42.1.1	0.00	294	213	0.75	2.75	1.2	.1249	0.4	2028	7	2
797.19.1.1	-0.06	170	124	0.75	2.72	1.7	.1249	0.6	2028	11	0
797.55.1.1	0.00	209	221	1.10	2.72	1.3	.1249	0.4	2028	8	1
797.36.1.1	-0.04	135	142	1.08	2.69	1.3	.1248	0.6	2026	10	-1
797.30.1.1	0.06	297	252	0.88	2.84	1.2	.1248	0.5	2026	9	4
797.40.1.1	0.03	115	127	1.14	2.80	1.3	.1247	0.6	2025	11	3
797.18.1.1	-0.03	278	255	0.95	2.76	1.2	.1247	0.4	2024	7	1
797.32.1.1	0.03	144	134	0.96	2.77	1.5	.1246	0.6	2023	11	2
797.57.1.1	0.01	188	171	0.94	2.77	1.3	.1246	0.5	2023	8	2
797.71.1.1	-0.01	250	243	1.01	2.75	1.3	.1246	0.4	2023	7	1
797.48.1.1	0.02	127	91	0.74	2.73	1.4	.1245	0.6	2021	10	1
797.29.1.1	0.03	120	127	1.10	2.71	1.3	.1244	0.6	2021	11	0
797.52.1.1	0.01	134	136	1.05	2.75	1.3	.1244	0.5	2021	10	1
797.68.1.1	0.00	472	340	0.74	2.70	1.2	.1244	0.3	2020	5	0
797.2.1.1	0.00	190	192	1.04	2.73	1.3	.1244	0.5	2020	8	0
797.33.1.1	0.02	64	39	0.63	2.74	1.5	.1244	0.8	2020	15	1
797.27.1.1	-0.03	148	151	1.05	2.74	1.3	.1244	0.5	2020	10	1
797.17.1.1	0.00	129	99	0.79	2.71	1.6	.1243	0.6	2019	10	0
797.22.1.1	-0.01	376	319	0.88	2.77	1.2	.1243	0.3	2019	6	2
797.14.1.1	0.05	129	61	0.49	2.73	1.3	.1243	0.6	2019	11	0
797.9.1.1	0.02	252	257	1.05	2.81	1.2	.1243	0.4	2019	7	3
797.24.1.1	-0.01	111	49	0.46	2.69	1.3	.1242	0.6	2018	10	-1
797.41.1.1	0.03	267	143	0.55	2.73	1.3	.1242	0.4	2018	7	0
797.43.1.1	-0.02	95	41	0.44	2.71	1.4	.1242	0.7	2018	12	0
797.64.1.1	-0.01	312	218	0.72	2.77	1.2	.1242	0.4	2017	7	1
797.50.1.1	0.02	264	104	0.41	2.72	1.2	.1242	0.4	2017	7	0
797.26.1.1	0.01	293	280	0.99	2.74	1.2	.1242	0.4	2017	6	1
797.1.1.1	0.07	164	145	0.91	2.71	1.3	.1241	0.5	2017	10	0
797.28.1.1	0.01	99	38	0.39	2.72	1.6	.1241	0.7	2016	13	0
797.65.1.1	0.01	308	261	0.87	2.76	1.2	.1241	0.4	2016	7	1
797.20.1.1	0.02	311	252	0.84	2.76	1.2	.1241	0.4	2016	7	1
797.13.1.1	-0.04	90	34	0.39	2.72	1.4	.1240	0.7	2015	12	0
797.49.1.1	0.08	139	121	0.90	2.86	1.3	.1240	0.6	2015	11	4
797.6.1.1	0.01	139	146	1.08	2.72	1.3	.1240	0.6	2014	10	0
797.54.1.1	0.04	382	295	0.80	2.76	1.2	.1239	0.4	2013	7	1
797.67.1.1	0.04	248	174	0.72	2.74	1.2	.1238	0.4	2012	8	0
797.12.1.1	0.00	161	171	1.09	2.74	1.3	.1237	0.5	2010	9	0
797.34.1.1	0.03	70	39	0.58	2.69	1.8	.1236	0.8	2009	14	-1
797.45.1.1	-0.01	362	307	0.88	2.74	1.2	.1236	0.3	2008	6	0
797.15.1.1	0.01	106	59	0.58	2.77	1.3	.1235	0.7	2007	12	1
797.63.1.1	0.04	144	120	0.86	2.73	1.3	.1235	0.6	2007	10	0
797.46.1.1	0.03	275	279	1.05	2.72	1.2	.1233	0.4	2005	7	-1
797.61.1.1	0.03	363	187	0.53	2.75	1.2	.1233	0.4	2004	6	0
797.44.1.1	0.00	189	85	0.46	2.76	1.4	.1231	0.5	2002	9	0

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
797.69.1.1	0.04	115	50	0.44	2.69	1.3	.1230	0.6	2000	11	-2
797.58.1.1	0.06	165	187	1.17	2.70	1.4	.1229	0.6	1999	10	-2
797.60.1.1	0.05	110	116	1.09	2.70	1.4	.1229	0.7	1999	12	-1
797.5.1.1	0.01	189	193	1.06	2.74	1.3	.1229	0.5	1999	8	0
797.66.1.1	-0.01	69	63	0.96	2.97	1.5	.1225	0.8	1993	14	6
797.37.1.1	0.11	129	56	0.45	2.69	1.3	.1221	0.6	1987	12	-3
Analysis >10% discordant (n = 1)											
797.53.1.1	0.14	164	197	1.24	3.70	1.3	.1232	0.7	2003	13	30

35. WARROW QUARTZITE, MOSELEY NOBS: 2009371028

GA Sample ID:	**2009371028**
GA Sample Number:	**1999464**
Other Sample ID:	
1:250,000 Sheet:	**YARDEA SI 53-3**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**633488 6355944 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**4/7/2009**
Formal Name:	**Warrow Quartzite**
Informal Name:	
Lithology:	**muscovite-bearing quartzite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6111**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**21 - 22/12/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.24% (2σ) [31 of 31]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.5 ± 2.1 Ma [15 of 15]**
Interpreted Age:	**2003 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

Moseley Nobs is located ~20 km north of the town of Kimba, Eyre Peninsula, South Australia. This sample comes from the hills ~5 km east of Moseley Nobs and consists of a massive, white, recrystallised quartzite, with minor muscovite and radial splays of tourmaline (Figure 35.1).

Figure 35.1. *Outcrop of Warrow Quartzite, near Moseley Nobs; sample 2009371028.*

Zircon Description

Zircons from this sample occur as rounded grains and fragments ranging in size from ~100 to 200 μm in long dimension. Many grains show pitted outer surfaces and most exhibit oscillatory internal zonation in cathodoluminesence images (Figure 35.2). All grains are interpreted to be of detrital origin in this sedimentary rock.

U-Pb Isotopic Results

A total of 48 analyses were collected from 47 different zircon grains (Figure 35.3). All but one of these analyses are less than 10% discordant, and all analyses contain less than 0.5% common Pb ($^{206}Pb_c$). Three analyses range in age between ~2600 and 2500 Ma, while all other analyses cluster in age around ~2000 Ma. Forty-four analyses combine to yield a statistically coherent group with a weighted mean $^{207}Pb/^{206}Pb$ age of 2003 ± 4 Ma (95% confidence; MSWD = 1.3; probability of fit = 0.10; Figure 35.4).

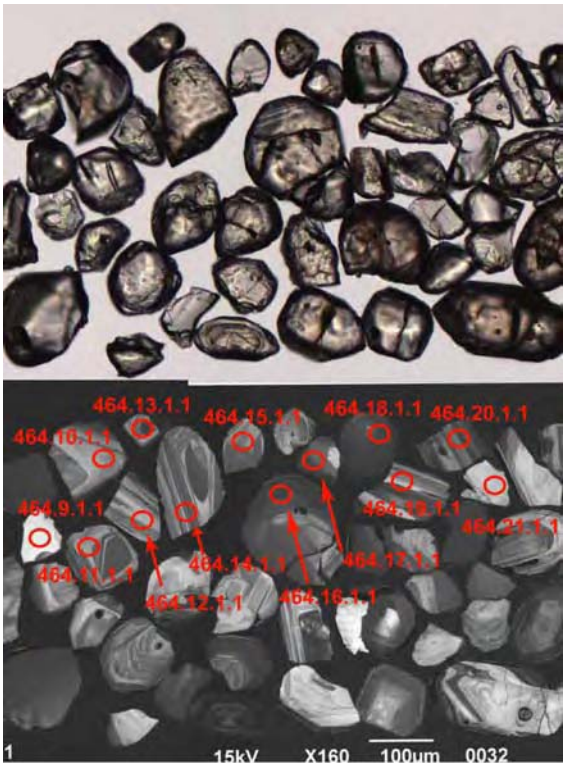

Figure 35.2. *Representative transmitted light and cathodoluminescence images of zircons from Warrow Quartzite, near Moseley Nobs (2009371028), with locations of some SHRIMP analyses.*

Geochronological Interpretation

The youngest statistically coherent group of analyses, with a weighted mean age of 2003 ± 4 Ma, is interpreted to represent a maximum age for the deposition of this sedimentary rock.

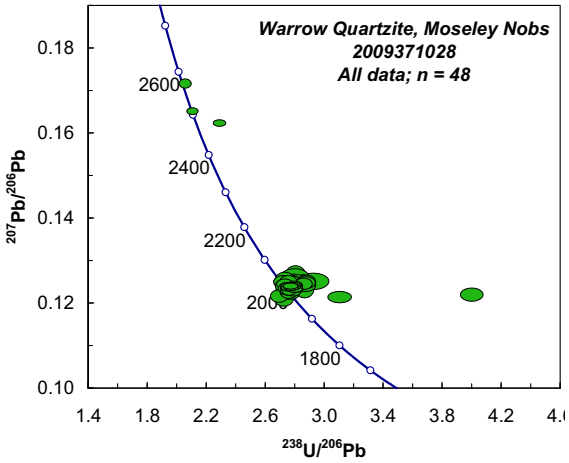

Figure 35.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Warrow Quartzite near Moseley Nobs (2009371028).*

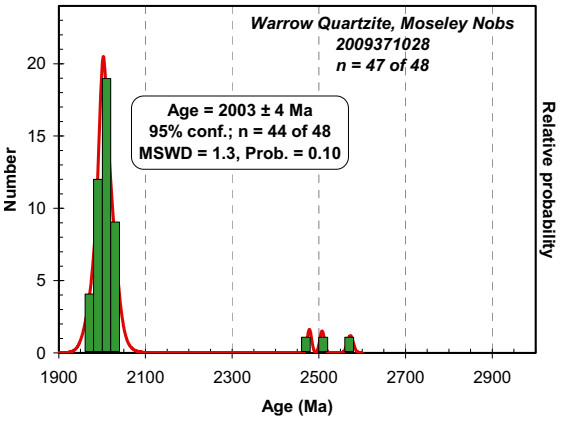

Figure 35.4. *Probability density diagram for zircon analyses from the Warrow Quartzite near Moseley Nobs (2009371028).*

Table 35.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371028 (1999464), Warrow Quartzite, Moseley Nobs.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Pre~2000 Ma detrital zircon (n = 3)											
464.39.1.1	0.00	138	126	0.94	2.05	1.3	.1715	0.4	2573	7	1
464.33.1.1	0.00	292	69	0.24	2.10	1.2	.1650	0.3	2507	5	0
464.32.1.1	0.10	344	88	0.26	2.29	1.3	.1621	0.3	2478	5	6
~2000 Ma detrital zircon (n = 44)											
464.21.1.1	-0.15	42	31	0.76	2.80	2.3	.1255	1.1	2036	20	3
464.9.1.1	0.14	27	23	0.86	2.80	1.8	.1253	1.6	2033	28	3
464.2.1.1	-0.13	45	37	0.86	2.73	1.6	.1249	1.0	2027	18	1
464.12.1.1	-0.02	77	61	0.81	2.76	1.4	.1247	0.7	2024	12	1
464.41.1.1	0.06	42	32	0.78	2.92	2.4	.1246	1.0	2023	18	7
464.11.1.1	-0.09	68	52	0.79	2.88	1.4	.1246	0.8	2022	15	5
464.38.1.1	0.04	75	46	0.63	2.74	2.0	.1245	0.8	2022	13	1
464.43.1.1	0.03	61	45	0.76	2.86	1.7	.1245	0.9	2022	15	5
464.36.1.1	0.05	65	54	0.85	2.72	1.5	.1245	0.8	2021	14	0
464.30.1.1	-0.06	44	61	1.42	2.82	1.5	.1244	0.9	2020	17	3
464.28.1.1	0.09	80	68	0.87	2.88	1.4	.1243	0.8	2019	13	5
464.46.1.1	-0.11	39	25	0.67	2.79	1.7	.1240	1.2	2015	21	2
464.14.1.1	0.03	86	73	0.87	2.86	1.4	.1240	0.7	2015	12	4
464.19.1.1	0.01	72	65	0.94	2.79	1.4	.1240	0.9	2014	17	2
464.27.1.1	0.03	48	41	0.89	2.79	1.6	.1240	0.9	2014	17	2
464.29.1.1	-0.07	104	65	0.64	2.73	1.3	.1239	0.7	2013	12	0
464.7.1.1	0.08	49	51	1.08	2.82	1.5	.1238	1.0	2011	17	3
464.24.1.1	-0.01	62	69	1.16	2.88	1.5	.1237	0.8	2010	14	5
464.5.1.1	0.03	209	166	0.82	2.80	1.2	.1236	0.5	2009	10	2
464.22.1.1	-0.06	62	46	0.78	2.72	1.5	.1235	0.8	2007	14	0
464.20.1.1	-0.01	190	137	0.74	2.79	1.3	.1235	0.5	2007	8	2
464.35.1.1	0.05	88	82	0.96	2.78	1.6	.1235	0.8	2007	15	1
464.25.1.1	-0.03	63	72	1.17	2.75	1.5	.1235	0.8	2007	14	0
464.3.1.1	0.01	278	210	0.78	2.77	1.2	.1234	0.4	2007	7	1
464.34.1.1	0.04	196	158	0.83	2.75	1.2	.1233	0.5	2005	9	0
464.16.1.1	0.00	278	219	0.82	2.79	1.2	.1233	0.4	2004	7	1
464.8.1.1	0.01	325	358	1.14	2.78	1.2	.1232	0.3	2002	6	1
464.6.1.1	0.04	293	339	1.20	2.76	1.2	.1231	0.4	2001	7	0
464.45.1.1	0.00	199	146	0.76	2.76	1.3	.1230	0.5	2000	8	0
464.47.2.1	0.04	246	290	1.22	2.77	1.3	.1229	0.4	1998	8	1
464.13.1.1	0.00	204	139	0.70	2.80	1.2	.1229	0.4	1998	8	2
464.17.1.1	0.02	129	115	0.92	2.74	1.3	.1229	0.8	1998	13	0
464.4.1.1	0.01	71	39	0.56	2.87	1.4	.1227	1.1	1996	19	3
464.26.1.1	0.02	325	364	1.16	2.80	1.2	.1227	0.4	1995	6	1
464.18.1.1	0.01	225	195	0.89	2.76	1.2	.1225	0.6	1992	11	0
464.40.1.1	0.09	67	55	0.85	2.75	1.5	.1223	0.9	1990	16	0
464.44.1.1	0.11	143	137	0.99	2.79	1.3	.1222	0.6	1989	11	1
464.1.1.1	0.05	215	239	1.15	2.76	1.4	.1222	0.5	1989	8	0
464.15.1.1	0.14	77	71	0.95	2.74	1.8	.1220	0.9	1986	15	-1
464.42.1.1	0.07	94	97	1.06	2.76	1.4	.1219	0.7	1984	13	0
464.31.1.1	0.02	105	94	0.92	2.77	1.5	.1215	0.7	1979	12	-1
464.10.1.1	0.11	76	45	0.61	2.69	1.4	.1211	0.8	1972	15	-3
464.37.1.1	0.04	93	101	1.12	3.10	1.7	.1209	0.8	1969	13	9
464.47.1.1	0.06	48	48	1.04	2.72	1.6	.1205	1.0	1964	18	-3
Analysis >10% discordant (n = 1)											
464.23.1.1	0.32	141	142	1.04	4.00	1.3	.1214	0.9	1977	15	38

36. BASEMENT GNEISS, MENNINNIE DAM: 2009371041

GA Sample ID:	**2009371041**
GA Sample Number:	**1999477**
Other Sample ID:	
1:250,000 Sheet:	**YARDEA SI 53-3**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**633312 6385790 Zone 53**
Collector:	**G. L. Fraser, N. L. Neumann & K. Cross**
Collection Date:	**2/7/2009**
Formal Name:	
Informal Name:	
Lithology:	**biotite gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6111**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**13 – 14/1/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.93% (2σ) [19 of 19]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.2 ± 3.1 Ma [14 of 14]**
Interpreted Age:	**2511 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

The Menninnie Dam Pb-Zn prospect is located ~40 km north of the town of Kimba, Eyre Peninsula, South Australia, and lies immediately south of the extensive outcrop of ~1590 Ma Gawler Range Volcanics. This sample comes from the depth interval 197 – 200.5 metres in drill hole MD093 at the Menninnie Dam Pb-Zn prospect. The rock is a biotite-rich gneiss, with banding defined by quartzofeldspathic leucosomes. This rock is interpreted to be part of the gneissic basement onto which the metasedimentary sequence that hosts the Menninnie Dam mineralisation was deposited.

Zircon Description

Abundant zircon was retrieved from this sample, occurring as good quality, clear grains. Grain size is relatively small, in many cases being less than ~100 μm in long dimension. Grains are typically euhedral to subhedral, ranging from equant to elongate, with aspect ratios up to 1:6. Most grains exhibit oscillatory internal zoning throughout. In cathodoluminescence (CL) images, a small number of grains exhibit bright, oscillatory zoned cores with dark rims. A few grains exhibit uniformly dark CL response (Figure 36.1).

U-Pb Isotopic Results

A total of 62 analyses were collected from 61 zircon grains (Figure 36.2). Six analyses are >10% discordant. The remaining 56 analyses all contain <0.5%$^{206}Pb_c$ and range in $^{207}Pb/^{206}Pb$ age from ~3170 Ma to ~2430 Ma. The youngest analysis (77.17.1.1; Figure 36.1) comes from a dark CL rim around an embayed, bright CL, oscillatory zoned core. This analysis yields a very low Th/U ratio of 0.02, typical of high-grade metamorphic zircon. The dominant age population in this sample is defined by a group of 21 analyses with a weighted mean $^{207}Pb/^{206}Pb$ age of 2511 ± 4 Ma (95% confidence; MSWD = 1.5; probability of fit = 0.07; Figure 36.3). Zircons in this group show oscillatory internal zoning, interpreted to be of igneous origin.

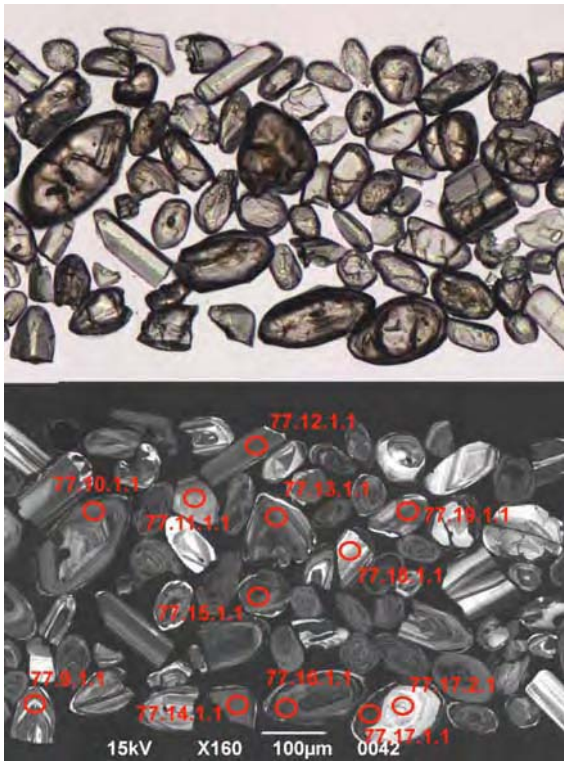

Figure 36.1. *Representative transmitted light and cathodoluminescence images of zircons from basement gneiss at Menninnie Dam (2009371041), with locations of some SHRIMP analyses.*

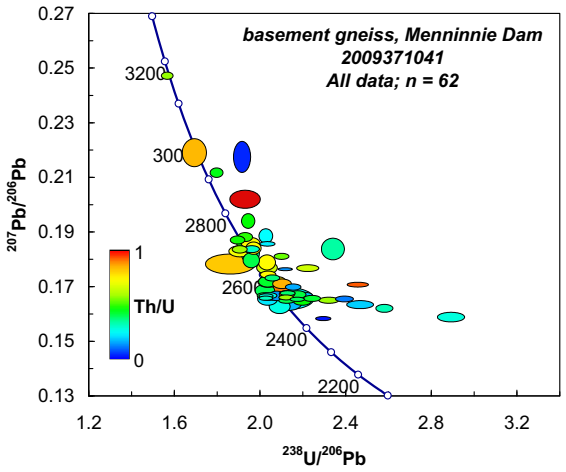

Figure 36.2. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the basement gneiss at Menninnie Dam (2009371041), coloured according to Th/U ratio.*

Thirty-four analyses are older than this dominant age group, and form a semi-continuous range in age between ~2705 Ma and ~2510 Ma. At the older end of this range, 7 analyses group together with a weighted mean $^{207}Pb/^{206}Pb$ age of 2705 ± 9 Ma (95% confidence; MSWD = 1.2; probability of fit = 0.30). Analyses that lie between the ~2510 Ma and ~2705 Ma populations may reflect partial Pb-loss at ~2510 Ma in original ~2705 Ma zircon, or may represent a range of zircon crystallisation ages, or some combination of both. Six analyses are older than the ~2705 Ma grouping, the oldest being a near-concordant analysis at 3168 ± 12 Ma (2σ; Figure 36.4).

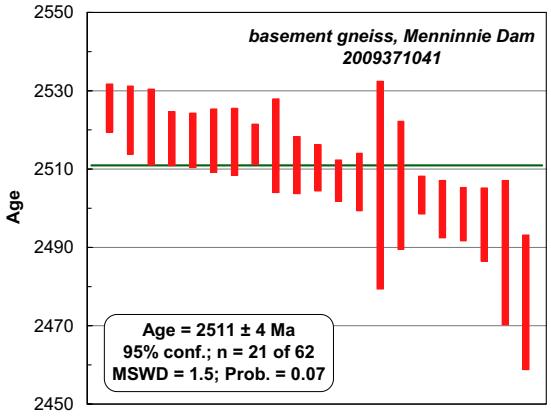

Figure 36.3. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of ~2510 Ma zircon analyses from the basement gneiss at Menninnie Dam (2009371041).*

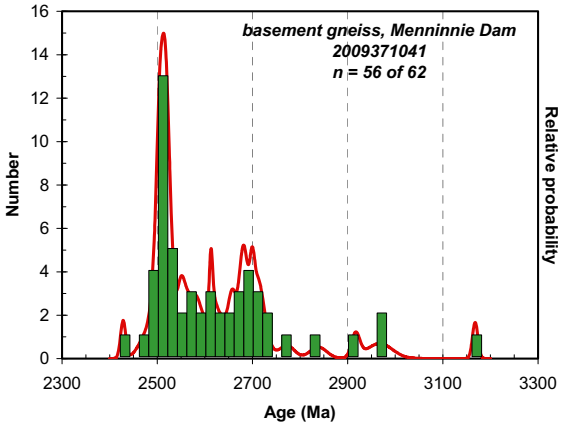

Figure 36.4. *Probability density diagram for <10% discordant zircon analyses from the basement gneiss from Menninnie Dam (2009371041)*

Geochronological Interpretation

A single analysis from a zircon overgrowth with an age of ~2430 Ma is consistent with "Sleafordian" high-grade metamorphism, although in this sample the volumetric proportion of such zircon is very small. Geological interpretation of the older zircon data depends on whether this gneiss is interpreted as of igneous or sedimentary origin. If interpreted as an orthogneiss, the dominant age population at 2511 ± 4 Ma is likely to represent the age of the igneous protolith. The range of pre~2510 Ma ages then represents inherited zircon, and includes a significant population at ~2700 Ma, and a single grain at ~3168 Ma is suggestive of Mesoarchean crust in the source area to this gneiss.

Alternatively, this rock could be interpreted as a paragneiss, of sedimentary origin, in which case the majority of zircon could be interpreted as of detrital origin. In this interpretation, the youngest dominant age of 2511 ± 4 Ma would represent a maximum depositional age for the sedimentary protolith, with the single overgrowth at ~2430 Ma representing timing of high-grade metamorphism.

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Table 36.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371041 (1999477), basement gneiss, Menninnie Dam.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Pre~2705 Ma zircon (n = 6)											
77.35.1.1	-0.02	114	63	0.57	1.56	1.2	.2474	0.4	3168	6	-1
77.11.1.1	0.03	69	57	0.84	1.69	2.2	.2188	1.6	2972	25	-1
77.41.1.1	0.00	283	9	0.03	1.91	1.4	.2173	1.8	2960	28	9
77.4.1.1	0.03	176	75	0.44	1.79	1.1	.2115	0.5	2917	9	2
77.30.1.1	0.04	20	80	4.18	1.92	2.4	.2015	1.1	2838	18	5
77.45.1.1	0.00	411	182	0.46	1.94	1.0	.1936	1.0	2773	16	4
~2705 Ma zircon (n = 7)											
77.15.1.1	0.05	467	108	0.24	2.02	1.0	.1880	0.9	2725	15	5
77.22.1.1	0.00	124	59	0.49	1.93	1.2	.1876	0.6	2721	10	1
77.7.1.1	0.03	142	64	0.47	1.89	1.2	.1865	0.5	2712	8	-1
77.33.1.1	-0.03	57	25	0.45	1.93	1.5	.1856	0.9	2703	14	0
77.17.2.1	-0.03	40	28	0.74	1.95	1.5	.1854	0.7	2702	12	1
77.10.1.1	0.02	239	51	0.22	2.03	1.1	.1851	0.3	2699	5	5
77.5.1.1	-0.03	119	38	0.33	1.95	1.5	.1842	0.9	2691	15	1
~2705 Ma to ~2510 Ma zircon (n =21)											
77.34.1.1	0.01	428	125	0.30	1.96	1.2	.1831	0.4	2681	7	1
77.56.1.1	0.00	96	54	0.58	1.90	1.2	.1831	0.5	2681	8	-2
77.43.1.1	0.19	1380	773	0.58	1.96	1.2	.1830	0.8	2680	14	1
77.2.1.1	0.04	41	28	0.71	1.90	1.8	.1823	0.7	2674	12	-2
77.59.1.1	0.02	115	37	0.33	1.95	1.5	.1818	1.4	2669	23	0
77.6.1.1	0.10	181	93	0.53	2.10	1.1	.1804	0.4	2657	7	6
77.27.1.1	0.10	85	33	0.40	1.96	1.3	.1791	1.0	2644	17	-1
77.38.1.1	-0.03	91	64	0.73	2.03	1.3	.1783	1.0	2637	17	2
77.46.1.1	0.05	178	141	0.82	1.86	4.2	.1776	1.4	2630	23	-5
77.29.1.1	0.00	173	109	0.65	2.03	1.6	.1762	0.9	2618	15	1
77.39.1.1	0.07	163	103	0.65	2.22	1.6	.1761	0.5	2617	8	9
77.21.1.1	0.00	485	61	0.13	2.11	1.0	.1757	0.2	2613	4	5
77.31.1.1	0.08	126	90	0.74	2.04	1.2	.1738	0.5	2595	8	1
77.14.1.1	0.00	198	71	0.37	2.05	1.1	.1725	0.4	2582	7	1
77.37.1.1	0.09	66	27	0.43	2.03	1.4	.1712	0.8	2569	13	0
77.25.1.1	-0.02	38	23	0.62	2.04	1.5	.1709	0.8	2567	13	0
77.26.1.1	0.08	79	65	0.85	2.10	1.4	.1703	0.7	2561	11	2
77.24.1.1	-0.05	89	67	0.79	2.09	1.3	.1697	1.3	2555	21	1
77.16.1.1	0.07	192	28	0.15	2.15	1.1	.1692	0.4	2549	7	4
77.1.1.1	0.00	48	18	0.40	2.02	1.5	.1679	0.9	2536	15	-2
77.57.1.1	0.04	129	113	0.91	2.10	1.2	.1677	1.2	2535	20	1

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
~2510 Ma zircon (n = 21)											
77.53.1.1	0.03	189	69	0.38	2.13	1.1	.1668	0.4	2526	6	2
77.49.1.1	-0.01	228	197	0.89	2.12	1.1	.1665	0.5	2523	9	1
77.48.1.1	0.00	491	195	0.41	2.17	1.2	.1663	0.6	2521	10	3
77.52.1.1	-0.01	152	38	0.26	2.04	1.1	.1660	0.4	2518	7	-2
77.47.1.1	-0.01	147	59	0.41	2.02	1.2	.1660	0.4	2518	7	-3
77.40.1.1	-0.01	114	19	0.17	2.20	1.2	.1660	0.5	2517	8	4
77.32.1.1	-0.04	101	48	0.48	2.14	1.5	.1660	0.5	2517	9	2
77.50.1.1	0.00	265	71	0.28	2.02	1.1	.1659	0.3	2517	5	-3
77.54.1.1	-0.04	142	18	0.13	2.08	1.2	.1659	0.7	2516	12	-1
77.36.1.1	0.02	129	31	0.25	2.04	1.5	.1654	0.4	2511	7	-2
77.12.1.1	0.01	208	116	0.58	2.12	1.1	.1653	0.4	2511	6	1
77.8.1.1	0.03	233	69	0.31	2.02	1.1	.1650	0.3	2507	5	-3
77.23.1.1	0.03	163	66	0.42	2.24	1.2	.1649	0.4	2507	7	5
77.61.1.1	-0.01	278	64	0.24	2.13	3.6	.1649	1.6	2506	27	1
77.42.1.1	-0.06	38	8	0.21	2.03	1.5	.1649	1.0	2506	16	-3
77.58.1.1	-0.01	356	134	0.39	2.17	1.1	.1646	0.3	2504	5	3
77.3.1.1	0.10	152	85	0.57	2.32	1.4	.1643	0.4	2500	7	8
77.28.1.1	0.00	150	59	0.41	2.12	1.1	.1641	0.4	2499	7	0
77.32.2.1	0.12	96	42	0.46	2.20	1.2	.1639	0.6	2496	9	3
77.18.1.1	0.15	33	5	0.17	2.13	1.9	.1632	1.1	2489	19	0
77.20.1.1	0.08	37	10	0.27	2.09	1.5	.1619	1.0	2476	17	-2
Metamorphic zircon (n = 1)											
77.17.1.1	0.01	525	8	0.02	2.29	1.0	.1574	0.3	2428	5	4
Analyses >10% discordant (n = 6)											
77.44.1.1	0.17	77	25	0.34	2.34	1.5	.1832	1.5	2682	24	17
77.13.1.1	0.04	227	205	0.93	2.46	1.3	.1700	0.3	2558	6	16
77.19.1.1	0.01	163	17	0.11	2.39	1.2	.1647	0.4	2505	7	11
77.9.1.1	0.12	153	27	0.18	2.47	1.7	.1626	0.6	2483	10	13
77.55.1.1	0.35	870	270	0.32	2.58	1.0	.1613	0.6	2469	10	17
77.60.1.1	0.80	706	188	0.28	2.89	1.5	.1581	0.7	2435	12	27

37. CUNYARIE GRANITE: 2009371027

GA Sample ID:	**2009371027**
GA Sample Number:	**1999463**
Other Sample ID:	
1:250,000 Sheet:	**YARDEA SI 53-3**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS84):	**620993 6358609 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**4/7/2009**
Formal Name:	
Informal Name:	
Lithology:	**granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6105**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**23 – 27/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.54% (2σ) [41 of 41]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.8 ± 1.8 Ma [20 of 20]**
Interpreted Age:	**1598 ± 7 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

The Cunyarie Granite is located ~25 km north of the town of Kimba, northern Eyre Peninsula, South Australia. This sample consists of coarse-grained undeformed, orange-weathering granite with distinctive large, equant quartz and pink feldspar phenocrysts (Figure 37.1). It is mapped as part of the Hiltaba Suite.

Figure 37.1. *Texture of Cunyarie Granite; sample 2009371027.*

Zircon Description

Zircons from this sample are good quality, optically clear, subhedral grains and fragments. In cathodoluminescence (CL) images the majority of grains exhibit concentric, oscillatory zoning. A few of the larger grain fragments show uniform CL response. No morphologically-distinct zircon cores that might represent inherited zircon were found in the separated zircon fraction.

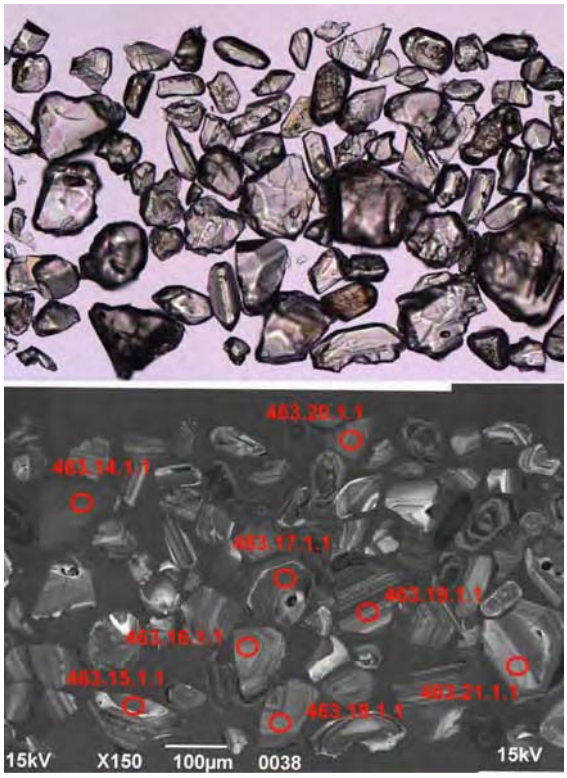

Figure 37.2. *Representative transmitted light and cathodoluminescence images of zircons from the Cunyarie Granite (2008371027), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 25 analyses were collected from 25 different zircon grains (Figure 37.3). Two analyses are >10% discordant. The remaining 23 analyses cluster in a single age population with a weighted mean $^{207}Pb/^{206}Pb$ age of 1598 ± 7 Ma (95% confidence; MSWD = 1.17; probability of fit = 0.27; Figure 37.4). Zircon from this sample contain between ~60 and 250 ppm U, and have Th/U ratios between ~0.6 and 1.5.

Geochronological Interpretation

The weighted mean age of 1598 ± 7 Ma is interpreted as the time of igneous crystallisation of this granite. No evidence of zircon inheritance was found in the separated zircon fraction.

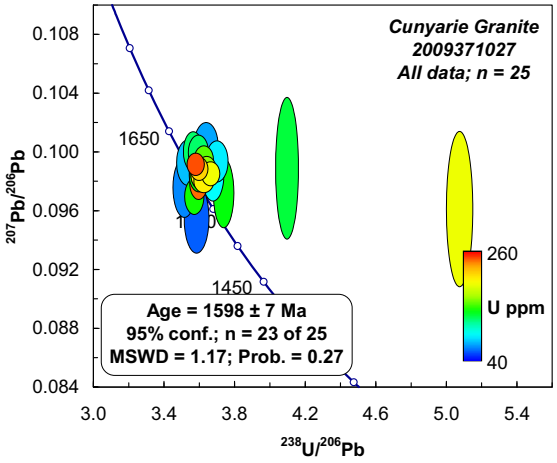

Figure 37.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Cunyarie Granite (2009371027).*

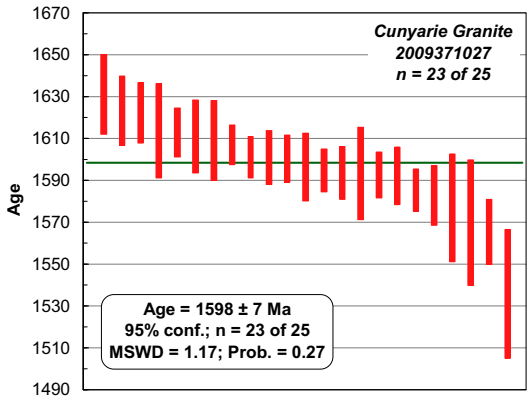

Figure 37.4. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of near-concordant zircon analyses from the Cunyarie Granite (2009371027).*

Table 37.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371027 (1999463), Cunyarie Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Igneous zircon (n = 23)											
463.2.1.1	-0.09	72	46	0.66	3.63	1.2	.1004	1.0	1631	19	4
463.3.1.1	-0.18	124	101	0.84	3.56	1.1	.1000	0.9	1623	17	2
463.24.1.1	0.00	124	177	1.48	3.59	1.0	.0999	0.8	1622	14	2
463.10.1.1	0.17	69	47	0.70	3.59	1.2	.0994	1.2	1613	23	2
463.20.1.1	0.02	155	85	0.57	3.62	1.0	.0994	0.6	1613	12	3
463.7.1.1	0.08	88	72	0.84	3.69	1.1	.0993	0.9	1611	17	4
463.23.1.1	-0.08	77	110	1.47	3.52	1.2	.0992	1.0	1609	19	0
463.17.1.1	0.03	247	180	0.75	3.57	0.9	.0991	0.5	1607	10	1
463.14.1.1	0.00	216	262	1.25	3.59	0.9	.0988	0.5	1601	10	1
463.9.1.1	0.06	171	179	1.08	3.61	1.0	.0988	0.7	1601	13	1
463.19.1.1	-0.01	165	156	0.98	3.63	1.0	.0987	0.6	1600	11	2
463.1.1.1	0.08	105	90	0.88	3.59	1.1	.0985	0.9	1596	16	1
463.5.1.1	0.00	196	156	0.82	3.66	1.0	.0984	0.6	1595	10	2
463.11.1.1	0.03	154	121	0.81	3.60	1.0	.0984	0.7	1593	13	1
463.21.1.1	0.18	93	60	0.66	3.67	1.1	.0984	1.2	1593	22	3
463.12.1.1	-0.04	198	132	0.69	3.60	1.0	.0983	0.6	1592	11	1
463.18.1.1	0.00	143	119	0.86	3.59	1.0	.0983	0.7	1592	14	0
463.8.1.1	0.02	205	267	1.35	3.62	1.1	.0979	0.5	1585	10	1
463.22.1.1	0.03	243	188	0.80	3.59	0.9	.0978	0.8	1583	14	0
463.13.1.1	0.18	66	48	0.75	3.51	1.2	.0975	1.4	1577	26	-3
463.4.1.1	0.92	139	175	1.30	3.73	1.0	.0971	1.6	1570	30	3
463.25.1.1	0.10	143	69	0.50	3.56	1.0	.0969	0.8	1565	16	-2
463.6.1.1	0.39	58	50	0.90	3.58	1.3	.0954	1.6	1535	31	-3
Analyses >10% discordant (n = 2)											
463.16.1.1	2.34	131	96	0.76	4.09	1.1	.0988	3.2	1602	60	14
463.15.1.1	2.68	194	439	2.33	5.08	1.0	.0960	3.6	1548	69	34

38. CARAPPEE GRANITE: 2008371033

GA Sample ID:	**2008371033**
GA Sample Number:	**1958071**
Other Sample ID:	
1:250,000 Sheet:	**KIMBA SI 53-7**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**618417 6302091 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**22/5/2008**
Formal Name:	**Carappee Granite**
Informal Name:	
Lithology:	**K-feldspar megacrystic granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6066**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**19 – 22/10/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.49% (2σ) [26 of 27]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.2 ± 2.4 Ma [14 of 14]**
Interpreted Age:	**1720 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

Carappee Hill is located ~35 km northwest of the town of Cleve, Eyre Peninsula, South Australia. This sample was collected from the base of Carappee Hill on its southeastern side. The sample is a coarse-grained, homogeneous granite composed of elongate K-feldspar phenocrysts up to ~3cm long, in a quartz, plagioclase, biotite matrix (Figure 38.1). A sub-vertical foliation trends ~north-south. Abundant blue anatase (TiO2) was noted in this sample during the zircon mineral separation process.

Figure 38.1. *Texture of Carappee Granite; sample 2008371033.*

Zircon Description

Zircons from this sample occur as clear, rounded, subhedral, equant grains, generally less than 100 μm in diameter (Figure 38.2). These grains are unusual for an igneous rock, many showing cuspate outer surfaces suggesting partial resorbtion of zircon. This may be consistent with influx of fluid that may be responsible for the abundant anatase in this sample. No other obvious signs of fluid alteration, such as epidote veining, was noted in the field. The zircons from this rock exhibit oscillatory internal zoning in cathodoluminescence (CL) images and in some cases this zoning is also evident in transmitted light. The zircons are most simply interpreted as

of primary igneous origin, and appear to have undergone some post-crystallisation resorbtion.

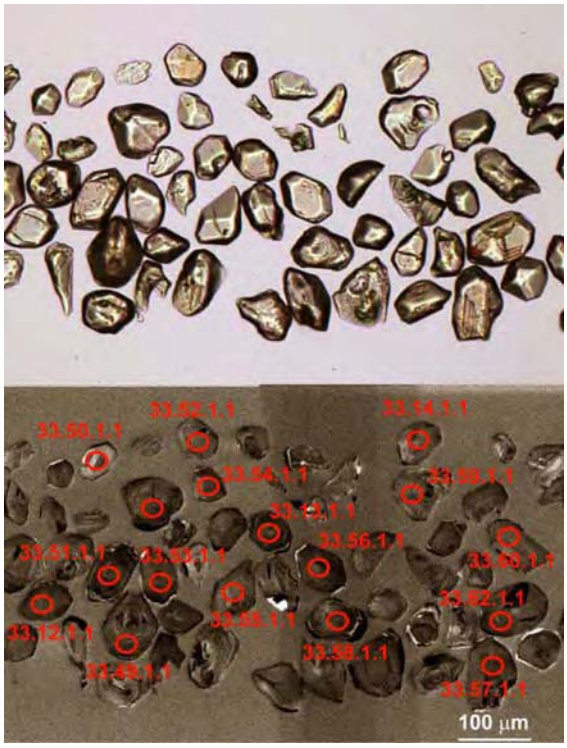

Figure 38.2. *Representative transmitted light and cathodoluminescence images of zircons from the Carappee Granite (2008371033), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Twenty-eight analyses were collected from the Carappee Granite during this analytical session. Of these, four analyses (33.41.1.1, 33.42.1.1, 33.47.1.1, 33.59.1.1) are >10% discordant, and have not been included in the geological interpretation. The remaining 24 analyses yield a single age population with a weighted mean $^{207}Pb/^{206}Pb$ age of 1720 ± 3 Ma (95% confidence; MSWD = 1.17; probability of fit = 0.26; Figure 38.3). The four analyses that are >10% discordant yield $^{207}Pb/^{206}Pb$ ages within uncertainty of the mean age, indicating that Pb-loss was recent.

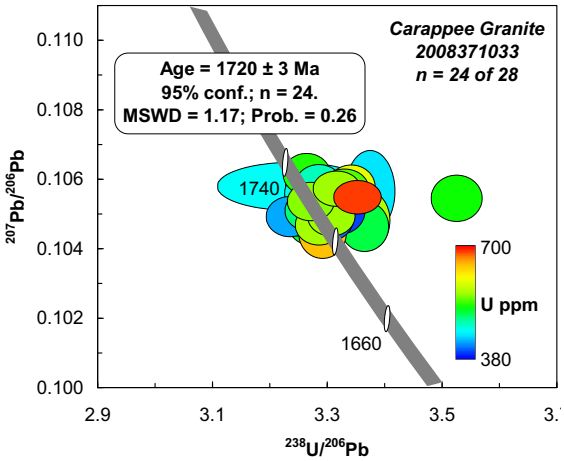

Figure 38.3. *Tera-Wasserburg concordia diagram showing results of near-concordant zircon analyses from the Carappee Granite (2008371033), coloured according to U content.*

Geochronological Interpretation

The weighted mean age of 1720 ± 3 Ma is interpreted as the time of igneous crystallisation of this granite.

Table 38.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371033 (1958071), Carappee Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Igneous zircon (n = 24)											
33.63.1.1	0.01	428	153	0.37	3.24	0.8	.1049	0.4	1713	7	-1
33.64.1.1	0.05	450	146	0.33	3.25	0.8	.1050	0.4	1714	7	-1
33.65.1.1	0.06	513	164	0.33	3.27	0.8	.1050	0.6	1715	11	0
33.52.1.1	0.14	458	1193	2.69	3.24	2.7	.1058	0.4	1728	8	0
33.51.1.1	0.21	646	171	0.27	3.29	0.8	.1044	0.5	1704	8	0
33.61.1.1	0.04	498	150	0.31	3.27	0.8	.1051	0.4	1716	7	0
33.43.1.1	0.06	565	178	0.33	3.29	0.8	.1047	0.4	1708	7	0
33.46.1.1	0.05	559	175	0.32	3.27	0.8	.1053	0.3	1720	6	0
33.67.1.1	0.05	463	129	0.29	3.27	0.8	.1056	0.4	1724	7	0
33.62.1.1	0.06	463	141	0.31	3.27	0.8	.1057	0.5	1727	8	0
33.55.1.1	0.08	409	251	0.63	3.30	0.9	.1049	0.4	1712	8	0
33.57.1.1	0.06	564	198	0.36	3.31	0.8	.1049	0.4	1713	7	1
33.48.1.1	0.08	534	116	0.22	3.26	0.8	.1061	0.4	1734	7	1
33.60.1.1	0.04	481	150	0.32	3.29	0.8	.1058	0.4	1729	7	1
33.50.1.1	0.05	399	221	0.57	3.32	0.9	.1051	0.4	1716	8	1
33.45.1.1	0.08	457	265	0.60	3.32	0.8	.1053	0.5	1720	8	1
33.53.1.1	0.01	565	206	0.38	3.32	0.8	.1057	0.3	1727	6	2
33.68.1.1	0.21	510	247	0.50	3.37	0.8	.1046	0.5	1708	8	2
33.54.1.1	-0.01	546	190	0.36	3.33	0.8	.1058	0.3	1727	6	2
33.49.1.1	0.13	574	167	0.30	3.37	0.8	.1048	0.6	1711	10	2
33.56.1.1	0.04	686	207	0.31	3.35	0.8	.1055	0.3	1723	6	2
33.58.1.1	0.00	599	210	0.36	3.34	0.8	.1058	0.4	1728	7	2
33.44.1.1	0.44	447	105	0.24	3.37	0.8	.1056	0.7	1726	14	3
33.66.1.1	0.09	529	199	0.39	3.53	0.8	.1054	0.4	1722	8	7
Analyses >10% discordant (n = 4)											
33.59.1.1	0.27	552	298	0.56	3.79	0.8	.1052	0.5	1718	10	14
33.42.1.1	0.18	628	233	0.38	4.68	0.9	.1061	0.9	1734	17	39
33.47.1.1	0.83	1014	304	0.31	7.06	0.8	.1039	1.1	1695	21	98
33.41.1.1	1.64	1289	2729	2.19	9.58	0.8	.1053	2.0	1720	37	169

39. MEGACRYSTIC GNEISS, BASCOMBE ROCKS: 2009371026

GA Sample ID:	**2009371026**
GA Sample Number:	**1999462**
Other Sample ID:	
1:250,000 Sheet:	**KIMBA SI 53- 7**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**618528 6347447 Zone 53**
Collector:	**G. Fraser & N. Neumann**
Collection Date:	**4/7/2009**
Formal Name:	
Informal Name:	
Lithology:	**K-feldspar megacrystic, biotite gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6104**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**16 - 17/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.43% (2σ) [35 of 37]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.1 ± 1.8 Ma [19 of 19]**
Interpreted Age:	**2004 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

Bascombe Rocks is located ~20 km northwest of the town of Kimba, Eyre Peninsula, South Australia. Outcrop at Bascombe Rocks consists of extensive horizontal pavements of gneiss and granite. This sample is a coarse-grained, quartzofeldspathic gneiss with prominent, discontinuous biotite schlieren (Figure 39.1). This is the dominant rock-type at Bascombe Rocks, and has been mapped as an equivalent to the Carappee Granite (Flint and Rankin, 1989) (see Sample 2008371033).

Figure 39.1. *Texture of megacrystic gneiss, Bascombe Rocks; sample 2009371026.*

Zircon Description

Zircon from this sample occurs as euhedral grains or fragments, with aspect ratios between 1 and 3 and between 100 and 200 µm in long dimension. In cathodoluminescence (CL) images, most grains exhibit concentric, oscillatory zoning. In some grains oscillatory zoning appears to have been modified to a patchy or mottled appearance (Figure 39.2).

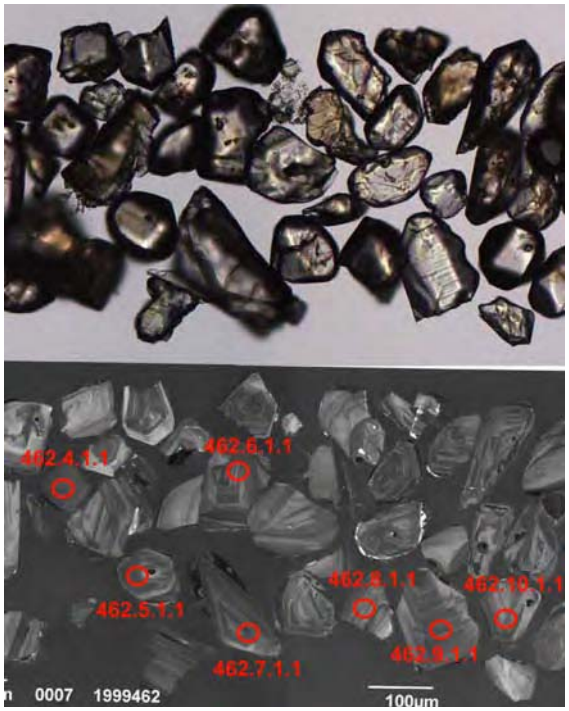

Figure 39.2. *Representative transmitted light and cathodoluminescence images of zircons from the megacrystic gneiss, Bascombe Rocks (2008371026), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 28 analyses were collected on 26 different zircon grains. All but three of these analyses plot near concordia in a cluster at ~2000 Ma (Figure 39.3). Of the 3 exceptions, two are slightly discordant and trend away from the main cluster in a trajectory consistent with minor modern Pb-loss. One analysis (462.14.1.1) is 6% discordant and appears to have experienced some ancient Pb-loss. This analysis is from a grain that is dark in transmitted light and shows a mottled CL pattern suggestive of lattice damage. These three discordant analyses have not been included in pooled age calculation.

Of the remaining 25 analyses, 24 define a weighted mean $^{207}Pb/^{206}Pb$ age of 2004 ± 3 Ma (95% confidence; MSWD = 1.11; probability of fit = 0.62; Figure 39.4). The only one of these 25 analysis rejected in this calculation is 462.20.1.1, which lies at the young end of the main age population, with a $^{207}Pb/^{206}Pb$ of 1980 ± 3 Ma (Figure 39.4). This analysis comes from a partly opaque grain with mottled CL pattern, suggestive of crystal lattice damage. This analysis also contains by far the highest U content (1513 ppm) of zircon analysed from this sample. It is suggested that this grain has experience subtle Pb-loss.

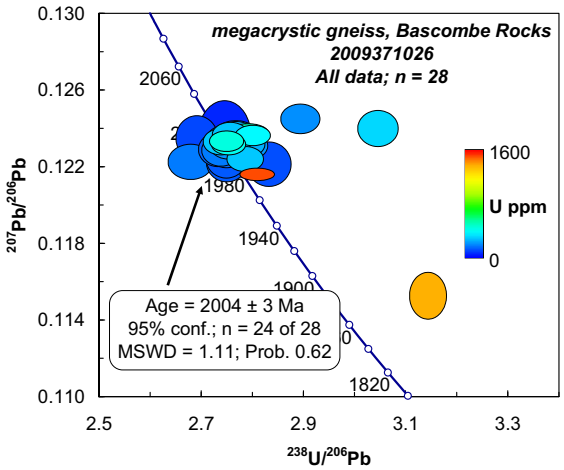

Figure 39.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the megacrystic gneiss at Bascombe Rocks (2009371026), coloured according to U content.*

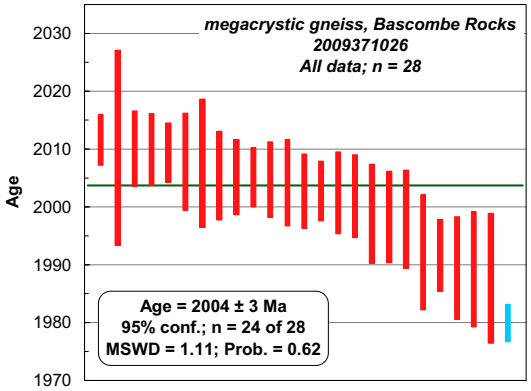

Figure 39.4. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of zircon analyses from the megacrystic gneiss at Bascombe Rocks (2009371026). Blue bar indicates an analysis not included in the mean age calculation.*

Geochronological Interpretation

The mean age of 2004 ± 3 Ma is interpreted as the igneous age of the protolith to this gneiss.

Table 39.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371026 (1999462), megacrystic gneiss, Bascombe Rocks.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
~2000 Ma igneous zircon (n = 24)											
462.19.1.1	0.00	520	310	0.62	2.79	0.9	.1238	0.2	2012	4	2
462.12.1.1	0.15	50	39	0.79	2.75	1.2	.1237	1.0	2010	17	0
462.25.1.1	-0.04	261	238	0.94	2.77	0.8	.1237	0.4	2010	7	1
462.9.1.1	0.02	277	229	0.86	2.76	0.8	.1237	0.4	2010	6	1
462.7.1.1	0.00	374	309	0.85	2.80	0.8	.1236	0.3	2010	5	2
462.16.1.1	-0.02	145	74	0.52	2.77	1.1	.1235	0.5	2008	8	1
462.26.1.1	-0.09	98	51	0.54	2.69	1.0	.1235	0.6	2008	11	-1
462.24.1.1	0.01	179	108	0.62	2.75	0.9	.1234	0.4	2005	8	0
462.22.1.1	0.01	260	186	0.74	2.76	0.8	.1234	0.4	2005	7	1
462.11.1.1	0.02	437	390	0.92	2.75	0.8	.1233	0.3	2005	5	0
462.11.2.1	0.04	282	202	0.74	2.74	0.8	.1233	0.4	2005	7	0
462.5.1.1	0.01	302	263	0.90	2.76	0.8	.1233	0.4	2004	7	1
462.6.1.1	0.01	250	193	0.80	2.79	0.9	.1232	0.4	2003	6	1
462.17.2.1	0.02	411	266	0.67	2.75	0.8	.1232	0.3	2003	5	0
462.17.1.1	0.02	211	121	0.59	2.75	0.9	.1232	0.4	2003	7	0
462.15.1.1	0.04	214	152	0.74	2.79	0.9	.1231	0.4	2002	7	1
462.1.1.1	0.00	138	72	0.54	2.73	0.9	.1229	0.5	1999	9	-1
462.8.1.1	0.02	173	90	0.54	2.74	0.9	.1229	0.4	1998	8	0
462.21.1.1	0.01	148	73	0.51	2.75	0.9	.1228	0.5	1998	9	0
462.13.1.1	0.13	124	66	0.55	2.75	1.0	.1224	0.6	1992	10	0
462.4.1.1	0.02	282	188	0.69	2.79	0.8	.1224	0.4	1992	6	1
462.10.1.1	0.12	173	112	0.67	2.68	1.1	.1223	0.5	1989	9	-3
462.23.1.1	0.06	125	70	0.58	2.75	1.0	.1222	0.6	1989	10	0
462.3.1.1	0.03	109	57	0.54	2.83	1.0	.1221	0.6	1988	11	2
High U zircon subject to minor ancient Pb-loss (n = 1)											
462.20.1.1	0.05	1513	108	0.07	2.81	0.8	.1216	0.2	1980	3	1
Analyses >5% discordant and or containing >0.5% $^{206}Pb_c$ (n = 3)											
462.18.1.1	-0.02	202	120	0.61	2.89	0.9	.1245	0.4	2022	7	6
462.2.1.1	0.06	309	229	0.77	3.05	0.9	.1240	0.5	2015	9	10
462.14.1.1	0.65	1372	609	0.46	3.14	0.8	.1152	0.7	1883	13	6

40. GREY GRANITE, BASCOMBE ROCKS: 2009371025

GA Sample ID:	**2009371025**
GA Sample Number:	**1999461**
Other Sample ID:	
1:250,000 Sheet:	**KIMBA SI 53- 7**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**618286 6347344 Zone 53**
Collector:	**G. Fraser & N. Neumann**
Collection Date:	**22/5/2008**
Formal Name:	
Informal Name:	
Lithology:	**foliated biotite granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6104**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**17/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.43% (2σ) [35 of 37]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.1 ± 1.8 Ma [19 of 19]**
Interpreted Age:	**1722 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

Bascombe Rocks is located ~20 km northwest of the town of Kimba, Eyre Peninsula, South Australia. Outcrop at Bascombe Rocks consists of extensive horizontal pavements of gneiss and granite. This sample is a medium-grained, grey, foliated, biotite granite (Figure 40.1), collected from a low, quarried rockwall in the NW part of the outcrop at Bascombe Rocks.

Figure 40.1. *Texture of grey granite, Bascombe Rocks; sample 2009371025.*

Zircon Description

Zircons in this sample occur as euhedral grains and fragments, typically equant and approximately 100 μm in diameter. All grains exhibit concentric, oscillatory zoning in cathodoluminescence (CL) images. Many grains contain bright CL inclusions. There is no morphological evidence for multiple stages of zircon growth in this sample.

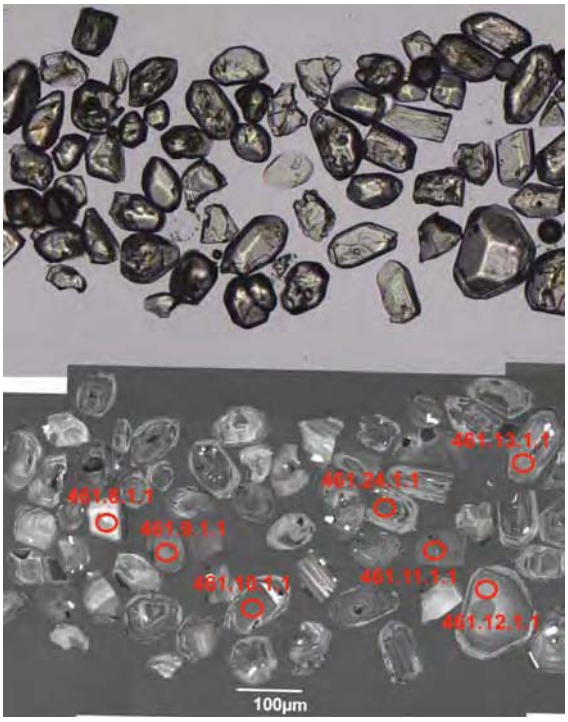

Figure 40.2. *Representative transmitted light and cathodoluminescence images of zircons from the grey granite at Bascombe Rocks (2009371025), with locations of some SHRIMP analyses.*

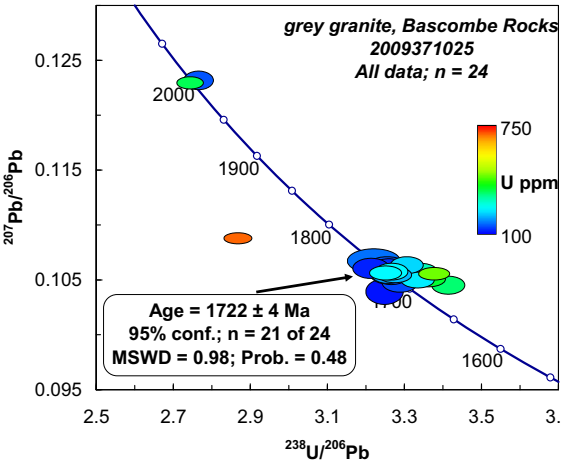

Figure 40.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the grey granite at Bascombe Rocks (2009371025), coloured according to U content.*

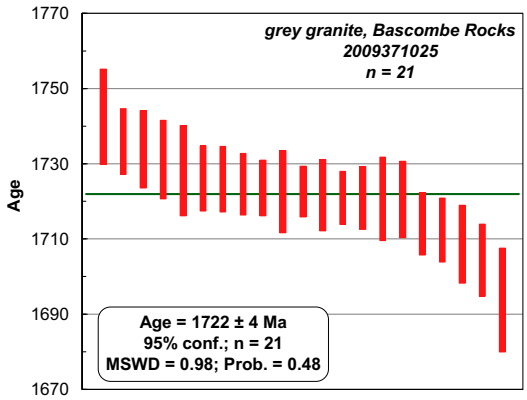

Figure 40.4. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of zircon analyses from the grey granite at Bascombe Rocks (2009371025).*

U-Pb Isotopic Results

A total of 24 analyses were collected from 24 different zircon grains (Figure 40.3). Twenty-one of these analyses combine to yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1722 ± 4 Ma (95% confidence; MSWD = 0.98; probability of fit = 0.48; Figure 40.4). A single analysis is 8% reversely discordant and has not been included in age calculations. This analysis also contains the highest U content (~700 ppm) measured from this sample. Two analyses plot near concordia with $^{207}Pb/^{206}Pb$ ages of 2000 ± 10 Ma (2σ) and 2004 ± 16 Ma (2σ), and are interpreted as inherited zircon, consistent with the age of the host gneiss (see sample 2009371026).

Geochronological Interpretation

The mean age of 1722 ± 4 Ma is interpreted as the igneous crystallisation age of this granite. The two ages of ~2000 Ma are interpreted as xenocrystic zircon, consistent with derivation from, or assimilation of, megacrystic gneiss at Bascombe Rocks (see sample 2009371026).

Table 40.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371025 (1999461), grey granite, Bascombe Rocks.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited zircon (n = 2)											
461.8.1.1	0.00	148	116	0.81	2.77	0.9	.1233	0.5	2004	8	1
461.10.1.1	0.00	357	356	1.03	2.74	0.8	.1230	0.3	2000	5	0
~1720 Ma igneous zircon (n = 21)											
461.15.1.1	-0.01	164	232	1.46	3.22	1.4	.1066	0.7	1743	13	0
461.5.1.1	0.04	226	375	1.72	3.31	0.9	.1062	0.5	1736	9	2
461.6.1.1	0.01	149	191	1.33	3.26	1.1	.1061	0.6	1734	10	0
461.14.1.1	0.00	118	142	1.24	3.21	1.0	.1060	0.6	1731	10	-1
461.2.1.1	-0.05	124	172	1.44	3.26	1.0	.1058	0.7	1728	12	0
461.13.1.1	0.07	251	322	1.33	3.27	0.8	.1057	0.5	1726	9	0
461.18.1.1	0.16	307	459	1.54	3.34	0.9	.1057	0.5	1726	9	2
461.23.1.1	0.00	195	322	1.71	3.30	0.9	.1056	0.4	1725	8	1
461.20.1.1	-0.01	252	284	1.17	3.25	0.8	.1055	0.4	1724	7	0
461.19.1.1	0.19	190	201	1.09	3.26	1.0	.1055	0.6	1723	11	0
461.24.1.1	0.15	450	512	1.17	3.38	0.8	.1055	0.4	1723	7	3
461.9.1.1	0.07	189	181	0.99	3.26	0.9	.1054	0.5	1722	9	0
461.11.1.1	-0.01	294	328	1.15	3.29	1.0	.1054	0.4	1721	7	1
461.1.1.1	-0.01	207	267	1.33	3.28	0.9	.1054	0.5	1721	8	0
461.22.1.1	0.10	156	200	1.32	3.32	0.9	.1054	0.6	1721	11	1
461.3.1.1	0.02	152	202	1.38	3.27	0.9	.1054	0.6	1721	10	0
461.16.1.1	0.15	374	612	1.69	3.36	0.9	.1050	0.4	1714	8	2
461.4.1.1	0.05	243	434	1.85	3.33	0.9	.1049	0.5	1712	9	1
461.12.1.1	0.03	141	212	1.55	3.29	0.9	.1047	0.6	1709	10	0
461.17.1.1	0.24	343	382	1.15	3.41	0.8	.1044	0.5	1704	10	3
461.21.1.1	0.07	110	117	1.10	3.25	1.0	.1038	0.7	1694	14	-2
Reversely discordant analysis											
461.7.1.1	0.14	702	306	0.45	2.87	0.8	.1087	0.3	1778	5	-8

41. BLUE RANGE BEDS, NINGANA: 2008371031

GA Sample ID:	**2008371031**
GA Sample Number:	**1958069**
Other Sample ID:	
1:250,000 Sheet:	**KIMBA SI 53-7**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**627329 6279817 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**21/5/2008**
Formal Name:	**Blue Range Beds**
Informal Name:	
Lithology:	**Red Sandstone**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6102**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**06 – 12/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.73% (2σ) [20 of 22]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.4 ± 2.6 Ma [19 of 19]**
Acquisition Date:	**06 – 12/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.12% (2σ) [8 of 8]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.7 ± 4.5 Ma [9 of 9]**
Interpreted Age:	**1750 ± 14 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample of the Blue Range Beds was collected from near Ningana Station, in the Cowell-Cleve Hills of Eyre Peninsula, South Australia. The sample was collected ~50 m above the base of the outcrop, which grades up from a conglomeratic basal unit to a sandstone, from a pink, coarse-grained to gritty silicified sandstone (Figure 41.1).

Figure 41.1. *Cross-bedded gritty sandstone of the Blue Range Beds from near Ningana Station (sample 2008371031), with pen for scale.*

Zircon Description

Zircons from this sample range from ~80 - 170 µm in length, and are clear and colourless. Some grains have an euhedral morphology with preserved prismatic terminations, whereas other grains are sub-rounded (Figure 41.2). Cathodoluminescence images record oscillatory zoning within most grains, while some grains have a dark cathodoluminescence character.

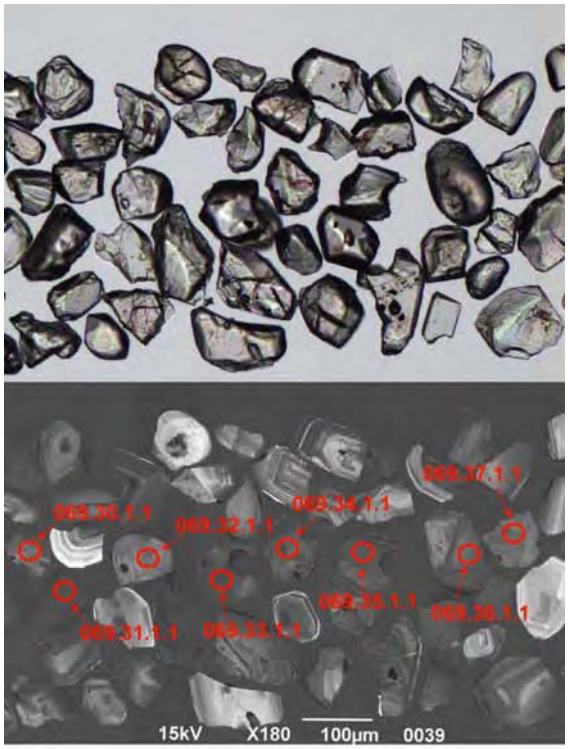

Figure 41.2. *Representative transmitted light and cathodoluminescence images of zircons from the Blue Range Beds (2008371031), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Sixty-eight analyses were undertaken, and two analyses with common Pb contents greater than an arbitrary value of 0.5% were excluded from further consideration. The remaining 66 analyses range in age from ~3116 Ma to ~1696 Ma (Figure 41.3). The age spectrum includes individual ages at ~3116 Ma, ~2978 Ma, and ~2801 Ma, five ages between ~2562 Ma and ~2491 Ma, a large group (n = 17) of ages between ~2035 Ma and ~1962 Ma, two ages at ~1912 Ma and another large cluster of ages (n = 39) between 1863 Ma and the youngest individual at ~1696 Ma. The large MSWD of 7.5 for the youngest cluster indicates that it is not a single population, and mixture modelling for 2 components suggests ages at 1756 ± 15 Ma (37% of the group) and 1839 ± 7 Ma (63% of the group).

Alternatively, using the MSWD and probability of fit of the weighted mean age as a statistical guide provides a $^{207}Pb/^{206}Pb$ age of 1750 ± 14 Ma (95% confidence; MSWD = 1.6; probability of fit = 0.08) for the youngest 13 analyses (Figure 41.4).

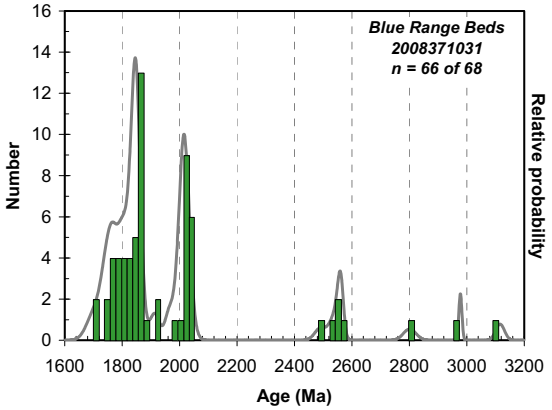

Figure 41.3. *Probability density diagram of zircon analyses from the Blue Range Beds (2008371031).*

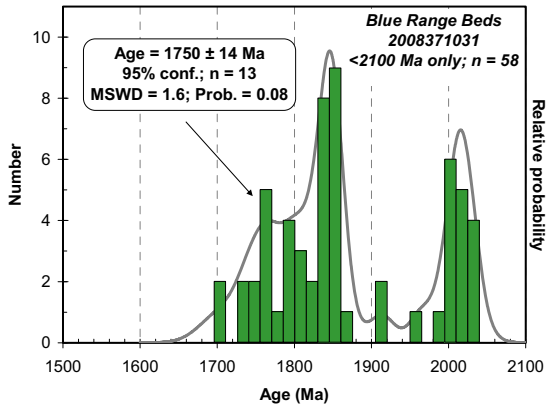

Figure 41.4. *Probability density diagram of zircon analyses from the Blue Range Beds (2008371031) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

Geochronological Interpretation

The weighted mean age of 1750 ± 14 Ma (95% confidence; n = 13) can be used to define a maximum depositional age for this sample of the Blue Range Beds.

Table 41.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371031 (1958069), Blue Range Beds, Ningana.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircon (n = 66)											
069.14.1.1	-0.02	175	98	0.58	1.60	2.8	.2394	1.0	3116	15	-1
069.68.1.1	-0.01	435	14	0.03	1.62	1.6	.2196	0.3	2978	5	-4
069.36.1.1	-0.02	100	41	0.42	1.77	2.7	.1970	1.3	2801	22	-3
069.12.1.1	0.03	214	159	0.77	2.08	2.0	.1704	0.5	2562	9	1
069.62.1.1	0.02	97	25	0.27	2.08	2.2	.1700	0.7	2558	11	1
069.21.1.1	0.01	87	50	0.60	2.20	2.3	.1696	0.8	2553	14	5
069.27.1.1	0.06	65	63	1.00	2.01	2.5	.1675	0.9	2533	16	-3
069.53.1.1	-0.04	91	33	0.37	2.16	2.2	.1634	1.2	2491	20	2
069.17.1.1	-0.05	116	49	0.43	2.80	2.2	.1254	0.9	2035	16	3
069.51.1.1	0.00	181	127	0.73	2.76	2.0	.1251	0.6	2030	11	2
069.5.1.1	-0.01	95	58	0.62	2.66	2.2	.1250	0.9	2029	16	-1
069.58.1.1	-0.04	178	142	0.83	2.85	2.0	.1249	0.7	2028	12	5
069.52.1.1	-0.03	112	97	0.89	2.85	2.1	.1245	1.4	2022	24	4
069.4.1.1	0.08	141	83	0.60	2.75	2.1	.1244	0.8	2021	15	1
069.15.1.1	-0.05	252	121	0.50	2.76	2.0	.1241	0.6	2016	11	1
069.22.1.1	0.03	163	156	0.99	2.80	2.1	.1241	0.8	2016	14	2
069.10.1.1	-0.01	228	238	1.08	2.73	2.0	.1239	0.6	2012	11	0
069.7.1.1	0.05	196	204	1.08	2.75	2.1	.1237	0.7	2010	12	1
069.9.1.1	0.08	151	76	0.52	2.86	2.1	.1236	0.9	2009	16	4
069.8.1.1	-0.15	48	44	0.95	2.75	2.5	.1234	1.4	2006	26	0
069.46.1.1	0.15	133	142	1.10	2.81	2.4	.1233	1.0	2005	17	2
069.2.1.1	0.07	179	134	0.77	2.67	2.2	.1230	0.7	2001	12	-3
069.69.1.1	-0.03	75	60	0.83	2.67	1.9	.1230	1.2	2000	22	-2
069.32.1.1	0.12	130	60	0.48	2.73	2.2	.1220	1.0	1986	17	-1
069.13.1.1	0.08	166	119	0.74	2.78	2.1	.1204	0.7	1962	13	-1
069.65.1.1	0.08	162	111	0.70	3.02	2.1	.1172	0.8	1914	14	4
069.48.1.1	-0.05	115	211	1.89	2.98	2.1	.1169	1.6	1910	29	2
069.49.1.1	-0.02	166	96	0.60	3.11	2.1	.1140	0.8	1863	14	4
069.19.1.1	0.05	256	127	0.51	3.03	2.0	.1136	0.7	1858	12	1
069.35.1.1	-0.08	224	95	0.44	3.09	2.0	.1136	0.7	1857	13	3
069.31.1.1	-0.08	234	100	0.44	3.05	2.0	.1135	0.7	1856	12	2
069.38.1.1	0.08	164	82	0.52	3.09	2.1	.1135	0.8	1856	15	3
069.30.1.1	-0.01	137	84	0.64	3.06	2.1	.1131	0.9	1850	16	1
069.56.1.1	-0.13	28	38	1.41	3.29	2.8	.1131	1.9	1849	34	8
069.55.1.1	0.08	153	71	0.48	2.98	2.1	.1130	0.8	1849	14	-1
069.18.1.1	0.04	335	132	0.41	3.02	2.1	.1129	0.6	1847	10	0
069.40.1.1	0.05	192	85	0.46	2.96	2.0	.1129	0.7	1847	12	-2
069.6.1.1	0.02	273	157	0.59	3.04	2.0	.1128	0.6	1845	11	1
069.16.1.1	-0.04	163	88	0.56	2.92	2.1	.1128	0.8	1845	14	-3
069.57.1.1	0.00	192	107	0.58	3.13	2.2	.1126	0.7	1842	13	3
069.47.1.1	0.05	225	118	0.54	3.01	2.0	.1125	0.7	1840	12	-1
069.20.1.1	0.03	165	63	0.39	3.05	2.1	.1124	0.8	1839	15	1
069.25.1.1	0.07	189	93	0.51	2.99	2.1	.1122	0.7	1835	13	-1
069.44.1.1	0.00	142	72	0.53	3.18	2.1	.1121	0.8	1834	15	4
069.43.1.1	0.05	262	136	0.53	3.04	2.0	.1119	0.6	1830	11	0
069.28.1.1	0.05	143	100	0.72	3.09	2.1	.1114	1.0	1822	18	1
069.29.1.1	0.01	230	136	0.61	3.10	2.0	.1111	0.7	1817	12	1
069.39.1.1	-0.04	111	60	0.56	3.12	2.1	.1103	0.9	1804	17	1
069.26.1.1	0.06	127	83	0.67	3.20	2.2	.1102	1.0	1803	17	3
069.3.1.1	0.02	109	60	0.57	3.06	2.2	.1100	0.9	1800	17	-1
069.37.1.1	0.01	153	73	0.49	3.24	2.1	.1100	0.8	1800	15	4
069.60.1.1	-0.18	51	64	1.30	3.41	2.5	.1100	1.5	1799	28	8
069.24.1.1	0.08	138	75	0.56	3.25	2.1	.1094	1.0	1790	19	3
069.11.1.1	0.05	107	38	0.37	3.15	2.2	.1092	1.2	1786	22	0
069.50.1.1	0.14	139	68	0.51	3.31	2.1	.1083	1.0	1770	19	4
069.42.1.1	0.13	134	51	0.39	3.08	2.0	.1082	0.9	1769	17	-2
069.45.1.1	0.12	131	70	0.55	3.12	2.1	.1080	0.9	1767	16	-1
069.34.1.1	0.10	180	108	0.62	3.25	2.1	.1078	0.9	1762	17	2
069.41.1.1	0.05	160	69	0.45	3.19	2.1	.1075	0.8	1758	15	0
069.66.1.1	0.12	51	52	1.05	3.12	2.0	.1075	1.5	1757	28	-2
069.59.1.1	0.24	134	126	0.98	3.35	2.1	.1066	1.1	1742	20	3
069.61.1.1	0.04	203	161	0.82	3.25	2.0	.1065	0.8	1740	14	1
069.67.1.1	0.12	105	105	1.03	3.33	2.5	.1059	1.1	1730	20	2
069.54.1.1	0.12	71	117	1.70	3.26	2.3	.1057	1.4	1726	25	0

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
069.64.1.1	0.34	86	62	0.74	3.19	2.2	.1041	1.5	1698	28	-4
069.1.1.1	0.07	110	163	1.53	3.20	2.1	.1039	1.2	1696	22	-3
Analyses >0.5% $^{206}Pb_c$ (n = 2)											
069.23.1.1	1.01	138	288	2.16	3.06	2.5	.1209	1.7	1970	30	7
069.63.1.1	0.55	36	101	2.88	3.24	2.6	.1025	2.2	1670	40	-4

Southern Gawler Craton

COULTA DOMAIN

The Coulta Domain is interpreted to consist primarily of late Archean metasedimentary and volcanic rocks of the Sleaford Complex (Ferris *et al*., 2002), and is intruded by granite plutons of the ~1590 Ma Hiltaba Suite (Figure vii). The boundary with the Cleve Domain to the east is interpreted to be a major shear zone identified as a linear boundary in magnetic images. The western boundary of the Coulta Domain is also interpreted as a fault boundary, separating Archean rocks of the Coulta Domain from interpreted younger intrusive rocks of the Nuyts Domain to the west.

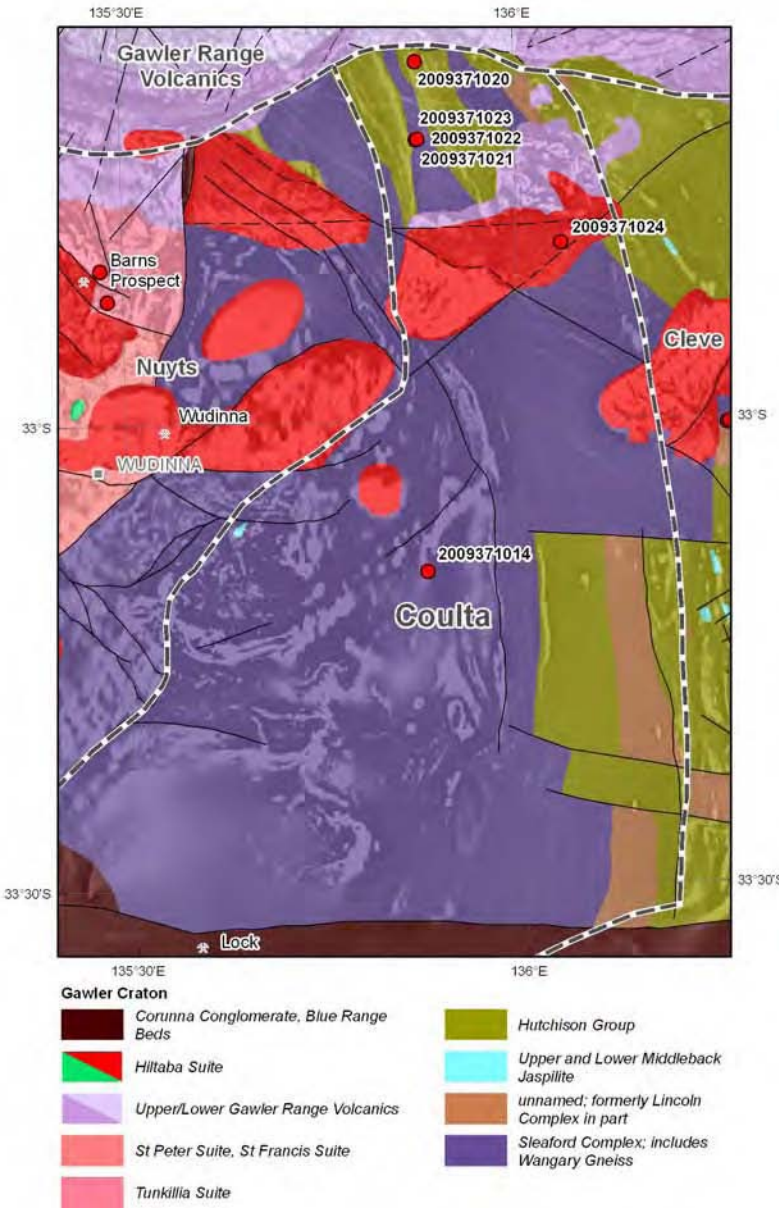

Figure vii. *Locations of new samples analysed for SHRIMP U-Pb zircon geochronology from the Coulta Domain, Gawler Craton, South Australia, displayed on a partially transparent solid geology map (Cowley, 2006) laid over a magnetic intensity image.*

42. BUCKLEBOO GRANITE, AT BUCKLEBOO STATION: 2009371024

GA Sample ID:	**2009371024**
GA Sample Number:	**1999460**
Other Sample ID:	
1:250,000 Sheet:	**YARDEA SI 53-3**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**599067 6369240 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**3/7/2009**
Formal Name:	**Buckleboo Granite**
Informal Name:	
Lithology:	**biotite granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6104**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**18/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.43% (2σ) [35 of 37]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.1 ± 1.8 Ma [19 of 19]**
Interpreted Age:	**1586 ± 6 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

This sample was collected a few hundred metres west of the Buckleboo homestead, northern Eyre Peninsula, South Australia, from near the Geoscience Australia seismic monitoring station. The rock is a purple, massive, undeformed biotite-bearing granite with prominent, blocky, K-feldspar phenocrysts and dark-grey quartz phenocrysts (Figure 42.1).

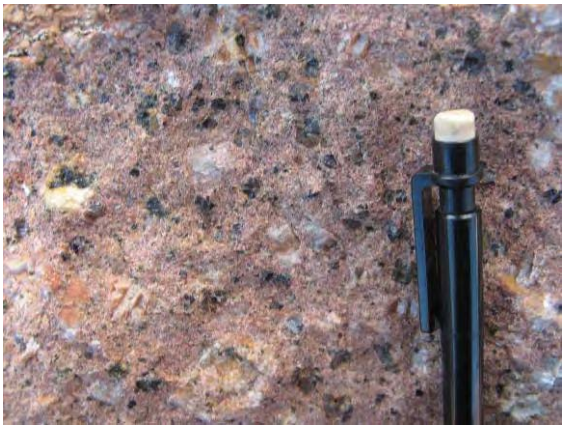

Figure 42.1. *Texture of Buckleboo Granite; sample 2009371024.*

Zircon Description

Zircon from this sample occurs as clear, euhedral grains with sharp pointed crystal terminations, typically with aspect ratios between 2 and 3. Cathodoluminescence (CL) images reveal well-preserved, fine-scale concentric, oscillatory zoning that is concordant with external crystal faces (Figure 42.2). There is no evidence for distinct, inherited zircon cores.

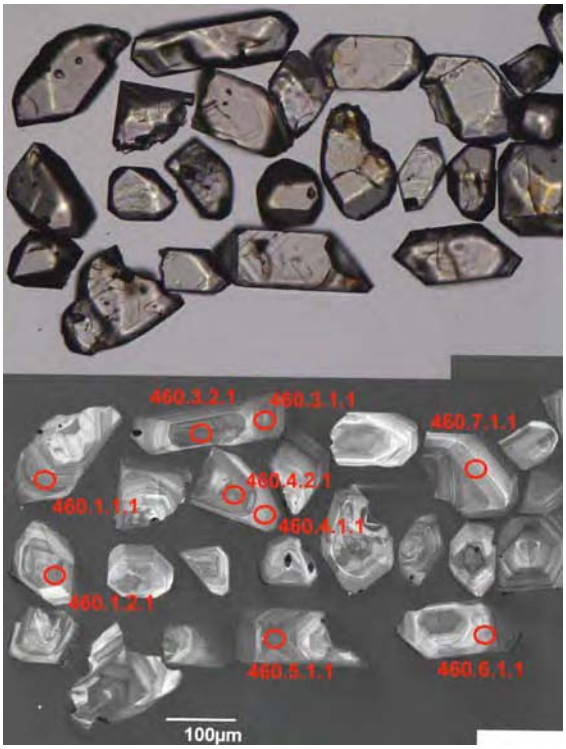

Figure 42.2. *Representative transmitted light and cathodoluminescence images of zircons from the Buckleboo Granite at Buckleboo Station (2009371024), with locations of some SHRIMP analyses.*

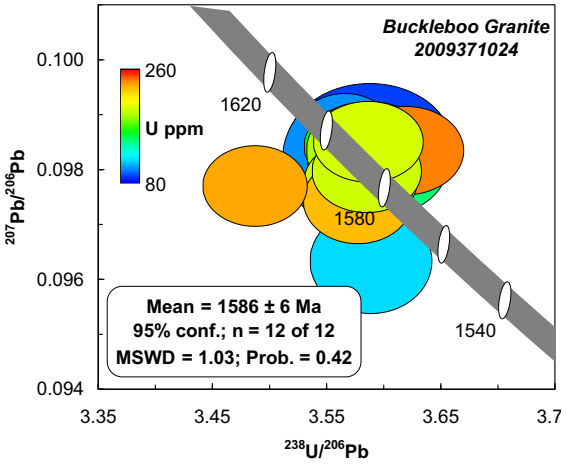

Figure 42.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Buckleboo Granite (2009371024), coloured according to U content.*

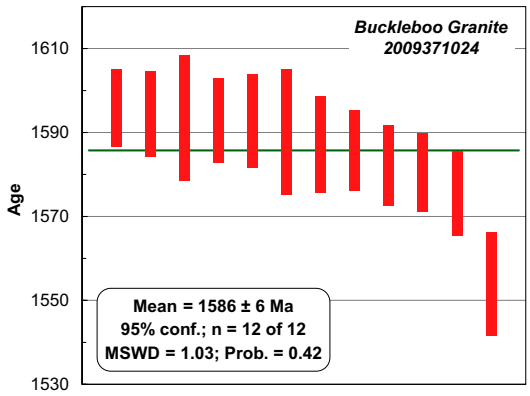

Figure 42.4. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of zircon analyses from the Buckleboo Granite (2009371024).*

U-Pb Isotopic Results

Twelve analyses were collected on ten different zircon grains. All analyses are near concordant (<3% discordant) and contain < 0.1 % $^{206}Pb_c$. All twelve analyses combine to yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1586 ± 6 Ma (95% confidence; MSWD = 1.03; probability of fit = 0.42; Figures 42.3 & 42.4).

Geochronological Interpretation

The age of 1586 ± 6 Ma is interpreted as the intrusive age of this granite, consistent with the mapping interpretation that it is part of the Hiltaba Suite.

Table 42.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371024 (1999460), Buckleboo Granite.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Igneous zircon (n = 12)											
460.9.1.1	-0.01	199	124	0.64	3.59	0.9	.0985	0.5	1596	9	1
460.8.1.1	0.00	164	103	0.65	3.59	1.0	.0984	0.5	1595	10	1
460.10.1.1	0.02	90	79	0.91	3.59	1.3	.0984	0.8	1594	15	1
460.5.1.1	0.08	243	132	0.56	3.62	0.9	.0983	0.5	1593	10	1
460.4.2.1	0.10	188	111	0.61	3.58	0.9	.0983	0.6	1593	11	0
460.7.1.1	0.03	103	59	0.59	3.57	1.0	.0982	0.8	1590	15	0
460.4.1.1	0.01	147	84	0.59	3.59	1.1	.0981	0.6	1587	12	0
460.2.1.1	0.01	197	162	0.85	3.58	0.9	.0980	0.5	1586	10	0
460.3.1.1	0.01	199	104	0.54	3.58	0.9	.0978	0.5	1582	10	0
460.3.2.1	0.05	237	185	0.81	3.49	0.9	.0977	0.5	1581	9	-3
460.1.1.1	0.05	231	138	0.62	3.58	0.9	.0974	0.5	1576	10	-1
460.6.1.1	-0.01	116	61	0.55	3.59	1.0	.0963	0.7	1554	12	-2

43. WARROW QUARTZITE, THURLGA STATION: 2009371020

GA Sample ID:	**2009371020**
GA Sample Number:	**1999456**
Other Sample ID:	
1:250,000 Sheet:	**YARDEA SI 53-3**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**582260 6391202 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**3/7/2009**
Formal Name:	**Warrow Quartzite**
Informal Name:	
Lithology:	**muscovite-bearing quartzite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6111**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**17 - 18/12/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.38% (2σ) [21 of 22]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.4 ± 2.5 Ma [10 of 10]**
Interpreted Age:	**2507 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample was collected from a prominent hill-forming quartzite on the southern part of Thurlga Station, near the southern extent of the Gawler Range Volcanics, Eyre Peninsula, South Australia. The sample is a relatively clean quartzite with a steeply dipping muscovite-foliation striking ~340° (Figure 43.1). This quartzite has been mapped as Warrow Quartzite and, therefore, interpreted as part of the Hutchison Group.

Figure 43.1. *Warrow Quartzite on Thurlga Station; sample 2009371020.*

Zircon Description

Zircons from this sample are of generally good quality. Larger grains tend to be more rounded and show surface pitting, whereas many of the slightly smaller grains retain subhedral morphologies. Most grains exhibit oscillatory internal zoning, evident in cathodoluminescence images (Figure 43.2).

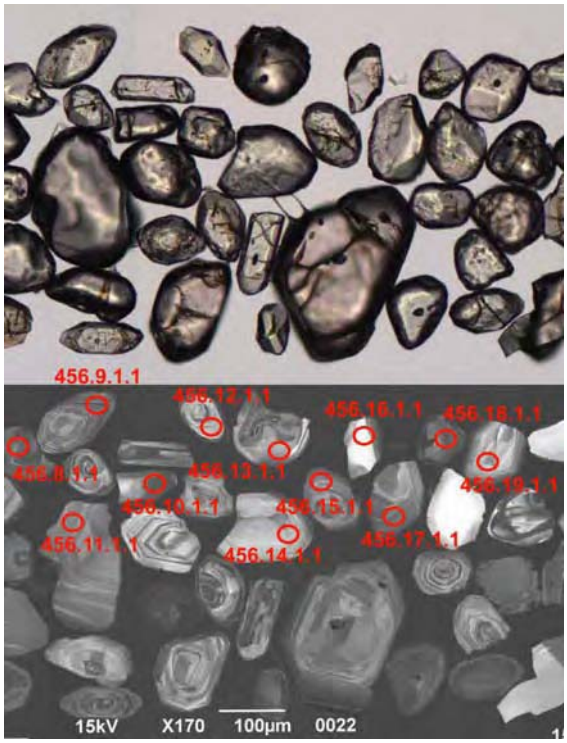

Figure 43.2. *Representative transmitted light and cathodoluminescence images of zircons from Warrow Quartzite at Thurlga Station (2009371020), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 67 analyses were collected from 67 different zircon grains. Two analyses are >10% discordant and have not been considered in geological interpretation (Figure 43.3). A single analysis (456.7.1.1), which is 3% discordant, yields the youngest age from this sample at~2240 Ma, from zircon with the highest U content (~1000 ppm). The geological significance of this single young age is uncertain. It might result from Paleoproterozoic Pb-loss from late Archean zircon, it might represent a contaminating zircon grain, or it may represent a real geological age component within this sedimentary rock. Without additional corroborating analyses of similar age we prefer not to attribute geological significance to this young outlier. The remaining 64 analyses yield $^{207}Pb/^{206}Pb$ ages between ~3000 and ~2500 Ma, with major clusters of ages at ~2700 Ma and ~2510 Ma (Figure 43.4). The youngest 13 analyses in the youngest major age cluster define a statistically coherent group with a weighted mean $^{207}Pb/^{206}Pb$ age of 2507 ± 5 Ma (95% confidence; MSWD = 1.7; probability of fit = 0.07).

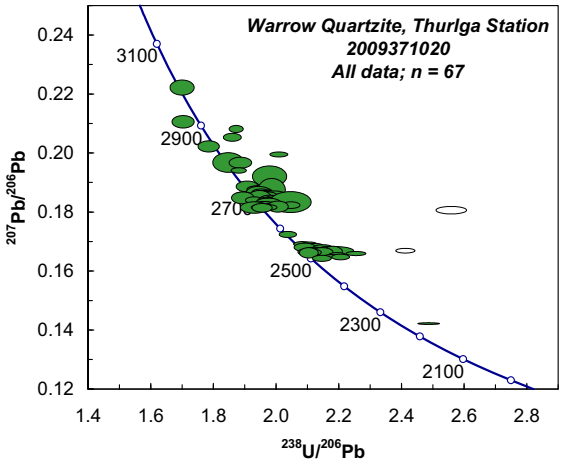

Figure 43.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the Warrow Quartzite on Thurlga Station (2009371020). Unfilled ellipses indicate discordant analyses not included in Figure 43.4.*

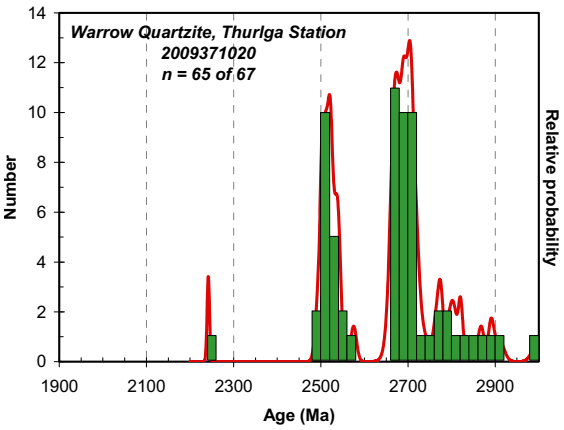

Figure 43.4. *Probability density diagram for zircon analyses from the Warrow Quartzite on Thurlga Station (2009371020).*

Geochronological Interpretation

The youngest statistically coherent group of analyses, with a weighted mean age of 2507 ± 5 Ma, is interpreted to represent a maximum age for the deposition of this sedimentary rock.

Table 43.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371020 (1999456), Warrow Quartzite, Thurlga Station.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircon (n = 64)											
456.52.1.1	0.13	26	10	0.41	1.69	1.5	.2223	0.8	2997	12	0
456.36.1.1	-0.02	29	59	2.07	1.70	1.4	.2105	0.7	2909	11	-3
456.58.1.1	0.00	335	298	0.92	1.87	0.8	.2081	0.4	2890	6	5
456.39.1.1	0.00	84	39	0.47	1.86	1.0	.2052	0.4	2868	7	3
456.14.1.1	-0.04	41	15	0.37	1.78	1.3	.2020	0.6	2843	10	-1
456.10.1.1	0.02	204	50	0.25	2.00	0.9	.1993	0.3	2821	5	8
456.6.1.1	0.06	124	61	0.51	1.86	0.9	.1974	0.5	2805	8	1
456.20.1.1	0.20	16	6	0.39	1.84	1.8	.1965	1.1	2798	19	0
456.49.1.1	-0.04	46	31	0.69	1.88	1.2	.1965	0.6	2797	11	2
456.47.1.1	0.00	160	50	0.32	1.87	0.9	.1938	0.3	2775	5	1
456.42.1.1	-0.01	157	116	0.76	1.98	0.9	.1929	0.4	2767	7	5
456.55.1.1	-0.22	17	6	0.39	1.97	1.8	.1918	1.2	2758	20	4
456.57.1.1	0.05	44	20	0.47	1.90	1.3	.1883	0.7	2727	11	0
456.63.1.1	0.03	95	40	0.44	1.94	1.0	.1872	0.5	2718	8	1
456.61.1.1	-0.01	105	53	0.52	1.93	1.0	.1872	0.4	2718	7	1
456.45.1.1	-0.03	29	16	0.56	1.98	1.4	.1872	1.4	2717	23	3
456.43.1.1	-0.06	63	43	0.71	1.95	1.1	.1863	0.6	2710	9	2
456.19.1.1	0.12	36	16	0.46	1.94	1.3	.1863	0.7	2709	12	1
456.37.1.1	0.02	102	65	0.66	1.95	1.1	.1860	0.4	2708	7	2
456.29.1.1	-0.06	78	58	0.78	1.95	1.0	.1860	0.5	2707	8	1
456.9.1.1	0.00	152	133	0.90	1.96	0.9	.1859	0.3	2706	6	2
456.41.1.1	-0.01	119	80	0.70	1.94	0.9	.1856	0.4	2704	6	1
456.17.1.1	-0.03	90	56	0.64	1.99	1.3	.1854	0.5	2701	8	3
456.11.1.1	0.00	79	59	0.77	1.89	1.0	.1851	0.5	2699	7	-1
456.59.1.1	-0.04	83	89	1.12	1.97	1.0	.1850	0.5	2698	8	2
456.23.1.1	0.02	45	28	0.64	1.94	1.2	.1847	0.8	2695	14	1
456.12.1.1	0.10	39	16	0.43	1.89	1.3	.1843	0.7	2692	12	-2
456.53.1.1	0.02	159	172	1.12	2.02	0.9	.1843	0.4	2692	6	4
456.46.1.1	-0.03	81	69	0.88	1.98	1.1	.1841	0.5	2690	8	2
456.5.1.1	-0.03	96	68	0.72	1.99	0.9	.1840	0.4	2689	7	2
456.62.1.1	0.04	116	84	0.75	1.93	0.9	.1836	0.4	2686	7	0
456.31.1.1	0.04	95	66	0.72	1.96	1.0	.1834	0.4	2684	7	1
456.64.1.1	0.01	201	112	0.58	1.98	0.9	.1833	0.4	2683	7	2
456.16.1.1	-0.05	11	6	0.53	2.04	2.1	.1829	1.3	2680	21	4
456.8.1.1	0.01	174	122	0.72	1.97	1.0	.1826	0.3	2677	5	1
456.27.1.1	-0.01	56	29	0.54	1.97	1.4	.1825	0.6	2676	11	1
456.44.1.1	0.02	138	140	1.05	1.96	0.9	.1821	0.4	2672	6	0
456.50.1.1	-0.01	128	119	0.96	2.04	0.9	.1819	0.4	2670	6	4
456.2.1.1	0.05	81	84	1.06	1.96	1.3	.1817	0.5	2669	8	0
456.56.1.1	-0.01	150	110	0.75	1.98	0.9	.1816	0.4	2667	6	1
456.15.1.1	0.05	60	39	0.67	2.00	1.1	.1813	0.7	2665	11	2
456.13.1.1	0.10	43	33	0.79	1.93	1.5	.1811	0.7	2663	12	-1
456.54.1.1	0.02	119	64	0.55	1.96	1.4	.1811	0.4	2663	7	0
456.1.1.1	0.04	88	73	0.85	1.95	1.1	.1810	0.5	2662	9	0
456.18.1.1	0.03	131	79	0.62	2.03	0.9	.1718	0.4	2575	7	0
456.21.1.1	0.01	183	105	0.59	2.08	0.9	.1685	0.3	2542	5	0
456.3.1.1	0.03	198	71	0.37	2.10	0.8	.1683	0.4	2540	6	1
456.51.1.1	-0.01	219	119	0.56	2.12	0.8	.1679	0.3	2537	5	2
456.35.1.1	-0.09	64	26	0.42	2.09	1.1	.1674	0.6	2532	10	0
456.48.1.1	0.01	95	86	0.94	2.15	1.0	.1671	0.5	2529	8	3
456.4.1.1	0.01	244	82	0.35	2.13	1.0	.1664	0.3	2522	5	2
456.32.1.1	-0.09	85	38	0.46	2.16	1.0	.1664	0.5	2522	8	3
456.40.1.1	0.03	116	45	0.40	2.12	0.9	.1662	0.4	2520	8	1
456.67.1.1	-0.07	82	51	0.65	2.18	1.9	.1662	0.6	2520	10	4
456.25.1.1	0.00	117	49	0.43	2.18	0.9	.1658	0.8	2516	13	3
456.38.1.1	0.02	73	57	0.81	2.11	1.3	.1658	0.5	2515	9	0
456.22.1.1	0.03	58	18	0.32	2.14	1.1	.1657	0.6	2515	10	2
456.24.1.1	0.00	127	50	0.41	2.11	0.9	.1656	0.4	2514	7	1
456.34.1.1	0.04	99	51	0.53	2.10	1.0	.1655	0.7	2512	12	0
456.65.1.1	0.08	294	195	0.68	2.25	0.9	.1653	0.3	2510	5	6
456.33.1.1	0.02	281	113	0.41	2.19	0.8	.1649	0.3	2506	5	3
456.28.1.1	0.00	477	200	0.43	2.17	0.8	.1644	0.2	2502	3	3
456.30.1.1	0.02	411	81	0.20	2.20	0.9	.1640	0.4	2498	7	3
456.66.1.1	0.02	146	49	0.34	2.14	0.9	.1636	0.4	2493	7	1

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Young outlier (n = 1)											
456.7.1.1	0.05	1002	110	0.11	2.48	0.9	.1412	0.2	2242	3	3
>10% discordant (n = 2)											
456.26.1.1	0.14	102	59	0.60	2.56	1.3	.1802	0.5	2654	8	25
456.60.1.1	0.00	226	147	0.67	2.41	0.8	.1663	0.3	2520	5	13

44. GRANITE, PETER PAN PLATFORMS: 2009371023

GA Sample ID:	**2009371023**
GA Sample Number:	**1999459**
Other Sample ID:	
1:250,000 Sheet:	**YARDEA SI 53-3**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**582285 6381945 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**3/7/2009**
Formal Name:	
Informal Name:	
Lithology:	**biotite granite**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6104**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**14 - 16/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.43% (2σ) [35 of 37]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.1 ± 1.8 Ma [19 of 19]**
Interpreted Age:	**1724 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

This sample comes from scattered subhorizontal outcrops informally called Peter Pan platforms, near Peter Pan Dam on Buckleboo Station, northern Eyre Peninsula, South Australia. The sample is a white to pale-grey gneissic granite with distinctive tabular, white feldspar phenocrysts up to ~2 cm long, preferentially aligned within a quartz + biotite matrix. Anastamosing biotite-rich shear-bands, evenly-spaced ~20 cm apart, parallel the fabric defined by aligned feldspars (Figure 44.1).

Figure 44.1. *Outcrop of granite at Peter Pan Platforms, sample 2009371023.*

Zircon Description

Zircons from this sample are typically between 100 and 200 µm in long dimension, and occur as equant to slightly elongate grains and fragments. Internal zonation patterns range from oscillatory zoned to homogenous. In cathodoluminescence (CL) images a couple of grains show narrow, bright CL overgrowths, but most grains do not show evidence for multiple stages of zircon growth (Figure 44.2).

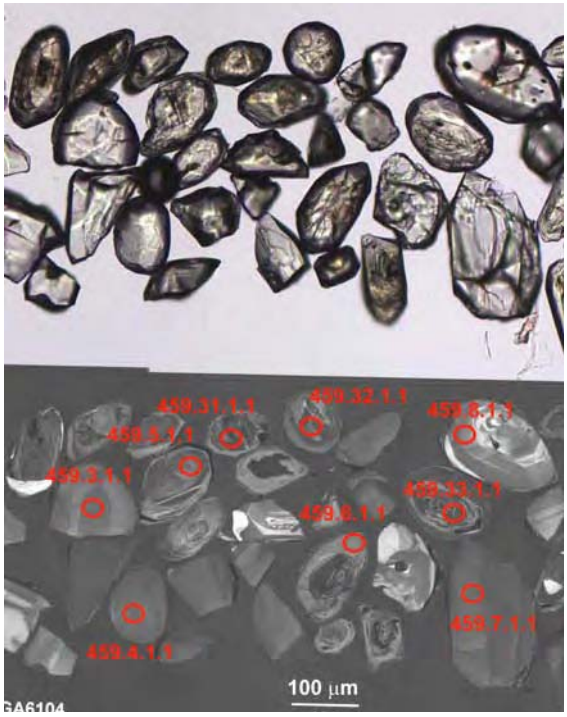

Figure 44.2. *Representative transmitted light and cathodoluminescence images of zircons from granite at Peter Pan platforms (2009371023), with locations of some SHRIMP analyses.*

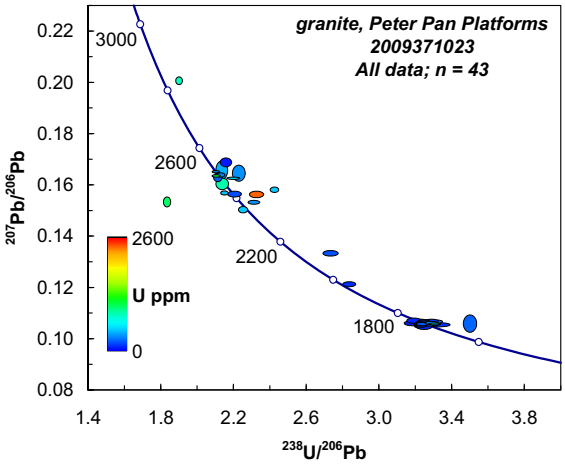

Figure 44.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the granite at Peter Pan Platforms (2009371023), coloured according to U content.*

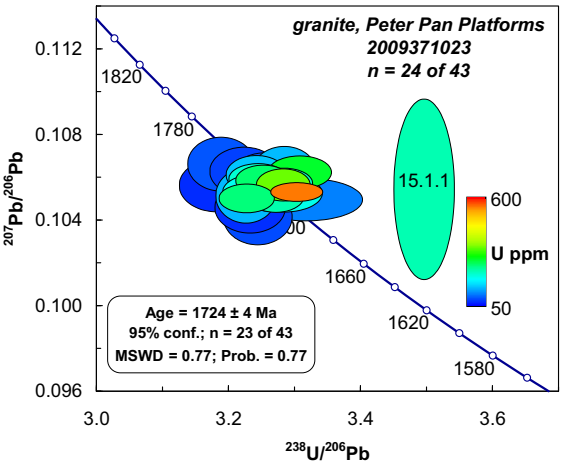

Figure 44.4. *Tera-Wasserburg concordia diagram showing results of ~1724 Ma-aged zircon analyses from the granite at Peter Pan Platforms (2009371023), coloured according to U content. The discordant analysis labelled 15.1.1 has not been included in the mean age calculation.*

U-Pb Isotopic Results

A total of 43 analyses were collected from 42 different zircon grains. When plotted on a concordia diagram a large group of analyses cluster near concordia at ~1724 Ma. Another large group of analyses scattter around concordia between ~2550 and 2350 Ma. Two analyses plot between these two groups, and one analysis is significantly older, with a $^{207}Pb/^{206}Pb$ age of ~2830 Ma (Figure 44.3). Four analyses are >10% discordant and/or contain >0.5%$^{206}Pb_c$, and have not been included in geological interpretation.

The younger age group consists of 23 analyses which yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1724 ± 4 Ma (95% confidence; MSWD = 0.77; probability of fit = 0.77; Figure 44.4). These analyses come from zircon that shows relatively uniform CL response or broad zonation. The zonation is similar to that seen in TEMORA standard zircon. These analyses contain U contents that range between ~70 and 550 ppm, with Th/U ratios typically between ~0.2 and 1.2.

The 13 analyses in the older age group scatter in age between ~2380 Ma and 2550 Ma. Three of these cluster around ~2420 Ma. A further six analyses form an older grouping with a weighted mean $^{207}Pb/^{206}Pb$ age of 2499 ± 10 Ma (95% confidence; MSWD = 2.2; probability of fit = 0.05). Analyses in these age groupings come from zircon interiors, generally with mottled CL zoning that in some cases appears to show relict

oscillatory zoning that has been subsequently modified by radiation damage or partial recrystallisation. This zircon is interpreted as inherited.

Geochronological Interpretation

The dominant zircon population in this rock, with an age of 1724 ± 4 Ma, is interpreted to represent the igneous crystallisation age of this granite. A range of inherited zircons are also present, with relatively poorly defined age groupings at ~2425 Ma and ~2500 Ma. These ages are consistent with granite derivation from, or assimilation of, typical "Sleaford Complex" crust.

Table 44.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371023 (1999459), granite, Peter Pan Platforms.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Pre-2600 Ma inherited zircon (n = 1)											
459.23.1.1	0.17	805	605	0.78	1.90	0.8	.2008	0.6	2833	10	4
~2550 to ~2380 Ma inherited zircon (n = 13)											
459.35.1.1	0.08	50	44	0.91	2.15	1.2	.1688	0.8	2546	14	4
459.34.1.1	0.01	404	37	0.10	2.13	1.2	.1658	1.8	2515	30	1
459.12.1.1	0.01	340	78	0.24	2.10	0.8	.1651	0.2	2509	4	0
459.37.1.1	0.13	335	88	0.27	2.23	1.3	.1645	1.6	2503	27	5
459.32.1.1	0.10	307	89	0.30	2.13	0.8	.1639	0.4	2496	7	0
459.31.1.1	0.01	1050	1716	1.69	2.10	0.8	.1634	0.2	2492	4	-1
459.19.1.1	0.01	219	130	0.61	2.11	0.9	.1629	0.8	2486	14	-1
459.14.1.1	0.02	524	149	0.29	2.20	1.4	.1626	0.2	2483	4	3
459.21.1.1	0.11	843	412	0.50	2.13	1.3	.1604	1.1	2460	19	-1
459.41.1.1	0.01	441	30	0.07	2.15	0.8	.1568	0.4	2421	7	-2
459.13.1.1	0.02	174	58	0.35	2.20	1.4	.1563	0.6	2416	10	0
459.33.1.1	0.05	2416	446	0.19	2.32	1.4	.1562	0.7	2415	11	5
459.39.1.1	0.02	339	38	0.12	2.31	1.2	.1531	0.4	2381	7	3
Analyses affected by ancient Pb-loss (n = 2)											
459.5.1.1	0.06	180	57	0.33	2.73	1.2	.1331	0.7	2140	12	6
459.8.1.1	0.05	100	158	1.64	2.83	1.0	.1209	0.6	1969	11	1
Igneous zircon (n =23)											
459.26.1.1	-0.12	91	106	1.21	3.19	1.0	.1066	0.8	1743	14	-1
459.6.1.1	0.13	141	101	0.74	3.28	0.9	.1063	0.7	1737	13	1
459.27.1.1	-0.01	81	6	0.07	3.22	1.1	.1063	0.7	1737	13	0
459.20.2.1	0.03	284	3	0.01	3.31	1.0	.1062	0.5	1736	9	2
459.24.1.1	-0.04	146	221	1.57	3.24	0.9	.1061	0.6	1734	10	0
459.16.1.1	-0.02	93	73	0.82	3.26	1.0	.1061	0.7	1733	12	0
459.7.1.1	0.01	209	194	0.96	3.25	0.9	.1059	0.5	1730	8	0
459.42.1.1	0.01	100	104	1.08	3.27	1.0	.1059	0.7	1730	12	1
459.10.1.1	0.06	257	101	0.41	3.25	0.8	.1058	0.5	1729	8	0
459.1.1.1	-0.01	216	164	0.78	3.28	0.9	.1057	0.4	1727	8	1
459.25.1.1	0.01	345	220	0.66	3.28	0.8	.1056	0.5	1726	9	1
459.40.1.1	-0.01	70	268	3.93	3.18	1.2	.1056	0.8	1725	14	-2
459.2.1.1	0.00	171	52	0.32	3.26	0.9	.1056	0.5	1725	9	0
459.11.1.1	0.11	156	67	0.45	3.27	1.1	.1053	0.6	1720	11	0
459.20.1.1	0.03	192	3	0.01	3.23	0.9	.1053	0.5	1720	9	-1
459.14.2.1	0.00	551	98	0.18	3.30	0.8	.1053	0.3	1720	5	1
459.3.1.1	0.09	194	278	1.48	3.28	1.2	.1052	0.6	1719	10	0
459.38.1.1	0.05	140	101	0.75	3.23	0.9	.1051	0.8	1717	15	-1
459.4.1.1	0.02	230	107	0.48	3.27	0.9	.1051	0.5	1717	9	0
459.9.1.1	-0.03	252	93	0.38	3.23	0.9	.1050	0.4	1714	8	-1
459.30.1.1	-0.02	112	145	1.33	3.32	1.7	.1050	0.6	1713	12	1
459.17.1.1	0.00	72	77	1.11	3.23	1.1	.1046	0.8	1707	14	-2
459.28.1.1	0.08	86	99	1.19	3.24	1.1	.1042	0.8	1699	16	-2
Analyses containing >0.5% $^{206}Pb_c$ and/or >10% discordant (n = 4)											
459.22.1.1	0.70	987	25	0.03	1.83	0.9	.1532	1.0	2382	17	-15
459.36.1.1	0.54	472	102	0.22	2.42	0.8	.1580	0.5	2435	9	9
459.29.1.1	0.78	463	117	0.26	2.25	0.9	.1501	0.7	2348	12	-1
459.15.1.1	2.19	228	170	0.77	3.50	0.9	.1054	2.7	1722	49	6

45. MEGACRYSTIC GNEISS, PETER PAN PLATFORMS: 2009371022

GA Sample ID:	**2009371022**
GA Sample Number:	**1999458**
Other Sample ID:	
1:250,000 Sheet:	**YARDEA SI 53-3**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**582236 6381848 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**3/7/2009**
Formal Name:	
Informal Name:	
Lithology:	**feldspar-megacrystic gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6111**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**18 - 19/1/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.00% (2σ) [8 of 8]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.5 ± 3.3 Ma [6 of 6]**
Interpreted Age:	**2470 ± 8 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**
Interpreted Age:	**~2430 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**High-grade metamorphic age**
Interpreted Age:	**1723 ± 13 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**High-grade metamorphic age**

Sample Description

This sample comes from scattered subhorizontal outcrops informally called Peter Pan platforms, near Peter Pan Dam on Buckleboo Station, northern Eyre Peninsula, South Australia. This sample represents one of the dominant rock-types at Peter Pan Platforms, and crops out in numerous subhorizontal platforms up to several tens of metres across. The sample is a feldspar-megacrystic gneiss, composed of aligned, tabular white feldspar crystals up to ~2 cm long wrapped by a ~north-south trending biotite foliation (Figure 45.1).

Figure 45.1. *Outcrop of megacrystic gneiss at Peter Pan platforms (2009371022).*

Zircon Description

Most zircons from this sample are slightly elongate, subhedral grains measuring ~40 x 120 µm. A few larger, equant grains range up to ~200 µm in diameter. The larger grains are dark in transmitted light, with a metamict appearance. In cathodoluminescence (CL) images most grains appear distinctively mottled, typical of metamict grains. Although mottled and patchy in CL, some grains preserve evidence of original oscillatory internal zonation (Figure 45.2). A small number of grains exhibit bright CL cores, mantled by dark CL overgrowths and medium CL rims. A couple of large grains are unusually clear with relatively uniform, dark CL response.

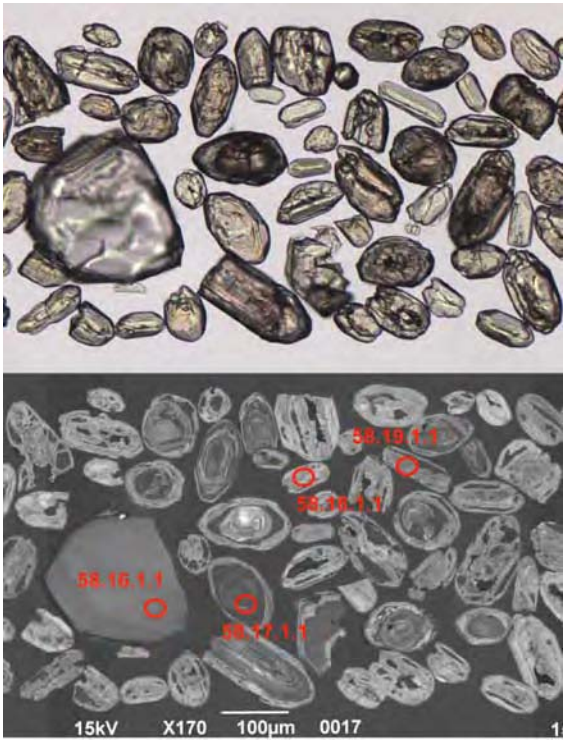

Figure 45.2. *Representative transmitted light and cathodoluminescence images of zircons from megacrystic gneiss at Peter Pan Platforms (2009271022), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Twentyfour analyses were collected from 23 different zircon grains. On a concordia diagram the data are rather scattered and discordant, consistent with the mottled and metamict appearance of the zircons (Figure 45.3). Distinct age and compositional patterns can, however, be discerned using U and Th abundances and Th/U ratios.

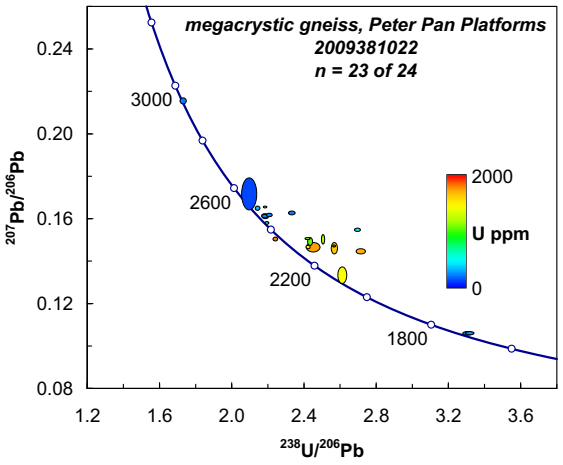

Figure 45.3. *Tera-Wasserburg concordia diagram showing results of zircon analyses from the megacrystic gneiss at Peter Pan Platforms (2009371022), coloured according to U content. A single, highly negatively discordant analysis (13.1.1) has been excluded from this diagram.*

Three analyses are either highly discordant (58.1.1.1, 58.13.1.1) or contain high common Pb (58.23.1.1), and have not been included in geological interpretation. A single analysis yields a concordant age of ~2950 Ma, interpreted as an inherited grain. Two analyses with ages of 2511 and 2505 Ma are also interpreted as inherited zircon. The majority of analyses scatter between ~2500 and 2100 Ma. These can be separated into two groups based on zircon morphology and chemical composition (Figure 45.4). Five analyses of zircon cores, most of which preserve relict oscillatory zoning, yield a weighted mean age of 2470 ± 8 Ma (95% confidence; MSWD =1.4; probability of fit = 0.22). These analyses contain U abundances of between ~180 and 570 ppm, and Th/U ratios of 0.5 to 0.8, and are interpreted to be of igneous origin.

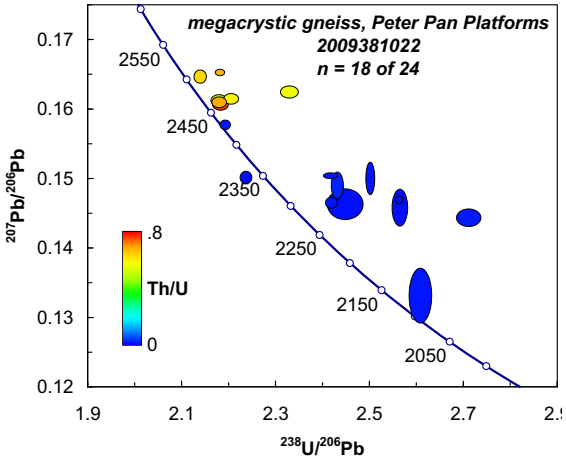

Figure 45.4. *Tera-Wasserburg concordia diagram showing results of late Archean to early Proterozoic zircon analyses from the megacrystic gneiss at Peter Pan Platforms (2009371022), coloured according to Th/U ratio.*

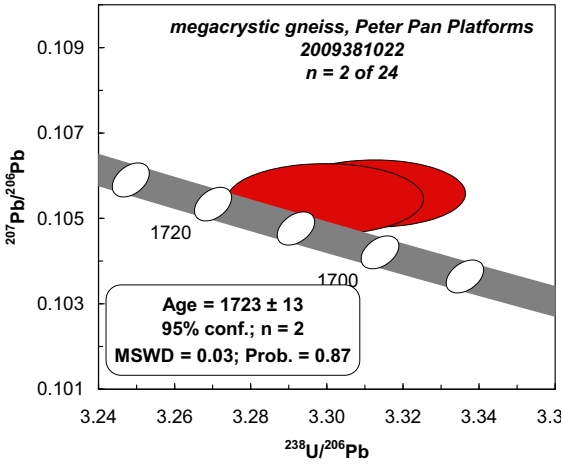

Figure 45.5. *Tera-Wasserburg concordia diagram showing results of ~1723 Ma-aged zircon from the megacrystic gneiss at Peter Pan Platforms (2009371022).*

Eleven analyses come from zircon with mottled CL response that forms entire grains or overgrowths on oscillatory zoned cores. Zircon of this type contains much higher U than the zircon cores, typically >1000 ppm, and has much lower Th/U ratio of 0.01 to 0.02. The occurrence as overgrowths and the very low Th/U is consistent with a high-grade metamorphic origin for this zircon. Most of these analyses are significantly discordant, and they range in $^{207}Pb/^{206}Pb$ age from ~2430 to ~2140 Ma (Figure 45.4). The only concordant analysis in this group is also the oldest, with a $^{207}Pb/^{206}Pb$ age of 2432 ± 10 Ma (2σ), and provides the best estimate for the timing of this generation of zircon growth.

Two analyses of large, unusually clear grains both yield near-concordant $^{207}Pb/^{206}Pb$ ages of ~1725 Ma, with a weighted mean age of 1723 ± 13 (95% confidence; MSWD = 0.03, probability of fit = 0.87, Figure 45.5). These two analyses contain ~250 and 220 ppm U, and Th/U ratios of ~0.4 and 0.6. The age of this zircon is consistent with the age of igneous zircon from two other samples from Peter Pan Platforms (see 2009371021 and 2009371023), and is interpreted to indicate high-grade metamorphism associated with local intrusions.

Geochronological Interpretation

The mean age of 2470 ± 8 Ma from oscillatory zoned zircon cores is interpreted as the igneous crystallisation age of the protolith of this gneissic rock. Inherited zircon with ages of ~2510 Ma and ~2950 Ma is also present. A distinct generation of high-grade metamorphic zircon is present in this rock, of poorly defined age estimated at ~2430 Ma, consistent with "Sleaford" age metamorphism. Zircon of age 1723 ± 13 Ma is coeval with the age of adjacent granite and gneiss, and is interpreted to result from melt injection from adjacent ~1725 Ma granite, or possibly from partial melting.

Table 45.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371022 (1999458), megacrystic gneiss, Peter Pan Platforms.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited zircon (n = 3)											
58.3.1.1	0.02	220	79	0.37	1.73	0.7	.2157	0.4	2949	7	0
58.17.1.1	0.00	571	377	0.68	2.18	0.3	.1653	0.2	2511	3	3
58.14.1.1	0.15	315	194	0.63	2.14	0.4	.1647	0.4	2505	6	1
~2470 Ma igneous zircon (n = 5)											
58.8.1.1	0.06	222	120	0.56	2.33	0.5	.1625	0.4	2482	6	8
58.4.1.1	0.01	238	136	0.59	2.20	0.5	.1615	0.3	2471	5	2
58.20.1.1	0.01	178	92	0.53	2.18	0.5	.1613	0.4	2469	6	1
58.10.1.1	0.01	239	160	0.69	2.18	0.5	.1610	0.3	2466	5	1
58.12.1.1	0.04	212	158	0.77	2.18	0.5	.1607	0.3	2463	6	1
~2430 Ma metamorphic zircon (n = 11)											
58.23.2.1	0.02	548	9	0.02	2.19	0.3	.1578	0.3	2432	5	0
58.15.1.1	0.07	1136	16	0.01	2.42	0.4	.1504	0.2	2350	3	5
58.7.1.1	0.45	1809	14	0.01	2.24	0.4	.1501	0.4	2347	7	-2
58.21.1.1	0.04	1152	15	0.01	2.50	0.3	.1500	1.0	2346	17	8
58.2.1.1	0.30	1050	24	0.02	2.43	0.4	.1489	0.9	2334	15	5
58.19.1.1	0.07	1683	15	0.01	2.56	0.2	.1469	0.3	2310	4	9
58.5.1.1	0.39	1516	19	0.01	2.42	0.3	.1464	0.4	2305	6	3
58.22.1.1	0.20	1765	17	0.01	2.45	1.0	.1462	1.0	2302	17	4
58.18.1.1	0.89	1645	15	0.01	2.56	0.4	.1457	1.2	2297	21	8
58.6.1.1	0.38	1720	28	0.02	2.71	0.6	.1443	0.6	2279	10	13
58.9.1.1	0.72	1432	20	0.01	2.61	0.6	.1330	2.0	2138	35	2
~1725 Ma metamorphic zircon (n = 2)											
58.16.1.1	0.04	253	95	0.39	3.31	0.5	.1056	0.5	1724	9	1
58.11.1.1	0.05	221	120	0.56	3.30	0.5	.1054	0.5	1722	10	1
High common Pb and/or highly discordant zircon (n = 3)											
58.23.1.1	3.47	122	103	0.87	2.09	1.3	.1715	2.9	2572	49	2
58.1.1.1	0.02	418	127	0.31	2.69	0.4	.1545	0.3	2396	6	18
58.13.1.1	0.30	1586	15	0.01	1.33	0.2	.1390	0.3	2215	5	-39

46. GREY GNEISS, PETER PAN PLATFORMS: 2009371021

GA Sample ID:	**2009371021**
GA Sample Number:	**1999457**
Other Sample ID:	
1:250,000 Sheet:	**YARDEA SI 53-3**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**582109 6381910 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**3/7/2009**
Formal Name:	
Informal Name:	
Lithology:	**quartzofeldspathic biotite gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6104**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**14 - 16/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.43% (2σ) [35 of 37]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.1 ± 1.8 Ma [19 of 19]**
Interpreted Age:	**1724 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

This sample comes from scattered subhorizontal outcrops informally called Peter Pan platforms, near Peter Pan Dam on Buckleboo Station, northern Eyre Peninsula, South Australia. This sample is a fine-grained, even-grained, homogeneous, grey, quartz-rich gneiss, with minor biotite schlieren. The rock appears massive in hand sample and breaks almost concoidally, but on weathered surfaces a strong gneissic fabric is evident (Figure 46.1). This is the dominant rock-type at Peter Pan Platforms, together with feldspar-megacrystic gneiss (see sample 2009371022), and is intruded by felsic dykes and granite (see sample 2009371023).

Figure 46.1. *Outcrop of grey gneiss at Peter Pan platforms; sample 2009371021.*

Zircon Description

Zircons from this sample are typically equant to slightly elongate (aspect ratios 1 to 2), with rounded outlines. Grain size ranges from ~100 µm up to ~250 µm in long dimension. Cathodoluminescence (CL) images reveal a range of internal zonation patterns. Many grains show concentric, oscillatory zoning throughout, others show uniform CL across all or most of the grain, in some cases with a small zircon core with contrasting CL response. A small number of grains exhibit broad, bright CL (low U) rims, generally ~25 µm wide (Figure 46.2).

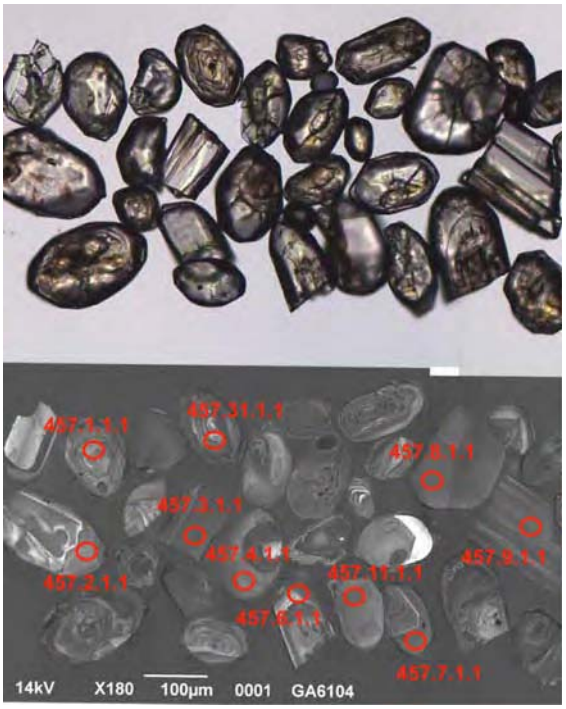

Figure 46.2 *Representative transmitted light and cathodoluminescence images of zircons from grey gneiss at Peter Pan platforms (2009371021), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 39 analyses were collected on 38 different zircon grains. On a concordia diagram the data cluster into (i) a near-concordant group at ~1720 Ma, (ii) a scattered grouping along concordia between ~2600 and 2400 Ma, and (iii) a single near-concordant analysis at ~2700 Ma (Figure 46.3). Three analyses contain >0.5% $^{206}Pb_c$ and yield ages with poor precision – these have not been included in geological interpretation.

A group of 18 analyses cluster around ~1720 Ma. Analyses in this ~1720 Ma grouping have U-contents between 100 and 570 ppm, and Th/U ratios typically between 0.2 and 1. These 18 analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1724 ± 4 Ma (95% confidence; MSWD = 1.4; probability of fit = 0.11; Figure 46.4). Zircon in this population tends to have large grain size, and exhibit subtle oscillatory zoning, or occur as zircon fragments with parallel internal compositional banding. This zircon is interpreted to be of igneous origin.

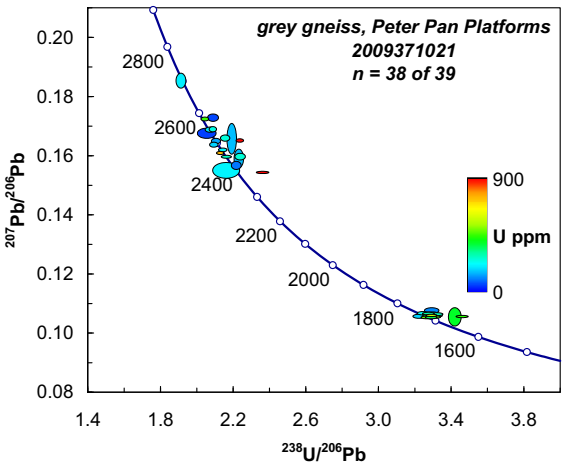

Figure 46.3. *Tera-Wasserburg concordia diagram showing results of zircon analyses from the grey gneiss at Peter Pan Platforms (2009371021), coloured according to U content. A single analysis (19.2.1) containing high common Pb, and yielding a very imprecise age, has not been plotted.*

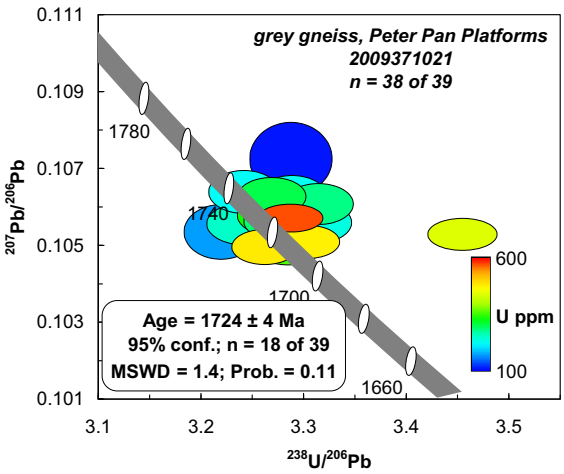

Figure 46.4. *Tera-Wasserburg concordia diagram showing results of ~1724 Ma-aged zircon analyses from the grey gneiss at Peter Pan Platforms (2009371021), coloured according to U content.*

Seventeen analyses scatter around concordia with $^{207}Pb/^{206}Pb$ ages between ~2600 and 2400 Ma (Figure 46.5). These analyses do not form statistically well-defined age groupings. The youngest five of these analyses all come from regions of uniform CL zircon that could be interpreted as of metamorphic origin. These analyses suggest a period of high-grade metamorphism at ~2450 Ma, although this age is poorly defined due to the paucity of analyses.

The majority of analyses older than ~2450 Ma come from grain interiors showing oscillatory zoning. These are interpreted as of igneous origin, and could either represent the age of an igneous protolith between ~2550 and 2450 Ma, with a few older inherited zircons, or all the pre-2450 Ma ages might represent detrital zircon in a sedimentary protolith. The relatively homogeneous, rather than compositionally banded, nature of this rock type suggests an igneous rather than sedimentary protolith.

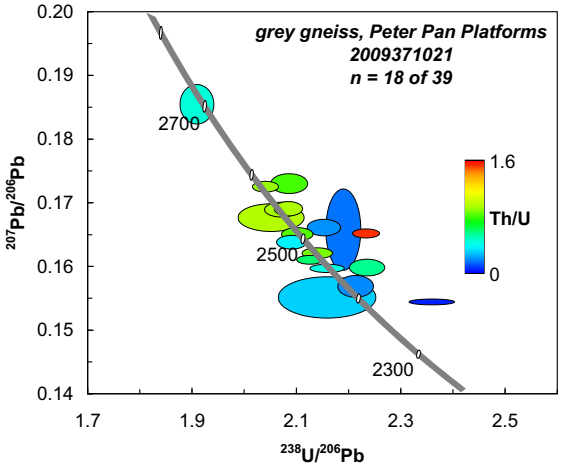

Figure 46.5 *Tera-Wasserburg concordia diagram showing results of pre-2000 Ma-aged zircon analyses from the grey gneiss at Peter Pan Platforms (2009371021), coloured according to Th/U ratio.*

Geochronological Interpretation

The preferred interpretation for this dataset is that it represents an igneous rock with a crystallisation age 1724 ± 3 Ma, which contains inherited zircons from a protolith of age between ~2550 and 2500 Ma, with minor zircon inheritance as old as ~2700 Ma. The protolith may have been metamorphosed at ~2450 Ma.

Table 46.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371021 (1999457), grey gneiss, Peter Pan Platforms.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc(%)
Pre-2600 Ma Inherited zircon (n = 1)											
457.6.1.1	0.02	198	87	0.45	1.91	1.1	.1855	1.1	2703	18	-1
~2600 Ma to ~2400 inherited zircon (n = 12)											
457.30.1.1	0.04	55	43	0.81	2.08	1.1	.1730	0.6	2587	10	2
457.32.1.1	0.01	451	399	0.91	2.04	0.8	.1725	0.3	2582	5	0
457.31.1.1	0.29	241	222	0.95	2.08	0.8	.1690	0.5	2548	8	1
457.1.1.1	0.01	190	173	0.94	2.07	1.0	.1689	0.5	2546	8	0
457.27.1.1	0.03	49	46	0.97	2.05	2.0	.1676	0.9	2534	14	-1
457.36.1.1	0.03	252	50	0.20	2.15	1.0	.1660	0.5	2518	9	2
457.5.1.1	0.01	151	24	0.16	2.19	1.0	.1657	2.6	2515	43	4
457.14.1.1	0.31	896	1340	1.55	2.23	0.8	.1651	0.3	2509	5	5
457.25.1.1	0.04	132	106	0.83	2.10	0.9	.1650	0.4	2507	7	0
457.19.1.1	0.24	169	59	0.36	2.09	0.9	.1637	0.4	2495	7	-1
457.37.1.1	0.04	204	173	0.88	2.14	0.9	.1620	0.3	2476	6	0
457.34.1.1	0.06	765	448	0.61	2.12	0.8	.1609	0.3	2466	5	-1
Possible ~2450 Ma metamorphic zircon (n = 5)											
457.7.1.1	0.02	256	139	0.56	2.23	1.0	.1597	0.5	2452	9	3
457.28.1.1	0.00	276	115	0.43	2.16	1.0	.1596	0.3	2451	5	0
457.18.1.1	-0.03	92	17	0.19	2.21	1.0	.1567	0.7	2421	12	1
457.4.1.1	0.01	205	58	0.29	2.16	2.8	.1550	1.4	2402	24	-2
457.16.1.1	0.15	898	38	0.04	2.36	1.2	.1543	0.2	2394	3	5
~1725 Ma igneous zircon (n = 18)											
457.38.1.1	-0.06	109	63	0.60	3.29	1.0	.1072	0.7	1753	13	2
457.21.1.1	0.00	223	115	0.53	3.24	0.9	.1064	0.4	1738	8	0
457.9.1.1	-0.02	301	151	0.52	3.27	0.8	.1063	0.4	1736	7	1
457.20.1.1	0.03	226	46	0.21	3.29	0.9	.1062	0.4	1736	8	1
457.22.1.1	0.03	279	346	1.28	3.31	0.8	.1061	0.4	1733	8	2
457.12.1.1	0.02	331	179	0.56	3.27	0.8	.1058	0.4	1728	7	0
457.35.1.1	0.01	572	360	0.65	3.29	0.8	.1057	0.3	1727	5	1
457.10.1.1	0.01	286	120	0.43	3.28	0.8	.1056	0.4	1725	7	0
457.33.1.1	-0.01	236	104	0.45	3.31	0.9	.1056	0.4	1725	8	1
457.11.1.1	0.03	250	115	0.47	3.24	1.0	.1055	0.4	1724	8	0
457.24.1.1	-0.02	297	310	1.08	3.29	1.0	.1055	0.4	1724	7	1
457.15.1.1	-0.01	184	41	0.23	3.27	1.0	.1054	0.5	1721	9	0
457.2.1.1	0.03	169	9	0.06	3.22	0.9	.1053	0.6	1720	10	-1
457.23.1.1	0.00	438	274	0.65	3.45	0.8	.1053	0.3	1719	6	5
457.8.1.1	0.06	320	73	0.24	3.28	0.8	.1051	0.4	1716	7	0
457.3.1.1	0.04	476	244	0.53	3.30	0.8	.1051	0.3	1716	6	1
457.29.1.1	0.03	357	197	0.57	3.29	0.8	.1049	0.4	1713	7	0
457.17.1.1	0.02	482	396	0.85	3.26	0.8	.1049	0.4	1713	7	-1
High common Pb zircon (n = 3)											
457.13.1.1	0.97	149	83	0.57	2.23	0.9	.1590	1.6	2445	28	2
457.26.1.1	2.11	386	175	0.47	3.42	0.8	.1051	2.5	1717	45	4
457.19.2.1	3.74	3	0	0.05	3.33	5.4	.0833	31.8	1277	620	-25

47. MIGMATITIC GNEISS, WADDIKEE ROCKS: 2009371014

GA Sample ID:	**2009371014**
GA Sample Number:	**1999450**
Other Sample ID:	
1:250,000 Sheet:	**KIMBA SI 53-7**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS84):	**582146 6330350 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**1/7/2009**
Formal Name:	
Informal Name:	
Lithology:	**migmatitic garnet-biotite gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6105**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**23 – 27/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.54 % (2σ) [41 of 41]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.8 ± 1.8 Ma [20 of 20]**
Interpreted Age:	**2597 ± 8 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age (?)**

Sample Description

Waddikee Rocks is on the Eyre Highway, between the towns of Kimba and Kyancutta, northern Eyre Peninsula, South Australia. This sample was collected from a low, quarried rock-wall and represents the dominant rock-type at Waddikee Rocks. The sample is a highly deformed, stromatic migmatite, consisting of biotite-rich mesosomes interlayered at the centimetre-scale with quartzofeldspathic leucosomes. Some of the leucosomes are garnet-bearing. Regions of coherently-layered mesosome and leucosome are disrupted by regions dominated by leucosome material, probably representing areas of melt accumulation and transport (Figure 47.1).

Figure 47.1. *Outcrop of migmatitic gneiss at Waddikee Rocks; sample 2009371014.*

Zircon Description

Zircons from this sample include small (~50 μm diameter) equant grains, slightly elongate, subhedral grains ~70 – 100 μm long, and large grains and fragments up to ~250 μm long. Larger grains in particular appear metamict and are almost opaque in transmitted light images. Most also contain large cracks. Cathodoluminescence (CL) images reveal a range of internal zonation patterns and CL responses. Most grains are mantled by a rim of very dark CL zircon, of variable thickness. Many of the larger grains

exhibit cores with relic concentric oscillatory zoning (Figure 47.2).

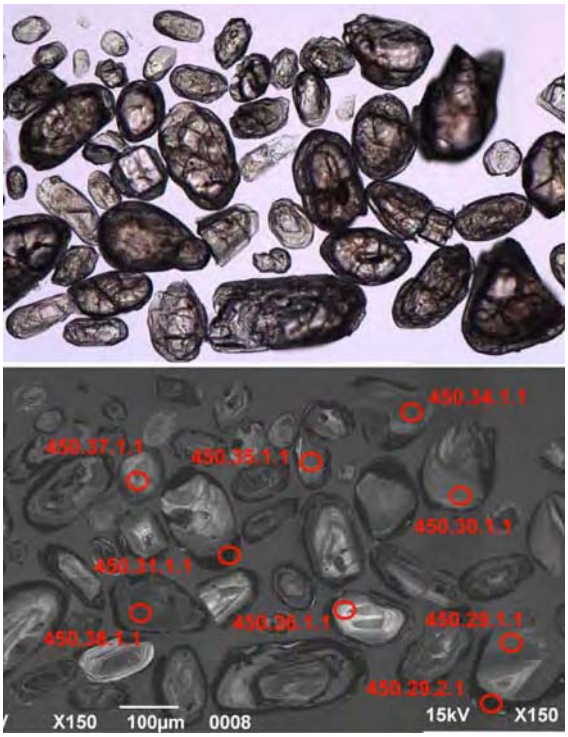

Figure 47.2. *Representative transmitted light and cathodoluminescence images of zircons from migmatitic gneiss at Waddikee Rocks (2009371014), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Fifty-one analyses were collected from 47 different zircon grains (Figure 47.3). Ten of these are >10% discordant and/or contain >0.5% $^{206}Pb_c$. Most of these very discordant analyses come from zircon rims containing >1000 ppm uranium, and that is, therefore, susceptible to Pb loss after accumulation of radiation damage. The remaining data range in $^{207}Pb/^{206}Pb$ age from ~2940 Ma to ~2140 Ma. The two oldest analyses (450.19.1.1, 450.29.1.1) are 8% and 6% discordant, and yield $^{207}Pb/^{206}Pb$ ages of 2940 and 2786 Ma respectively. These are interpreted as inherited zircon grains. A group of four analyses from zircon cores cluster around concordia to yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2751 ± 8 Ma (95% confidence; MSWD = 0.54; probability of fit = 0.66; Figure 47.4). Another group of five analyses yield a weighted

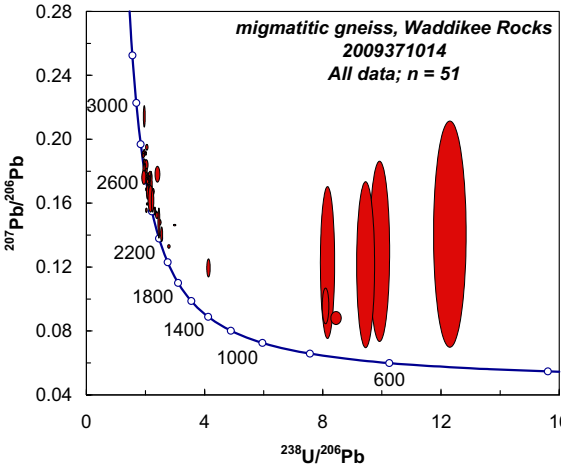

Figure 47.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the migmatitic gneiss from Waddikee Rocks (2009371014).*

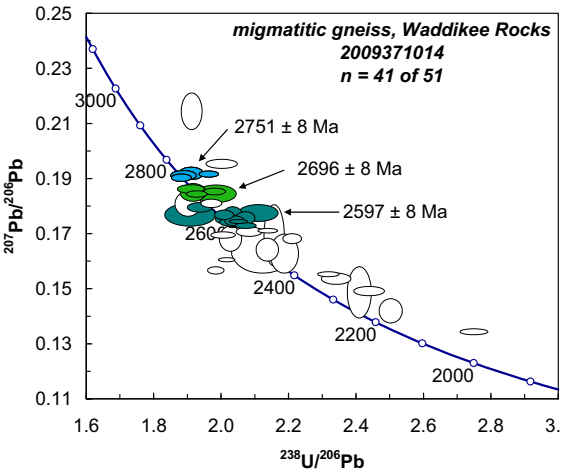

Figure 47.4. *Tera-Wasserburg concordia diagram showing results of near-concordant zircon analyses from the migmatitic gneiss from Waddikee Rocks (2009371014). Coloured ellipses show analyses grouped to yield weighted mean $^{207}Pb/^{206}Pb$ ages as shown. Unfilled ellipses have not been included in mean age calculations.*

mean $^{207}Pb/^{206}Pb$ age of 2696 ± 8 Ma (95% confidence; MSWD = 0.50; probability of fit = 0.73). A still younger group of near-concordant analyses yields a weighted mean $^{207}Pb/^{206}Pb$ age of 2597 ± 8 Ma (95% confidence; MSWD = 1.5; probability of fit = 0.14). Three analyses scatter in age between the ~2696 Ma and ~2597 Ma groups, and are interpreted to have been affected

by ancient Pb-loss. A series of 17 increasingly discordant analyses scatter towards younger ages and are difficult to interpret geologically. The older end of this series is broadly coeval with regional Sleaford-aged metamorphism, although most of the analyses in this age range are very imprecise. A scattered discordia trend is consistent with an episode of partial Pb-loss during the Paleoproterozoic, perhaps during the Kimban Orogeny. The dark CL rims evident on most grains from this sample contain very high U contents, typically >1500 ppm, and highly discordant data. The timing of growth of these zircon rims remains uncertain.

Geochronological Interpretation

The range of zircon ages in this sample is interpreted to reflect source components in a metasedimentary rock. The main discernable zircon ages are 2751 ± 8 Ma, 2696 ± 8 Ma and 2597 ± 8 Ma. In addition, a single zircon of age ~2940 Ma indicates the presence of some older components. Many zircons in this sample are mantled by very high U, metamict rims that yields extremely discordant data. These zircon rims may have grown during high-grade metamorphism and migmatisation, but their age remains unresolved. If the interpretation of the zircon cores as detrital zircon in a sedimentary protolith is correct, then the youngest age grouping of 2597 ± 8 Ma represents a maximum age constraint on the timing of sedimentary deposition.

Table 47.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371014 (1999450), migmatitic gneiss, Waddikee Rocks.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Individual inherited zircon components (n = 2)											
450.19.1.1	0.42	116	49	0.43	1.91	1.1	.2146	2.1	2940	33	8
450.29.1.1	0.35	211	148	0.73	2.00	1.5	.1952	0.6	2786	10	6
~2750 Ma grouping (n = 4)											
450.36.1.1	0.04	54	29	0.55	1.91	1.3	.1918	0.8	2757	13	1
450.43.1.1	0.16	178	227	1.32	1.96	1.0	.1914	0.4	2754	6	4
450.10.1.1	0.01	173	56	0.33	1.88	1.3	.1909	0.6	2750	10	0
450.27.1.1	-0.02	118	49	0.43	1.88	1.0	.1901	0.5	2743	8	0
~2695 Ma grouping (n = 5)											
450.15.1.1	0.07	137	79	0.60	1.91	1.4	.1859	0.6	2706	10	0
450.39..1	0.00	102	64	0.65	1.98	1.1	.1849	0.4	2698	7	2
450.16.1.1	0.08	45	35	0.80	1.91	1.3	.1846	1.2	2695	19	-1
450.25.1.1	0.02	74	71	0.99	1.98	2.0	.1842	1.2	2691	19	2
450.37.1.1	0.03	114	102	0.93	1.92	1.0	.1841	0.4	2690	7	0
Analyses affected by ancient Pb-loss (n = 3)											
450.8.1.1	-0.05	125	83	0.68	1.97	1.0	.1806	0.6	2659	10	0
450.4.1.1	0.08	67	16	0.25	1.90	1.3	.1804	1.7	2657	28	-3
450.45.1.1	0.15	69	42	0.63	1.93	1.3	.1792	0.6	2645	10	-2
~2595 Ma grouping (n = 10)											
450.7.1.1	0.03	89	43	0.50	2.11	1.8	.1771	1.2	2626	20	5
450.5.1.1	-0.15	34	15	0.44	1.90	2.6	.1764	1.6	2620	27	-4
450.40.1.1	0.04	289	169	0.61	2.00	0.9	.1763	0.7	2619	11	0
450.40.2.1	0.26	124	100	0.83	2.03	1.0	.1755	1.5	2611	24	1
450.44.1.1	0.03	240	200	0.86	2.07	0.9	.1752	0.9	2608	15	3
450.3.1.1	0.15	132	79	0.62	2.02	1.3	.1747	0.7	2604	11	0
450.24.1.1	0.00	198	118	0.61	2.04	0.9	.1742	0.7	2599	11	1
450.21.1.1	0.07	328	340	1.07	2.05	0.9	.1739	0.3	2596	5	1
450.33.1.1	0.01	221	103	0.48	2.03	1.2	.1737	0.6	2594	10	0
450.28.1.1	0.07	153	156	1.06	2.07	1.0	.1724	0.4	2581	7	2
Scattered post-2595 Ma analyses (n = 17)											
450.47.1.1	0.06	241	138	0.59	2.13	0.9	.1705	0.3	2563	6	3
450.41.1.1	0.03	187	121	0.67	2.08	1.2	.1702	0.7	2559	12	1
450.12.1.1	0.01	217	83	0.40	2.00	1.2	.1689	0.5	2547	8	-3
450.2.1.1	0.03	463	204	0.45	2.15	0.9	.1688	4.4	2546	74	4
450.11.1.1	-0.03	99	57	0.60	2.02	1.1	.1676	1.8	2534	30	-2
450.38.1.1	0.11	543	355	0.68	2.21	0.9	.1676	0.7	2534	12	5
450.35.1.1	0.04	192	98	0.53	2.13	1.0	.1636	1.7	2493	29	1
450.13.1.1	0.00	252	125	0.51	2.12	2.9	.1630	3.3	2487	56	0
450.42.1.1	0.01	456	217	0.49	2.18	1.3	.1620	2.9	2477	50	2
450.23.1.1	0.31	1034	319	0.32	2.01	0.8	.1598	0.3	2453	5	-6
450.14.1.1	0.11	1054	430	0.42	1.98	0.8	.1559	0.5	2412	9	-9
450.9.1.1	0.12	236	207	0.91	2.31	0.9	.1545	0.4	2397	7	4
450.46.1.1	0.09	532	67	0.13	2.34	1.2	.1528	0.9	2377	15	4
450.17.1.1	0.16	301	56	0.19	2.44	1.2	.1483	0.7	2326	13	5
450.30.1.1	0.06	148	127	0.89	2.41	1.0	.1478	4.2	2320	72	4
450.34.1.1	0.05	294	197	0.69	2.50	0.9	.1409	2.1	2239	36	3
450.1.1.1	0.09	137	80	0.60	2.75	1.0	.1333	0.6	2142	10	7
Discordant and/or high common Pb analyses (n = 10)											
450.20.1.1	0.29	33	26	0.80	2.35	2.2	.1785	1.8	2639	30	15
450.22.1.1	0.79	1051	425	0.42	2.27	0.8	.1553	1.1	2406	18	2
450.18.1.1	0.01	2717	319	0.12	2.93	0.8	.1467	0.2	2308	4	22
450.13.2.1	28.44	3049	2030	0.69	12.29	3.0	.1410	33.0	2239	571	344
450.39.1.1	24.15	1830	714	0.40	9.91	2.3	.1302	28.5	2101	500	239
450.11.2.1	21.28	1723	514	0.31	8.14	2.0	.1232	25.4	2003	451	168
450.29.2.1	22.61	2040	228	0.12	9.43	2.2	.1219	28.1	1984	500	205
450.26.1.1	3.05	1430	57	0.04	4.09	0.9	.1199	3.2	1955	56	39
450.32.1.1	5.00	4856	112	0.02	8.07	0.9	.0962	7.7	1551	145	106
450.31.1.1	0.73	6373	218	0.04	8.43	1.4	.0886	3.0	1395	58	93

Southern Gawler Craton

NUYTS DOMAIN

The Nuyts Domain is a large, poorly outcropping region to the southwest of the Gawler Range Volcanics (Figure viii). It is interpreted to be largely composed of late Paleoproterozoic (~1620 -1608 Ma; Swain *et al*., 2008) intrusives of the St Peter Suite, as well as plutons of the ~1690 Ma Tunkillia Suite and ~1590 Ma Hiltaba Suite. The boundary between the Nuyts Domain and the Coulta Domain to the east is poorly understood, and is interpreted primarily on the basis of a change in magnetic signature. The eastern side of the Nuyts Domain hosts several Au-prospects of the Central Gawler Gold Province, including the Barns Prospect (Drown, 2003; Ferris and Schwarz, 2003; Fraser *et al*., 2007).

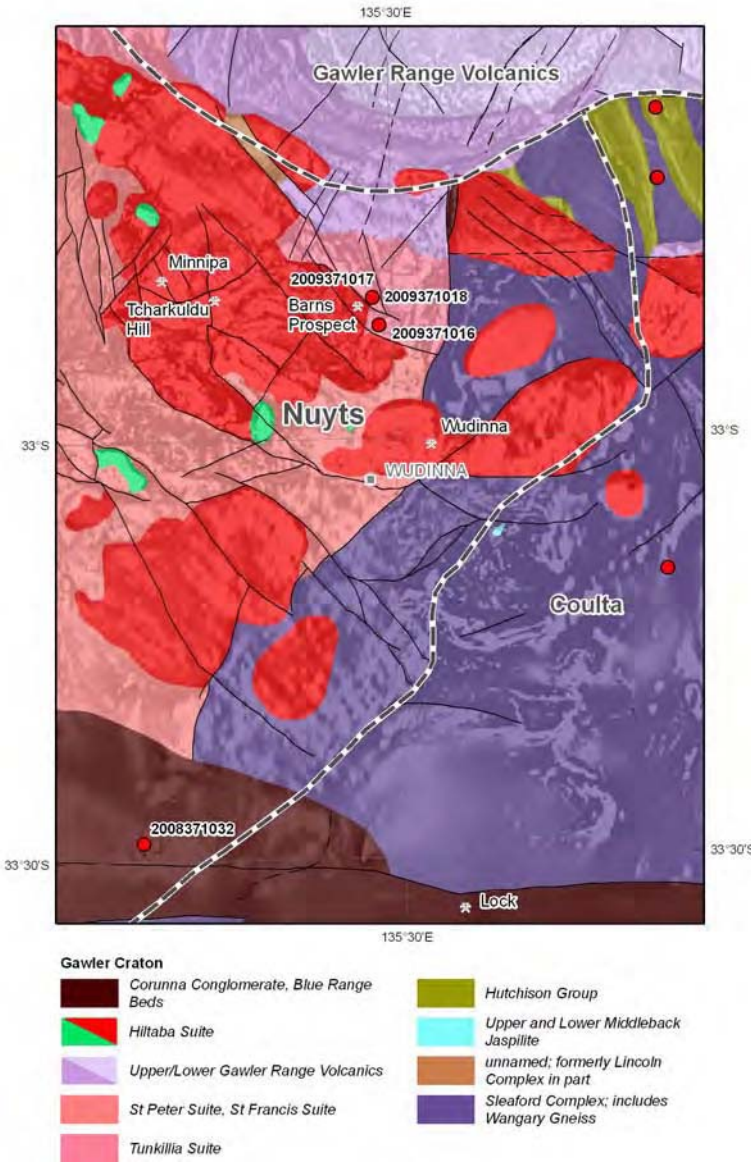

Figure viii. *Locations of new samples analysed for SHRIMP U-Pb zircon geochronology from the Nuyts Domain, Gawler Craton, South Australia, displayed on a partially transparent solid geology map (Cowley, 2006) laid over a magnetic intensity image.*

48. BLUE RANGE BEDS, MOUNT WEDGE: 2008371032

GA Sample ID:	**2008371032**
GA Sample Number:	**1958070**
Other Sample ID:	
1:250,000 Sheet:	**KIMBA SI 53-7**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS 84):	**511985 6295688 Zone 53**
Collector:	**G. Fraser, N. Neumann, M. Szpunar, S. McAvaney**
Collection Date:	**21/5/2008**
Formal Name:	**Blue Range Beds**
Informal Name:	
Lithology:	**Red sandstone**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6102**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**06 – 12/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.73% (2σ) [20 of 22]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3467.4 ± 2.6 Ma [19 of 19]**
Acquisition Date:	**06 – 12/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 3.12% (2σ) [8 of 8]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.7 ± 4.5 Ma [9 of 9]**
Interpreted Age:	**1605 ± 9 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample was collected from Mount Wedge, ~60 km west of Lock, on the central Eyre Peninsula, South Australia. The sample is a coarse-grained, well-sorted, massive to bedded sandstone (Figure 48.1).

Figure 48.1. *Thick-bedded, cross-bedded coarse-grained sandstone of the Blue Range Beds from Mount Wedge (sample 2008371032).*

Zircon Description

Zircons from this sample range from ~100 µm to ~210 µm in length, and are clear and light brown in colour. Some grains have a euhedral morphology, and preserve some prismatic terminations, whereas other grains are sub-rounded to rounded with minor pitting (Figure 48.2). Cathodoluminescence images record oscillatory zoning within most grains.

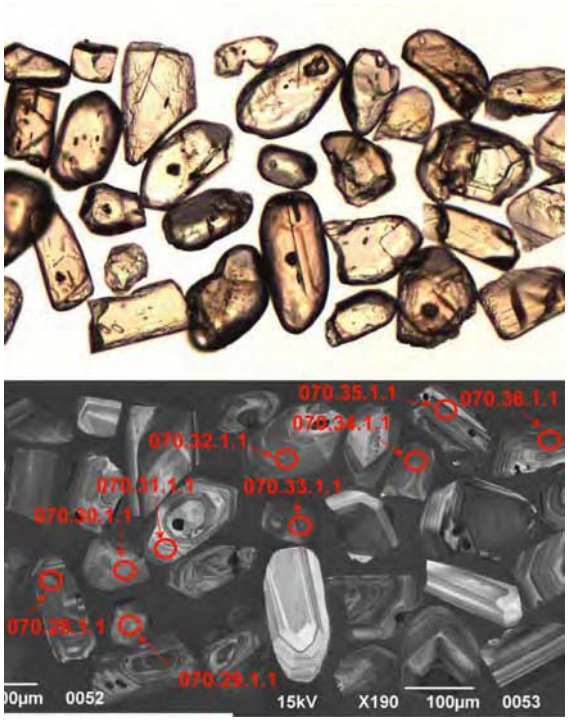

Figure 48.2. *Representative transmitted light and cathodoluminescence images of zircons from the Blue Range Beds (2008371032) with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Forty-five zircons were analysed, and two analyses which have common Pb contents greater than an arbitrary value of 0.5% were excluded from further consideration. The remaining 43 analyses range in age from ~1726 Ma to ~1569 Ma, with one older age at ~2706 Ma (Figure 48.3).

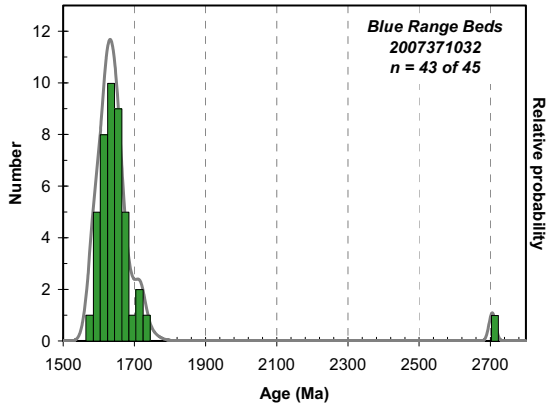

Figure 48.3. *Probability density diagram of zircon analyses from the Blue Range Beds (2008371032).*

Mixture modelling of the main group based on 3 components provides a youngest age of 1589 ± 14 Ma (17% of the group), with the other ages at ~1634 Ma and ~1715 Ma. Alternatively, using the MSWD and probability of fit as statistical guides provides a youngest weighted mean $^{207}Pb/^{206}Pb$ age of 1605 ± 9 Ma (95% confidence; n = 19; MSWD = 1.4; probability of fit = 0.12; Figure 48.4).

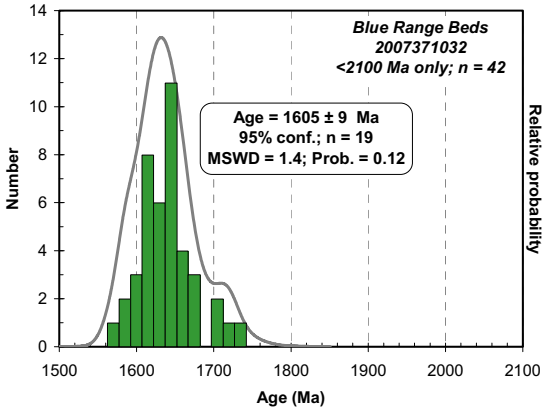

Figure 48.4. *Probability density diagram of zircon analyses from the Blue Range Beds (2008371032) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

Geochronological Interpretation

The youngest age of 1605 ± 9 Ma (95% confidence; n = 19) calculated using statistical guides can be used to define a maximum depositional age of this Blue Range Bed sample.

Table 48.1. SHRIMP U-Pb isotopic data for zircons from sample 2008371032 (1958070), Blue Range Beds, Mount Wedge.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircon (n = 43)											
070.17.1.1	0.00	137	110	0.83	1.97	2.1	.1858	0.6	2706	9	2
070.26.1.1	0.19	56	44	0.82	3.32	2.0	.1057	1.4	1726	26	2
070.41.1.1	0.00	133	57	0.44	3.30	1.7	.1053	0.7	1719	13	1
070.43.1.1	0.13	100	55	0.57	3.23	1.8	.1048	0.9	1710	16	-2
070.3.1.1	-0.38	34	70	2.14	3.60	2.7	.1040	2.6	1697	48	7
070.22.1.1	0.09	48	107	2.30	3.38	2.1	.1026	1.7	1672	32	0
070.13.1.1	0.21	67	40	0.62	3.31	2.3	.1026	1.8	1671	33	-2
070.40.1.1	-0.14	56	61	1.12	3.49	2.0	.1024	1.6	1668	30	3
070.19.1.1	-0.12	90	93	1.08	3.55	1.9	.1022	1.1	1665	21	4
070.30.1.1	0.11	72	72	1.02	3.59	2.1	.1021	1.1	1662	20	5
070.2.1.1	-0.01	94	116	1.27	3.47	2.8	.1019	1.1	1660	19	2
070.38.1.1	-0.09	168	118	0.73	3.53	1.8	.1017	0.7	1655	13	3
070.44.1.1	-0.01	59	36	0.63	3.40	1.9	.1013	1.0	1649	19	-1
070.31.1.1	-0.11	74	45	0.62	3.51	1.9	.1013	1.1	1649	21	2
070.29.1.1	0.00	127	89	0.73	3.52	1.7	.1013	0.8	1649	15	2
070.12.1.1	-0.04	82	80	1.01	3.56	2.2	.1013	1.2	1648	22	3
070.4.1.1	-0.24	52	101	2.02	3.49	2.4	.1013	1.9	1648	35	1
070.23.1.1	-0.12	55	54	1.02	3.50	2.0	.1012	1.6	1646	30	2
070.24.1.1	-0.03	142	85	0.62	3.42	1.8	.1009	0.9	1641	18	-1
070.39.1.1	-0.01	45	52	1.19	3.49	2.0	.1008	1.3	1638	25	1
070.8.1.1	0.08	76	134	1.83	3.46	2.2	.1007	1.3	1637	23	0
070.32.1.1	0.06	117	96	0.85	3.40	1.8	.1007	0.8	1637	15	-2
070.34.1.1	0.08	115	97	0.87	3.42	1.8	.1006	0.9	1636	17	-1
070.27.1.1	0.04	161	145	0.93	3.47	1.7	.1005	0.7	1633	12	0
070.5.1.1	0.04	123	91	0.76	3.47	2.1	.1004	1.0	1631	18	0
070.16.1.1	-0.01	112	86	0.79	3.56	2.1	.1003	1.0	1630	18	2
070.15.1.1	0.08	115	98	0.87	3.50	2.1	.1002	1.1	1628	20	0
070.42.1.1	0.09	184	102	0.57	3.39	1.8	.1001	0.7	1626	13	-3
070.9.1.1	0.16	75	61	0.85	3.53	2.3	.0998	1.8	1621	33	1
070.21.1.1	0.25	70	40	0.60	3.47	2.6	.0998	1.6	1620	29	-1
070.35.1.1	0.17	110	102	0.96	3.59	1.8	.0997	1.1	1618	21	2
070.25.1.1	0.02	230	156	0.70	3.43	1.7	.0996	0.6	1617	11	-2
070.18.1.1	-0.08	80	201	2.59	3.61	2.2	.0995	1.2	1614	23	2
070.11.1.1	-0.06	144	86	0.62	3.51	2.1	.0994	0.9	1613	16	0
070.36.1.1	0.12	115	157	1.41	3.52	1.8	.0992	1.0	1610	18	0
070.37.1.1	0.07	139	132	0.98	3.52	1.7	.0992	0.7	1609	14	0
070.7.1.1	0.00	66	65	1.02	3.49	2.3	.0991	1.3	1608	23	-1
070.28.1.1	0.04	79	65	0.85	3.50	1.9	.0986	1.0	1598	18	-1
070.20.1.1	0.01	189	467	2.56	3.61	1.7	.0985	0.7	1595	13	1
070.1.1.1	-0.01	102	107	1.08	3.41	2.2	.0984	1.0	1593	19	-4
070.10.1.1	0.01	170	301	1.83	3.59	2.3	.0979	0.8	1585	15	0
070.45.1.1	0.03	278	207	0.77	3.53	1.7	.0979	0.5	1584	10	-2
070.33.1.1	0.10	163	94	0.59	3.64	1.7	.0971	0.7	1569	13	0
Analyses >0.5% $^{206}Pb_c$ (n = 2)											
070.6.1.1	1.35	84	84	1.03	3.51	2.2	.0983	2.7	1593	50	-1
070.14.1.1	0.91	86	58	0.70	3.47	2.2	.0997	2.2	1618	41	-1

49. GRANITIC GNEISS, POVERTY CORNER: 2009371016

GA Sample ID:	**2009371016**
GA Sample Number:	**1999452**
Other Sample ID:	
1:250,000 Sheet:	**YARDEA SI 53-3**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS84):	**544969 6363452 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**1/7/2009**
Formal Name:	
Informal Name:	
Lithology:	**granitic gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6105**
Instrument:	**SHRIMP-IIe Geoscience Australia**
Acquisition Date:	**23 – 27/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.54 % (2σ) [41 of 41]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.8 ± 1.8 Ma [20 of 20]**
Interpreted Age:	**1717 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

Poverty Corner is located ~20 km north of the town of Wudinna, Eyre Peninsula, South Australia. Outcrop at Poverty Corner is dominated by horizontal platforms of quartzofeldspathic gneisses. This sample was collected from boulders on the roadside adjacent to the main platform outcrops. It consists of orange-weathering granitic gneiss, with layering defined by discontinuous, biotite-rich schlieren (Figure 49.1).

Fanning *et al*. (2007) reported an age of 1710 ± 10 Ma from an interpreted metasedimentary enclave within gneisses at Poverty Corner.

Figure 49.1. *Outcrop of granitic gneiss at Poverty Corner; sample 2009371016.*

Zircon Description

Zircons from this sample occur as blocky, euhedral grains, typically with aspect ratios between 1.5 and 2. In cathodoluminescence images (CL) the zircons are dominated by concentric, oscillatory zoning throughout. One example was found (grain 16) in which the interior of the grain contains a rounded core overgrown by oscillatory zoned zircon. Most grains are rimmed by a zone of dark CL response, too narrow to place the SHRIMP spot on (Figure 49.2). Many of the zircons contain clear inclusions with bright CL response.

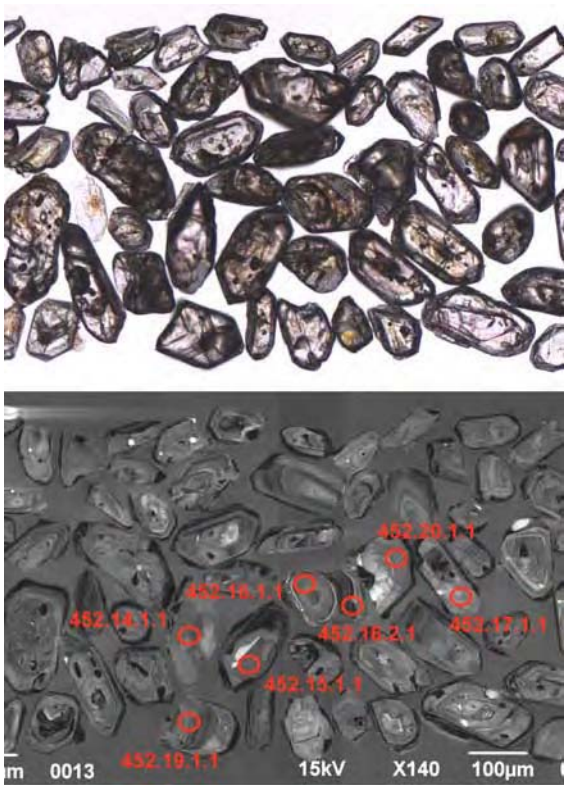

Figure 49.2. *Representative transmitted light and cathodoluminescence images of zircons from granitic gneiss at Poverty Corner (2009381016), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 23 zircon analyses were collected from 21 different zircon grains. All but one of these analyses yields a Paleoproterozoic $^{207}Pb/^{206}Pb$ age of approximately 1700 Ma (Figure 49.3). The exception is analysis 452.16.1.1 that comes from a morphologically distinct core, and yields a $^{207}Pb/^{206}Pb$ age of 2650 Ma that is 13% discordant, and is interpreted as an inherited xenocryst. Of the remaining 22 analyses, 3 are >10% discordant and have not been included in weighted mean age calculations. Nineteen analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1717 ± 4 Ma (95% confidence; MSWD = 0.69; probability of fit = 0.82; Figure 49.4).

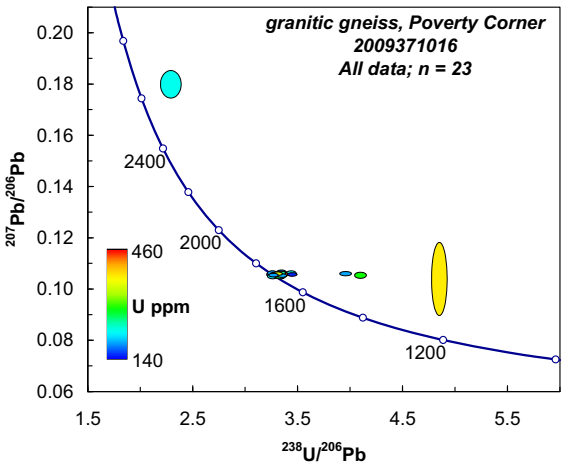

Figure 49.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the granitic gneiss from Poverty Corner (2009371016), coloured according to U content.*

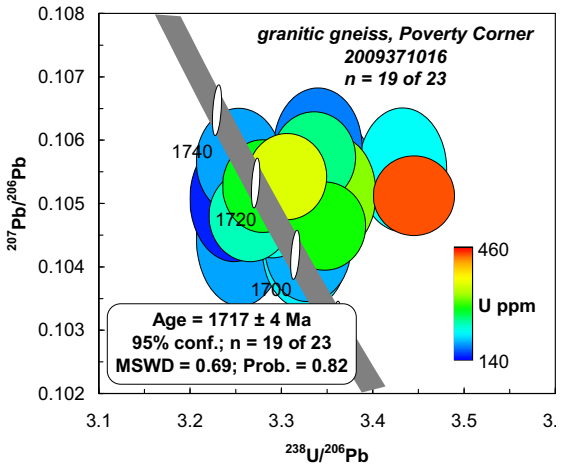

Figure 49.4. *Tera-Wasserburg concordia diagram showing results of near-concordant, Paleoproterozoic zircon analyses from the granitic gneiss from Poverty Corner (2009371016), coloured according to U content.*

Geochronological Interpretation

The mean age of 1717 ± 4 Ma is interpreted as the igneous crystallisation age of this rock.

Table 49.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371016 (1999452), granitic gneiss, Poverty Corner.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited zircon (n = 1)											
452.16.1.1	0.39	222	279	1.30	2.28	2.8	.1797	2.0	2650	32	13
Igneous zircon (n = 19)											
452.6.1.1	0.02	175	84	0.50	3.34	1.0	.1059	0.6	1730	11	2
452.9.1.1	0.03	256	142	0.57	3.34	0.9	.1057	0.5	1727	8	2
452.13.2.1	-0.02	187	115	0.64	3.25	1.0	.1057	0.5	1726	10	0
452.8.1.1	0.06	185	88	0.49	3.34	1.0	.1056	0.6	1725	11	2
452.19.1.1	0.17	219	129	0.61	3.43	0.9	.1055	0.6	1724	11	5
452.4.1.1	0.09	356	178	0.52	3.31	0.9	.1054	0.4	1722	8	1
452.13.1.1	0.23	187	93	0.51	3.35	1.1	.1053	0.7	1719	13	2
452.1.1.1	0.07	281	126	0.46	3.28	0.9	.1053	0.5	1719	8	0
452.15.1.1	0.03	194	131	0.70	3.31	0.9	.1052	0.5	1719	10	1
452.14.1.1	0.04	319	187	0.61	3.36	0.9	.1052	0.6	1717	11	2
452.21.1.1	0.07	441	249	0.58	3.45	0.9	.1051	0.4	1716	7	4
452.11.1.1	0.00	148	64	0.45	3.25	1.0	.1051	0.6	1716	12	-1
452.2.1.1	0.03	171	85	0.51	3.31	1.0	.1049	0.6	1713	10	1
452.20.1.1	0.01	224	117	0.54	3.29	0.9	.1049	0.5	1712	9	0
452.18.1.1	0.01	242	127	0.54	3.26	0.9	.1048	0.5	1711	8	-1
452.5.1.1	0.04	289	168	0.60	3.35	0.9	.1046	0.4	1708	8	1
452.17.1.1	0.07	187	87	0.48	3.25	1.0	.1045	0.7	1705	13	-1
452.12.1.1	0.01	190	98	0.53	3.33	1.0	.1043	0.6	1702	10	1
452.3.1.1	0.11	211	95	0.46	3.33	0.9	.1043	0.6	1701	11	0
>10% discordant (n = 3)											
452.10.1.1	-0.03	215	403	1.93	3.96	0.9	.1054	0.5	1721	10	18
452.7.1.1	0.33	272	253	0.96	4.10	0.9	.1048	0.8	1711	14	22
452.16.2.1	7.54	384	449	1.21	4.85	1.0	.1033	9.2	1684	169	39

50. GREY GNEISS, LITTLE PINBONG ROCKHOLE: 2009371017

GA Sample ID:	**2009371017**
GA Sample Number:	**1999453**
Other Sample ID:	
1:250,000 Sheet:	**YARDEA SI 53-3**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS84):	**544180 6367107 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**1/7/2009**
Formal Name:	
Informal Name:	
Lithology:	**quartzofeldspathic biotite gneiss**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6105**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**23 – 27/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.54 % (2σ) [41 of 41]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.8 ± 1.8 Ma [20 of 20]**
Interpreted Age:	**1714 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

Little Pinbong Rockhole is located ~25 km north of the town of Wudinna, Eyre Peninsula, South Australia. This sample is a banded, migmatitic grey gneiss, with prominent leucosomes forming the gneissic banding (Figure 50.1). This represents the dominant rock type at Little Pinbong Rockhole.

Fanning *et al.* (2007) reported an age of 1669 ± 13 Ma from a foliated granodiorite from Little Pinbong Rockhole.

Figure 50.1. *Outcrop of grey gneiss at Little Pinbong Rockhole; sample 2009371017.*

Zircon Description

Zircons from this sample form subhedral, slightly elongate (aspect ratios typically ~2), blocky grains. In cathodoluminesence (CL) images most grains preserve relict oscillatory zoning. In most cases this zonation appears to have been subsequently modified to a mottled appearance (Figure 50.2).

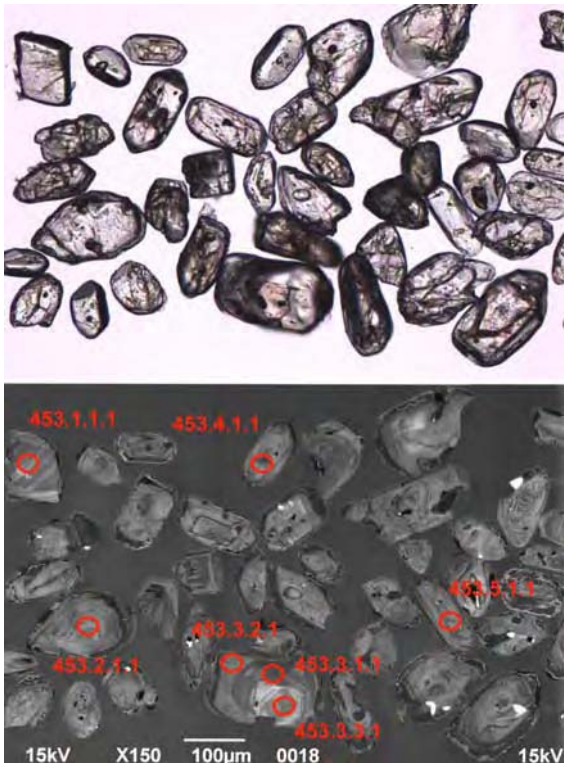

Figure 50.2. *Representative transmitted light and cathodoluminescence images of zircons from grey gneiss at Little Pinbong Rockhole (2009371017), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 29 analyses were collected from 27 different zircon grains. All 29 analyses define a single age population with a weighted mean $^{207}Pb/^{206}Pb$ age of 1714 ± 4 Ma (95% confidence; MSWD = 1.2; probability of fit = 0.21; Figure 50.3). Uranium content of the grains is typically between ~180 and 250 ppm, and Th/U ranges between ~0.4 and 0.7. A single analysis (453.Z.27.1.1) was collected from a very dark CL, mottled region containing a much higher U-content (1468 ppm) and very low Th/U (0.07). This analysis, although compositionally distinct, yields an age that is statistically indistinguishable from the grouping defined by the other 28 analyses.

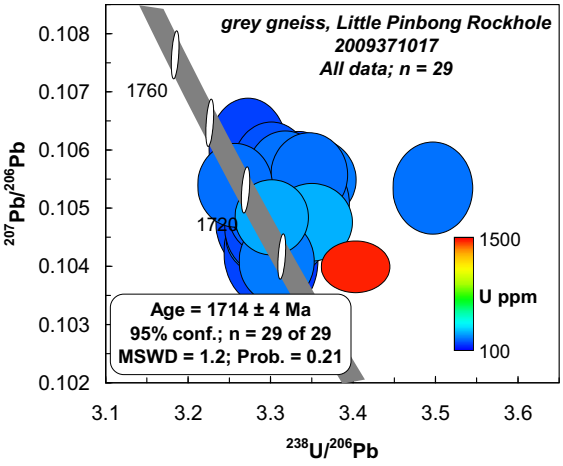

Figure 50.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the grey gneiss from Little Pinbong Rockhole (2009371017), coloured according to U content.*

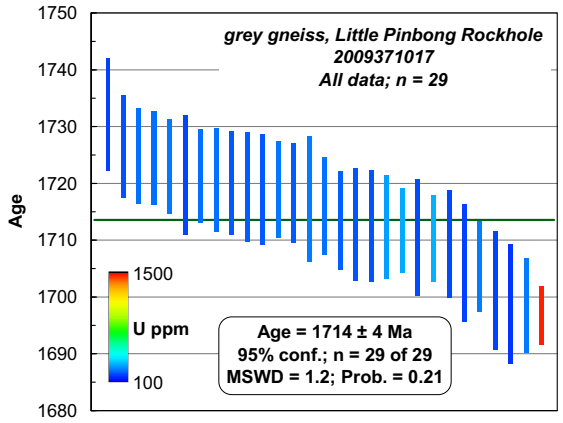

Figure 50.4. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of concordant zircon analyses from the grey gneiss at Little Pinbong Rockhole (2009371017), coloured according to U content.*

Geochronological Interpretation

The age of 1714 ± 4 Ma is interpreted as the best estimate of the time of igneous crystallisation of this rock. There is no evidence in the zircon morphologies, or in the isotopic data, for any zircon inheritance in this rock.

Table 50.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371017 (1999453), grey gneiss, Little Pinbong Rockhole.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Igneous zircon (n = 29)											
453.20.1.1	0.03	177	84	0.49	3.27	1.0	.1060	0.5	1732	10	1
453.14.1.1	-0.04	199	106	0.55	3.30	0.9	.1057	0.5	1727	9	1
453.6.1.1	0.00	240	128	0.55	3.32	0.9	.1056	0.5	1725	8	2
453.3.2.1	-0.01	237	104	0.45	3.35	0.9	.1056	0.5	1725	8	2
453.7.1.1	0.02	248	167	0.70	3.35	1.1	.1055	0.5	1723	8	2
453.13.1.1	0.05	184	95	0.53	3.33	1.0	.1054	0.6	1722	11	2
453.17.1.1	0.02	236	135	0.59	3.26	0.9	.1054	0.4	1721	8	0
453.19.1.1	0.04	239	161	0.69	3.50	0.9	.1054	0.5	1721	9	6
453.23.1.1	0.00	208	129	0.64	3.33	0.9	.1053	0.5	1720	9	2
453.9.1.1	0.09	213	130	0.63	3.33	0.9	.1053	0.5	1719	10	1
453.22.1.1	0.06	208	124	0.62	3.30	0.9	.1053	0.5	1719	10	1
453.25.1.1	0.00	247	166	0.70	3.31	1.1	.1053	0.5	1719	9	1
453.5.1.1	0.02	211	120	0.59	3.29	0.9	.1052	0.5	1718	9	0
453.1.1.1	0.22	252	183	0.75	3.33	0.9	.1052	0.6	1717	11	1
453.26.1.1	0.03	239	115	0.49	3.35	0.9	.1051	0.5	1716	9	2
453.11.1.1	-0.01	215	131	0.63	3.30	1.0	.1050	0.5	1714	9	0
453.21.1.1	0.05	204	103	0.52	3.30	0.9	.1049	0.5	1713	10	1
453.2.1.1	0.04	201	105	0.54	3.31	1.0	.1049	0.5	1713	10	1
453.12.1.1	0.15	296	191	0.67	3.34	0.9	.1049	0.5	1712	9	1
453.10.1.1	0.02	310	230	0.77	3.30	0.9	.1049	0.4	1712	7	0
453.16.1.1	0.07	190	96	0.52	3.29	1.1	.1048	0.6	1711	10	0
453.3.1.1	0.05	319	234	0.76	3.35	1.0	.1048	0.4	1710	8	2
453.18.1.1	0.00	186	86	0.47	3.29	0.9	.1047	0.5	1709	10	0
453.24.1.1	0.06	179	89	0.52	3.30	1.0	.1045	0.6	1706	10	0
453.4.1.1	0.03	255	142	0.57	3.31	1.2	.1045	0.4	1705	8	0
453.3.3.1	0.07	181	134	0.76	3.29	0.9	.1043	0.6	1701	10	-1
453.15.1.1	0.05	164	78	0.49	3.31	1.0	.1041	0.6	1699	11	0
453.8.1.1	0.02	251	135	0.56	3.31	0.9	.1041	0.5	1698	8	0
453.27.1.1	0.01	1468	94	0.07	3.40	0.8	.1040	0.3	1697	5	2

51. LEUCOCRATIC SEGREGATION, LITTLE PINBONG ROCKHOLE: 2009371018

GA Sample ID:	**2009371018**
GA Sample Number:	**1999454**
Other Sample ID:	
1:250,000 Sheet:	**YARDEA SI 53-3**
Region:	**Eyre Peninsula, South Australia**
Grid Reference (WGS84):	**544180 6367107 Zone 53**
Collector:	**G. L. Fraser & N. L. Neumann**
Collection Date:	**1/7/2009**
Formal Name:	
Informal Name:	
Lithology:	**leucocratic segregation**
Geochronologist:	**G. L. Fraser**
Mount ID:	**GA6105**
Instrument:	**SHRIMP-IIe Geoscience Australia**
Acquisition Date:	**23 – 27/10/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.54 % (2σ) [41 of 41]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.8 ± 1.8 Ma [20 of 20]**
Interpreted Age:	**1712 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

Little Pinbong Rockhole is located ~25 km north of the town of Wudinna, Eyre Peninsula, South Australia. This sample was collected from the same location as 2009371017 (1999453) and represents a segregation of leucocratic material that is distributed at a variety of scales throughout the gneissic host rock. In this case, the leucocratic material forms an irregular shaped segregation approximately 1 metre in length within a fold hinge in the host gneiss (Figure 51.1).

Figure 51.1. *Leucocratic segregation (lower right) at Little Pinbong Rockhole; sample 2009371018.*

Zircon Description

Zircon from this sample occurs as subhedral, slightly elongate grains, with similar morphology and internal zonation as seen in zircon from the host gneiss (sample 2009371017), although the grains in this sample are, on average, smaller, typically <100 μm in long dimension (Figure 51.2).

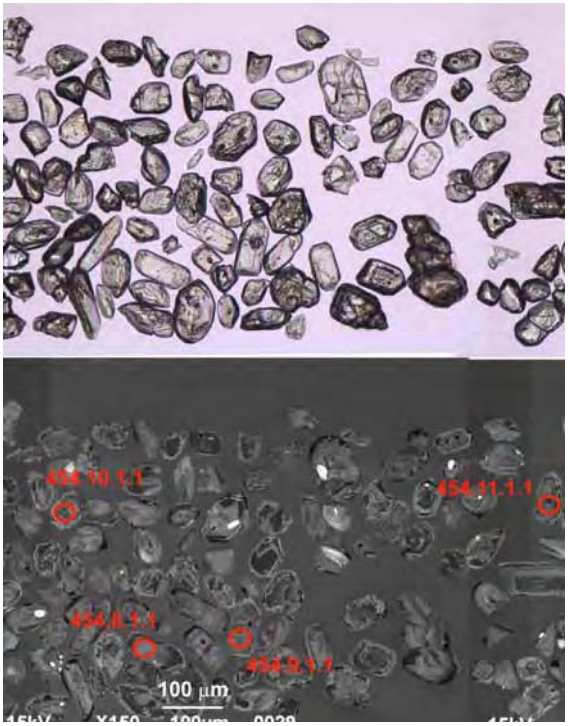

Figure 51.2. *Representative transmitted light and cathodoluminescence images of zircons from leucocratic segregation at Little Pinbong Rockhole (2009371018), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 27 analyses were collected from 27 different zircon grains. All 27 analyses plot near concordia in a single age grouping with a weighted mean $^{207}Pb/^{206}Pb$ age of 1712 ± 3 Ma (95% confidence; MSWD = 1.04; probability of fit = 0.41; Figure 51.3). With the exception of 2 analyses, U-content ranges between ~180 and 500 ppm, and Th/U is typically between ~0.6 and 1.0. Two analyses (454.10.1.1 and 454.16.1.1) contain much higher U-contents of ~2640 and 1820 ppm respectively, but yield ages indistinguishable from the main age grouping.

Geochronological Interpretation

The mean age of 1712 ± 3 Ma is interpreted as the best estimate for the time of igneous crystallisation of this rock, and is within uncertainty of the age derived from the host gneiss (sample 2009371017).

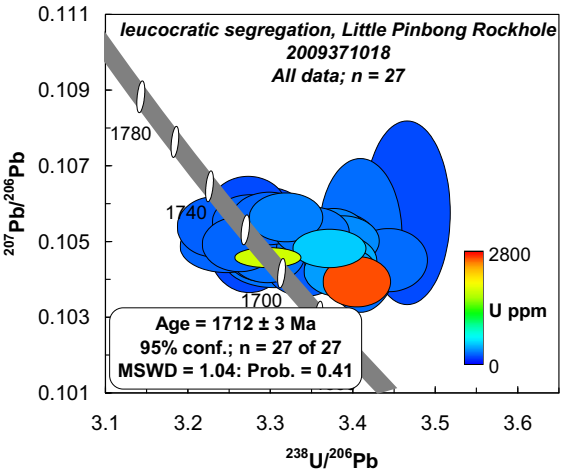

Figure 51.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from the leucocratic segregation at Little Pinbong Rockhole (2009371018), coloured according to U content.*

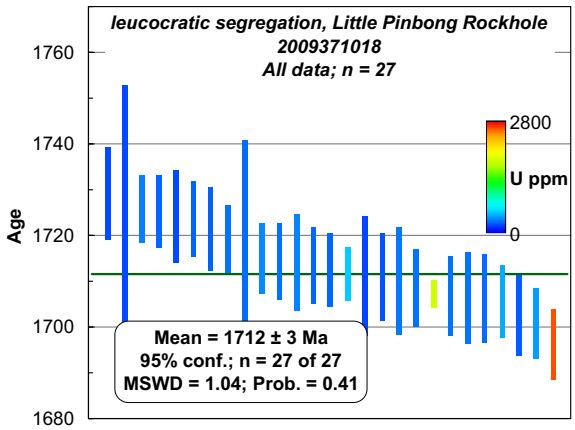

Figure 51.4. *Mean age diagram showing $^{207}Pb/^{206}Pb$ ages of concordant zircon analyses from the leucocratic segregation at Little Pinbong Rockhole (2009371018), coloured according to U content.*

Table 51.1. SHRIMP U-Pb isotopic data for zircons from sample 2009371018 (1999454), leucocratic segregation, Little Pinbong Rockhole.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Igneous zircon (n = 27)											
454.8.1.1	0.04	179	100	0.58	3.27	1.0	.1059	0.6	1729	10	1
454.22.1.1	0.67	181	248	1.42	3.47	1.0	.1058	1.5	1728	28	6
454.21.1.1	0.01	315	233	0.76	3.32	0.9	.1057	0.4	1726	7	2
454.24.1.1	0.00	248	161	0.67	3.30	0.9	.1056	0.4	1725	8	1
454.6.1.1	0.04	178	90	0.52	3.30	1.0	.1056	0.6	1724	10	1
454.25.1.1	-0.02	244	144	0.61	3.28	0.9	.1055	0.5	1723	8	0
454.17.1.1	0.02	235	150	0.66	3.23	0.9	.1054	0.5	1721	9	-1
454.12.1.1	0.00	285	199	0.72	3.35	0.9	.1053	0.4	1719	7	2
454.5.1.1	0.51	267	149	0.58	3.41	1.0	.1052	1.3	1717	23	4
454.15.1.1	0.05	344	262	0.79	3.39	0.9	.1050	0.4	1715	8	3
454.14.1.1	0.04	275	178	0.67	3.30	0.9	.1050	0.5	1714	8	1
454.27.1.1	0.03	326	299	0.95	3.38	0.9	.1050	0.6	1714	11	3
454.2.1.1	0.03	248	156	0.65	3.26	0.9	.1049	0.5	1713	8	-1
454.7.1.1	0.00	248	145	0.61	3.25	1.1	.1049	0.4	1712	8	-1
454.11.1.1	-0.01	504	342	0.70	3.37	0.9	.1048	0.3	1711	6	2
454.23.1.1	0.07	173	80	0.48	3.28	1.0	.1048	0.7	1711	13	0
454.26.1.1	0.04	204	110	0.56	3.29	0.9	.1048	0.5	1711	10	0
454.13.1.1	0.20	294	276	0.97	3.39	0.9	.1048	0.6	1710	12	3
454.19.1.1	0.02	278	208	0.77	3.30	0.9	.1047	0.5	1708	8	0
454.16.1.1	0.01	1823	1602	0.91	3.30	0.8	.1046	0.2	1707	3	0
454.9.1.1	0.03	282	148	0.54	3.31	1.2	.1046	0.5	1707	9	0
454.4.1.1	0.04	283	207	0.75	3.37	0.9	.1045	0.5	1706	10	2
454.1.1.1	0.12	265	160	0.62	3.44	0.9	.1045	0.5	1706	10	4
454.18.1.1	0.14	428	244	0.59	3.39	0.9	.1045	0.4	1706	8	2
454.20.1.1	0.02	225	138	0.63	3.34	0.9	.1043	0.5	1702	9	1
454.3.1.1	0.11	388	221	0.59	3.39	0.9	.1042	0.4	1701	8	2
454.10.1.1	0.34	2644	2953	1.15	3.41	0.8	.1040	0.4	1696	8	2

Curnamona Province

MOOLAWATANA DOMAIN

The Moolawatana Domain, as defined by Conor and Preiss (2008), is located at the north-western extremity of the Curnamona Province, and includes the Mount Painter and Mount Babbage Inliers, and the shallowly buried eastern extension of these rocks (Figure ix). The geological framework of the Mount Painter and Mount Babbage Inliers, based on the stratigraphic summary of Teale (1993a, 1993b), divides Proterozoic lithostratigraphic units into two broad groups; multiply deformed Paleoproterozoic metasedimentary and meta-igneous units, and Mesoproterozoic siliceous volcanics, sedimentary sequences and granites. Paleozoic granites within the Mount Painter and Babbage Inliers are associated with metamorphism and deformation during the Delamerian Orogeny and Alice Springs Orogeny (e.g., McLaren *et al*., 2006). Stratigraphic units east of the Mount Painter and Mount Babbage Inliers are defined by drillhole information.

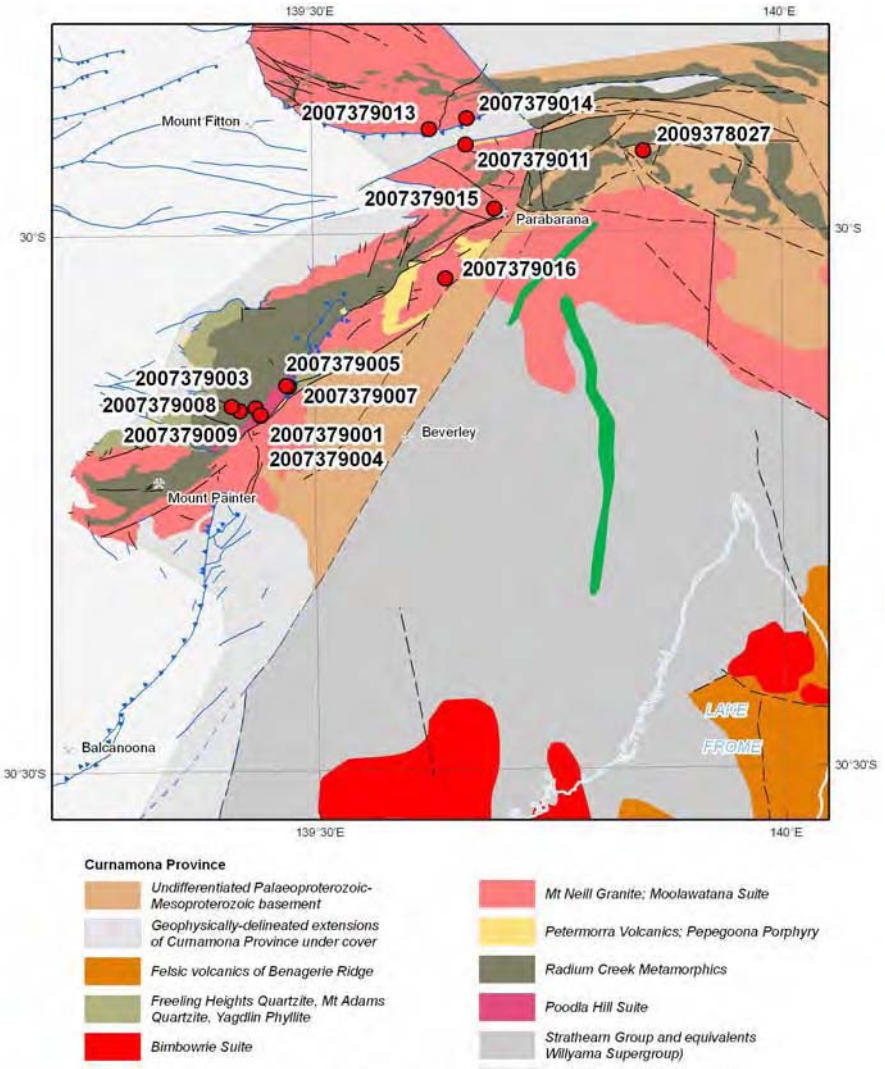

Figure ix. *Location of new samples analysed for SHRIMP U-Pb zircon geochronology from the Moolawatana Domain, South Australia, displayed on a solid geology map (Cowley, 2006).*

52. RADIUM CREEK METAMORPHICS, PARALANA CREEK: 2007379003

GA Sample ID:	**2007379003**
GA Sample Number:	**1952105**
Other Sample ID:	
1:250,000 Sheet:	**COPLEY SH 54-9**
Region:	**Mount Painter Inlier, South Australia**
Grid Reference (WGS 84):	**349475 6662232 Zone 54**
Collector:	**N. L. Neumann, G. L. Fraser & S. Hore**
Collection Date:	**19/10/2007**
Formal Name:	**Radium Creek Metamorphics**
Informal Name:	**Metasediment; Suite 4**
Lithology:	**Quartzofeldspathic gneiss**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6051**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**08 – 12/08/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.57% (2σ) [27 of 28]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3468.1 ± 2.1 Ma [27 of 28]**
Interpreted Age:	**1600 ± 8 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample was collected from Paralana Creek, ~1.5 km north north-west of the Paralana Hot Springs, Mount Painter Inlier, South Australia. The sample is from the unit mapped as Radium Creek Metamorphics (Coats *et al*., 1969), which equates to Suite 4 of Teale (1993a), and is a quartzofeldspathic gneiss with heavy mineral banding (Figure 52.1).

Figure 52.1. *Quartzofeldspathic gneiss of the Radium Creek Metamorphics from Paralana Creek, Mount Painter Inlier (sample 2007379003).*

Zircon Description

Zircons from this sample range in length from ~80 µm to ~180 µm, with some larger grains up to ~220 µm in length (Figure 52.2). Some grains have a euhedral morphology with some prismatic terminations preserved, while others are rounded to well-rounded. Most grains are clear and colourless, with cathodoluminescence images recording oscillatory zoning within most grains (Figure 52.2). Some grains have thin, bright cathodoluminescence rims. As this sample was analysed to determine a maximum depositional age, analyses were located on central oscillatory zones within grains, away from any rims which may record later metamorphism.

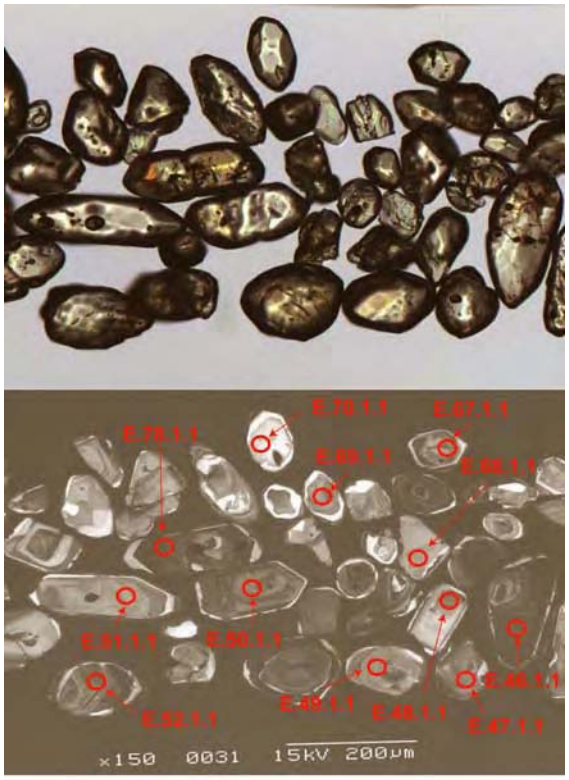

Figure 52.2. *Representative transmitted light and cathodoluminescence images of zircons from the Radium Creek Metamorphics (2007379003), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Eighty seven analyses were undertaken on 86 zircons. Five analyses with common Pb contents greater than an arbitrary value of 0.5% have been excluded from further consideration, as have two discordant analyses. The four youngest ages are ≥5% discordant, including both analyses of grain E.73, and so given their analytical uncertainly, haven't been used to define the provenance or the calculation of the maximum depositional age of this sample.

The remaining 76 analyses range in age between ~2473 Ma and ~1557 Ma (Figure 52.3), and include individual ages at ~2473 Ma and ~2123 Ma, and two ages at ~1870 Ma, with the remaining ages forming a range between ~1810 Ma and ~1557 Ma., with possible age clusters at ~1725 Ma, ~1670 Ma and ~1605 Ma (Figure 52.3).

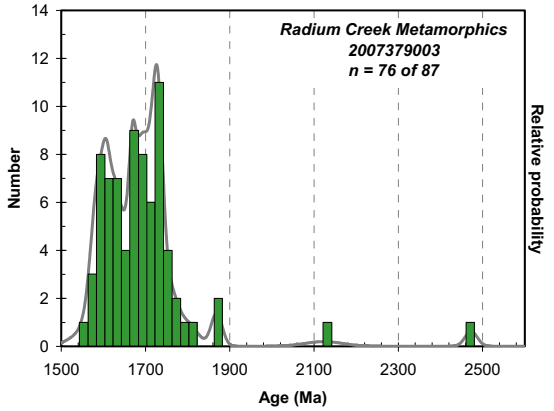

Figure 52.3. *Probability density diagram of zircon analyses from the Radium Creek Metamorphics (2007379003).*

The youngest individual age is 1557 ± 70 Ma (2σ), and this analysis forms part of the ~1810 Ma to ~1557 Ma cluster (Figure 52.4). The youngest mixture modelling age this youngest cluster is 1603 ± 6 Ma, which is indistinguishable from the weighted mean $^{207}Pb/^{206}Pb$ age of 1600 ± 8 Ma (95% confidence; MSWD = 1.5; probability of fit = 0.07) for the youngest 23 analyses in this cluster (Figure 52.4).

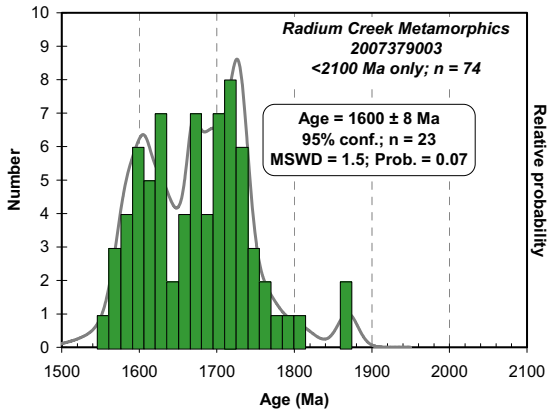

Figure 52.4. *Probability density diagram of zircon analyses from the Radium Creek Metamorphics (2007379003) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

Geochronological Interpretation

The weighted mean age of 1600 ± 8 Ma (95% confidence; n = 23) can be used to define a maximum depositional age for this sample.

Table 52.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379003 (1952105), Radium Creek Metamorphics, Paralana Creek.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircon (n = 76)											
E.41.1.1	0.01	1293	81	0.06	2.21	1.4	.1616	0.9	2473	15	3
E.27.1.1	0.02	572	81	0.15	2.49	1.4	.1319	2.6	2123	46	-3
E.19.1.1	0.05	171	104	0.63	3.00	1.5	.1143	0.8	1869	15	1
E.83.1.1	0.01	279	93	0.34	2.91	1.4	.1143	0.7	1868	12	-2
E.59.1.1	-0.08	101	55	0.56	3.26	1.6	.1107	1.1	1811	20	5
E.84.1.1	0.07	221	160	0.75	3.34	1.5	.1098	1.1	1796	20	6
E.64.1.1	0.10	202	120	0.61	3.17	1.5	.1083	0.7	1770	13	0
E.24.1.1	-0.13	89	95	1.11	3.31	1.6	.1082	1.2	1769	22	4
E.76.1.1	0.04	211	104	0.51	3.29	1.5	.1074	0.9	1756	16	3
E.69.1.1	0.00	165	109	0.68	3.24	1.5	.1069	0.8	1747	15	1
E.25.1.1	-0.06	209	185	0.91	3.33	1.5	.1069	0.7	1747	12	3
E.37.1.1	0.04	474	332	0.72	3.36	1.4	.1065	0.5	1740	8	4
E.57.1.1	-0.02	665	283	0.44	3.35	1.4	.1060	0.4	1731	8	3
E.63.1.1	0.14	140	199	1.47	3.22	1.5	.1058	1.0	1729	18	-1
E.9.1.1	-0.03	298	161	0.56	3.32	1.4	.1058	0.5	1729	10	2
E.35.1.1	0.07	308	342	1.14	3.31	1.4	.1058	0.6	1728	12	1
E.14.1.1	-0.02	163	59	0.38	3.42	1.5	.1058	0.7	1728	13	4
E.16.1.1	-0.04	307	209	0.70	3.35	1.6	.1058	0.6	1728	11	3
E.8.1.1	0.02	287	216	0.78	3.33	1.4	.1056	0.6	1725	10	2
E.77.1.1	0.09	184	142	0.80	3.27	1.5	.1055	0.9	1724	17	0
E.13.1.1	0.02	336	214	0.66	3.39	1.4	.1055	0.5	1723	10	3
E.74.1.1	0.08	347	186	0.55	3.30	1.4	.1054	0.6	1722	12	1
E.82.1.1	0.07	224	192	0.89	3.32	1.5	.1054	0.7	1722	13	1
E.21.1.1	0.03	140	154	1.14	3.35	1.5	.1050	1.0	1715	18	2
E.40.1.1	0.02	418	155	0.38	3.31	1.4	.1049	0.7	1713	13	1
E.22.1.1	0.22	231	156	0.70	3.34	1.4	.1048	0.8	1711	14	1
E.7.1.1	0.16	108	64	0.61	3.34	1.6	.1046	1.3	1708	23	1
E.6.1.1	-0.02	107	67	0.64	3.41	1.6	.1044	0.9	1704	16	3
E.79.1.1	0.04	217	143	0.68	3.52	1.5	.1044	0.7	1704	13	5
E.11.1.1	0.03	126	99	0.82	3.36	1.6	.1041	0.8	1698	15	1
E.17.1.1	0.08	238	271	1.18	3.40	1.4	.1040	0.7	1697	13	2
E.81.1.1	0.25	123	135	1.13	3.22	1.9	.1039	1.1	1695	20	-3
E.80.1.1	0.13	308	169	0.57	3.24	1.4	.1039	0.6	1695	12	-2
E.49.1.1	0.11	169	130	0.80	3.34	1.5	.1039	1.0	1695	18	0
E.67.1.1	0.08	255	305	1.24	3.42	1.6	.1036	0.7	1689	12	2
E.34.1.1	0.05	246	191	0.80	3.37	1.6	.1035	0.6	1688	12	1
E.44.1.1	0.24	58	33	0.59	3.34	1.8	.1033	1.5	1684	27	0
E.48.1.1	0.19	161	225	1.45	3.53	1.5	.1030	1.0	1680	19	4
E.54.1.1	0.09	276	90	0.34	3.36	1.4	.1029	0.7	1678	12	0
E.61.1.1	0.07	333	190	0.59	3.41	1.4	.1028	0.6	1674	11	1
E.20.1.1	0.07	158	192	1.26	3.35	1.7	.1027	0.9	1674	17	-1
E.12.1.1	0.07	155	78	0.52	3.48	1.5	.1027	1.1	1673	20	3
E.33.1.1	0.00	313	143	0.47	3.42	1.4	.1026	0.5	1672	10	1
E.78.1.1	0.02	773	379	0.51	3.29	1.4	.1024	0.3	1668	6	-2
E.52.1.1	0.08	401	315	0.81	3.39	1.4	.1021	0.5	1663	10	0
E.4.1.1	0.03	241	126	0.54	3.58	1.5	.1020	0.6	1661	12	4
E.85.1.1	0.24	106	127	1.24	3.32	1.6	.1019	1.3	1660	25	-2
E.47.1.1	-0.01	188	142	0.78	3.65	1.5	.1019	0.8	1658	14	6
E.23.1.1	0.02	53	56	1.10	3.49	1.8	.1011	1.4	1644	26	1
E.56.1.1	0.04	336	191	0.59	3.42	1.4	.1010	0.5	1642	10	-1
E.72.1.1	0.13	177	130	0.76	3.47	1.5	.1004	0.8	1632	15	0
E.45.1.1	0.14	135	138	1.05	3.62	1.8	.1004	1.0	1631	18	4
E.62.1.1	0.04	167	134	0.83	3.54	1.5	.1003	0.8	1630	14	1
E.29.1.1	0.01	400	300	0.78	3.50	1.4	.1002	0.5	1627	9	0
E.30.1.1	0.23	125	61	0.50	3.53	1.6	.1001	1.2	1625	22	1
E.86.1.1	0.12	132	87	0.68	3.58	1.5	.1000	1.1	1624	20	2
E.1.1.1	0.12	113	106	0.97	3.52	1.7	.0999	1.3	1623	25	1
E.55.1.1	0.13	93	90	1.01	3.53	1.7	.0995	1.4	1615	25	0
E.2.1.1	0.07	130	101	0.81	3.50	1.7	.0994	1.0	1613	19	-1
E.68.1.1	0.03	113	69	0.63	3.56	1.6	.0994	1.0	1612	19	1
E.39.1.1	0.00	306	327	1.10	3.76	1.4	.0993	0.6	1612	11	6
E.46.1.1	0.04	701	589	0.87	3.57	1.4	.0991	0.5	1608	9	1
E.75.1.1	0.06	260	389	1.54	3.46	1.4	.0989	0.6	1604	12	-2
E.26.1.1	0.08	200	96	0.49	3.64	1.5	.0988	0.8	1601	14	2

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
E.32.1.1	0.10	129	141	1.13	3.46	2.1	.0986	1.1	1598	20	-2
E.15.1.1	-0.05	290	217	0.77	3.59	1.4	.0985	0.6	1596	11	1
E.50.1.1	0.02	238	142	0.62	3.58	1.8	.0982	0.7	1591	14	0
E.31.1.1	0.20	153	153	1.03	3.56	1.6	.0982	1.0	1590	19	0
E.71.1.1	0.18	152	140	0.95	3.55	1.5	.0980	1.0	1587	19	-1
E.28.1.1	0.05	242	164	0.70	3.54	1.4	.0978	0.7	1582	13	-1
E.10.1.1	0.01	194	106	0.57	3.64	1.7	.0977	0.7	1581	14	1
E.66.1.1	0.06	394	143	0.38	3.55	1.4	.0977	0.6	1580	11	-1
E.51.1.1	0.25	120	61	0.53	3.49	1.6	.0971	1.6	1570	30	-3
E.60.1.1	0.14	277	198	0.74	3.59	1.4	.0971	0.7	1569	14	-1
E.58.1.1	0.28	36	39	1.14	3.55	2.2	.0971	2.5	1568	46	-2
E.18.1.1	0.43	72	52	0.75	3.61	1.7	.0965	1.9	1557	35	-1
Young ages and ≥5% discordant (n = 4)											
E.53.1.1	0.33	112	169	1.56	4.01	1.6	.0964	1.5	1555	28	8
E.73.1.1	0.10	155	115	0.77	3.92	1.5	.0957	1.0	1542	18	5
E.5.1.1	0.45	87	69	0.83	3.59	1.7	.0943	1.7	1515	32	-5
E.73.2.1	0.22	139	85	0.63	4.05	1.5	.0942	1.1	1513	21	6
Analyses >0.5% $^{206}Pb_c$ (n = 5)											
E.36.1.1	1.04	35	53	1.55	3.62	2.1	.0931	3.6	1490	68	-6
E.43.1.1	0.99	66	73	1.14	3.31	1.8	.0992	4.1	1609	76	-6
E.70.1.1	0.68	44	38	0.90	3.54	2.0	.0930	2.8	1488	54	-8
E.38.1.1	0.67	44	23	0.55	3.34	2.0	.1036	2.9	1689	53	0
E.3.1.1	0.54	50	41	0.83	3.56	2.0	.0958	2.3	1545	43	-3
Analyses >10% discordant (n = 2)											
E.42.1.1	0.09	187	67	0.37	4.28	1.5	.1011	1.1	1645	21	18
E.65.1.1	0.14	60	45	0.77	3.48	3.8	.0897	5.6	1420	106	-15

53. RADIUM CREEK METAMORPHICS, PARALANA CREEK: 2007379009

GA Sample ID:	**2007379009**
GA Sample Number:	**1952111**
Other Sample ID:	
1:250,000 Sheet:	**COPLEY SH 54-9**
Region:	**Mount Painter Inlier, South Australia**
Grid Reference (WGS 84):	**347862 6661922 Zone 54**
Collector:	**N. L. Neumann, G. L. Fraser & S. Hore**
Collection Date:	**21/10/2007**
Formal Name:	
Informal Name:	**Metasediment; Suite 5**
Lithology:	**Quartzofeldspathic gneiss**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6051**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**08 – 12/08/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.57% (2σ) [27 of 28]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3468.1 ± 2.1 Ma [27 of 28]**
Interpreted Age:	**1591 ± 6 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample was collected from Paralana Creek, ~3 km north-west of the Paralana Hot Springs, Mount Painter Inlier, South Australia. The sample is from the unit mapped as the Radium Creek Metamorphics (Coats *et al*., 1969), which equates to Suite 5 of Teale (1993a), and is a quartzofeldspathic gneiss with feldspathic banding (Figure 53.1).

Figure 53.1. *Quartzofeldspathic gneiss of the Radium Creek Metamorphics from Paralana Creek, Mount Painter Inlier (sample 2007379009).*

Zircon Description

Zircons from this sample range in length from ~80 µm to ~140 µm, with some larger grains up to ~200 µm in length (Figure 53.2). Most grains have a rounded morphology, while some still preserve some prismatic edges. Most grains are clear and colourless, with cathodoluminescence images recording oscillatory zoning within most grains (Figure 53.2). As this sample was analysed to determine a maximum depositional age, analyses were located on the central oscillatory zones within grains.

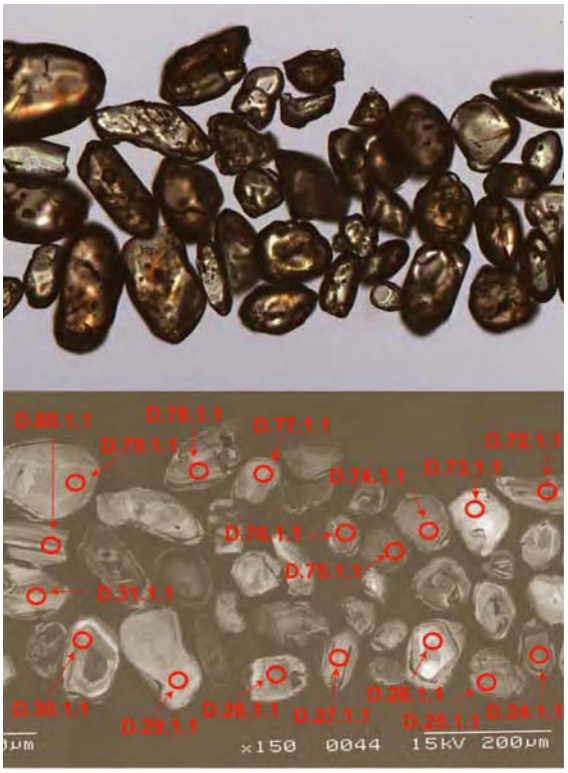

Figure 53.2. *Representative transmitted light and cathodoluminescence images of zircons from the Radium Creek Metamorphics (2007379009), with locations of some SHRIMP analyses.*

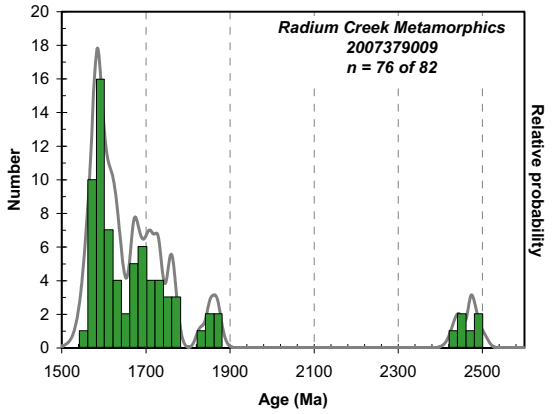

Figure 53.3. *Probability density diagram of zircon analyses from the Radium Creek Metamorphics (2007379009).*

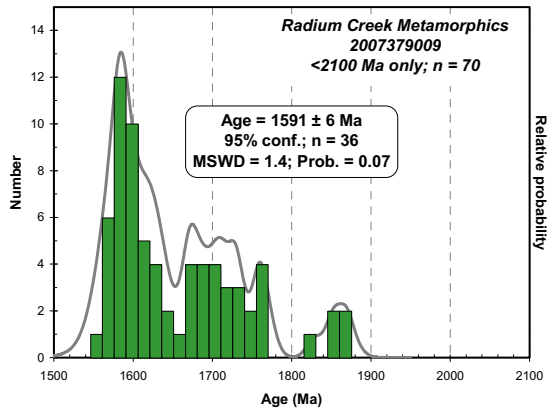

Figure 53.4. *Probability density diagram of zircon analyses from the Radium Creek Metamorphics (2007379009) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

U-Pb Isotopic Results

Eighty-two zircons were analysed from this sample, with two analyses containing common Pb contents greater than an arbitrary value of 0.5%, and four analyses which are ≥10% discordant excluded from further consideration. The remaining 76 analyses range in age between ~2498 Ma and ~1559 Ma (Figure 53.3). There are six ages between ~2498 Ma and ~2437 Ma, a small number of ages between ~1874 Ma and ~1830 Ma, and a large range of ages between ~1769 Ma and ~1559 Ma. The youngest individual age of 1559 ± 30 Ma (2σ) forms part of the youngest cluster, which is the largest grouping within the age spectrum (Figure 53.4). The youngest mixture modelling age for this youngest cluster is 1585 ± 6 Ma, which is within error of the weighted mean $^{207}Pb/^{206}Pb$ age of 1591 ± 6 Ma (95% confidence; MSWD = 1.4; probability of fit = 0.07) for the youngest 36 analyses (Figure 53.4).

Geochronological Interpretation

The weighted mean age of 1591 ± 6 Ma (95% confidence; n = 36) can be used to define a maximum depositional age for this sample.

Table 53.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379009 (1952111), Radium Creek Metamorphics, Paralana Creek.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircon (n = 76)											
D.40.1.1	0.04	228	158	0.72	2.05	1.5	.1641	0.7	2498	13	-2
D.45.1.1	0.01	617	213	0.36	2.13	1.4	.1625	0.5	2482	8	0
D.75.1.1	0.04	387	96	0.26	2.13	1.4	.1615	0.4	2472	7	0
D.7.1.1	0.02	502	25	0.05	2.22	1.5	.1600	1.2	2456	20	2
D.43.1.1	0.00	832	28	0.03	2.29	1.7	.1588	0.7	2443	12	4
D.10.1.1	0.01	388	98	0.26	2.19	1.4	.1583	1.0	2437	17	0
D.1.1.1	0.26	299	87	0.30	3.09	1.4	.1146	0.7	1874	12	4
D.21.1.1	0.04	355	143	0.42	3.08	1.4	.1143	0.5	1869	8	3
D.67.1.1	0.06	291	115	0.41	2.95	1.4	.1136	0.6	1857	10	-1
D.48.1.1	0.06	374	111	0.31	2.98	1.4	.1132	0.5	1851	8	-1
D.32.1.1	0.08	289	146	0.52	3.01	1.4	.1118	0.6	1830	10	-1
D.12.1.1	-0.01	262	279	1.10	3.19	1.4	.1082	0.6	1769	10	1
D.80.1.1	0.03	261	122	0.48	3.15	1.4	.1080	0.7	1766	12	0
D.72.1.1	0.05	413	254	0.64	3.21	1.4	.1077	0.5	1760	9	1
D.70.1.1	0.03	523	339	0.67	3.23	1.4	.1076	0.4	1758	8	1
D.2.1.1	0.05	162	114	0.73	3.20	1.6	.1071	0.8	1751	15	0
D.69.1.1	0.03	107	68	0.65	3.18	1.8	.1067	1.0	1744	19	-1
D.81.1.1	0.06	428	277	0.67	3.22	1.4	.1062	0.5	1735	9	0
D.50.1.1	0.04	635	386	0.63	3.25	1.5	.1058	0.4	1729	7	0
D.37.1.1	0.08	201	187	0.96	3.35	1.5	.1056	0.7	1725	14	2
D.47.1.1	0.11	303	241	0.82	3.39	1.4	.1055	0.6	1724	11	3
D.57.1.1	0.07	318	241	0.78	3.32	1.4	.1049	0.6	1712	10	1
D.5.1.1	0.13	171	98	0.59	3.25	1.5	.1048	0.8	1712	15	-1
D.19.1.1	0.01	267	153	0.59	3.47	1.4	.1047	0.6	1709	10	4
D.31.1.1	0.13	165	98	0.62	3.39	1.5	.1043	0.8	1702	16	2
D.79.1.1	0.00	216	191	0.91	3.35	1.5	.1042	0.6	1699	12	1
D.65.1.1	0.08	199	97	0.50	3.37	1.5	.1039	1.0	1695	19	1
D.9.1.1	0.24	93	71	0.79	3.28	1.6	.1039	1.3	1695	24	-1
D.29.1.1	0.14	123	76	0.64	3.33	1.6	.1037	1.4	1691	25	0
D.6.1.1	0.00	237	127	0.55	3.52	1.4	.1033	0.7	1685	12	4
D.23.1.1	0.09	395	344	0.90	3.47	1.4	.1032	0.5	1682	10	3
D.15.1.1	0.04	109	63	0.60	3.47	1.6	.1027	1.0	1674	19	2
D.51.1.1	0.11	241	193	0.83	3.67	1.4	.1026	0.7	1671	12	7
D.58.1.1	0.05	379	227	0.62	3.34	1.4	.1025	0.5	1671	9	-1
D.46.1.1	0.01	514	159	0.32	3.33	1.4	.1025	0.4	1671	8	-1
D.34.1.1	0.06	121	88	0.76	3.28	1.6	.1021	1.3	1663	23	-3
D.41.1.1	0.22	124	77	0.64	3.41	1.5	.1011	1.0	1644	19	-1
D.18.1.1	0.18	213	113	0.55	3.50	1.4	.1011	0.8	1644	15	2
D.62.1.1	0.03	357	530	1.53	3.52	1.4	.1006	0.5	1635	10	1
D.78.1.1	0.01	189	293	1.60	3.60	1.5	.1003	0.7	1629	13	3
D.24.1.1	0.09	310	200	0.67	3.52	1.4	.1000	0.6	1624	11	1
D.8.1.1	0.05	152	247	1.68	3.73	1.5	.0999	0.9	1622	16	6
D.66.1.1	0.06	239	229	0.99	3.49	1.4	.0997	0.7	1618	14	0
D.39.1.1	0.04	327	183	0.58	3.51	2.3	.0997	0.9	1618	18	0
D.52.1.1	0.04	410	374	0.94	3.56	1.4	.0997	0.5	1618	10	1
D.77.1.1	-0.01	197	146	0.77	3.59	1.9	.0993	0.9	1612	17	2
D.59.1.1	0.36	24	71	3.02	3.48	2.3	.0993	2.7	1611	51	-1
D.16.1.1	0.05	114	64	0.58	3.60	1.6	.0990	1.4	1605	26	1
D.42.1.1	0.07	157	85	0.56	3.50	1.7	.0990	0.9	1604	17	-1
D.38.1.1	0.26	116	63	0.56	3.54	1.9	.0987	1.2	1599	23	0
D.36.1.1	0.16	166	104	0.65	3.54	1.5	.0987	1.0	1599	20	0
D.27.1.1	0.22	140	100	0.73	3.64	1.5	.0986	1.2	1598	22	2
D.25.1.1	0.03	227	201	0.92	3.72	1.4	.0985	0.7	1595	13	4
D.17.1.1	0.05	307	224	0.75	3.66	1.4	.0985	0.6	1595	11	2
D.55.1.1	0.05	309	211	0.71	3.51	1.4	.0984	0.6	1595	11	-1
D.11.1.1	0.14	218	171	0.81	3.58	1.5	.0983	0.8	1591	15	0
D.14.1.1	0.26	76	71	0.96	3.69	1.7	.0982	1.7	1591	31	3
D.53.1.1	0.01	517	234	0.47	3.55	1.5	.0980	0.4	1586	8	-1
D.35.1.1	0.42	63	57	0.93	3.58	1.8	.0979	2.0	1584	38	0
D.26.1.1	0.19	99	135	1.41	3.56	1.6	.0979	1.2	1584	23	-1
D.49.1.1	0.16	194	190	1.01	3.49	1.5	.0979	0.9	1584	17	-3
D.64.1.1	0.12	325	244	0.78	3.93	1.4	.0978	0.8	1584	15	8
D.74.1.1	0.10	277	176	0.66	3.58	1.7	.0978	0.7	1583	13	0
D.68.1.1	0.45	56	83	1.52	3.62	1.8	.0978	2.0	1583	37	1

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
D.33.1.1	0.05	742	568	0.79	3.65	1.4	.0978	0.4	1582	7	1
D.76.1.1	0.08	292	205	0.73	3.60	1.4	.0976	0.6	1579	12	0
D.60.1.1	0.09	435	366	0.87	3.59	1.4	.0976	0.6	1579	12	0
D.44.1.1	0.30	91	92	1.04	3.48	1.6	.0974	1.6	1575	30	-3
D.4.1.1	0.06	163	114	0.72	3.55	1.5	.0974	0.9	1575	16	-1
D.28.1.1	0.17	216	158	0.76	3.61	1.5	.0973	0.9	1574	16	0
D.63.1.1	0.01	155	58	0.39	3.71	1.6	.0973	0.9	1572	16	2
D.56.1.1	0.15	206	128	0.64	3.50	1.8	.0972	0.9	1571	17	-3
D.54.1.1	0.16	149	175	1.21	3.53	1.5	.0971	1.0	1569	19	-2
D.30.1.1	0.06	157	116	0.76	3.94	1.5	.0970	1.0	1568	19	7
D.82.1.1	0.26	141	93	0.68	3.85	1.5	.0968	1.2	1564	23	5
D.71.1.1	0.09	251	125	0.51	3.90	1.4	.0966	0.8	1559	15	6
Analyses >0.5% $^{206}Pb_c$ (n = 2)											
D.13.1.1	0.55	68	91	1.39	3.63	1.8	.0932	2.3	1493	43	-5
D.73.1.1	0.52	83	42	0.53	3.56	1.7	.0970	1.9	1568	35	-2
Analyses ≥10% discordant (n 4)											
D.61.1.1	0.06	880	407	0.48	4.35	1.4	.0990	0.4	1605	7	17
D.3.1.1	0.11	170	159	0.96	4.42	1.6	.0950	1.0	1528	19	14
D.20.1.1	0.25	317	107	0.35	2.72	1.4	.1423	4.1	2255	70	11
D.22.1.1	0.30	70	34	0.49	4.45	1.7	.0915	1.9	1456	36	10

54. UNNAMED MIGMATITE, PARALANA HOT SPRINGS: 2007379001

GA Sample ID:	**2007379001**
GA Sample Number:	**1952103**
Other Sample ID:	
1:250,000 Sheet:	**COPLEY SH 54-9**
Region:	**Mount Painter Inlier, South Australia**
Grid Reference (WGS 84):	**350007 6661398 Zone 54**
Collector:	**N. L. Neumann, G. L. Fraser & S. Hore**
Collection Date:	**19/10/2007**
Formal Name:	
Informal Name:	**Migmatite; Suite 1**
Lithology:	**Biotite-rich migmatite**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6051**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**25 – 26/08/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.37% (2σ) [10 of 10]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3465.3 ± 2.8 Ma [9 of 9]**
Interpreted Age:	**1584 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**
Interpreted Age:	**1564 ± 6 Ma and ~1550 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Metamorphic/recrystallisation age**

Sample Description

This migmatite sample was collected ~300 m north of the Paralana Hot Springs, Mount Painter Inlier, South Australia. The unit is equivalent to Suite 1 of Teale (1993a). The migmatite comprises plagioclase-quartz leucosomes and biotite-rich melanosomes, and the sample was collected from the biotite-rich melanosome phase (Figure 54.1).

Figure 54.1. *Layered leucosomes and melanosomes of the unnamed migmatite from near the Paralana Hot Springs, Mount Painter Inlier (sample 2007379001), with pen for scale.*

Zircon Description

Zircons from this sample range from ~100 µm to ~180 µm in length and have sub-euhedral to blocky morphologies (Figure 54.2). Many grains are turbid, metamict, have irregular-shaped grain edges and numerous inclusions. Non-metamict grains are colourless to light brown in colour. In cathodoluminescence images most grains have a

dark, heterogeneous, speckled response, with a minor percent of homogeneous bright or dark grains or some with preserved oscillatory zoning. Analyses avoided metamict grains, focusing on those which are clear in transmitted light with a homogeneous luminescence or oscillatory zoning.

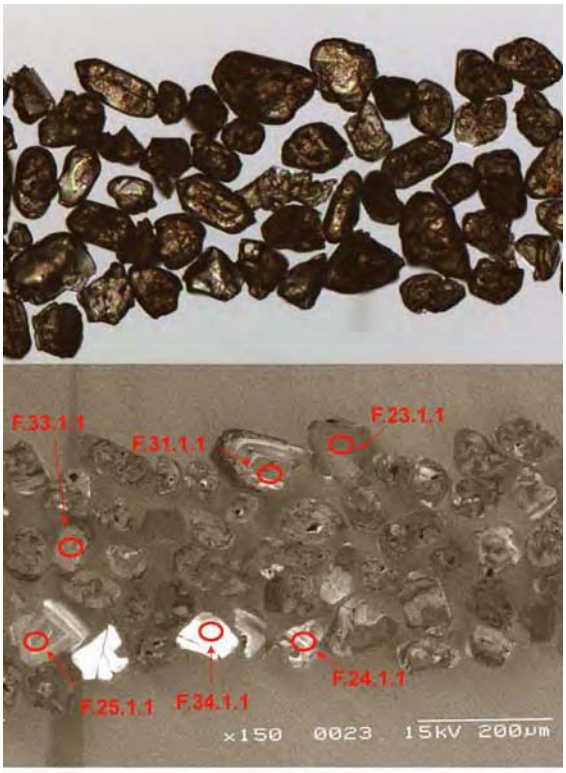

Figure 54.2. *Representative transmitted light and cathodoluminescence images of zircons from the unnamed migmatite (2007379001), with locations of some SHRIMP analyses.*

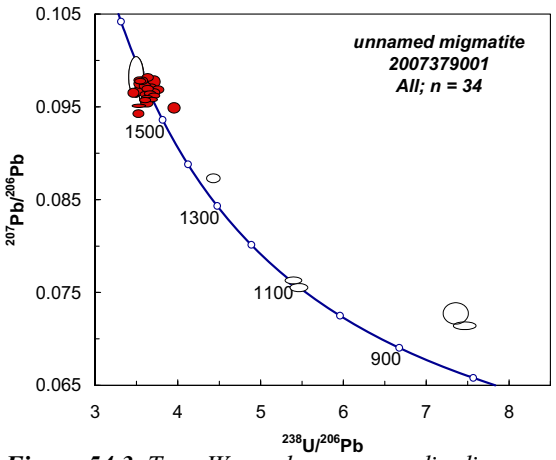

Figure 54.3. *Tera-Wasserburg concordia diagram of all zircon analyses from the unnamed migmatite (2007379001). Open ellipses represent analyses excluded from age interpretations.*

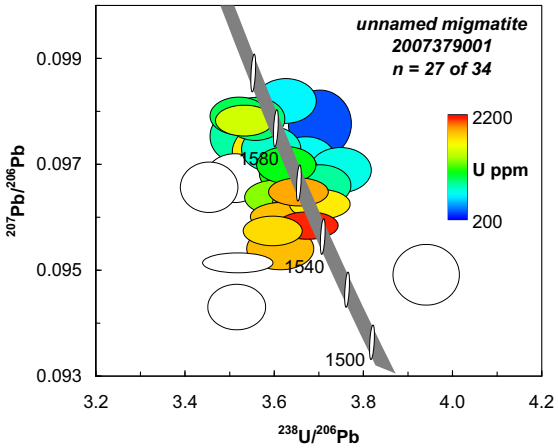

Figure 54.4. *Tera-Wasserburg concordia diagram of selected zircon analyses from the unnamed migmatite (2007379001), coloured according to U content. Open ellipses represent analyses excluded from age interpretations.*

U-Pb Isotopic Results

Thirty-four zircons were analysed (Figure 54.3), and two analyses which are greater than 10% discordant and two analyses which have large analytical uncertainties have been excluded from further consideration. There are two concordant analyses at ~1090 Ma and one at ~1365 Ma, and the geological significance of these ages is unknown. The remaining 27 analyses range in age between ~1590 Ma and ~1513 Ma, but do not form a statistically coherent age grouping. Reducing the accepted discordance range to less than 4% eliminates five analyses (Figure 54.4).

The weighted mean age for the remaining 22 analyses has a large MSWD (= 11.7), and the ages form two distinct groups according to their Th/U ratio (Figure 54.5). One group has higher Th/U ratios (between 0.26 and 0.53), whereas the other group has much lower Th/U values (ranging between 0.04 and 0.1). The low Th/U ratio group also has higher U ppm values than most of the high Th/U ratio group (1319 to 2161 ppm compared with 337 to 1729 ppm). Using this subdivision, the high Th/U ratio group of 14 analyses record a weighted mean age with a

MSWD of 5.1. Using probability density diagrams and mixture modelling for 2 components suggests two weighted mean $^{207}Pb/^{206}Pb$ ages at 1584 ± 4 Ma (n = 6; MSWD = 0.53; probability of fit = 0.75) and 1564 ± 6 Ma (n = 8; MSWD = 1.7; probability of fit = 0.10; Figure 54.5). The eight analyses from the low Th/U ratio group have a weighted mean age of ~1550 Ma, but their MSWD of 2.8 suggests that there is still some isotopic dispersion within this cluster.

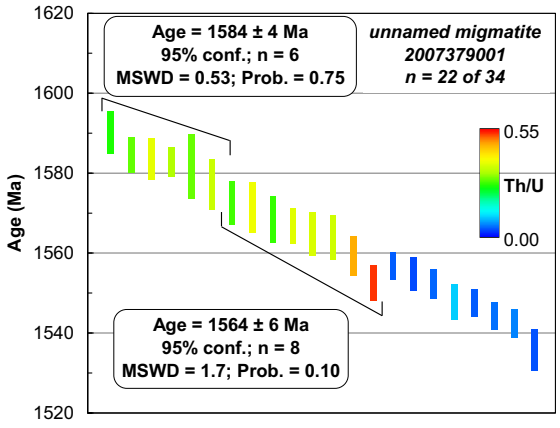

Figure 54.5. *Weighted mean age diagram of selected zircon analyses from the unnamed migmatite (2007379001), coloured according to Th/U ratio.*

Geochronological Interpretation

Although it is difficult to determine any primary textures in this migmatite, the absence of identified ages older than ~1588 Ma suggests that the protolith of this sample may be igneous rather than sedimentary in origin.

The geological significance of the ~1090 Ma and ~1365 Ma ages is unknown. The remaining analyses provide a range of ages which are difficult to group simply into ages which can be geologically interpreted. Based on the most concordant ages, and using the Th/U ratios of the zircons to group the analyses, the oldest weighted mean age of 1584 ± 4 Ma (n = 6) is interpreted to record the magmatic crystallisation age of this rock. Grouping the data this way provides another cluster of high Th/U ratio analyses with a weighted mean age of 1564 ± 6 Ma (n = 8). The low Th/U ratio group records an age of ~1550 Ma. One interpretation is that the protolith to this migmatite was metamorphosed and possibly re-melted to form the two Th/U ratio zircon groups between ~1565 and ~1550 Ma.

Table 54.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379001 (1952103), unnamed migmatite, Paralana Hot Springs.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
~1584 Ma ages (n = 6)											
F.6.1.1	0.00	661	168	0.26	3.62	1.2	.0982	0.3	1590	5	1
F.18.1.1	0.00	990	280	0.29	3.52	1.2	.0979	0.2	1584	5	-2
F.25.1.1	0.00	941	344	0.38	3.55	1.2	.0978	0.3	1583	5	-1
F.4.1.1	0.00	1506	484	0.33	3.53	1.2	.0978	0.2	1583	4	-2
F.34.1.1	-0.03	337	96	0.29	3.70	1.3	.0978	0.4	1582	8	2
F.22.1.1	0.00	871	298	0.35	3.52	1.2	.0975	0.3	1577	6	-2
~1564 Ma ages (n = 8)											
F.32.1.1	0.01	792	214	0.28	3.59	1.2	.0973	0.3	1572	5	-1
F.3.1.1	0.01	1729	648	0.39	3.57	1.2	.0972	0.3	1571	6	-1
F.29.1.1	0.02	700	185	0.27	3.67	1.2	.0970	0.3	1568	6	1
F.31.1.1	0.00	1089	394	0.37	3.62	1.2	.0970	0.2	1566	4	0
F.2.1.1	-0.01	732	260	0.37	3.75	1.2	.0969	0.3	1565	5	3
F.14.1.1	0.02	1154	400	0.36	3.63	1.2	.0968	0.3	1564	6	0
F.17.1.1	-0.02	881	405	0.47	3.70	1.2	.0966	0.3	1559	5	1
F.30.1.1	0.01	1345	689	0.53	3.66	1.2	.0962	0.2	1552	4	0
Low Th/U zircons (n = 8)											
F.23.1.1	-0.01	1942	84	0.04	3.65	1.2	.0965	0.2	1557	3	0
F.13.1.1	0.02	1319	45	0.04	3.60	1.3	.0963	0.2	1555	4	-2
F.8.1.1	0.01	1718	81	0.05	3.70	1.2	.0962	0.2	1552	4	1
F.12.1.1	0.00	2161	209	0.10	3.64	1.2	.0960	0.2	1548	4	-1
F.1.1.1	0.01	1867	80	0.04	3.61	1.3	.0960	0.2	1547	4	-2
F.26.1.1	0.01	2149	112	0.05	3.67	1.2	.0958	0.2	1544	3	-1
F.10.1.1	0.02	1775	109	0.06	3.59	1.2	.0957	0.2	1542	4	-3
F.27.1.1	-0.01	1875	72	0.04	3.61	1.4	.0954	0.3	1535	5	-3
Analyses >4% discordant (n = 5)											
F.16.1.1	0.01	413	153	0.38	3.94	1.3	.0949	0.4	1526	8	4
F.11.1.1	0.02	624	220	0.36	3.51	1.2	.0967	0.3	1562	6	-4
F.15.1.1	0.02	883	269	0.31	3.45	1.2	.0965	0.3	1558	6	-5
F.9.1.1	0.00	3562	199	0.06	3.51	1.5	.0951	0.1	1530	2	-5
F.24.1.1	0.12	1225	211	0.18	3.51	1.2	.0943	0.3	1513	6	-7
Analyses >10% discordant (n = 2)											
F.7.1.1	0.17	1110	212	0.20	7.35	1.4	.0726	1.1	1002	21	18
F.33.1.1	-0.02	1085	43	0.04	7.46	1.2	.0712	0.4	964	8	16
Analyses with large uncertainties (n = 2)											
F.21.1.1	0.02	3701	222	0.06	3.48	1.7	.0982	1.5	1591	28	-2
F.28.1.1	0.02	998	318	0.33	3.59	1.2	.0963	0.8	1554	15	-2
Young ages (n = 3)											
F.20.1.1	0.02	1069	70	0.07	4.42	1.2	.0872	0.4	1365	7	4
F.5.1.1	0.00	948	17	0.02	5.38	1.2	.0761	0.3	1099	7	0
F.19.1.1	0.03	822	15	0.02	5.45	1.3	.0754	0.4	1079	8	-1

55. HOT SPRINGS GNEISS, PARALANA CREEK: 2007379004

GA Sample ID:	**2007379004**
GA Sample Number:	**1952106**
Other Sample ID:	
1:250,000 Sheet:	**COPLEY SH 54-9**
Region:	**Mount Painter Inlier, South Australia**
Grid Reference (WGS 84):	**349987 6661495 Zone 54**
Collector:	**N. L. Neumann, G. L. Fraser & S. Hore**
Collection Date:	**19/10/2007**
Formal Name:	
Informal Name:	**Hot Springs Gneiss**
Lithology:	**Pink, coarse-grained augen granitic gneiss**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6051**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**18 – 21/08/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.97% (2σ) [25 of 26]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.5 ± 2.1 Ma [20 of 20]**
Interpreted Age:	**1582 ± 6 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**
Interpreted Age:	**1553 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Metamorphic/recrystallisation age**

Sample Description

This sample was collected from Paralana Creek, ~1 km north north-west of the Paralana Hot Springs, within the Mount Painter Inlier, South Australia. The unit is equivalent to Suite 2 of Teale (1993a). The sample is a pink, coarse-grained augen granitic gneiss with strong biotite foliation (Figure 55.1).

Figure 55.1. *Pink coarse-grained granitic gneiss of the Hot Springs Gneiss from Paralana Creek, Mount Painter Inlier (sample 2007379004).*

Zircon Description

Zircons from this sample range from ~80 µm to ~180 µm in length, with some grains up to ~220 µm in length (Figure 55.2). The grains have a range of morphologies – some sub-euhedral grains preserve prismatic terminations, while others have rounded grain edges or a blocky morphology. Many grains are turbid and metamict, while others are clear and colourless to light brown in colour. In cathodoluminescence

images, some grains have a dark, heterogeneous, speckled response, while others have a homogeneous bright or dark response or preserve oscillatory zoning (Figure 55.2). Analyses avoided metamict grains, focusing on grains which are clear in transmitted light and preserve zones with a homogeneous or oscillatory zoned cathodoluminescence character.

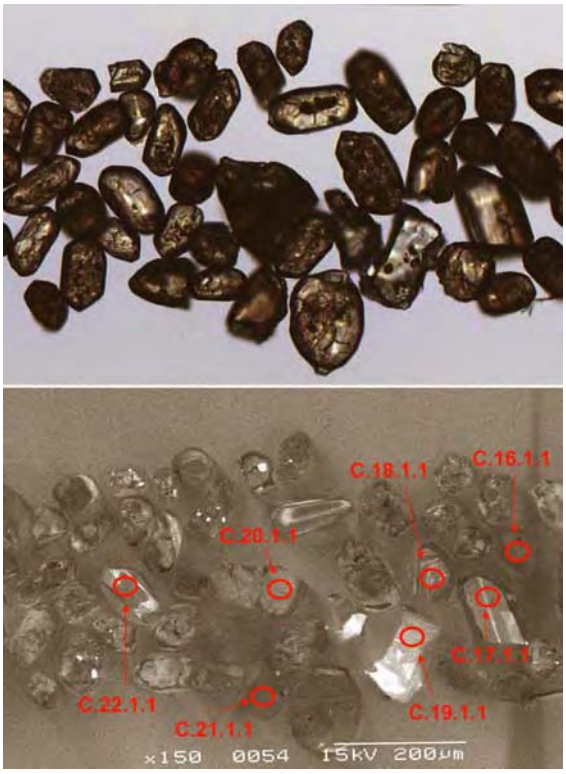

Figure 55.2. *Representative transmitted light and cathodoluminescence images of zircons from the Hot Springs Gneiss (2007379004), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Thirty-five analyses were undertaken and one analysis (C.28.1.1) greater than 10% discordant and one analysis with large analytical uncertainties (C.12.1.1) were excluded from further consideration (Figure 55.3). There are four ages much younger than the rest of the analyses, with ages ranging between ~1190 Ma and ~1086 Ma. There is also one age at ~1461 Ma and three ages at ~1514 Ma, and all have Th/U values of <0.09. None of these analyses have been included in the calculations documented below.

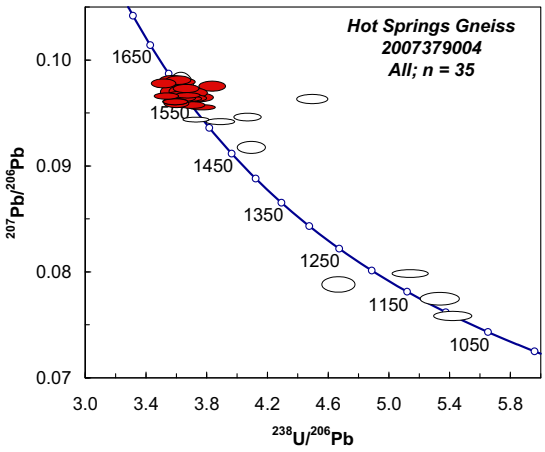

Figure 55.3. *Tera-Wasserburg concordia diagram of all zircon analyses from the Hot Springs Gneiss (2007379004). Open ellipses represent analyses excluded from age interpretations.*

The remaining 25 analyses record a range of ages between ~1587 Ma and ~1538 Ma, but the MSWD of 9.4 for the weighted mean age of the entire population indicates that it in not a single population (Figure 55.4). The analyses have a range of Th/U values between 0.73 and 0.04, and U contents of 2779 to 515 ppm.

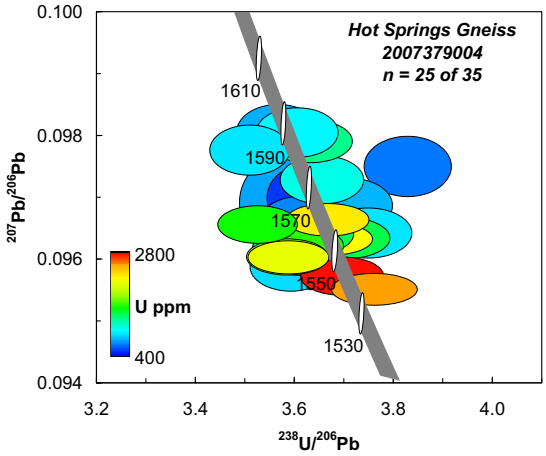

Figure 55.4. *Tera-Wasserburg concordia diagram of selected zircon analyses from the Hot Springs Gneiss (2007379004), coloured according to U content.*

Mixture modelling of these 25 analyses for 2 components suggests ages of 1581 ± 5 Ma and 1552 ± 3 Ma. Alternatively, using statistical constraints and Th/U compositions to group the

analyses provides a weighted mean $^{207}Pb/^{206}Pb$ age of 1582 ± 6 Ma (95% confidence; MSWD = 1.4; probability of fit = 0.23) for the oldest six analyses (Figure 55.5). Using this approach, the weighted mean age for the remaining 19 analyses has a MSWD of 2.9, suggesting they are not a single population. These analyses can be grouped according to their Th/U values, into a low Th/U value cluster (<0.08) and a higher Th/U value cluster (>0.2). Using this compositional difference, the higher Th/U analyses group to form a weighted mean age of 1553 ± 4 Ma (95% confidence; n = 11; MSWD = 1.3; probability of fit = 0.23; Figure 55.5). The 8 analyses with low Th/U values also have a weighted mean age of ~1550 Ma but the calculated MSWD of 5.5 indicates they are not a single age population.

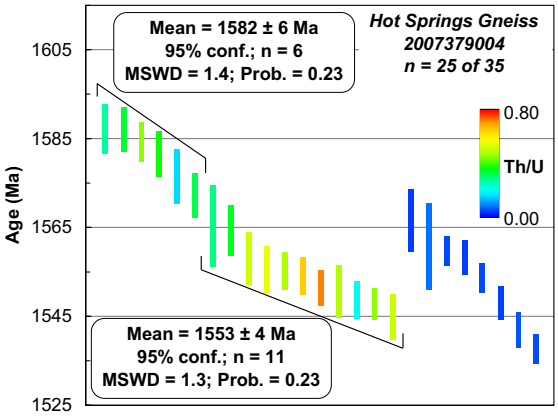

Figure 55.5. *Weighted mean age diagram of selected zircon analyses from the Hot Springs Gneiss (2007379004), coloured according to Th/U ratio.*

Geochronological Interpretation

The coarse-grained augen texture of the gneiss, together with an absence of identified ages older than ~1588 Ma suggests that the protolith of this gneiss is interpreted to be igneous rather than sedimentary in origin.

There are a number of ages between~1190 Ma and ~1086 Ma, and at ~1461 Ma and ~1514 Ma, and although these analyses are analytically robust, the ages are younger than the majority of ages within the sample. The zircons and their CL responses are not obviously different to other grains within the sample. Therefore, although these grains may record younger events within the samples, their geological significance is unknown.

The grouped ages calculated within this sample can be interpreted in two ways, and the ages and interpretations presented here are similar to the other unnamed gneiss sample (2007379007) discussed within this record. In the first interpretation, the weighted mean age of 1582 ± 6 Ma (95% confidence) for the oldest 6 analyses could be interpreted as the magmatic crystallisation age of this gneiss.

The younger calculated age of 1553 ± 4 Ma is recorded by zircons which in general have higher Th/U values but similar U ppm contents compared to the ~1582 Ma group. The remaining analyses which do not form a statistical age group have much lower Th/U values (less than 0.08), together with much higher U ppm and lower Th ppm values than the other groups. One interpretation for these younger ages is that there is a high-grade metamorphic and/or hydrothermal event at ~1553 Ma which partially reset the isotopic ages of these zircons, systematically in the lower U zircons, but variably in the high U grains resulting in a smear of ages. This resetting has also resulted in a range of elemental compositions – with some zircons gaining Th (resulting in higher Th/U values) and some losing Th as well as gaining U relative to the ~1582 Ma compositions (resulting in lower Th/U values).

The second interpretation for the set of ages is that the 1582 ± 6 Ma age records inheritance, and that ~1553 Ma age is the magmatic crystallisation age for the sample. In this interpretation the low Th/U zircons may record late-stage crystallisation from a fractionated magma. However, given that the ~1582 Ma zircons form a single population rather than a range of ages, the first interpretation for these ages is preferred.

Table 55.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379004 (1952106), Hot Springs Gneiss, Paralana Creek.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
~1582 Ma zircons (n = 6)											
C.30.1.1	0.01	768	202	0.27	3.56	1.6	.0981	0.3	1587	6	0
C.17.1.1	0.01	952	311	0.34	3.60	1.5	.0980	0.3	1587	5	1
C.3.1.1	0.01	1248	543	0.45	3.63	1.6	.0979	0.2	1584	4	1
C.34.1.1	0.01	907	325	0.37	3.51	1.5	.0978	0.3	1582	5	-2
C.15.1.1	0.02	652	100	0.16	3.83	1.5	.0975	0.3	1577	6	5
C.6.1.1	0.01	1036	323	0.32	3.65	1.5	.0973	0.3	1572	5	1
~1553 Ma zircons (n = 11)											
C.8.1.1	0.01	751	211	0.29	3.57	1.5	.0969	0.5	1565	9	-2
C.19.1.1	0.00	784	264	0.35	3.71	1.5	.0968	0.3	1564	6	2
C.29.1.1	0.01	688	345	0.52	3.61	1.5	.0965	0.3	1558	6	-1
C.18.1.1	0.02	906	488	0.56	3.75	1.6	.0964	0.3	1556	5	2
C.36.1.1	0.00	1344	629	0.48	3.63	1.5	.0964	0.2	1555	4	-1
C.32.1.1	-0.01	1366	858	0.65	3.70	1.6	.0963	0.2	1554	4	1
C.24.1.1	0.00	1565	1099	0.73	3.61	1.5	.0962	0.2	1552	4	-1
C.1.1.1	0.01	1312	620	0.49	3.59	1.5	.0961	0.3	1551	6	-2
C.22.1.1	0.00	1266	249	0.20	3.61	1.5	.0960	0.2	1549	4	-2
C.23.1.1	0.02	2059	899	0.45	3.58	1.5	.0960	0.2	1548	3	-2
C.2.1.1	0.01	880	437	0.51	3.59	1.5	.0959	0.3	1545	5	-3
Low Th/U zircons (n = 8)											
C.10.1.1	0.04	515	21	0.04	3.63	1.5	.0970	0.4	1567	7	0
C.5.1.1	0.01	1779	136	0.08	3.60	1.5	.0967	0.5	1561	10	-1
C.14.1.1	0.00	2229	110	0.05	3.66	1.5	.0966	0.2	1560	3	0
C.4.1.1	0.00	1521	62	0.04	3.52	1.5	.0965	0.2	1558	4	-3
C.21.1.1	0.00	2159	105	0.05	3.67	1.6	.0963	0.2	1554	3	0
C.26.1.1	0.00	1798	78	0.05	3.58	1.5	.0960	0.2	1548	4	-3
C.33.1.1	0.00	2779	158	0.06	3.69	1.5	.0957	0.2	1542	4	0
C.13.1.1	0.01	2516	131	0.05	3.76	1.5	.0955	0.2	1538	3	1
Young ages (n = 8)											
C.7.1.1	0.02	2640	144	0.06	4.06	1.5	.0946	0.3	1519	5	7
C.25.1.1	0.01	2869	262	0.09	3.72	1.5	.0943	0.2	1514	3	-1
C.27.1.1	0.01	2143	113	0.05	3.88	1.6	.0941	0.2	1511	4	2
C.35.1.1	0.04	1886	92	0.05	4.09	1.5	.0917	0.4	1461	8	3
C.16.1.1	0.01	1235	36	0.03	5.14	1.5	.0797	0.3	1190	6	4
C.31.1.1	0.11	773	35	0.05	4.67	1.6	.0787	0.6	1164	12	-8
C.9.1.1	0.01	1169	37	0.03	5.34	1.6	.0773	0.5	1129	10	2
C.20.1.1	0.05	992	22	0.02	5.42	1.5	.0757	0.4	1086	8	0
Analysis >10% discordant (n = 1)											
C.28.1.1	0.04	1031	480	0.48	4.49	1.5	.0963	0.3	1553	6	17
Analysis with a large uncertainty (n = 1)											
C.12.1.1	0.02	583	136	0.24	3.62	1.6	.0971	1.1	1570	21	0

56. HOT SPRINGS GNEISS, FOUR MILE CREEK: 2007379007

GA Sample ID:	**2007379007**
GA Sample Number:	**1952109**
Other Sample ID:	
1:250,000 Sheet:	**COPLEY SH 54-9**
Region:	**Mount Painter Inlier, South Australia**
Grid Reference (WGS 84):	**352897 6664449 Zone 54**
Collector:	**N. L. Neumann, G. L. Fraser & S. Hore**
Collection Date:	**20/10/2007**
Formal Name:	
Informal Name:	**Hot Springs Gneiss**
Lithology:	**Pink, equigranular medium-grained gneiss**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6051**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**18 – 21/08/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.97% (2σ) [25 of 26]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.5 ± 2.1 Ma [20 of 20]**
Interpreted Age:	**1582 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**
Interpreted Age:	**1547 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Metamorphic/recrystallisation age**

Sample Description

This sample was collected from Four Mile Creek, ~500 m from the basement contact with the Frome Plains, within the Mount Painter Inlier, South Australia. The unit is equivalent to Suite 3 of Teale (1993a). The sample is a pink, equigranular medium-grained K-feldspar granite gneiss which is weakly deformed (Figure 56.1).

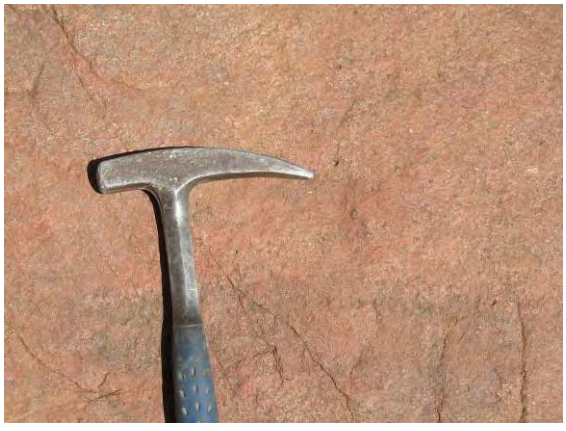

Figure 56.1. *Pink equigranular granitic gneiss of the Hot Springs Gneiss, from Four Mile Creek, Mount Painter Inlier (sample 2007379007).*

Zircon Description

Most zircons from this sample range from ~90 µm to ~140 µm in length, with some grains up to ~260 µm in length (Figure 56.2). The grains have a range of morphologies – some sub-euhedral grains preserve prismatic terminations, while others have rounded grain edges or a blocky morphology. Some grains are metamict, but others are clear and colourless to light brown in response, while others have a homogeneous

colour. In cathodoluminescence images, some grains have a dark, heterogeneous, speckled bright or dark response or preserve oscillatory zoning (Figure 56.2). Some zircons have thin dark cathodoluminescence rims. Analyses avoided metamict grains, focusing on grains which are clear in transmitted light and preserve zones with a homogeneous or oscillatory zoned cathodoluminescence character.

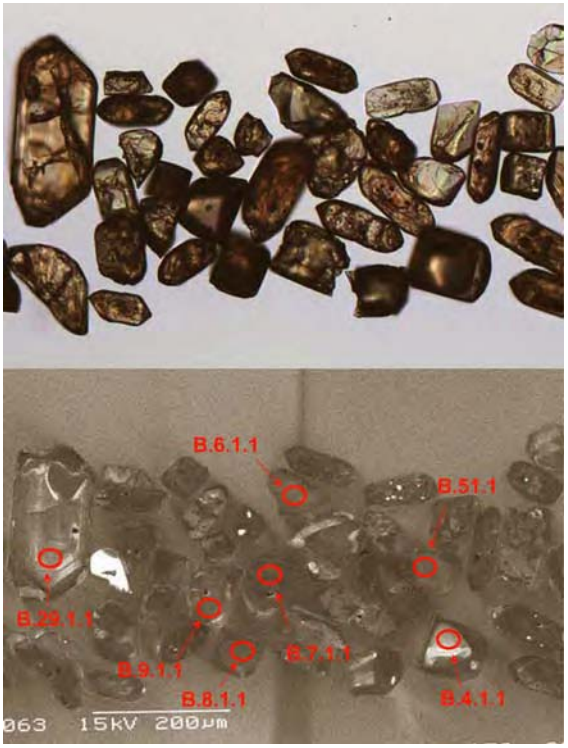

Figure 56.2. *Representative transmitted light and cathodoluminescence images of zircons from the Hot Springs Gneiss (2007379007), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Thirty-six zircons from this sample were analysed, and one analysis (B.31.1.1) which is greater than 10% discordant was excluded from further consideration (Figure 56.3). Two analyses (B.4.1.1 and B.16.1.1) which are younger than the remaining analyses are also ≥ 5% discordant, and have also been excluded. A further analysis (B14.1.1) also has an age younger that that the other analyses (1517 ± 12 Ma, 2σ), and its geological significance is unknown (Figure 56.3).

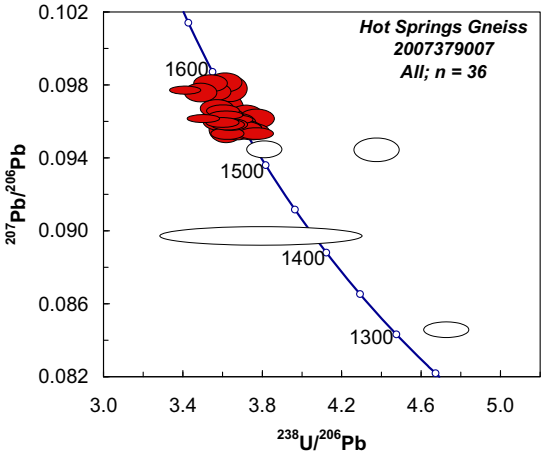

Figure 56.3. *Tera-Wasserburg concordia diagram of all zircon analyses from the Hot Springs Gneiss (2007379007). Open ellipses represent analyses excluded from age interpretations.*

The remaining 32 analyses range in age between ~1588 Ma and ~1534 Ma (Figure 56.3), and record a large range in U content (4600 ppm to 393 ppm) and Th/U values (0.87 to 0.02). Weighted mean age diagrams suggest that these analyses form two distinct groups. The older group consists of 6 analyses, which have Th/U values greater than 0.18 and form a weighted mean $^{207}Pb/^{206}Pb$ age of 1582 ± 4 Ma (95% confidence; MSWD = 0.58; probability of fit = 0.71; Figure 56.5). The average Th/U value for these zircons is 0.31, and the average U and Th values are 1295 ppm and 436 ppm, respectively.

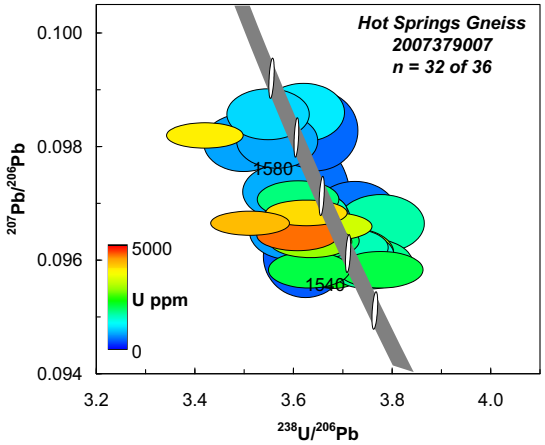

Figure 56.4. *Tera-Wasserburg concordia diagram of selected zircon analyses from the Hot Springs Gneiss (2007379007), coloured according to U content.*

The MSWD of 2.3 suggests that the remaining 26 analyses do not form a single age population. The Th/U values for these analyses form two distinct groups (Figure 56.5) – one with low Th/U values (<0.08) and one with higher values (>0.28). Dividing the data in this way provides a weighted mean age of 1547 ± 5 Ma (95% confidence; n = 10; MSWD = 1.6; probability of fit = 0.10) for the higher Th/U group (Figure 56.5). The average Th/U value for these zircons is 0.58, and the average U and Th values are 1365 and 786 ppm. Although the low Th/U group (n = 16) also provide a weighted mean age of ~1548 Ma, the MSWD value of 2.8 calculated for these analyses still suggests that it is not a statistically coherent group. The average Th/U value for these zircons is 0.05, and the average U and Th values are 2191 ppm and 108 ppm, respectively.

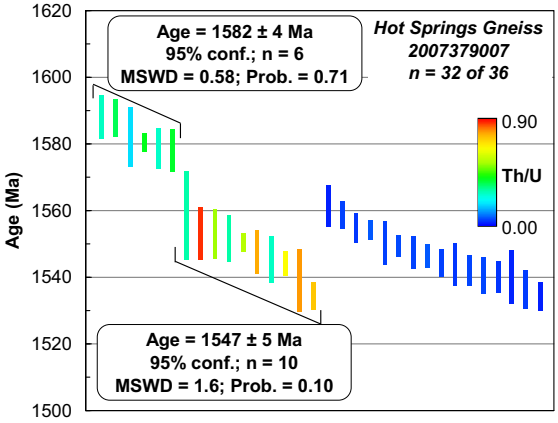

Figure 56.5. *Weighted mean age diagram of selected zircon analyses from the Hot Springs Gneiss (2007379007), coloured according to Th/U ratio.*

Geochronological Interpretation

As no ages older than ~1588 Ma were identified within this rock, and all the ages range between ~1585 and ~1534 Ma, the protolith of this gneiss is interpreted to be igneous rather than sedimentary in origin.

The grouped ages calculated within this sample can be interpreted in two ways, and the ages and interpretations presented here are similar to the other unnamed gneiss sample (2007379004) discussed within this record. Firstly, the weighted mean age of 1582 ± 4 Ma (95% confidence) recorded by the oldest 6 analyses could be interpreted as the magmatic crystallisation age of this gneiss. The younger calculated age of 1547 ± 5 Ma is recorded by zircons with higher Th/U values but similar U ppm contents compared to the ~1582 Ma group. In contrast, the remaining analyses, which do not form a statistically coherent age group, have much lower Th/U values (less than 0.07), together with much higher U ppm and lower Th ppm values than the other groups. One interpretation for these younger ages is that there is a high-grade metamorphic and/or hydrothermal event at ~1547 Ma which partially reset the isotopic ages of these zircons – preferentially in the lower U zircons, but variably in the high U grains, resulting in a smear of ages. This resetting also resulted in a range of elemental compositions – with some zircons gaining Th (resulting in higher Th/U values) and some losing Th as well as gaining U relative to the ~1582 Ma compositions (resulting in lower Th/U values).

An alternative interpretation for the set of ages is that the 1582 ± 4 Ma age records inheritance, and that 1547 ± 5 Ma is the magmatic crystallisation age for the sample. In this interpretation the low Th/U zircons may record late-stage crystallisation from a fractionated magma. However, given that the ~1582 Ma zircons form a single population rather than a range of ages, the first interpretation for these ages is preferred.

Table 56.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379007 (1952109), Hot Springs Gneiss, Four Mile Creek.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
~1582 Ma zircons (n = 6)											
B.26.1.1	0.00	1086	292	0.28	3.62	1.5	.0981	0.3	1588	6	1
B.32.1.1	0.01	976	337	0.36	3.54	1.6	.0981	0.3	1588	6	-1
B.21.1.1	0.00	456	80	0.18	3.64	1.6	.0978	0.5	1582	9	1
B.3.1.1	0.00	3775	1445	0.40	3.41	1.5	.0977	0.1	1581	3	-5
B.29.1.1	0.01	751	196	0.27	3.56	1.5	.0976	0.3	1579	6	-1
B.2.1.1	-0.01	724	269	0.38	3.49	1.5	.0976	0.3	1578	6	-3
~1547 Ma zircons (n = 10)											
B.34.1.1	0.07	485	139	0.30	3.62	1.6	.0966	0.7	1559	13	-1
B.28.1.1	0.02	502	423	0.87	3.72	1.6	.0963	0.4	1553	8	1
B.1.1.1	0.01	1226	617	0.52	3.60	1.5	.0963	0.4	1553	7	-2
B.10.1.1	0.01	609	176	0.30	3.63	1.6	.0962	0.4	1552	7	-1
B.11.1.1	0.00	4197	2233	0.55	3.51	1.5	.0961	0.1	1551	3	-4
B.30.1.1	0.00	700	528	0.78	3.59	1.5	.0960	0.3	1548	6	-2
B.33.1.1	0.04	647	173	0.28	3.68	1.5	.0959	0.4	1545	7	0
B.12.1.1	0.01	2856	1807	0.65	3.63	1.5	.0958	0.2	1544	4	-2
B.15.1.1	-0.03	393	304	0.80	3.62	1.6	.0956	0.5	1539	9	-2
B.36.1.1	0.03	2037	1459	0.74	3.63	1.5	.0953	0.2	1534	4	-2
Low Th/U zircons (n = 16)											
B.25.1.1	0.00	769	18	0.02	3.57	1.5	.0967	0.3	1561	6	-2
B.23.1.1	0.00	1828	89	0.05	3.60	1.5	.0966	0.2	1559	4	-1
B.6.1.1	0.01	1551	63	0.04	3.62	1.5	.0964	0.2	1555	4	-1
B.19.1.1	0.00	3938	262	0.07	3.62	1.5	.0963	0.2	1554	3	-1
B.17.1.1	0.00	1656	79	0.05	3.77	1.5	.0961	0.4	1550	7	2
B.35.1.1	0.01	3263	180	0.06	3.67	1.5	.0961	0.2	1549	3	0
B.7.1.1	0.00	1785	89	0.05	3.62	1.5	.0960	0.3	1548	5	-2
B.27.1.1	0.00	4600	309	0.07	3.60	1.5	.0959	0.2	1546	4	-2
B.13.1.1	0.00	1896	91	0.05	3.64	1.5	.0958	0.2	1544	4	-1
B.8.1.1	0.00	1788	71	0.04	3.66	1.5	.0958	0.3	1544	6	-1
B.5.1.1	-0.01	1598	82	0.05	3.70	1.6	.0957	0.2	1542	5	0
B.24.1.1	0.00	2963	154	0.05	3.71	1.5	.0956	0.3	1540	6	0
B.18.1.1	0.01	1427	57	0.04	3.71	1.5	.0956	0.3	1540	5	0
B.20.1.1	0.00	2215	58	0.03	3.68	1.5	.0956	0.4	1540	8	-1
B.9.1.1	0.00	1751	77	0.05	3.75	1.5	.0954	0.3	1536	6	1
B.22.1.1	0.02	2035	46	0.02	3.77	1.5	.0953	0.2	1534	4	1
Analysis >10% discordant (n = 1)											
B.31.1.1	0.04	669	131	0.20	4.38	1.7	.0944	0.5	1517	9	13
Young ages (n = 3)											
B.4.1.1	0.00	565	148	0.27	3.79	8.8	.0897	0.4	1420	7	-6
B.16.1.1	0.02	1156	41	0.04	4.72	1.6	.0846	0.3	1306	7	5
B.14.1.1	0.02	2704	463	0.18	3.81	1.5	.0945	0.3	1517	6	1

57. MOUNT NEILL GRANITE, YAGDLIN SPRING: 2007379016

GA Sample ID:	**2007379016**
GA Sample Number:	**1952118**
Other Sample ID:	
1:250,000 Sheet:	**FROME SH 54-10**
Region:	**Mount Painter Inlier, South Australia**
Grid Reference (WGS 84):	**369013 6675667 Zone 54**
Collector:	**N. L. Neumann & G. L. Fraser**
Collection Date:	**28/10/2007**
Formal Name:	**Mount Neill Granite**
Informal Name:	
Lithology:	**Pink coarse-grained granite**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6051**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**18 – 21/08/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.97% (2σ) [25 of 26]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.5 ± 2.1 Ma [20 of 20]**
Interpreted Age:	**1585 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**

Sample Description

This sample of the Mount Neill Granite was collected ~1 km west of the Yagdlin Springs in the Mount Painter Inlier, South Australia. The sample is a dark pink, coarse-grained, megacrystic granite (Figure 57.1).

Figure 57.1. *Coarse-grained megacrystic granite of the Mount Neill Granite from west of Yagdlin Springs, Mount Painter Inlier (sample 2007379016), with coin for scale.*

Zircon Description

Zircons from this sample range in length from ~100 µm to ~160 µm, with some more elongated grains up to ~220 µm in length (Figure 57.2). The zircons are colourless to pale brown, euhedral, glassy grains with some preserved prismatic terminations. Cathodoluminescence images reveal oscillatory zoning, with some featureless bright or dark zones (Figure 57.2).

Figure 57.2. *Representative transmitted light and cathodoluminescence images of zircons from the Mount Neill Granite (2007379016), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Thirty-two zircons were analysed, targeting a range of morphologies and cathodoluminescence responses. Two analyses which were greater than 10% discordant were excluded from further consideration (Figure 57.3).

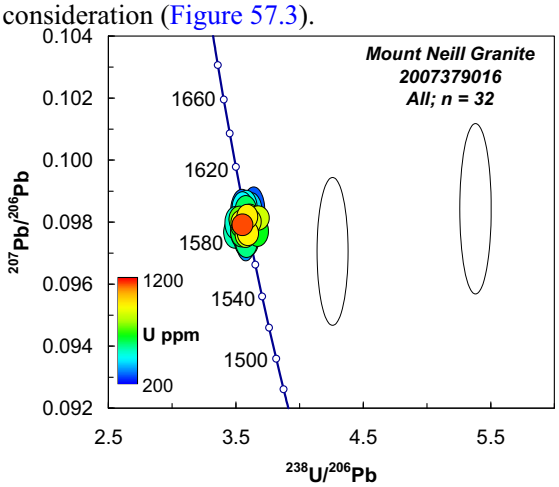

Figure 57.3. *Tera-Wasserburg concordia diagram of all zircon analyses from the Mount Neill Granite (2007379016), coloured according to U content. Open ellipses represent analyses excluded from age interpretations.*

The remaining 30 analyses have Th/U values which range from 0.47 to 0.21, and form a weighted mean $^{207}Pb/^{206}Pb$ age of 1585 ± 3 Ma (95% confidence; n = 30; MSWD = 0.85; probability of fit = 0.69; Figure 57.4).

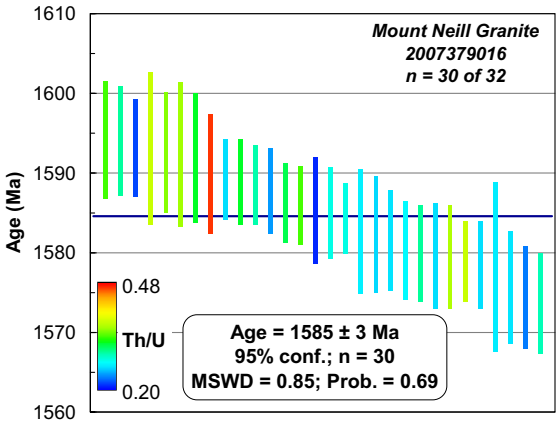

Figure 57.4. *Weighted mean age diagram of zircon analyses from the Mount Neill Granite (2007379016), coloured according to Th/U ratio.*

Geochronological Interpretation

The weighted mean age of 1585 ± 3 Ma is interpreted to record the magmatic crystallisation age of this granite. No inherited ages were identified within this granite.

Table 57.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379016 (1952118), Mount Neill Granite, Yagdlin Springs.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
~1585 Ma ages (n = 30)											
A.17.1.1	0.02	453	150	0.34	3.57	1.6	.0984	0.4	1594	7	0
A.19.1.1	-0.01	436	125	0.30	3.54	1.5	.0984	0.4	1594	7	-1
A.30.1.1	0.01	588	123	0.22	3.57	1.5	.0984	0.3	1593	6	0
A.3.1.1	0.01	276	101	0.38	3.63	1.6	.0983	0.5	1593	10	1
A.31.1.1	0.02	389	134	0.36	3.61	1.5	.0983	0.4	1593	8	1
A.22.1.1	-0.06	296	104	0.36	3.53	1.7	.0983	0.5	1592	9	-1
A.15.1.1	0.00	348	108	0.32	3.58	1.6	.0983	0.4	1592	8	0
A.10.1.1	0.03	445	202	0.47	3.57	1.5	.0982	0.4	1590	8	0
A.26.1.1	0.02	955	237	0.26	3.58	1.5	.0981	0.3	1589	5	0
A.23.1.1	0.01	740	230	0.32	3.60	1.5	.0981	0.3	1589	5	0
A.7.1.1	-0.01	850	240	0.29	3.66	1.5	.0981	0.3	1588	5	2
A.25.1.1	0.00	735	169	0.24	3.52	1.6	.0981	0.3	1588	5	-2
A.9.1.1	0.01	876	265	0.31	3.60	1.5	.0980	0.3	1586	5	0
A.16.1.1	0.02	920	305	0.34	3.54	1.7	.0980	0.3	1586	5	-1
A.21.1.1	0.01	492	99	0.21	3.48	1.5	.0979	0.4	1585	7	-3
A.32.1.1	0.02	700	186	0.27	3.53	1.5	.0979	0.3	1585	6	-2
A.14.1.1	0.02	1147	305	0.28	3.54	1.5	.0979	0.2	1584	4	-1
A.2.1.1	0.01	421	107	0.26	3.59	1.6	.0978	0.4	1583	8	0
A.6.1.1	0.01	941	232	0.25	3.65	1.6	.0978	0.4	1582	7	1
A.12.1.1	0.03	571	143	0.26	3.63	1.5	.0977	0.3	1581	6	1
A.5.1.1	0.05	644	165	0.27	3.66	1.5	.0977	0.3	1580	6	1
A.11.1.1	0.01	619	177	0.30	3.53	1.5	.0977	0.3	1580	6	-2
A.28.1.1	0.01	527	131	0.26	3.48	1.7	.0976	0.4	1580	7	-3
A.27.1.1	0.01	535	191	0.37	3.53	1.6	.0976	0.3	1579	6	-2
A.20.1.1	0.03	946	347	0.38	3.58	1.5	.0976	0.3	1579	5	-1
A.24.1.1	0.03	829	206	0.26	3.56	1.5	.0976	0.3	1578	6	-1
A.8.1.1	0.06	332	84	0.26	3.57	1.6	.0976	0.6	1578	11	-1
A.4.1.1	0.00	881	220	0.26	3.59	1.5	.0974	0.4	1576	7	-1
A.1.1.1	0.00	590	132	0.23	3.56	1.6	.0974	0.3	1574	6	-1
A.18.1.1	0.01	559	157	0.29	3.57	1.6	.0973	0.3	1573	6	-1
Analyses >10% discordant (n = 2)											
A.29.1.1	1.56	1514	386	0.26	5.38	1.5	.0984	1.9	1594	35	31
A.13.1.1	0.88	284	65	0.24	4.25	1.9	.0970	1.6	1568	31	13

58. BOX BORE GRANITE, PARABARANA HILL: 2007379015

GA Sample ID:	**2007379015**
GA Sample Number:	**1952117**
Other Sample ID:	
1:250,000 Sheet:	**CALLABONNA SH 54-6**
Region:	**Mount Painter Inlier, South Australia**
Grid Reference (WGS 84):	**374085 6682887 Zone 54**
Collector:	**N. L. Neumann & G. L. Fraser**
Collection Date:	**28/10/2007**
Formal Name:	**Box Bore Granite**
Informal Name:	
Lithology:	**Pink coarse-grained granite**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6052**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**11 – 16/07/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.06% (2σ) [33 of 34];**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.6 ± 1.4 Ma [31 of 31]**
Acquisition Date:	**26 – 28/08/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.60% (2σ) [20 of 20];**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3469.0 ± 2.2 Ma [16 of 16]**
Interpreted Age:	**1583 ± 2 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**
Interpreted Age:	**~599 Ma and ~574Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Metamorphic/recrystallisation age**

Sample Description

This sample of the Box Bore Granite was collected ~750 m northwest of Parabarana Hill, in the northeastern Mount Painter Inlier, South Australia. The sample is a coarse-grained, megacrystic granite with K-feldspar megacrysts in quartz and biotite matrix and a strong gneissic fabric (Figure 58.1).

Figure 58.1 (right). *Coarse-grained, megacrystic granite of the Box Bore Granite from northwest of Parabarana Hill, Mount Painter Inlier (sample 2007379015), with pen for scale.*

Zircon Description

Zircons from this sample range in length from ~90 µm to ~170 µm, and are clear and colourless to light brown in colour. The zircons have a range of morphologies, from euhedral grains with preserved prismatic terminations to blocky grains (Figure 58.2). Cathodoluminescence images reveal a number of different responses. Many grains record oscillatory zoning and some of these grains also have dark cathodoluminescence rims, some have a homogeneous very dark character, whereas other grains have a heterogeneous dull grey-black irregular character.

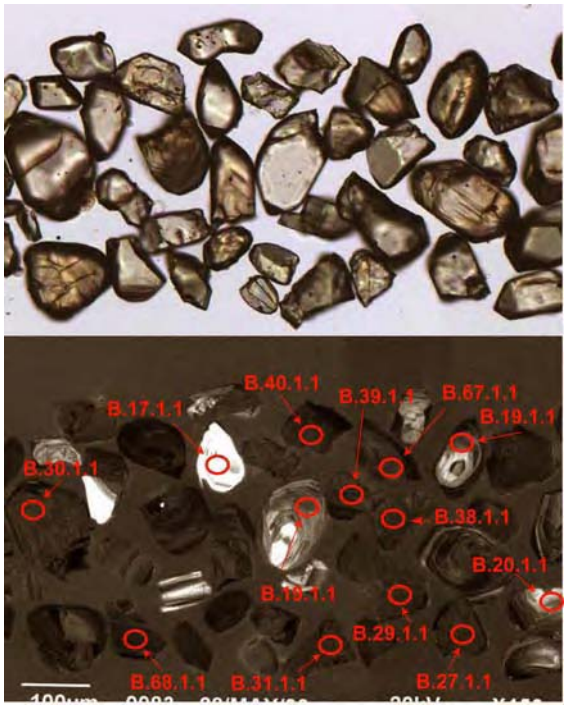

Figure 58.2. *Representative transmitted light and cathodoluminescence images of zircons from the Box Bore Granite (2007379015), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Eighty zircons were analysed, targeting a wide range of morphologies and cathodoluminescence responses (Figure 58.2). One analysis (B.19.1.1) has a large analytical uncertainty and was excluded from further consideration. The remaining analyses form two distinct clusters; one which is early Mesoproterozoic and one which is Paleozoic, with one analysis (B.73.1.1) plotting as a discordant analysis between these groups (Figure 58.3).

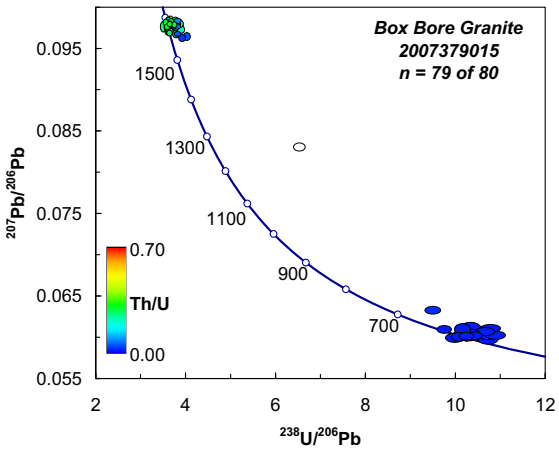

Figure 58.3. *Tera-Wasserburg concordia diagram of zircon analyses from the Box Bore Granite (2007379015), coloured according to Th/U ratio. Analysis B.19.1.1 is not plotted and the open ellipse represents an analysis (B.73.1.1) excluded from age interpretations.*

The Mesoproterozoic group consists of 55 analyses, but 6 analyses are greater than 4% discordant and have been excluded from the age calculations (Figure 58.4). Zircons from the remaining 49 analyses record a range of Th/U values from 0.69 to 0.04, with a range of U values from 2069 ppm to 178 ppm.

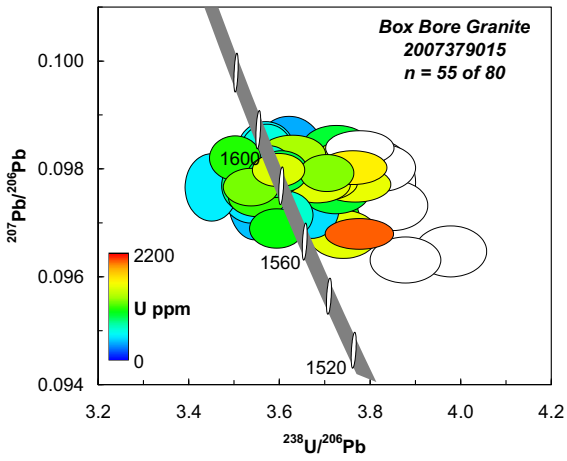

Figure 58.4. *Tera-Wasserburg concordia diagram of Mesoproterozoic zircon analyses from the Box Bore Granite (2007379007), coloured according to U content. Open ellipses represent analyses excluded from age interpretations.*

The MSWD value of the weighted mean age for the entire group indicates that they are not a single population. Excluding the youngest two individuals (which both have low Th/U ratios) results in a weighted mean $^{207}Pb/^{206}Pb$ age of 1583 ± 2 Ma (95% confidence; MSWD = 1.3; probability of fit = 0.07; Figure 58.5). This is within error of the older mixture modelling age of 1583 ± 2 Ma (2σ; 89% of the group).

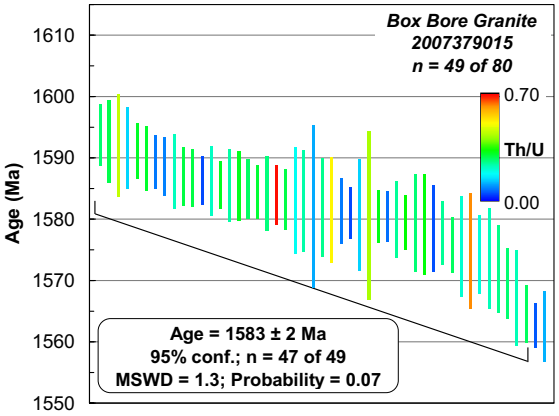

Figure 58.5. *Weighted mean age diagram of Mesoproterozoic ages from the Box Bore Granite (2007379015), coloured according to Th/U ratio.*

There are 23 analyses within the Paleozoic group, from zircons that have a heterogeneous, dull, grey-black irregular cathodoluminescence response. The Th/U values for zircons from this group range from 0.03 to 0.01, with U contents of 874 ppm to 1361 ppm (Figure 58.6) Analysis (B.27.1.1) is 9% discordant, has the highest Th/U ratio and an older age than the other analyses, so has been excluded from further consideration. The ~630 Ma age calculated for analysis B31.1.1 is also older than the rest of the cluster and so has also been excluded (Figure 58.6).

The MSWD value of 3.7 for the weighted mean $^{206}Pb/^{238}U$ age of the remaining 21 analysis indicates that they are not a single population. Dividing the analyses into two age groups (Figure 58.7) yields weighted mean $^{206}Pb/^{238}U$ ages of 599.0 ± 5.0 Ma (95% conf; n = 13; MSWD = 1.3; probability of fit = 0.20) and 574.0 ± 5.2 Ma (95% conf; n = 8; MSWD = 0.24; probability of fit = 0.98). These ages are within error of the calculated ages using mixture modelling, and are the preferred interpretation for the ages within this Paleozoic group.

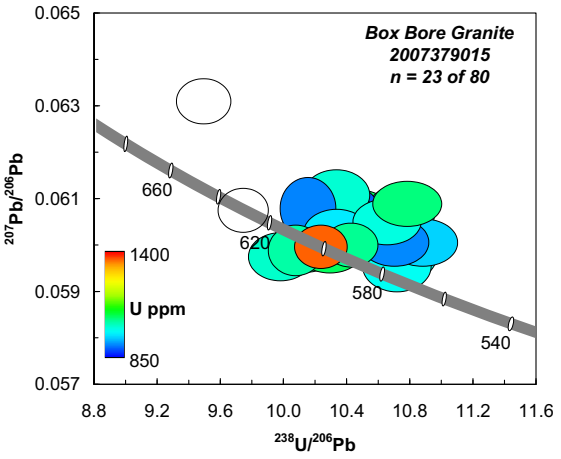

Figure 58.6. *Tera-Wasserburg concordia diagram of Paleozoic zircon analyses from the Box Bore Granite (2007379007), coloured according to U content. Open ellipses represent analyses excluded from age interpretations.*

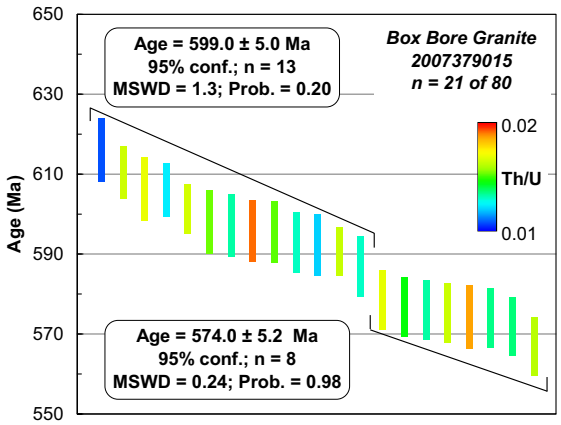

Figure 58.7. *Weighted mean age diagram of Paleozoic ages from the Box Bore Granite (2007379015), coloured according to Th/U ratio.*

Geochronological Interpretation

There are three separate ages identified within this sample of the Box Bore Granite. The oldest age of 1583 ± 2 Ma (95% confidence; n = 47) is calculated from zircons which predominantly have Th/U values of ~0.25. This age is interpreted to record the magmatic crystallisation age of this granite. A small number of younger Mesoproterozoic zircons record an age ~1560 Ma and record lower Th/U values, but it is unclear

what geological event these ages represent. They may record isotopic resetting associated with the emplacement of the adjacent Terrapinna Granite at ~1560 Ma (see sample 2007379011).

There are also two Paleozoic ages recorded within the Box Bore Granite. Both the 599.0 ± 5.0 Ma (95% conf; n = 13) and 574.0 ± 5.2 Ma (95% conf; n = 8) ages are from zircon zones which record low Th/U values, and may record either metamorphism, fluid flow or some other isotopic resetting within the granite. These ages have not been identified elsewhere within the Mount Painter or Mount Babbage Inliers.

Table 58.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379015 (1952117), Box Bore Granite, Parabarana Hill.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
~Mesoproterozoic zircons (n = 49)											
B.54.1.1	0.00	924	235	0.26	3.72	1.3	.0984	0.3	1594	5	4
B.16.1.1	0.05	514	140	0.28	3.57	1.2	.0983	0.4	1593	7	0
B.52.1.1	-0.02	335	143	0.44	3.62	1.4	.0983	0.4	1592	8	1
B.18.1.1	-0.02	601	78	0.13	3.57	1.1	.0983	0.4	1592	7	0
B.68.1.1	0.01	1305	380	0.30	3.63	1.3	.0983	0.2	1591	5	1
B.13.1.1	0.00	1056	304	0.30	3.50	1.1	.0982	0.3	1590	5	-2
B.65.1.1	0.02	1389	99	0.07	3.75	1.3	.0982	0.2	1589	4	4
B.60.1.1	0.00	1321	102	0.08	3.75	1.3	.0981	0.3	1589	5	4
B.74.1.1	0.02	721	153	0.22	3.64	1.4	.0981	0.3	1588	6	1
B.38.1.1	-0.01	1002	277	0.29	3.71	1.3	.0980	0.3	1587	5	3
B.42.1.1	-0.01	1125	310	0.29	3.66	1.3	.0980	0.2	1587	5	2
B.64.1.1	0.00	1656	72	0.04	3.76	1.3	.0980	0.2	1586	4	4
B.33.1.1	0.00	673	140	0.21	3.72	1.3	.0980	0.3	1586	6	3
B.9.1.1	0.01	1479	436	0.30	3.59	1.1	.0980	0.2	1586	4	0
B.8.1.1	0.04	668	151	0.23	3.57	1.2	.0980	0.3	1586	6	0
B.1.1.1	0.01	667	197	0.31	3.54	1.1	.0979	0.3	1585	6	-1
B.7.1.1	0.01	892	232	0.27	3.60	1.1	.0979	0.3	1585	5	0
B.5.1.1	0.02	1224	348	0.29	3.70	1.1	.0979	0.2	1585	4	3
B.79.1.1	-0.02	764	189	0.26	3.78	1.4	.0979	0.3	1584	6	4
B.80.1.1	0.01	1063	714	0.69	3.70	1.3	.0979	0.3	1584	5	3
B.10.1.1	0.02	882	242	0.28	3.58	1.1	.0978	0.3	1583	5	0
B.53.1.1	0.01	473	81	0.18	3.73	1.4	.0978	0.5	1583	9	3
B.20.1.1	0.01	354	80	0.23	3.55	1.3	.0978	0.4	1583	8	-1
B.24.1.1	0.06	445	45	0.11	3.61	1.1	.0978	0.7	1582	13	0
B.32.1.1	0.02	1036	247	0.25	3.75	1.2	.0978	0.4	1582	8	4
B.15.1.1	-0.04	291	147	0.52	3.67	1.1	.0977	0.5	1582	9	2
B.77.1.1	0.01	1413	102	0.07	3.60	1.3	.0977	0.3	1581	5	0
B.70.1.1	-0.01	1559	65	0.04	3.69	1.4	.0977	0.2	1581	4	2
B.56.1.1	0.00	1383	175	0.13	3.78	1.3	.0977	0.5	1581	9	4
B.17.1.1	0.17	178	71	0.41	3.59	1.3	.0977	0.7	1581	14	0
B.55.1.1	0.03	1498	448	0.31	3.68	1.3	.0977	0.2	1580	4	2
B.50.1.1	0.01	1531	102	0.07	3.77	1.4	.0977	0.2	1580	4	4
B.26.1.1	0.01	812	189	0.24	3.53	1.1	.0977	0.3	1580	6	-2
B.21.1.1	0.02	1200	372	0.32	3.53	1.1	.0976	0.2	1580	4	-2
B.22.1.1	0.03	483	122	0.26	3.45	1.1	.0976	0.4	1579	8	-4
B.2.1.1	0.04	468	144	0.32	3.53	1.3	.0976	0.4	1579	8	-2
B.72.1.1	0.00	2069	97	0.05	3.74	1.3	.0976	0.4	1579	7	3
B.39.1.1	0.02	930	218	0.24	3.72	1.3	.0976	0.3	1578	5	3
B.25.1.1	0.01	1090	286	0.27	3.55	1.2	.0975	0.2	1576	5	-2
B.6.1.1	0.06	394	78	0.20	3.70	1.2	.0974	0.4	1576	8	2
B.23.1.1	0.05	375	228	0.63	3.54	1.1	.0974	0.5	1575	9	-2
B.11.1.1	0.01	528	100	0.20	3.59	1.1	.0974	0.3	1574	6	0
B.67.1.1	0.00	792	171	0.22	3.69	1.3	.0973	0.4	1574	8	2
B.4.1.1	0.04	446	107	0.25	3.67	1.1	.0972	0.4	1572	7	1
B.12.1.1	0.01	645	164	0.26	3.61	1.2	.0971	0.3	1570	6	0
B.62.1.1	0.02	983	213	0.22	3.76	1.3	.0970	0.4	1567	8	3
B.3.1.1	0.02	997	263	0.27	3.59	1.1	.0969	0.3	1565	5	-1
B.49.1.1	0.00	2050	107	0.05	3.77	1.3	.0968	0.2	1563	4	3
B.75.1.1	-0.01	1510	160	0.11	3.74	1.4	.0968	0.3	1563	6	2
Analyses >4% discordant (n = 6)											
B.57.1.1	0.00	1563	131	0.09	3.77	1.3	.0984	0.2	1594	4	5
B.61.1.1	0.00	773	171	0.23	3.82	1.3	.0980	0.3	1586	6	6
B.69.1.1	0.03	343	117	0.35	3.81	1.5	.0977	0.5	1581	10	5
B.40.1.1	0.04	812	180	0.23	3.85	1.3	.0973	0.3	1573	6	5
B.63.1.1	0.05	1566	73	0.05	3.98	1.3	.0964	0.3	1556	6	7
B.51.1.1	0.00	1533	49	0.03	3.88	1.3	.0963	0.3	1553	6	5
Analysis with a large uncertainty (n = 1)											
B.19.1.1	0.02	649	29	0.05	2.17	2.2	.1634	6.3	2491	106	2
Analysis >10% discordant (n = 1)											
B.73.1.1	-0.01	1268	154	0.13	6.50	1.3	.0830	0.4	1269	8	27

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{206}Pb/^{238}U$ Age, Ma	± Ma (1σ)	Disc (%)
~Paleozoic zircons (n = 23)											
B.27.1.1	0.05	1073	29	0.03	9.49	1.2	.0631	0.5	646	7	9
B.31.1.1	-0.02	1052	16	0.02	9.74	1.1	.0607	0.5	630	7	0
B.59.1.1	0.01	1014	15	0.01	9.98	1.3	.0597	0.6	616	8	-4
B.29.1.1	0.07	1033	17	0.02	10.07	1.1	.0599	0.6	610	7	-2
B.44.1.1	-0.02	1045	18	0.02	10.14	1.4	.0600	0.7	606	8	0
B.30.1.1	0.05	914	14	0.02	10.15	1.2	.0608	0.7	606	7	4
B.28.1.1	0.06	1361	23	0.02	10.23	1.1	.0599	0.5	601	6	0
B.78.1.1	0.02	1063	17	0.02	10.29	1.4	.0599	0.6	598	8	0
B.76.1.1	0.10	936	14	0.02	10.31	1.4	.0601	0.8	597	8	2
B.41.1.1	0.05	1009	18	0.02	10.33	1.3	.0611	0.6	596	8	7
B.66.1.1	-0.04	969	16	0.02	10.33	1.4	.0602	0.6	595	8	3
B.43.1.1	0.03	874	13	0.02	10.38	1.4	.0605	0.6	593	8	5
B.37.1.1	-0.05	894	13	0.02	10.39	1.4	.0607	0.7	592	8	6
B.14.1.1	0.02	1041	18	0.02	10.42	1.1	.0600	0.5	591	6	2
B.58.1.1	0.11	1059	16	0.02	10.50	1.3	.0604	0.8	587	8	5
B.46.1.1	0.00	1000	17	0.02	10.65	1.3	.0605	0.5	578	7	7
B.47.1.1	0.05	988	16	0.02	10.69	1.3	.0599	0.7	577	7	4
B.35.1.1	0.03	916	14	0.02	10.70	1.3	.0600	0.6	576	7	5
B.48.1.1	0.03	989	17	0.02	10.72	1.3	.0595	0.6	575	7	2
B.71.1.1	0.03	993	18	0.02	10.74	1.5	.0598	0.7	574	8	4
B.34.1.1	0.05	942	15	0.02	10.74	1.3	.0607	0.7	574	7	8
B.36.1.1	-0.03	1050	16	0.02	10.78	1.3	.0609	0.5	572	7	10
B.45.1.1	0.04	953	16	0.02	10.88	1.3	.0600	0.6	567	7	6

59. TERRAPINNA GRANITE, TERRAPINNA WATERHOLE: 2007379011

GA Sample ID:	**2007379011**
GA Sample Number:	**1952113**
Other Sample ID:	
1:250,000 Sheet:	**CALLABONNA SH 54-6**
Region:	**Mount Painter Inlier, South Australia**
Grid Reference (WGS 84):	**371107 6689505 Zone 54**
Collector:	**N. L. Neumann & G. L. Fraser**
Collection Date:	**26/10/2007**
Formal Name:	**Terrapinna Granite**
Informal Name:	
Lithology:	**Coarse-grained granite**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6052**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**11 – 16/07/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.06% (2σ) [33 of 34];**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.6 ± 1.4 Ma [31 of 31]**
Interpreted Age:	**1560 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**

Sample Description

This sample of the Terrapinna Granite was collected ~500 m south of the Terrapinna Waterhole along Hamilton Creek, in the northern Mount Painter Inlier, South Australia. The sample was collected away from local mylonitised zones and is a coarse-grained granite with K-feldspar megacrysts which is relatively undeformed (Figure 59.1).

Figure 59.1. *Coarse-grained megacrystic granite of the Terrapinna Granite from south of Terrapinna Waterhole, northern Mount Painter Inlier (sample 2007379011).*

Zircon Description

Zircons from this sample range in length from ~100 µm to ~180 µm, with some more elongated grains up to ~220 µm in length (Figure 59.2). The zircons are clear and colourless to pale brown, euhedral, glassy grains with some preserved prismatic terminations. Cathodoluminescence images reveal oscillatory zoning, with some featureless bright or dark zones (Figure 59.2).

Figure 59.2. *Representative transmitted light and cathodoluminescence images of zircons from the Terrapinna Granite (2007379011), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Thirty-four analyses were undertaken to target a range of morphologies and cathodoluminescence responses, including 3 zircons (A.1.1.1, A.2.1.1 and A.16.1.1) which were analysed in more than one location. One analysis (A.18.1.1) which records a common Pb content >0.5% was excluded from further consideration. One grain with an age older than the main population (A.16.1.1 = 1678 ± 36 Ma, 2σ; A.16.2.1 = 1667 ± 18 Ma, 2σ) is interpreted to record inheritance (Figure 59.3). The two analyses of A.1.1.1 and A.2.1.1 produce ages within error of each other. These analyses were included in the remaining 31 analyses which are indistinguishable from each other and form a weighted mean $^{207}Pb/^{206}Pb$ age of 1560 ± 3 Ma (95% confidence; MSWD = 0.68; probability of fit = 0.91; Figure 59.4).

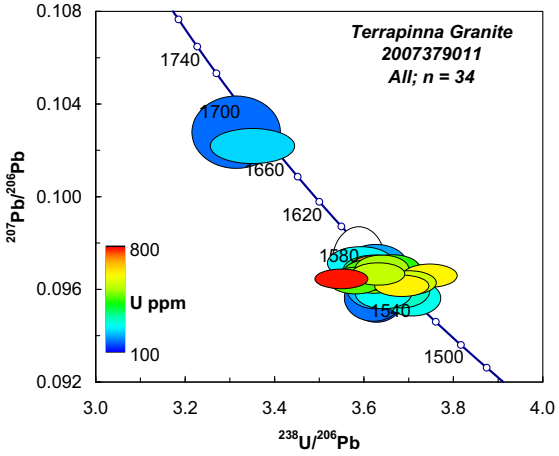

Figure 59.3. *Tera-Wasserburg concordia diagram of all zircon analyses from Terrapinna Granite (2007379011), coloured according to U content. Open ellipses represent analyses excluded from age interpretations.*

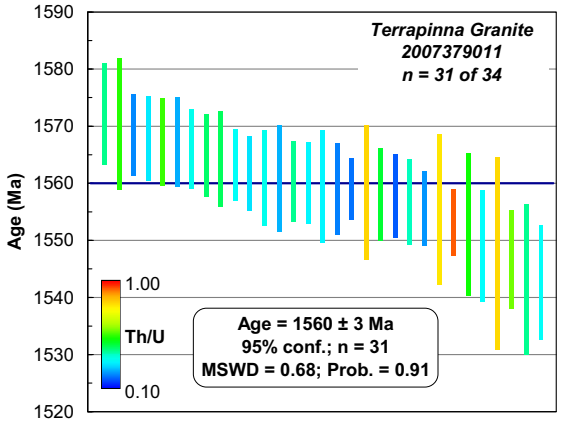

Figure 59.4. *Weighted mean age diagram of zircon analyses from the Terrapinna Granite (2007379011), coloured according to Th/U ratio.*

Geochronological Interpretation

The weighted mean age of 1560 ± 3 Ma is interpreted to record the magmatic crystallisation age of this granite. This sample also contains one inherited age at ~1670 Ma, which is older than any known stratigraphic ages within the Mount Painter or Babbage Inliers.

Table 59.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379011 (1952113), Terrapinna Granite, Terrapinna Waterhole.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited ages (n = 2)											
A.16.1.1	0.01	166	166	1.03	3.31	2.0	.1029	1.0	1678	18	-1
A.16.2.1	0.00	234	312	1.38	3.35	1.9	.1023	0.5	1667	9	-1
~1560 Ma ages (n = 31)											
A.4.1.1	-0.02	263	107	0.42	3.59	1.4	.0973	0.5	1572	9	-1
A.30.1.1	0.01	201	104	0.54	3.62	1.3	.0972	0.6	1570	12	0
A.13.1.1	0.02	440	89	0.21	3.66	1.1	.0971	0.4	1568	7	1
A.25.1.1	0.07	687	194	0.29	3.63	1.2	.0970	0.4	1568	7	0
A.3.1.1	0.01	512	272	0.55	3.64	1.1	.0970	0.4	1567	8	0
A.2.2.1	0.03	364	84	0.24	3.62	1.3	.0970	0.4	1567	8	0
A.26.1.1	0.05	534	172	0.33	3.67	1.1	.0969	0.4	1566	7	1
A.19.1.1	0.03	462	197	0.44	3.61	1.1	.0969	0.4	1565	7	-1
A.12.1.1	0.04	339	148	0.45	3.64	1.1	.0968	0.4	1564	8	0
A.24.1.1	0.01	540	168	0.32	3.63	1.1	.0968	0.3	1563	6	0
A.11.1.1	0.06	620	171	0.29	3.74	1.1	.0967	0.3	1562	6	2
A.14.1.1	0.14	496	160	0.33	3.64	1.1	.0967	0.4	1561	8	0
A.20.1.1	0.07	421	99	0.24	3.67	1.1	.0967	0.5	1561	9	0
A.21.1.1	0.02	456	183	0.41	3.63	1.2	.0966	0.4	1560	7	-1
A.17.1.1	0.04	422	125	0.31	3.62	1.1	.0966	0.4	1560	7	-1
A.28.1.1	0.09	281	83	0.31	3.63	1.3	.0966	0.5	1559	10	-1
A.16.3.1	0.08	492	96	0.20	3.62	1.1	.0966	0.4	1559	8	-1
A.15.1.1	0.03	790	145	0.19	3.55	1.1	.0966	0.3	1559	5	-3
A.2.1.1	0.08	214	170	0.82	3.64	1.5	.0965	0.6	1558	12	-1
A.6.1.1	0.03	422	196	0.48	3.68	1.1	.0965	0.4	1558	8	0
A.1.2.1	0.05	464	77	0.17	3.58	1.1	.0965	0.4	1558	7	-2
A.10.1.1	0.07	454	167	0.38	3.63	1.4	.0965	0.4	1557	7	-1
A.5.1.1	0.03	555	117	0.22	3.70	1.1	.0964	0.4	1556	7	1
A.23.1.1	0.11	217	167	0.79	3.67	1.2	.0964	0.7	1555	13	0
A.8.1.1	0.02	625	569	0.94	3.68	1.1	.0963	0.3	1553	6	0
A.22.1.1	0.15	214	107	0.52	3.62	1.2	.0963	0.7	1553	13	-1
A.27.1.1	0.08	312	96	0.32	3.68	1.1	.0961	0.5	1549	10	0
A.9.1.1	0.20	148	116	0.81	3.62	1.2	.0960	0.9	1548	17	-1
A.1.1.1	0.00	274	156	0.59	3.64	1.1	.0959	0.5	1547	9	-1
A.29.1.1	0.09	169	68	0.41	3.62	1.2	.0958	0.7	1543	13	-2
A.7.1.1	0.08	283	88	0.32	3.70	1.1	.0957	0.5	1542	10	0
Analysis >0.5% $^{206}Pb_c$ (n = 1)											
A.18.1.1	0.76	564	103	0.19	3.58	1.1	.0973	1.0	1573	19	-1

60. YERILA GRANITE, WEST OF MOUNT BABBAGE: 2007379013

GA Sample ID:	**2007379013**
GA Sample Number:	**1952115**
Other Sample ID:	
1:250,000 Sheet:	**CALLABONNA SH 54-6**
Region:	**Mount Babbage Inlier, South Australia**
Grid Reference (WGS 84):	**367324 6691080 Zone 54**
Collector:	**N. L. Neumann & G. L. Fraser**
Collection Date:	**27/10/2007**
Formal Name:	**Yerila Granite**
Informal Name:	
Lithology:	**Grey, coarse-grained granite**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6052**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**11 – 16/07/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.06% (2σ) [33 of 34]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.6 ± 1.4 Ma [31 of 31]**
Acquisition Date:	**26 – 28/08/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.60% (2σ) [20 of 20]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3469.0 ± 2.2 Ma [16 of 16]**
Interpreted Age:	**1558 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**

Sample Description

This Yerila Granite sample was collected from a creek section ~2 km west-southwest of Mount Babbage in the Mount Babbage Inlier, South Australia. The sample is a grey, coarse-grained tabular K-feldspar granite with hornblende and quartz (Figure 60.1).

Figure 60.1. *Grey, coarse-grained granite of the Yerila Granite, from southwest of Mount Babbage, Mount Babbage Inlier (sample 2007379013).*

Zircon Description

Zircons from this sample range in length from ~110 µm to ~200 µm, and are clear and colourless to light brown in colour (Figure 60.2). The zircons display a range of morphologies, from euhedral grains with preserved prismatic terminations to blocky grains. Cathodoluminescence images reveal three different responses – some grains have a homogeneous very dark or very bright character, whereas other grains record subtle oscillatory

zoning, some with dark cathodoluminescence rims (Figure 60.2).

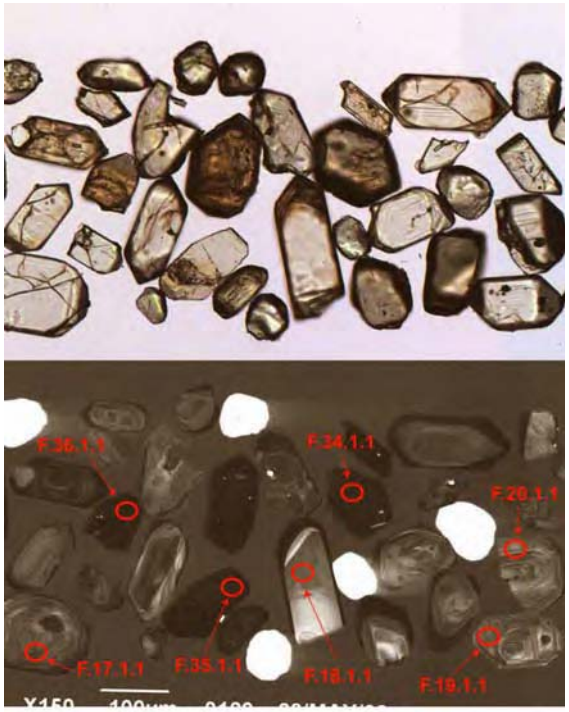

Figure 60.2. *Representative transmitted light and cathodoluminescence images of zircons from the Yerila Granite (2007379013), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Thirty-six analyses were collected over two separate analytical sessions, and targeted a range of morphologies and cathodoluminescence responses. The data were merged without any corrections. One analysis (F.33.1.1) is 4% discordant and records an age younger than the main population (1504 ± 8 Ma; 2σ), and this analysis has been excluded from further consideration (Figure 60.3). Another analysis (F.14.1.1) has an age which is older than the rest of the group (1775 ± 18 Ma; 2σ), and is interpreted to represent inheritance. The remaining 34 analyses record a range of ages between ~1591 and ~1542 Ma, have Th/U values between 0.64 and 0.05, and contain U contents between 3370 ppm and 307 ppm (Figure 60.3).

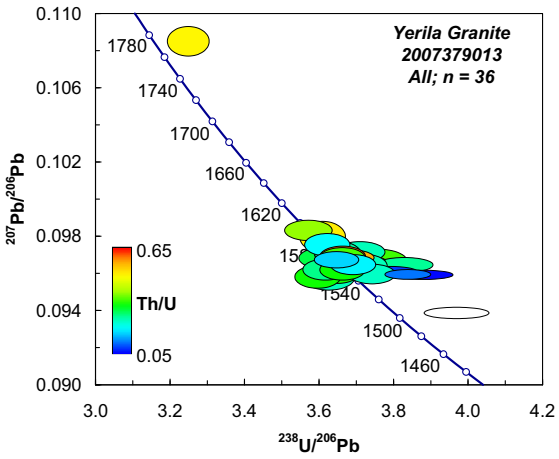

Figure 60.3. *Tera-Wasserburg concordia diagram of all zircon analyses from the Yerila Granite (2007379013), coloured according to Th/U ratio. Open ellipse represents an analysis excluded from age interpretations.*

The MSWD of the weighted mean age for the entire group (MSWD = 3.1) indicates that it is not one single population. Probability density diagrams and unmix modelling suggest that two analyses (F.26.1.1 and F.5.1.1) record ages older than the rest of the cluster, and so have been interpreted to represent possible inheritance at ~1585 Ma (Figure 60.4).

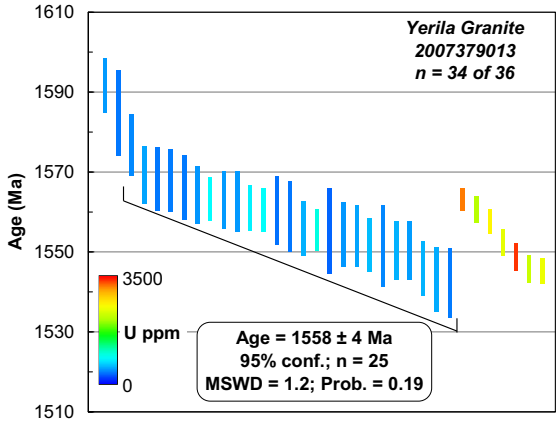

Figure 60.4. *Weighted mean age diagram of zircon analyses from the Yerila Granite (2007379013), coloured according to U content.*

The weighted mean age for the remaining 32 analyses still results in a high MSWD (= 2.2), and so the U, Th/U and Th contents of the zircons were used to interpret the age results. The U contents for 25 of the 32 analyses are less that 1000 ppm, with the remaining 7 analyses containing more than 2000 ppm of U (Figure 60.4). Of these 7 high U content analyses, 5 have low Th/U values (<0.11) whereas the remaining 2 high U analyses have high Th/U values (>0.5), and they also have high Th contents (>1200 ppm compared with <500 ppm for the other analyses). If the high U zircons are excluded, the remaining analyses record a weighted mean $^{207}Pb/^{206}Pb$ age of 1558 ± 4 Ma (95% conf; n = 25; MSWD = 1.2; probability of fit = 0.19; Figure 60.4). Although the weighted mean age of the high U zircons is also ~1554 Ma, the MSWD of 5.2 for these 7 analyses still suggest that there is isotopic dispersion within these zircons.

Geochronological Interpretation

There are a number of age groups interpreted within this sample of the Yerila Granite. There is one inherited age at ~1775 Ma, which is older than any known stratigraphic ages within either the Mount Painter or Mount Babbage inliers, and two ages at ~1585 Ma. Most of the remaining zircons combine to yield a weighted mean age of 1558 ± 4 Ma (95% conf; n = 25), which is interpreted to record the magmatic crystallisation age of this granite. There is also a range of ages for high U zircons within the sample between ~1563 Ma and ~1545 Ma, which may record late-stage fractionation and zircon formation within this magmatic system.

Table 60.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379013 (1952115), Yerila Granite, west of Mount Babbage.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited ages (n = 3)											
F.14.1.1	0.02	769	369	0.50	3.24	1.2	.1085	0.5	1775	9	2
F.26.1.1	-0.01	476	180	0.39	3.57	1.2	.0983	0.4	1591	7	0
F.5.1.1	0.00	364	178	0.51	3.61	1.1	.0979	0.6	1585	11	0
~1558 Ma ages (n = 25)											
F.18.1.1	0.04	424	79	0.19	3.62	1.1	.0975	0.4	1577	8	0
F.9.1.1	0.01	505	117	0.24	3.71	1.2	.0971	0.4	1569	7	2
F.8.1.1	-0.01	367	90	0.25	3.65	1.1	.0970	0.4	1568	8	0
F.24.1.1	-0.02	384	124	0.33	3.65	1.1	.0970	0.4	1568	8	0
F.1.1.1	0.00	370	124	0.35	3.65	1.1	.0969	0.4	1566	8	0
F.7.1.1	0.01	463	271	0.61	3.66	1.1	.0968	0.4	1564	7	0
F.22.1.1	0.01	831	455	0.57	3.68	1.2	.0968	0.3	1563	5	1
F.17.1.1	0.00	477	164	0.35	3.66	1.1	.0968	0.4	1563	7	0
F.19.1.1	0.04	471	134	0.29	3.61	1.3	.0968	0.4	1562	8	-1
F.15.1.1	0.01	782	124	0.16	3.64	1.1	.0967	0.3	1561	6	0
F.21.1.1	0.00	856	228	0.28	3.65	1.2	.0966	0.3	1560	5	0
F.4.1.1	0.01	347	116	0.35	3.65	1.1	.0966	0.5	1560	9	0
F.16.1.1	0.01	365	124	0.35	3.76	1.4	.0966	0.5	1559	9	2
F.3.1.1	0.02	548	99	0.19	3.69	1.1	.0964	0.4	1556	7	1
F.31.1.1	0.02	950	237	0.26	3.83	1.3	.0964	0.3	1555	5	4
F.11.1.1	0.07	307	84	0.28	3.68	1.2	.0964	0.6	1555	11	0
F.10.1.1	0.04	465	109	0.24	3.72	1.1	.0963	0.4	1554	8	1
F.12.1.1	0.07	509	117	0.24	3.65	1.1	.0963	0.4	1554	8	0
F.23.1.1	0.02	582	78	0.14	3.67	1.2	.0962	0.4	1552	7	0
F.6.1.1	0.01	415	133	0.33	3.65	1.2	.0962	0.5	1551	10	-1
F.20.1.1	0.03	549	140	0.26	3.61	1.1	.0961	0.4	1550	7	-2
F.2.1.1	0.02	485	154	0.33	3.66	1.1	.0961	0.4	1550	7	0
F.13.1.1	0.03	552	124	0.23	3.74	1.1	.0959	0.4	1546	7	1
F.28.1.1	0.03	531	170	0.33	3.59	1.1	.0958	0.4	1543	8	-3
F.27.1.1	0.06	376	88	0.24	3.62	1.3	.0957	0.5	1542	9	-2
High U zircons (n = 7)											
F.29.1.1	0.00	3182	268	0.09	3.68	1.3	.0968	0.2	1563	3	1
F.34.1.1	0.01	2147	1285	0.62	3.70	1.4	.0967	0.2	1561	3	1
F.32.1.1	0.00	2606	1613	0.64	3.67	1.3	.0965	0.2	1557	3	0
F.35.1.1	0.01	2413	225	0.10	3.66	1.3	.0962	0.2	1552	3	0
F.36.1.1	0.01	3370	259	0.08	3.79	1.3	.0960	0.2	1549	3	2
F.25.1.1	0.00	2247	242	0.11	3.84	1.1	.0959	0.2	1545	3	3
F.30.1.1	0.00	2454	126	0.05	3.88	1.3	.0959	0.2	1545	3	4
Young age (n = 1)											
F.33.1.1	0.04	2629	322	0.13	3.97	1.4	.0938	0.2	1504	4	4

61. WATTLEOWIE GRANITE, EAST OF MOUNT BABBAGE: 2007379014

GA Sample ID:	**2007379014**
GA Sample Number:	**1952116**
Other Sample ID:	
1:250,000 Sheet:	**CALLABONNA SH 54-6**
Region:	**Mount Babbage Inlier, South Australia**
Grid Reference (WGS 84):	**371202 6692193 Zone 54**
Collector:	**N. L. Neumann & G. L. Fraser**
Collection Date:	**27/10/2007**
Formal Name:	**Wattleowie Granite**
Informal Name:	
Lithology:	**White, coarse-grained granite**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6052**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**11 – 16/07/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.06% (2σ) [33 of 34];**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.6 ± 1.4 Ma [31 of 31]**
Interpreted Age:	**1563 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**

Sample Description

This sample of the Wattleowie Granite was collected from a creek section ~2 km east-northeast of Mount Babbage, within the Mount Babbage Inlier, South Australia. The sample is a white, coarse-grained granite with a strong biotite foliation (Figure 61.1).

Figure 61.1. *White, foliated, coarse-grained granite of the Wattleowie Granite from east of Mount Babbage, Mount Babbage Inlier (sample 2007379014).*

Zircon Description

Zircons from this sample range in length from ~90 µm to ~170 µm, with some elongate grains up to ~280 µm in length (Figure 61.2). The grains are predominately clear and colourless, with euhedral morphologies and rounded to prismatic terminations. Cathodoluminescence images display subtle oscillatory zoning within most grains (Figure 61.2).

Figure 61.2. *Representative transmitted light and cathodoluminescence images of zircons from the Wattleowie Granite (2007379014), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Twenty-seven zircons were analysed from this sample, targeting a range of morphologies and cathodoluminescence responses. The ages for all analyses are indistinguishable from each other and form a weighted mean $^{207}Pb/^{206}Pb$ age of 1563 ± 3 Ma (95% confidence; n = 27; MSWD = 0.76; probability of fit = 0.80; Figure 61.3 and 61.4).

Geochronological Interpretation

The weighted mean age of 1563 ± 3 Ma (95% confidence; n = 27) is interpreted to be the magmatic age for this sample of the Wattleowie Granite. There were no inherited ages identified within this sample.

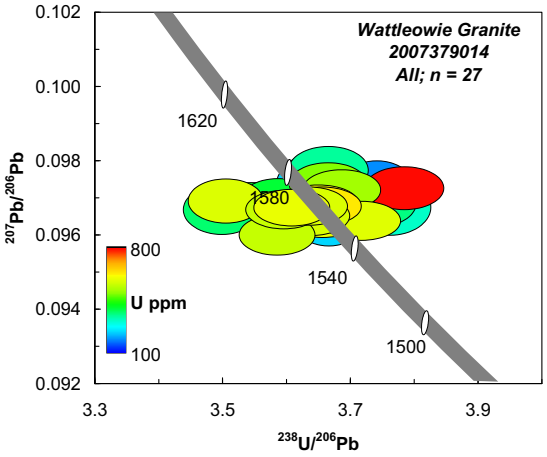

Figure 61.3. *Tera-Wasserburg concordia diagram of all zircon analyses from the Wattleowie Granite (2007379014), coloured according to U content.*

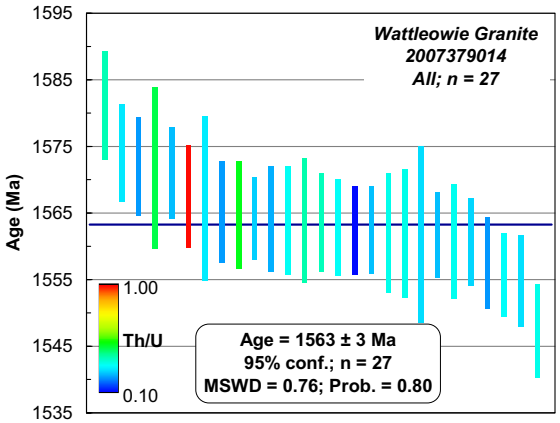

Figure 61.4. *Weighted mean age diagram of all zircon analyses from the Wattleowie Granite (2007379014), coloured according to Th/U ratio.*

Table 61.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379014 (1952116), Wattleowie Granite, east of Mount Babbage.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
~1563 Ma ages (n = 27)											
C.9.1.1	-0.02	339	128	0.39	3.66	1.1	.0977	0.4	1581	8	2
C.1.1.1	0.03	489	138	0.29	3.66	1.1	.0973	0.4	1574	7	1
C.23.1.1	0.00	796	171	0.22	3.78	1.1	.0972	0.4	1572	7	4
C.5.1.1	0.12	228	102	0.46	3.64	1.2	.0972	0.6	1572	12	1
C.14.1.1	0.02	506	123	0.25	3.68	1.1	.0972	0.4	1571	7	1
C.17.1.1	0.03	421	406	0.99	3.65	1.3	.0970	0.4	1567	8	0
C.6.1.1	0.10	187	54	0.30	3.74	1.2	.0970	0.7	1567	12	3
C.15.1.1	0.07	571	124	0.22	3.50	1.1	.0969	0.4	1565	8	-3
C.18.1.1	0.05	393	189	0.50	3.58	1.1	.0969	0.4	1565	8	-1
C.7.1.1	0.02	607	156	0.27	3.65	1.1	.0968	0.3	1564	6	0
C.13.1.1	0.06	418	97	0.24	3.65	1.1	.0968	0.4	1564	8	0
C.3.1.1	-0.03	352	111	0.32	3.74	1.1	.0968	0.4	1564	8	2
C.4.1.1	0.01	435	166	0.40	3.63	1.1	.0968	0.5	1564	9	0
C.24.1.1	0.00	402	150	0.38	3.54	1.7	.0968	0.4	1564	7	-3
C.20.1.1	0.05	553	172	0.32	3.66	1.1	.0968	0.4	1563	7	0
C.26.1.1	0.05	637	65	0.11	3.65	1.1	.0967	0.4	1562	7	0
C.27.1.1	0.02	569	139	0.25	3.63	1.1	.0967	0.4	1562	7	0
C.19.1.1	0.07	352	114	0.34	3.62	1.1	.0967	0.5	1562	9	-1
C.8.1.1	0.06	311	101	0.34	3.76	1.1	.0967	0.5	1562	10	3
C.2.1.1	0.06	234	63	0.28	3.66	1.2	.0967	0.7	1562	13	0
C.11.1.1	0.01	587	143	0.25	3.61	1.1	.0967	0.3	1562	6	-1
C.10.1.1	0.06	363	116	0.33	3.50	1.1	.0967	0.5	1561	9	-4
C.25.1.1	0.02	547	144	0.27	3.59	1.1	.0967	0.4	1561	7	-1
C.21.1.1	0.04	566	120	0.22	3.64	1.1	.0965	0.4	1557	7	-1
C.12.1.1	0.02	588	182	0.32	3.65	1.2	.0964	0.3	1556	6	0
C.16.1.1	0.03	576	157	0.28	3.72	1.1	.0964	0.4	1555	7	1
C.22.1.1	0.05	544	177	0.34	3.58	1.1	.0960	0.4	1547	7	-3

62. HODGKINSON GRANODIORITE, PARALANA CREEK: 2007379008

GA Sample ID:	**2007379008**
GA Sample Number:	**1952110**
Other Sample ID:	
1:250,000 Sheet:	**COPLEY SH 54-9**
Region:	**Mount Painter Inlier, South Australia**
Grid Reference (WGS 84):	**347021 6662350 Zone 54**
Collector:	**N. L. Neumann, G. L. Fraser & S. Hore**
Collection Date:	**21/10/2007**
Formal Name:	
Informal Name:	**Hodgkinson Granodiorite**
Lithology:	**Equigranular, medium-grained granodiorite**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6052**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**11 – 16/07/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.06% (2σ) [33 of 34];**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.6 ± 1.4 Ma [31 of 31]**
Interpreted Age:	**1552 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**
Interpreted Age:	**~520 Ma and ~458 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Metamorphic/recrystallisation age**

Sample Description

This sample was collected from Paralana Creek, ~3.5 km northwest of the Paralana Hot Springs, within the central granodiorite 'tail' of the British Empire Granite (as mapped in Coats *et al*., 1969), within the Mount Painter Inlier, South Australia. The sample is a white-black, equigranular medium-grained granodiorite with a weak biotite fabric (Figure 62.1). In adjacent outcrops the granodiorite contains feldspathic melt leucosomes, which were avoided when sampling.

Figure 62.1. *White, medium-grained granodiorite of the Hodgkinson Granodiorite, west of the Paralana Hot Springs, Mount Painter Inlier (sample 2007379008).*

Zircon Description

Zircons from this sample range in length from ~100 µm to ~180 µm, with some elongate grains up to ~260 µm in length (Figure 62.2). The grains are predominantly clear and colourless, with euhedral morphologies and prismatic to slightly rounded terminations. Cathodoluminescence

images record oscillatory zoning within most grains, with some also displaying dark cathodoluminescence rims (Figure 62.2).

Figure 62.2. *Representative transmitted light and cathodoluminescence images of zircons from the Hodgkinson Granodiorite (2007379008), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Forty-three analyses were undertaken on 34 zircons from this sample, targeting a wide range of morphologies and cathodoluminescence responses, including dark cathodoluminescence rims. Most of the analyses form two distant clusters; one which is early Mesoproterozoic and one which is Paleozoic in age (Figure 62.3). Mesoproterozoic ages are from core regions of zircons, whereas the Paleozoic ages are from the dark cathodoluminescence rims. Outside these two groups, there are three analyses with ages between ~1432 Ma and ~1130 Ma (D.33.1.1, D.31.1.1 and D.20.1.1). These analyses may represent isotopically mixed compositions between the older and younger zircon. Alternatively they are real ages, and their geological significance is unknown. They have been excluded from further considerations. There are also three ages older than the dominant Mesoproterozoic group (D.12.1.1, D.28.1.1, D.11.1.1; Figure 62.3) and these ages of ~1861 Ma, ~1772 Ma and ~1707 Ma are interpreted to represent inheritance (Figure 62.3).

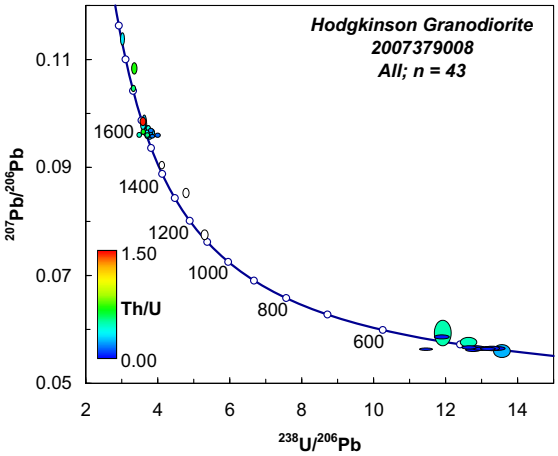

Figure 62.3. *Tera-Wasserburg concordia diagram of all zircon analyses from Hodgkinson Granodiorite (2007379008), coloured according to Th/U ratio.*

The remaining Mesoproterozoic group consists of 24 analyses, but the MWSD of 2.6 for the weighted mean age of these analyses indicate that they are not a single population. Probability density diagrams and unmix modelling suggest that the oldest four analyses may represent a group at ~1580 Ma. The remaining 20 analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1552 ± 4 Ma (95% confidence; MSWD = 1.3; probability of fit = 0.15; Figure 62.4).

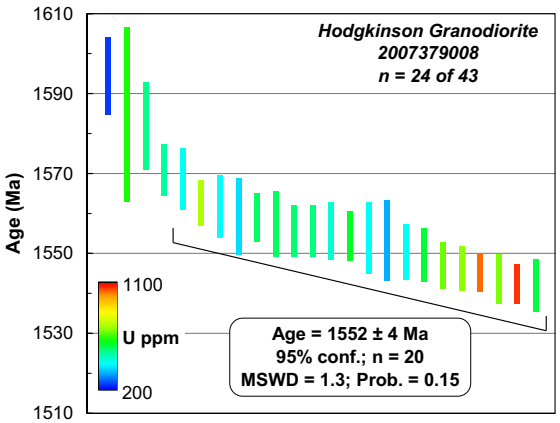

Figure 62.4. *Weighted mean age diagram of Mesoproterozoic zircon analyses from the Hodgkinson Granodiorite (2007379008), coloured according to U content.*

The Paleozoic cluster of thirteen ages includes two analyses (D.29.2.1 and D.26.1.1) which are older than the remaining ages, and provide a $^{206}Pb/^{238}U$ weighted mean age of ~520 Ma (Figure 62.5). The remaining 11 analyses form two distinct groups according to U content – 2 analyses (D.24.1.1 and D.25.2.1) have ~350 ppm U, whereas the other 9 analyses have much higher U contents of between 1798 and 4558 ppm (Figure 62.5). The 9 zircons with high U contents also have low Th/U ratios, of between 0.02 and 0.04, compared with the lower U content zircons which have Th/U ratios of 0.24 and 0.47 (Figure 62.6).

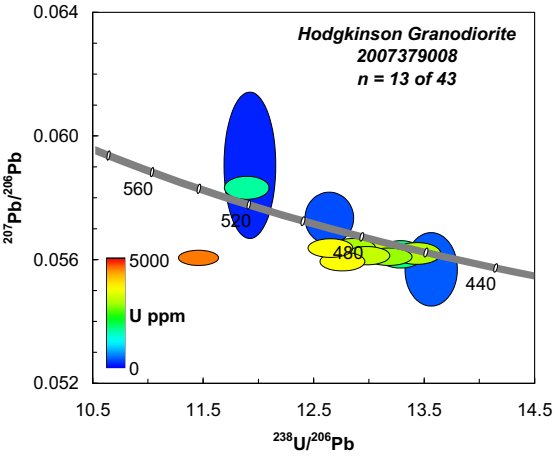

Figure 62.5. *Tera-Wasserburg concordia diagram of Paleozoic zircon analyses from Hodgkinson Granodiorite (2007379008), coloured according to U content.*

U-induced matrix affects can occur in zircons with over ~2500 ppm U (Butera *et al*., 2001), and this can, in turn, effect the calculated $^{206}Pb/^{238}U$ age for these grains. Given the high U content of many of the zircons in this sample, the $^{207}Pb/^{206}Pb$ values have been used to calculate the weighted mean age of this Paleozoic group. Using this approach, the 11 analyses combine to yield a weighted mean $^{207}Pb/^{206}Pb$ age of 458.0 ± 5.2 Ma (95% confidence; MSWD = 0.90; probability of fit = 0.53; Figure 62.6).

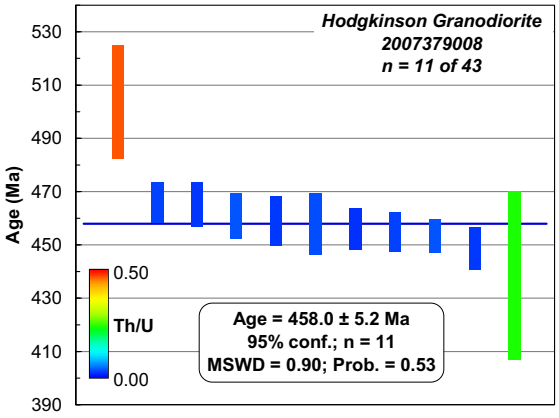

Figure 62.6. *Weighted mean age diagram for selected Paleozoic zircon analyses of the Hodgkinson Granodiorite (2007379008), coloured according to Th/U ratio.*

Geochronological Interpretation

This sample of the Hodgkinson Granodiorite records a number of ages. There are a range of inherited ages interpreted at ~1861 Ma, ~1772 Ma and ~1707 Ma, which have not currently been identified as stratigraphic ages within either the Mount Painter or Mount Babbage inliers. There are also 4 ages at ~1580 Ma. There is a large population of analyses which provide a mean age of 1552 ± 4 Ma (95% confidence; n = 20), and as these zircons record Th/U values between 0.14 and 0.67, this age is interpreted to record the time of magmatic crystallisation of this granodiorite. There are some zircon rims which contain lower Th/U values and record ages at ~520 Ma and ~458 Ma, and these ages are interpreted to represent either metamorphism or fluid flow within the sample.

Table 62.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379008 (1952110), Hodgkinson Granodiorite, Paralana Creek.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited ages (n = 3)											
D.12.1.1	0.02	255	80	0.33	2.97	1.1	.1138	0.7	1861	12	-1
D.28.1.1	0.10	208	143	0.71	3.29	1.5	.1084	0.6	1772	12	4
D.11.1.1	0.00	360	198	0.57	3.27	1.1	.1046	0.4	1707	7	-1
~Mesoproterozoic ages (n = 24)											
D.29.1.1	0.04	245	349	1.47	3.54	1.4	.0984	0.5	1594	10	-1
D.32.1.1	0.09	625	149	0.25	3.58	1.2	.0979	1.2	1585	22	0
D.25.1.1	0.06	517	175	0.35	3.54	1.2	.0978	0.6	1582	11	-1
D.8.1.1	0.00	508	207	0.42	3.69	1.1	.0972	0.3	1571	6	1
D.9.1.1	0.03	424	130	0.32	3.67	1.2	.0971	0.4	1568	8	1
D.19.1.1	0.02	740	117	0.16	3.76	1.2	.0968	0.3	1563	6	3
D.1.1.1	-0.03	411	114	0.29	3.66	1.1	.0967	0.4	1562	8	0
D.18.1.1	0.04	380	94	0.26	3.62	1.1	.0966	0.5	1559	10	-1
D.27.1.1	0.01	549	355	0.67	3.54	1.1	.0966	0.3	1559	6	-3
D.3.1.1	0.01	547	162	0.31	3.60	1.1	.0965	0.4	1557	8	-2
D.5.1.1	0.01	535	118	0.23	3.74	1.1	.0964	0.3	1556	6	2
D.7.1.1	0.02	526	165	0.32	3.68	1.1	.0964	0.3	1555	7	0
D.6.1.1	0.03	464	124	0.28	3.80	1.1	.0964	0.4	1555	7	3
D.21.1.1	0.02	590	193	0.34	3.64	1.1	.0963	0.3	1554	6	-1
D.16.1.1	0.05	422	142	0.35	3.69	1.2	.0963	0.5	1554	9	0
D.22.1.1	0.04	338	163	0.50	3.71	1.1	.0963	0.5	1553	10	1
D.13.1.1	0.01	426	87	0.21	3.69	1.1	.0961	0.4	1550	7	0
D.4.1.1	0.05	577	113	0.20	3.70	1.1	.0961	0.4	1550	7	1
D.17.1.1	0.03	685	306	0.46	3.43	1.2	.0959	0.3	1547	6	-7
D.14.1.1	0.03	707	364	0.53	3.66	1.1	.0959	0.3	1546	6	-1
D.15.1.1	-0.01	1031	140	0.14	3.94	1.1	.0959	0.3	1545	5	6
D.10.1.1	0.06	695	125	0.19	3.65	1.1	.0958	0.3	1544	6	-1
D.23.1.1	0.03	1067	171	0.17	3.80	1.1	.0957	0.3	1542	5	2
D.2.1.1	0.03	569	157	0.28	3.73	1.3	.0957	0.4	1542	7	1
Young Proterozoic ages (n = 3)											
D.33.1.1	0.06	349	116	0.34	4.06	1.1	.0903	0.5	1432	10	1
D.31.1.1	0.01	302	136	0.47	4.74	1.2	.0851	0.7	1318	13	6
D.20.1.1	0.06	171	195	1.18	5.26	1.2	.0773	0.8	1130	16	1
~Paleozoic ages (n = 13)											
D.29.2.1	0.01	1701	56	0.03	11.88	1.1	.0583	0.4	541	9	4
D.26.1.1	0.11	146	69	0.49	11.91	1.3	.0590	2.7	568	58	9
D.24.1.1	0.00	331	150	0.47	12.63	1.2	.0573	1.0	504	21	2
D.32.2.1	0.04	3632	101	0.03	12.64	1.1	.0563	0.3	466	8	-5
D.34.1.1	0.04	2950	67	0.02	12.85	1.1	.0563	0.4	465	8	-4
D.28.2.1	0.01	3219	115	0.04	13.13	1.1	.0562	0.4	461	9	-3
D.33.2.1	0.04	3014	71	0.02	13.43	1.1	.0562	0.4	459	9	-1
D.26.2.1	0.04	1798	58	0.03	13.28	1.1	.0561	0.5	458	12	-2
D.30.1.1	0.02	3163	63	0.02	12.98	1.1	.0561	0.3	456	8	-5
D.24.2.1	0.00	2857	78	0.03	13.17	1.1	.0561	0.3	455	7	-4
D.2.2.1	0.02	4558	161	0.04	11.44	1.1	.0560	0.3	453	6	-19
D.31.2.1	0.01	3624	86	0.02	12.75	1.1	.0559	0.4	448	8	-9
D.25.2.1	0.13	394	91	0.24	13.56	1.2	.0556	1.4	438	32	-5

63. HODGKINSON GRANODIORITE, FOUR MILE CREEK: 2007379005

GA Sample ID:	**2007379005**
GA Sample Number:	**1952107**
Other Sample ID:	
1:250,000 Sheet:	**COPLEY SH 54-9**
Region:	**Mount Painter Inlier, South Australia**
Grid Reference (WGS 84):	**352666 6664545 Zone 54**
Collector:	**N. L. Neumann, G. L. Fraser & S. Hore**
Collection Date:	**20/10/2007**
Formal Name:	
Informal Name:	**Hodgkinson Granodiorite**
Lithology:	**Equigranular medium-grained granodiorite**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6052**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**11 – 16/07/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.06% (2σ) [33 of 34];**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3466.6 ± 1.4 Ma [31 of 31]**
Acquisition Date:	**26 – 28/08/2008**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.60% (2σ) [20 of 20];**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3469.0 ± 2.2 Ma [16 of 16]**
Interpreted Age:	**1552 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**
Interpreted Age:	**~511 Ma and ~467 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Metamorphic/recrystallisation age**

Sample Description

This sample was collected from Four Mile Creek, ~1 km west of the basement contact with the Frome Plains, in the Mount Painter Inlier, South Australia. The sample is an equigranular medium-grained granodiorite with biotite fabric (Figure 63.1). The sample was collected ~30m from a mylonite zone and although there were alteration veins adjacent the sample outcrop (Figure 63.1), they were avoided during sample collection.

Figure 63.1. *Medium-grained granodiorite from the Hodgkinson Granodiorite, Four Mile Creek, Mount Painter Inlier (sample 2007379005).*

Zircon Description

Zircons from this sample have a range of sizes and morphologies. Most are ~60 µm to ~120 µm

in length, are clear and colourless, with euhedral morphologies and prismatic terminations (Figure 63.2). Others are larger (~120-180 µm in length) and have either a blocky or elongate, glassy morphology. Cathodoluminescence images record oscillatory zoning within most grains, with some also displaying dark cathodoluminescence rims (Figure 63.2). The glassy elongate grains have a relatively homogeneous cathodoluminescence character (e.g. E.2.1.1).

Figure 63.2. *Representative transmitted light and cathodoluminescence images of zircons from the Hodgkinson Granodiorite (2007379005), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Thirty-seven zircons were analysed, and most ages form two distant clusters; one which is Mesoproterozoic and one which is Paleozoic (Figure 63.3). The Mesoproterozoic ages are from larger zircons or core regions, whereas the Paleozoic ages are predominantly from glassy elongate grains or dark cathodoluminescence rims. Outside these two groups, there are analyses with ages of ~1487 Ma and ~1358 Ma (E.28.1.1 and E.13.1.1). These analyses may represent isotopically mixed compositions between older and younger zircon, or they are real ages, and their geological significance is unknown. They have been excluded from further considerations. Analysis (E.27.1.1) records an age of ~1796 Ma, which is older than the dominant Mesoproterozoic group, and is interpreted to represent inheritance (Figure 63.3).

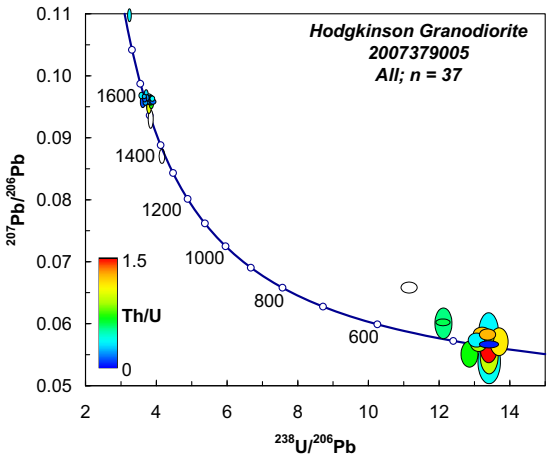

Figure 63.3. *Tera-Wasserburg concordia diagram of all zircon analyses from Hodgkinson Granodiorite (2007379005), coloured according to Th/U ratio. Open ellipses represent analyses not included in age calculations.*

The remaining nineteen analyses within the Mesoproterozoic cluster combine to yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1552 ± 4 Ma (95% confidence; MSWD = 1.10; probability of fit = 0.35; Figure 63.4).

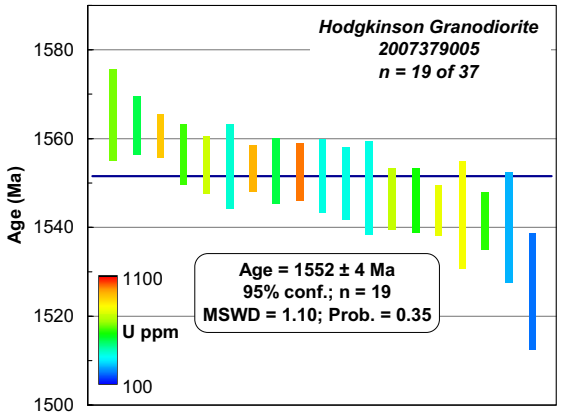

Figure 63.4. *Weighted mean age diagram of Mesoproterozoic zircon analyses from the Hodgkinson Granodiorite (2007379005), coloured according to U content.*

The Paleozoic cluster of 15 analyses from glassy elongate zircons or high cathodoluminescence rims includes 4 analyses which are greater than 15% discordant, and so have been excluded (Figure 63.5). There are two analyses with ages older than the main group (E.31.1.1 and E.26.1.1) and these combine to yield a $^{206}Pb/^{238}U$ age of ~512 Ma (Figure 63.6). The remaining nine analyses contain a range of U contents and Th/U values, and combine to produce a weighed mean $^{206}Pb/^{238}U$ age of 466.6 ± 4.9 Ma (95% confidence; MSWD = 1.30; probability of fit = 0.22; Figure 63.6).

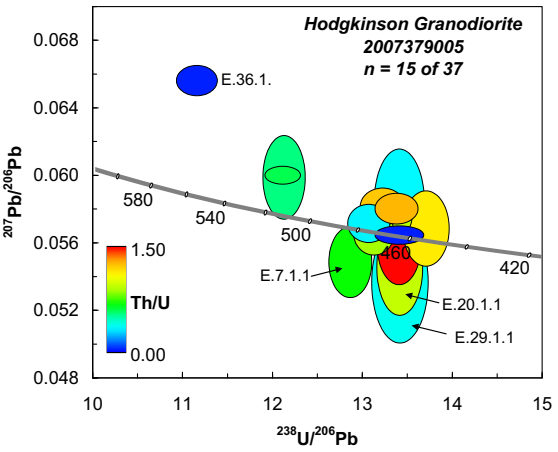

Figure 63.5. *Tera-Wasserburg concordia diagram of all Paleozoic zircon analyses from Hodgkinson Granodiorite (2007379005), coloured according to Th/U ratio. Labelled analyses are >15% discordant and have been excluded from age calculations.*

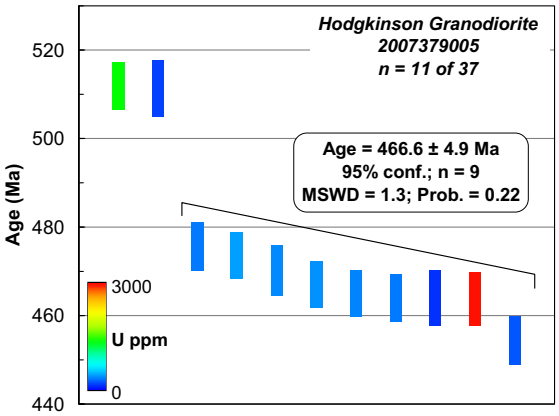

Figure 63.6. *Weighted mean age diagram of selected Paleozoic zircon analyses from the Hodgkinson Granodiorite (2007379005), coloured according to U content.*

Geochronological Interpretation

This sample records a number of ages, with one inherited age of ~1796 Ma, which is older than any known stratigraphic age in the region. The main older zircon group records a weighted mean age of 1552 ± 4 Ma (95% confidence; n = 19), which is interpreted to record the magmatic crystallisation age of this sample. Small elongate zircons record younger ages, with a possible group at ~511 Ma and a larger group at ~467 Ma. The Th/U values of these zircons are variable with only one analysis <0.01, suggesting that this age may record new zircon growth associated with melt emplacement.

Table 63.1. SHRIMP U-Pb isotopic data for zircons from sample 2007379005 (1952107), Hodgkinson Granodiorite, Four Mile Creek.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Inherited age (n = 1)											
E.27.1.1	-0.02	198	66	0.34	3.19	1.2	.1098	0.6	1796	11	2
Mesoproterozoic ages (n = 19)											
E.15.1.1	0.04	646	191	0.31	3.66	1.1	.0969	0.6	1565	10	0
E.30.1.1	0.00	505	165	0.34	3.52	1.2	.0968	0.4	1563	7	-3
E.4.1.1	0.00	921	222	0.25	3.61	1.1	.0966	0.3	1560	5	-1
E.16.1.1	0.01	601	118	0.20	3.69	1.1	.0964	0.4	1556	7	1
E.9.1.1	0.04	750	120	0.17	3.69	1.1	.0963	0.3	1554	7	0
E.37.1.1	0.01	390	131	0.35	3.74	1.4	.0963	0.5	1554	10	2
E.32.1.1	0.00	953	330	0.36	3.84	1.1	.0963	0.3	1553	5	4
E.12.1.1	0.04	509	98	0.20	3.72	1.2	.0962	0.4	1553	7	1
E.11.1.1	0.03	1014	117	0.12	3.62	1.1	.0962	0.3	1552	6	-1
E.6.1.1	0.02	370	131	0.37	3.81	1.2	.0962	0.4	1552	8	3
E.17.1.1	0.01	370	272	0.76	3.68	1.2	.0961	0.4	1550	8	0
E.35.1.1	0.06	367	110	0.31	3.79	1.4	.0960	0.6	1549	11	3
E.24.1.1	0.02	733	138	0.19	3.71	1.2	.0959	0.4	1546	7	0
E.14.1.1	0.06	567	174	0.32	3.75	1.2	.0959	0.4	1546	7	1
E.33.1.1	0.01	795	113	0.15	3.86	1.3	.0958	0.3	1544	6	4
E.1.1.1	0.03	815	83	0.11	3.57	1.4	.0957	0.6	1543	12	-3
E.3.1.1	0.03	586	123	0.22	3.64	1.2	.0957	0.3	1541	7	-2
E.5.1.1	0.07	258	179	0.71	3.81	1.2	.0956	0.7	1540	12	2
E.18.1.1	0.08	199	200	1.04	3.74	1.2	.0949	0.7	1525	13	0
Young Proterozoic ages (n = 2)											
E.28.1.1	0.20	127	144	1.17	3.79	1.3	.0929	1.1	1487	20	-2
E.13.1.1	0.16	160	86	0.55	4.11	1.2	.0869	0.9	1358	17	-3

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{206}Pb/^{238}U$ Age, Ma	± Ma (1σ)	Disc (%)
Paleozoic ages (n = 11)											
E.31.1.1	0.07	1373	795	0.60	12.10	1.1	.0600	0.6	512.0	5.3	15
E.26.1.1	0.23	168	88	0.54	12.11	1.3	.0598	2.8	511.3	6.4	14
E.23.1.1	0.07	321	106	0.34	13.06	1.2	.0571	1.3	475.6	5.4	4
E.25.1.1	0.18	421	356	0.87	13.12	1.2	.0565	1.5	473.6	5.3	0
E.22.1.1	-0.04	366	436	1.23	13.21	1.3	.0581	1.3	470.3	5.7	12
E.19.1.1	0.09	386	345	0.92	13.31	1.2	.0575	1.5	467.0	5.3	8
E.2.1.1	-0.05	349	429	1.27	13.37	1.2	.0580	1.0	465.0	5.3	12
E.21.1.1	0.24	320	464	1.50	13.40	1.2	.0558	2.8	464.1	5.4	-4
E.8.1.1	0.53	124	42	0.35	13.40	1.4	.0583	3.7	463.9	6.2	14
E.34.1.1	0.20	2967	112	0.04	13.40	1.3	.0564	0.6	463.9	6.0	1
E.10.1.1	0.33	226	249	1.14	13.70	1.3	.0568	2.6	454.2	5.5	6
Analyses >15% discordant (n = 4)											
E.36.1.1	0.04	2069	83	0.04	11.14	1.3	.0656	0.9	554.3	7.1	30
E.20.1.1	0.63	220	202	0.95	13.41	1.3	.0545	3.5	463.8	5.6	-19
E.7.1.1	0.46	307	205	0.69	12.86	1.2	.0548	2.6	482.9	5.7	-20
E.29.1.1	1.07	180	67	0.38	13.41	1.5	.0536	4.5	463.7	6.9	-31

64. UNNAMED CALC-SILICATE, SPH 1 DRILLHOLE: 2009378027

GA Sample ID:	**2009378027**
GA Sample Number:	**1999976**
Other Sample ID:	**SPH 1: 414 - 418.9 m depth**
1:250,000 Sheet:	**CALLABONNA SH 54-6**
Region:	**Curnamona Province, South Australia**
Grid Reference (WGS 84):	**389400 6688895 Zone 54**
Collector:	**A. Schofield**
Collection Date:	**07/2009**
Formal Name:	
Informal Name:	**Unnamed calc-silicate**
Lithology:	**Altered calc-silicate**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6099**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**10 – 14/09/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.19% (2σ) [30 of 31]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3468.4 ± 2.0 Ma [30 of 30]**
Interpreted Age:	**1558 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**

Sample Description

This sample was collected from the SPH 1 drill hole, between the 414 m to 418.9 m depth interval, within the Curnamona Province, South Australia. The sample is described as a banded, altered calc-silicate rock which consists of quartz, interlocking plagioclase crystals, epidote and minor garnet (Figure 64.1).

Figure 64.1. *Unnamed calc-silicate from the 414 m to 418. 9m depth interval of drill hole SPH 1 (sample 2009378027), with a pen for scale.*

Zircon Description

Zircons from this sample range from ~70 µm to ~170 µm in length and have sub-euhedral to blocky morphologies (Figure 64.2). Many grains are very metamict and cracked, and have irregular-shaped grain edges. Non-metamict grains are colourless to light brown in colour. In cathodoluminescence images, most grains have a dark, heterogeneous, speckled response, with a smaller number of homogeneous bright or dark cathodoluminescence grains (Figure 64.2). Some grains have a very thin, bright cathodoluminescence rim. Analyses avoided metamict grains, focusing on grains which are clear in transmitted light and preserve zones with a homogeneous cathodoluminescence character.

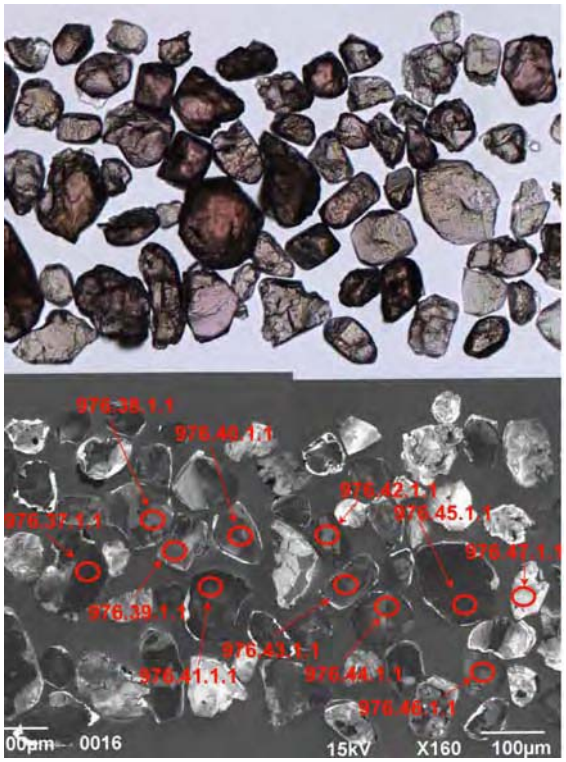

Figure 64.2. *Representative transmitted light and cathodoluminescence images of zircons from the unnamed calc-silicate, SPH 1 drillhole (2009378027), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Fifty-seven zircons were analysed, and their calculated ages range from ~1608 Ma to ~1537 Ma (Figure 64.3).

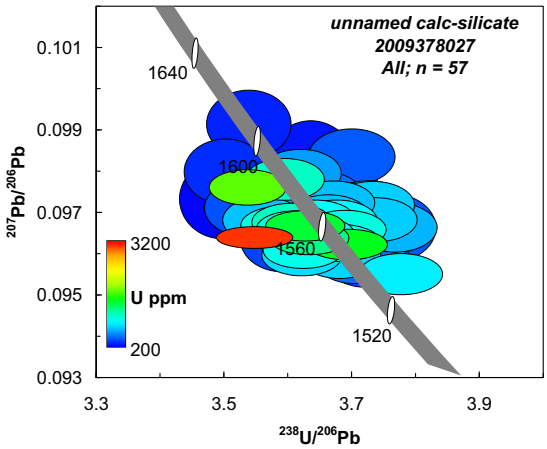

Figure 64.3. *Tera-Wasserburg concordia diagram of all zircon analyses from the unnamed calc-silicate, SPH 1 drillhole (2009378027), coloured according to U content.*

Uranium concentrations for the zircons range between 1774 ppm and 208 ppm, with one much higher at 3008 ppm, and Th/U ratios range between 0.40 and 0.06 (Figure 64.3 and 64.4). In general, zircons with younger ages have higher uranium concentrations, but as it is not a simple linear relationship, this criteria can not be used to group the analyses. The MWSD for the entire cluster indicates that it is not a single population, and mixture modeling suggests ages at ~1583 Ma (17% of analyses) and ~1558 Ma (83% of analyses). Alternatively, using the MSWD value as a statistical guide gives a youngest weighted mean $^{207}Pb/^{206}Pb$ age of 1558 ± 3 Ma (95% confidence; n = 49; MSWD = 1.2; probability of fit = 0.13), with the remaining eight analyses providing a weighted mean $^{207}Pb/^{206}Pb$ age of 1585 ± 6 Ma (95% confidence; MSWD = 1.07; probability of fit = 0.38; Figure 64.4).

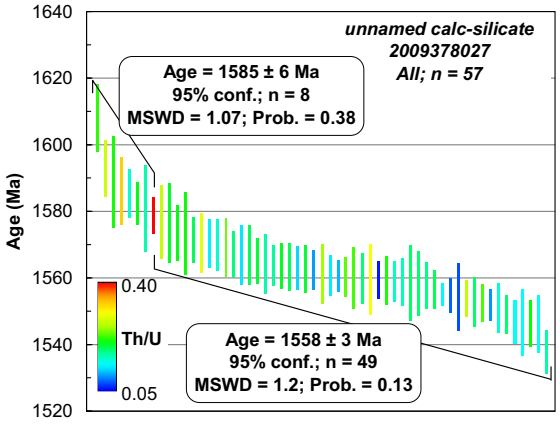

Figure 64.4. *Weighted mean age diagram of all zircon analyses from the unnamed calc-silicate, SPH 1 drillhole (2009378027), coloured according to Th/U ratio.*

Geochronological Interpretation

As no ages older than ~1608 Ma were identified from this sample, and all the ages range between ~1608 and ~1537 Ma, the protolith of this sample may be igneous rather than sedimentary in origin. Most analyses provide a weighted mean age of 1558 ± 3 Ma (95% confidence; n = 49), and as the majority of these analyses have Th/U values greater than 0.1, this age is interpreted to record the magmatic crystallisation age of this sample. This interpretation would then suggest that the older age of ~1585 recorded by 8 zircons may represent inheritance.

Table 64.1. SHRIMP U-Pb isotopic data for zircons from sample 2009378027 (1999976), unnamed calc-silicate, SPH 1 drillhole.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
~1585 Ma ages (n = 8)											
976.34.1.1	0.00	286	61	0.22	3.54	1.2	.0991	0.5	1608	10	0
976.39.1.1	0.02	435	117	0.28	3.70	1.2	.0983	0.5	1593	9	3
976.47.1.1	0.12	252	52	0.21	3.63	1.3	.0981	0.7	1589	14	1
976.5.1.1	0.06	313	101	0.33	3.50	1.2	.0980	0.5	1586	10	-2
976.30.1.1	0.01	619	91	0.15	3.62	1.2	.0979	0.4	1585	7	1
976.45.1.1	0.01	1115	222	0.21	3.59	1.1	.0978	0.3	1582	6	0
976.26.1.1	0.28	473	75	0.16	3.67	1.2	.0977	0.7	1581	13	2
976.37.1.1	0.00	1774	689	0.40	3.53	1.1	.0976	0.3	1579	6	-2
~1558 Ma ages (n = 49)											
976.33.1.1	0.06	300	79	0.27	3.60	1.3	.0975	0.6	1577	11	0
976.31.1.1	0.05	245	47	0.20	3.58	1.3	.0975	0.6	1576	12	-1
976.49.1.1	-0.01	495	99	0.21	3.65	1.2	.0973	0.4	1573	8	1
976.53.1.1	0.04	208	43	0.21	3.50	1.3	.0973	0.7	1573	12	-3
976.24.1.1	0.00	708	128	0.19	3.67	1.2	.0972	0.4	1571	7	1
976.16.1.1	0.03	455	128	0.29	3.55	1.2	.0972	0.5	1570	9	-2
976.35.1.1	0.06	749	93	0.13	3.73	1.2	.0972	0.4	1570	7	3
976.48.1.1	0.05	587	87	0.15	3.72	1.2	.0971	0.4	1570	8	2
976.3.1.1	0.04	412	95	0.24	3.53	1.2	.0971	0.5	1569	9	-2
976.51.1.1	0.01	680	117	0.18	3.65	1.2	.0970	0.4	1567	7	0
976.57.1.1	0.02	565	68	0.12	3.62	1.2	.0970	0.5	1567	9	0
976.14.1.1	-0.01	629	114	0.19	3.61	1.2	.0970	0.5	1567	9	-1
976.29.1.1	0.01	719	137	0.20	3.66	1.2	.0969	0.4	1565	7	1
976.28.1.1	0.04	434	70	0.17	3.68	1.4	.0968	0.5	1564	9	1
976.32.1.1	0.01	924	151	0.17	3.64	1.2	.0968	0.3	1563	6	0
976.19.1.1	0.02	745	145	0.20	3.74	1.2	.0968	0.4	1563	7	2
976.6.1.1	0.03	715	130	0.19	3.56	1.2	.0968	0.4	1563	7	-2
976.41.1.1	0.02	894	103	0.12	3.67	1.1	.0968	0.4	1563	7	1
976.40.1.1	0.00	672	128	0.20	3.64	1.2	.0968	0.4	1563	7	0
976.8.1.1	0.00	1129	108	0.10	3.60	1.1	.0967	0.3	1562	6	-1
976.42.1.1	0.03	479	118	0.25	3.71	1.2	.0967	0.5	1561	9	2
976.20.1.1	0.06	1003	122	0.13	3.59	1.2	.0967	0.3	1561	6	-1
976.7.1.1	0.01	1455	151	0.11	3.62	1.1	.0966	0.3	1560	5	-1
976.17.1.1	0.02	901	203	0.23	3.62	1.3	.0966	0.3	1560	6	-1
976.22.1.1	0.10	573	126	0.23	3.72	1.2	.0966	0.5	1560	9	2
976.44.1.1	0.02	679	118	0.18	3.77	1.2	.0966	0.4	1560	8	3
976.23.1.1	0.11	427	125	0.30	3.76	1.2	.0966	0.6	1559	11	3
976.1.1.1	0.02	1056	57	0.06	3.61	1.2	.0966	0.3	1559	6	-1
976.21.1.1	0.02	778	162	0.22	3.63	1.2	.0966	0.4	1559	7	-1
976.18.1.1	0.03	1026	157	0.16	3.69	1.1	.0966	0.3	1559	6	1
976.55.1.1	0.02	660	104	0.16	3.62	1.2	.0965	0.4	1558	7	-1
976.38.1.1	0.07	458	81	0.18	3.65	1.2	.0965	0.6	1558	11	0
976.46.1.1	0.21	672	118	0.18	3.74	1.2	.0965	0.5	1558	10	2
976.11.1.1	0.01	689	117	0.17	3.66	1.2	.0965	0.4	1557	7	0
976.10.1.1	0.00	923	168	0.19	3.64	1.1	.0964	0.3	1556	6	-1
976.36.1.1	0.01	3088	390	0.13	3.55	1.1	.0964	0.2	1555	3	-3
976.52.1.1	0.00	1270	98	0.08	3.63	1.1	.0963	0.3	1555	5	-1
976.25.1.1	0.05	373	27	0.07	3.59	1.2	.0963	0.5	1554	10	-2
976.12.1.1	0.01	1190	309	0.27	3.63	1.2	.0963	0.3	1554	5	-1
976.13.1.1	0.03	633	112	0.18	3.62	1.2	.0962	0.4	1553	8	-1
976.2.1.1	0.01	962	212	0.23	3.68	1.1	.0962	0.3	1552	6	0
976.27.1.1	0.01	1512	141	0.10	3.69	1.1	.0962	0.3	1552	5	0
976.50.1.1	0.02	673	97	0.15	3.67	1.2	.0961	0.4	1551	7	0
976.15.1.1	0.00	985	174	0.18	3.62	1.1	.0961	0.3	1549	6	-1
976.54.1.1	0.03	811	104	0.13	3.62	1.2	.0959	0.3	1547	7	-2
976.9.1.1	0.08	411	54	0.14	3.72	1.2	.0959	0.5	1546	10	1
976.43.1.1	0.03	774	158	0.21	3.68	1.2	.0959	0.4	1546	7	0
976.4.1.1	0.05	494	66	0.14	3.70	1.2	.0959	0.5	1546	9	0
976.56.1.1	0.02	859	140	0.17	3.77	1.2	.0955	0.3	1537	7	1

Curnamona Province

MUDGUARD AND MULYUNGARIE DOMAINS

Both the Mudguard and Mulyungarie Domains (Conor and Preiss, 2008), are predominantly covered by younger sediments (Figure x). The Mudgard Domain forms part of the shallowly buried Benagerie Ridge, and includes early Mesoproterozoic felsic and mafic volcanics and minor unmetamorphosed sediments. The boundaries of the Mulyungarie Domain are poorly defined, but the domain is characterised by a thick sulphidic succession that is interpreted to be possibly transitional between the Olary and Broken Hill domains (Conor and Preiss, 2008).

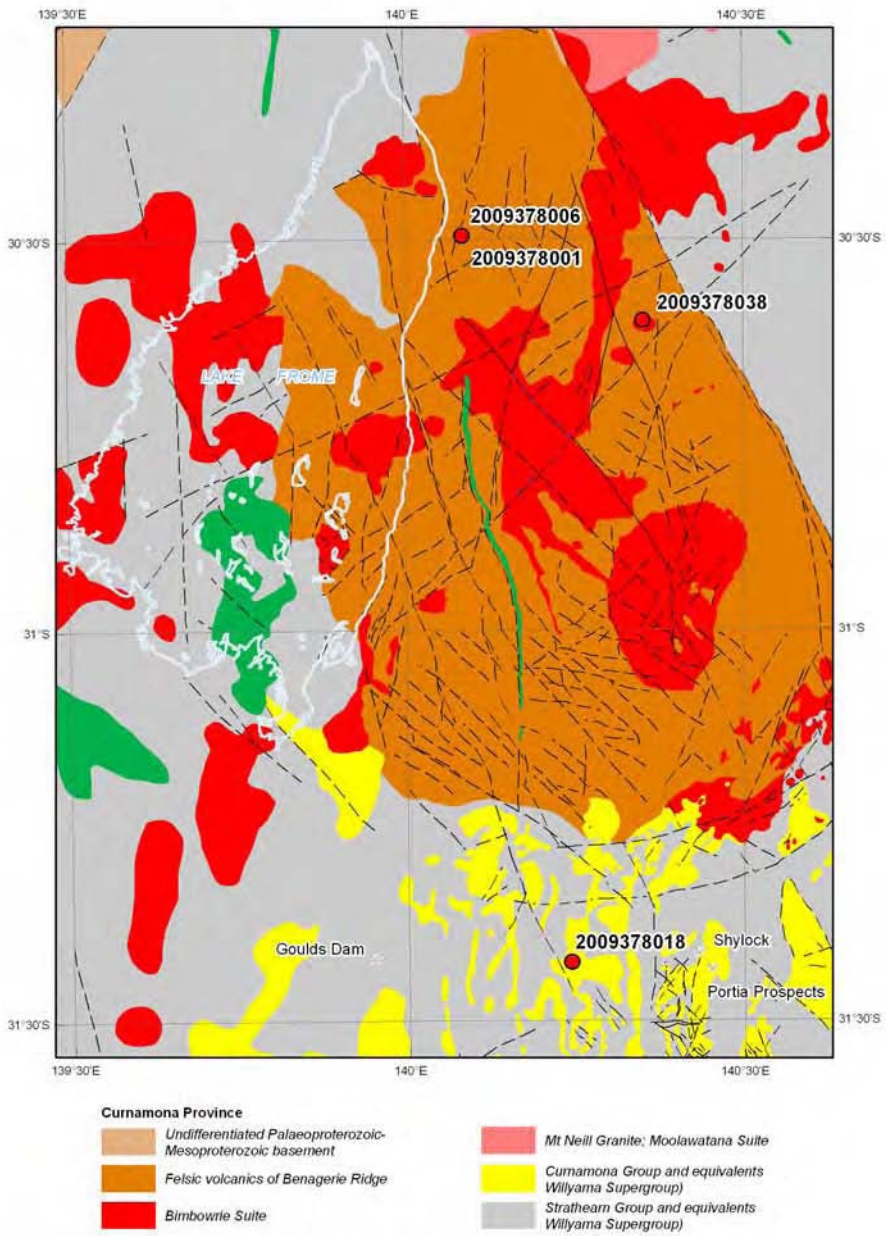

Figure x. *Location of new samples analysed for SHRIMP U-Pb zircon geochronology from the Mudguard and Mulyungarie Domains, South Australia, displayed on a solid geology map (Cowley, 2006).*

65. UNNAMED WHITE SANDSTONE, BUMBARLOW 1 DRILLHOLE: 2009378001

GA Sample ID:	**2009378001**
GA Sample Number:	**1999950**
Other Sample ID:	**Bumbarlow 1: 686 – 691 m depth**
1:250,000 Sheet:	**FROME SH 54-10**
Region:	**Curnamona Province, South Australia**
Grid Reference (WGS 84):	**412336 6625948 Zone 54**
Collector:	**A. Schofield**
Collection Date:	**07/2009**
Formal Name:	
Informal Name:	**White sandstone**
Lithology:	**White sandstone**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6099**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**10 – 14/09/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.19% (2σ) [30 of 31]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3468.4 ± 2.0 Ma [30 of 30]**
Interpreted Age:	**1591 ± 6 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample was collected from the Bumbarlow 1 drill hole, between the 686 m and 691 m depth interval, within the Curnamona Province, South Australia. The sample is a medium- to coarse-grained, poorly cemented, white sandstone with minor lithic fragments and heavy mineral banding (Figure 65.1).

Figure 65.1. *White sandstone from the 686 m and 691 m depth interval of drill hole Bumbarlow 1 (sample 2009378001), with pen for scale.*

Zircon Description

Zircons from this sample range from ~100 µm to ~180 µm in length, with some larger grains up to ~280 µm in length (Figure 65.2). Most are clear and colourless to light brown in colour, and have a range of morphologies from euhedral, glassy grains which preserve prismatic terminations and faces, to rounded grains, some of which are pitted. Cathodoluminescence images record oscillatory zoning within most grains, while other grains have a homogeneous dark cathodoluminescence character (Figure 65.2).

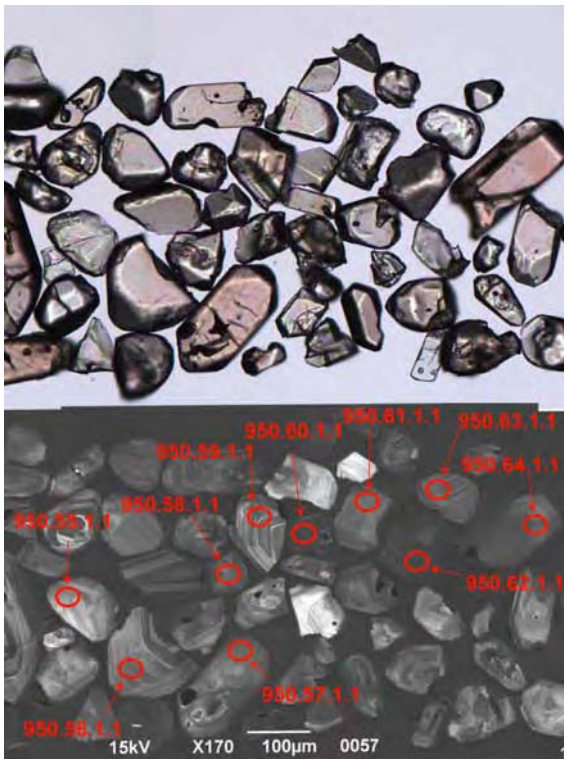

Figure 65.2. *Representative transmitted light and cathodoluminescence images of zircons from the white sandstone, Bumbarlow 1 drillhole (2009378001), with locations of some SHRIMP analyses.*

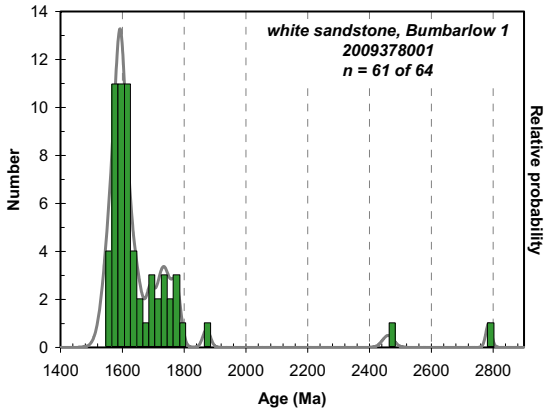

Figure 65.3. *Probability density diagram of zircon analyses from the white sandstone, Bumbarlow 1 drillhole (2009378001).*

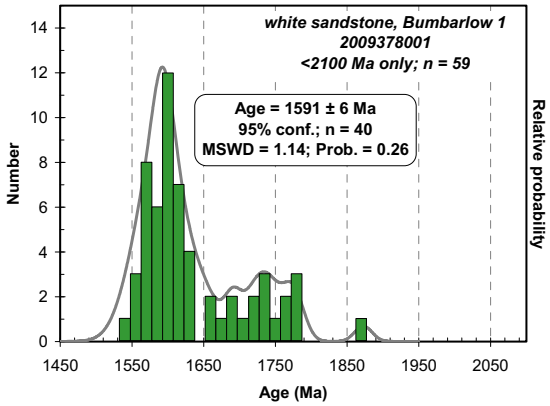

Figure 65.4. *Probability density diagram of zircon analyses from the white sandstone, Bumbarlow 1 drillhole (2009378001) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

U-Pb Isotopic Results

Sixty-four zircons were analysed from this sample, with three analyses containing common Pb contents greater than an arbitrary value of 0.5% excluded from further consideration.

The remaining 61 analyses range in age from ~2786 Ma to ~1541 Ma (Figure 65.3). The age spectrum includes individual ages at ~2786 Ma, ~2460 Ma and ~1873 Ma, a range of ages between ~1781 Ma and ~1679 Ma, and a large cluster of ages between ~1654 Ma and ~1541 Ma. The MSWD and probability of fit values for this large cluster indicate that it is not a single population, and mixture modelling suggests a youngest group at 1590 ± 6 Ma. This is within error of the weighted mean $^{207}Pb/^{206}Pb$ age of 1591 ± 6 Ma (95% confidence; MSWD = 1.14; probability of fit = 0.26) for the youngest 40 ages (Figure 65.4).

Geochronological Interpretation

The weighted mean age of 1591 ± 6 Ma (95% confidence; n = 40) can be used to define a maximum depositional age for this sample.

Table 65.1. SHRIMP U-Pb isotopic data for zircons from sample 2009378001 (1999950), unnamed white sandstone, Bumbarlow 1 drillhole.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircons (n = 61)											
950.1.1.1	0.09	87	72	0.85	1.81	1.5	.1951	0.6	2786	9	-2
950.8.1.1	0.01	145	90	0.64	2.16	2.2	.1604	1.1	2460	18	0
950.30.1.1	0.05	166	78	0.49	3.17	1.3	.1145	0.7	1873	12	6
950.15.1.1	-0.01	111	75	0.70	3.16	1.4	.1089	0.7	1781	13	0
950.63.1.1	-0.03	142	90	0.65	2.93	1.4	.1086	0.8	1776	15	-7
950.12.1.1	0.10	172	68	0.41	3.12	1.3	.1085	0.7	1774	13	-1
950.53.1.1	0.12	157	99	0.65	3.20	1.6	.1078	0.9	1763	16	0
950.61.1.1	0.08	114	65	0.59	3.08	1.4	.1075	0.9	1757	17	-3
950.2.1.1	0.24	173	112	0.67	3.27	1.3	.1067	0.8	1744	15	1
950.28.1.1	0.04	188	112	0.61	3.20	1.3	.1063	0.7	1737	13	-1
950.35.1.1	0.13	115	55	0.49	3.23	1.4	.1062	0.9	1735	16	0
950.24.1.1	0.13	146	78	0.55	3.20	1.3	.1057	0.8	1727	15	-2
950.44.1.1	0.06	281	272	1.00	3.15	1.2	.1052	0.7	1718	12	-4
950.36.1.1	0.39	119	76	0.66	3.21	1.4	.1049	1.3	1712	24	-2
950.29.1.1	0.30	95	102	1.10	3.29	1.5	.1039	1.4	1696	26	-1
950.32.1.1	0.06	150	161	1.11	3.54	1.9	.1038	0.9	1692	16	5
950.50.1.1	0.01	246	116	0.49	3.37	1.3	.1037	0.6	1692	11	1
950.21.1.1	0.11	129	143	1.15	3.47	1.3	.1030	0.9	1679	16	3
950.40.1.1	0.07	178	117	0.68	3.55	1.3	.1016	0.7	1654	14	3
950.33.1.1	0.06	149	90	0.62	3.52	1.3	.1014	0.8	1650	14	2
950.14.1.1	0.04	175	116	0.69	3.65	1.3	.1005	0.7	1634	12	4
950.52.1.1	-0.04	50	36	0.74	3.51	1.9	.1003	1.3	1629	24	1
950.55.1.1	0.06	62	44	0.73	3.48	1.7	.1002	1.2	1628	22	0
950.57.1.1	0.13	88	72	0.84	3.50	1.5	.0999	1.2	1623	23	0
950.6.1.1	0.05	124	61	0.51	3.71	1.3	.0997	0.9	1618	17	5
950.18.1.1	0.06	205	177	0.89	3.48	1.3	.0995	0.7	1615	14	-1
950.13.1.1	0.08	149	143	0.99	3.69	1.3	.0995	0.9	1614	16	4
950.10.1.1	0.18	72	54	0.77	3.46	1.6	.0993	1.4	1612	26	-1
950.23.1.1	0.17	43	51	1.22	3.68	1.8	.0993	1.8	1611	34	4
950.31.1.1	0.23	91	55	0.63	3.78	1.5	.0992	1.4	1609	26	6
950.56.1.1	0.01	110	69	0.65	3.58	1.4	.0991	0.9	1607	17	1
950.42.1.1	0.20	83	46	0.57	3.51	1.5	.0988	1.4	1601	26	-1
950.39.1.1	0.05	89	62	0.73	3.55	1.5	.0988	1.1	1601	20	0
950.27.1.1	0.04	159	123	0.80	3.60	1.3	.0988	0.7	1601	14	1
950.54.1.1	0.07	158	97	0.64	3.62	1.3	.0987	0.8	1600	15	2
950.5.1.1	0.10	117	55	0.49	3.70	1.4	.0986	0.9	1598	17	3
950.26.1.1	0.16	113	38	0.35	3.55	1.7	.0985	1.0	1596	19	0
950.37.1.1	-0.01	79	45	0.59	3.72	1.5	.0985	1.0	1596	19	4
950.51.1.1	0.12	121	82	0.70	3.58	1.4	.0985	1.1	1596	20	0
950.62.1.1	0.00	278	208	0.77	3.57	1.3	.0984	0.6	1595	11	0
950.16.1.1	0.10	185	82	0.46	3.62	1.3	.0984	0.8	1594	15	1
950.7.1.1	0.11	167	93	0.58	3.60	1.3	.0983	0.8	1593	14	1
950.60.1.1	0.02	256	128	0.51	3.57	1.3	.0983	0.6	1591	12	0
950.34.1.1	0.05	183	86	0.49	3.49	1.4	.0979	0.7	1585	14	-2
950.4.1.1	0.23	71	34	0.50	3.57	1.5	.0978	1.4	1583	26	-1
950.41.1.1	0.04	242	86	0.37	3.54	1.3	.0978	0.7	1582	13	-1
950.9.1.1	0.14	142	136	0.99	3.58	1.3	.0976	1.0	1578	18	-1
950.59.1.1	0.30	71	92	1.34	3.56	1.6	.0976	1.8	1578	34	-1
950.38.1.1	0.17	93	36	0.41	3.59	1.4	.0975	1.2	1577	22	0
950.25.1.1	0.27	87	51	0.61	3.62	1.5	.0973	1.4	1573	25	0
950.11.1.1	0.08	126	56	0.46	3.66	1.3	.0973	1.0	1573	18	1
950.43.1.1	0.11	140	129	0.96	3.57	1.4	.0973	1.0	1573	18	-1
950.19.1.1	0.18	86	51	0.61	3.53	1.5	.0972	1.2	1571	22	-2
950.46.1.1	0.13	101	62	0.63	3.80	1.5	.0971	1.4	1569	27	4
950.48.1.1	0.09	121	108	0.92	3.67	1.6	.0970	1.0	1567	19	1
950.49.1.1	0.14	129	57	0.45	3.54	1.4	.0969	1.0	1566	19	-2
950.64.1.1	0.09	116	50	0.44	3.60	1.4	.0969	1.2	1565	22	-1
950.47.1.1	0.30	69	36	0.54	3.55	1.7	.0963	1.6	1554	30	-3
950.17.1.1	0.10	139	60	0.44	3.59	1.3	.0963	1.0	1553	19	-2
950.20.1.1	0.24	119	80	0.69	3.56	2.0	.0960	1.1	1548	21	-3
950.22.1.1	0.38	149	102	0.71	3.71	1.3	.0957	1.2	1541	22	0
Analyses >0.5% $^{206}Pb_c$ (n = 3)											
950.45.1.1	0.71	37	19	0.54	3.40	2.5	.0935	2.9	1499	56	-11
950.58.1.1	0.65	159	100	0.65	4.99	1.4	.0976	1.6	1579	30	25
950.3.1.1	0.54	90	126	1.45	3.75	1.5	.0966	1.7	1559	31	2

66. UNNAMED RED SANDSTONE, BUMBARLOW 1 DRILLHOLE: 2009378006

GA Sample ID:	**2009378006**
GA Sample Number:	**1999955**
Other Sample ID:	**Bumbarlow 1: 469.3 - 474.6 m depth**
1:250,000 Sheet:	**FROME SH 54-10**
Region:	**Curnamona Province, South Australia**
Grid Reference (WGS 84):	**412336 6625948 Zone 54**
Collector:	**A. Schofield**
Collection Date:	**07/2009**
Formal Name:	
Informal Name:	**Red sandstone**
Lithology:	**Red sandstone**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6099**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**10 – 14/09/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.19% (2σ) [30 of 31]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3468.4 ± 2.0 Ma [30 of 30]**
Interpreted Age:	**1550 ± 6 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Maximum depositional age**

Sample Description

This sample was collected from the Bumbarlow 1 drill hole, between the 469.3 m to 474.6 m depth interval, within the Curnamona Province, South Australia. The sample is a coarse-grained, gritty, red sandstone with graded bedding (Figure 66.1).

Figure 66.1. *Red sandstone from the 469.3 m to 474.6 m depth interval of drill hole Bumbarlow 1 (sample 2009378006), with a pen for scale.*

Zircon Description

Zircons from this sample range from ~100 µm to ~180 µm in length, with some larger grains up to ~260 µm in length (Figure 66.2). Most are clear and colourless to light brown in colour, have some inclusions and are euhedral, glassy grains which preserve prismatic terminations and faces. A few grains have rounded morphologies. Cathodoluminescence images record oscillatory zoning within most grains (Figure 66.2).

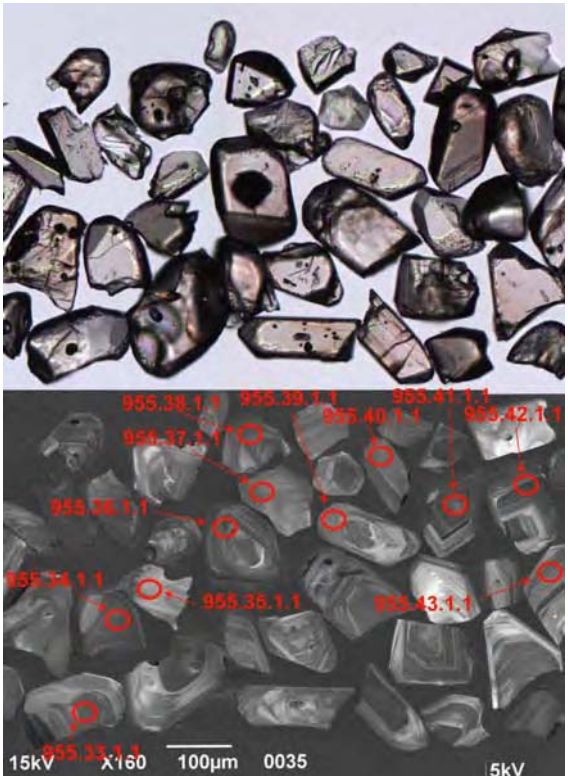

Figure 66.2. *Representative transmitted light and cathodoluminescence images of zircons from the red sandstone, Bumbarlow 1 drillhole (2009378006), with locations of some SHRIMP analyses.*

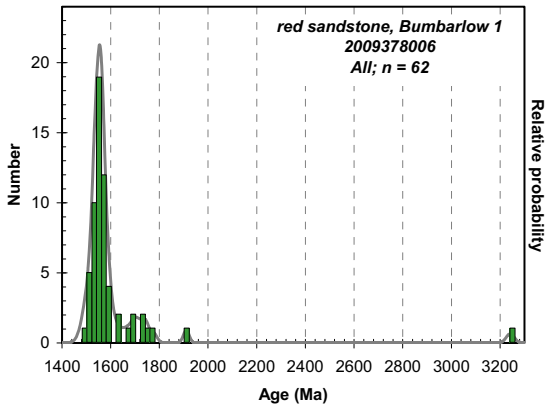

Figure 66.3. *Probability density diagram of zircon analyses from the red sandstone, Bumbarlow 1 drillhole (2009378006).*

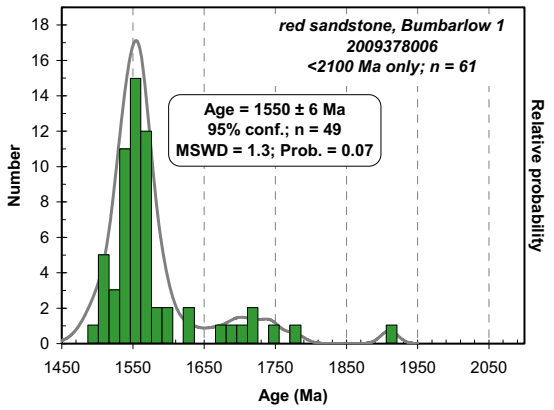

Figure 66.4. *Probability density diagram of zircon analyses from the red sandstone, Bumbarlow 1 drillhole (2009378006) yielding $^{207}Pb/^{206}Pb$ ages of less than 2100 Ma.*

U-Pb Isotopic Results

Sixty-two zircons were analysed, recording a range of ages between ~3242 Ma and ~1498 Ma (Figure 66.3). The age spectrum includes individual ages at ~3242 Ma and ~1910 Ma, a small number of ages between ~1775 Ma and ~1667 Ma, and a large cluster of ages between ~1634 Ma and ~1498 Ma. The MSWD and probability of fit values for the entire large cluster indicates that it is not a single statistical group. Mixture modelling suggests a youngest grouped age of 1549 ± 5 Ma. This calculation is within error of the weighted mean $^{207}Pb/^{206}Pb$ age of 1550 ± 6 Ma (95% confidence; MSWD = 1.3; probability of fit = 0.07; Figure 66.4) for the youngest 49 ages.

Geochronological Interpretation

The weighted mean age of 1550 ± 6 Ma (95% confidence; n = 49) can be used to define a maximum depositional age for this sample. This age group represents ~80% of the entire spectra, suggesting that the provenance source of this sedimentary rock is dominated by ~1550 Ma zircons. The older ages display no dominant populations.

Table 66.1. SHRIMP U-Pb isotopic data for zircons from sample 2009378006 (1999955), unnamed red sandstone, Bumbarlow 1 drillhole.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital zircons (n = 62)											
955.44.1.1	0.00	86	58	0.70	1.56	1.5	.2592	1.1	3242	17	1
955.32.1.1	0.10	162	90	0.57	2.92	1.5	.1170	0.7	1910	12	1
955.54.1.1	0.08	102	41	0.42	3.08	1.5	.1085	0.8	1774	15	-2
955.3.1.1	0.07	233	71	0.32	3.20	1.3	.1068	0.6	1746	12	0
955.58.1.1	-0.01	97	115	1.22	3.46	1.5	.1056	0.9	1725	17	5
955.20.1.1	0.12	137	174	1.32	3.27	1.4	.1054	0.9	1721	17	0
955.43.1.1	0.04	173	146	0.87	3.41	1.4	.1040	0.7	1696	13	2
955.11.1.1	0.13	62	101	1.69	3.41	1.6	.1034	1.3	1686	23	2
955.12.1.1	0.26	123	102	0.86	3.36	1.6	.1024	1.0	1667	18	-1
955.22.1.1	-0.10	74	36	0.50	3.51	1.6	.1005	1.1	1634	21	1
955.40.1.1	-0.03	111	59	0.55	3.61	1.4	.0999	0.9	1622	17	3
955.23.1.1	0.04	194	223	1.19	3.61	1.3	.0985	0.7	1596	13	1
955.28.1.1	0.07	138	78	0.58	3.57	1.4	.0984	0.9	1595	17	0
955.6.1.1	0.09	175	99	0.58	3.59	1.6	.0979	0.8	1584	15	0
955.10.1.1	0.17	132	81	0.64	3.64	1.4	.0978	1.1	1583	20	1
955.57.1.1	0.15	77	32	0.43	3.62	1.5	.0974	1.3	1574	23	0
955.46.1.1	0.03	181	49	0.28	3.70	1.5	.0973	0.7	1574	14	2
955.51.1.1	0.04	144	52	0.37	3.64	1.4	.0972	0.8	1570	15	0
955.27.1.1	0.12	133	36	0.28	3.80	1.4	.0970	1.0	1568	18	4
955.49.1.1	-0.06	103	39	0.39	3.64	1.4	.0970	0.9	1568	17	0
955.61.1.1	0.03	116	41	0.36	3.72	1.9	.0970	1.0	1567	18	2
955.16.1.1	0.01	160	53	0.35	3.70	1.3	.0969	0.8	1566	14	1
955.24.1.1	0.06	104	36	0.35	3.70	1.4	.0968	1.2	1564	22	1
955.9.1.1	0.08	119	37	0.32	3.81	1.8	.0968	0.9	1564	18	4
955.47.1.1	0.05	108	79	0.76	3.66	1.7	.0968	1.0	1563	19	0
955.19.1.1	0.04	315	96	0.31	3.91	1.2	.0968	0.6	1563	11	6
955.14.1.1	0.08	297	74	0.26	3.64	1.4	.0967	0.6	1561	11	0
955.38.1.1	0.02	190	44	0.24	3.66	1.3	.0966	0.7	1560	13	0
955.45.1.1	0.10	120	52	0.45	3.64	1.4	.0966	1.0	1560	19	0
955.60.1.1	-0.05	172	75	0.45	3.90	1.4	.0966	0.8	1560	14	6
955.52.1.1	0.14	161	192	1.24	3.57	1.8	.0966	1.1	1559	20	-2
955.21.1.1	0.12	113	42	0.38	3.80	1.5	.0966	1.1	1559	21	3
955.50.1.1	0.10	106	46	0.45	3.74	1.4	.0965	1.2	1558	23	2
955.13.1.1	0.04	177	39	0.23	3.76	1.3	.0964	0.8	1556	14	2
955.8.1.1	0.01	137	60	0.46	3.71	1.4	.0964	0.9	1555	17	1
955.35.1.1	0.20	86	24	0.29	3.60	1.5	.0963	1.1	1554	21	-2
955.37.1.1	0.08	134	45	0.35	3.66	1.4	.0963	0.9	1553	17	0
955.2.1.1	0.01	107	52	0.51	3.71	1.4	.0962	0.9	1552	17	1
955.42.1.1	0.01	244	109	0.46	3.75	1.3	.0962	0.6	1551	12	2
955.34.1.1	0.06	233	57	0.25	3.60	1.3	.0961	0.7	1549	13	-2
955.30.1.1	0.06	188	73	0.40	3.70	1.3	.0960	0.7	1548	14	0
955.25.1.1	0.14	154	114	0.76	3.68	1.3	.0959	1.0	1546	18	0
955.55.1.1	0.06	133	50	0.39	3.79	1.6	.0958	1.1	1545	22	2
955.7.1.1	0.12	64	26	0.42	3.68	1.6	.0957	2.0	1542	38	0
955.29.1.1	0.05	165	62	0.39	3.65	1.3	.0957	0.8	1541	15	-1
955.17.1.1	0.10	183	57	0.32	3.79	1.3	.0956	0.9	1540	18	2
955.56.1.1	0.08	154	26	0.18	3.64	1.3	.0956	0.9	1539	16	-2
955.18.1.1	0.08	179	52	0.30	3.75	1.9	.0955	0.9	1538	18	1
955.15.1.1	0.13	96	31	0.33	3.64	1.4	.0955	1.0	1538	18	-2
955.53.1.1	0.11	182	68	0.38	3.61	1.3	.0955	0.8	1538	15	-2
955.36.1.1	0.03	214	52	0.25	3.67	1.3	.0954	0.7	1536	13	-1
955.33.1.1	0.07	241	58	0.25	3.61	1.3	.0954	0.7	1535	12	-3
955.62.1.1	0.08	151	55	0.37	3.79	1.4	.0953	1.0	1534	19	2
955.48.1.1	0.06	204	77	0.39	3.70	1.3	.0951	0.7	1530	13	-1
955.41.1.1	0.17	128	37	0.29	3.75	2.0	.0950	1.1	1528	21	0
955.31.1.1	0.20	182	48	0.27	3.67	1.3	.0950	0.9	1528	17	-2
955.4.1.1	0.16	130	30	0.24	3.72	1.4	.0943	1.0	1514	18	-1
955.1.1.1	0.20	92	25	0.28	3.57	1.5	.0939	1.2	1507	23	-6
955.5.1.1	0.27	153	29	0.20	3.79	1.6	.0938	1.0	1504	19	0
955.59.1.1	0.15	131	68	0.54	3.60	1.4	.0936	1.1	1500	20	-5
955.39.1.1	0.44	99	31	0.33	3.76	1.5	.0936	1.5	1500	29	-1
955.26.1.1	0.30	138	53	0.40	3.65	1.4	.0935	1.2	1498	22	-4

67. UNNAMED GRANITE, BRD 012 DRILLHOLE: 2009378038

GA Sample ID:	**2009378038**
GA Sample Number:	**1999987**
Other Sample ID:	**BRD 012: 482 – 488 m depth**
1:250,000 Sheet:	**FROME SH 54-10**
Region:	**Curnamona Province, South Australia**
Grid Reference (WGS 84):	**437946 6614017 Zone 54**
Collector:	**A. Schofield**
Collection Date:	**07/2009**
Formal Name:	
Informal Name:	**Unnamed granite**
Lithology:	**Coarse-grained porphyritic granite**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6099**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**8 – 9/09/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.43% (2σ) [15 of 15]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3469.3 ± 2.5 Ma [14 of 15]**
Interpreted Age:	**1590 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Magmatic crystallisation age**

Sample Description

This sample was collected from the BRD 012 drill hole, between the 482 m to 488 m depth interval, within the Curnamona Province, South Australia. The sample is a medium-grained porphyritic granite (Figure 67.1.

Figure 67.1. *Porphyritic unnamed granite from the 482 m to 488 m depth interval of drill hole BRD 012 (sample 2009371038), with a pen for scale.*

Zircon Description

Zircons from this sample range from ~100 µm to ~200 µm in length, and are clear and colourless (Figure 67.2). Most grains have a euhedral morphology, and preserve prismatic terminations and faces. Cathodoluminescence images record oscillatory zoning within most grains (Figure 67.2).

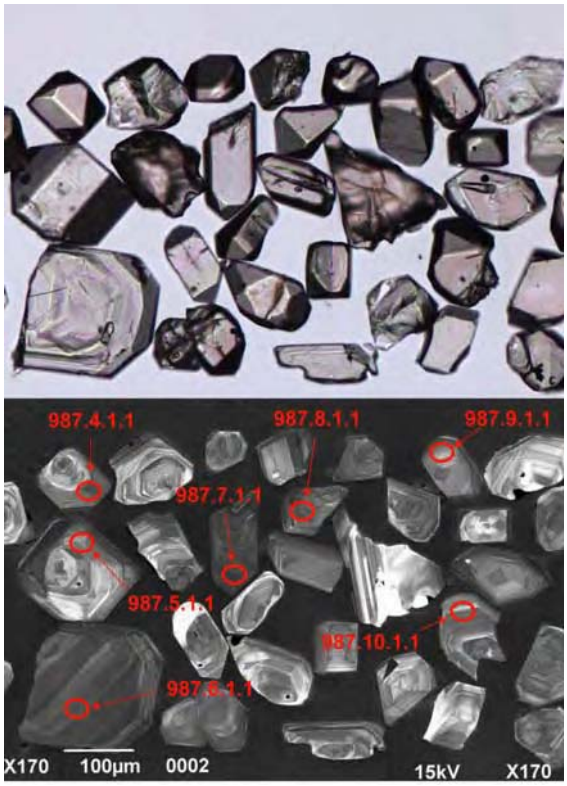

Figure 67.2. *Representative transmitted light and cathodoluminescence images of zircons from the unnamed granite, BRD 012 drillhole (2009378038), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

Thirty-seven zircons were analysed, targeting a wide range of grain morphologies. One analysis which is -6% discordant was excluded from further consideration (Figure 67.3). The remaining analyses combine to yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1590 ± 5 Ma (95% confidence; n = 36; MSWD = 1.2; probability of fit = 0.19; Figure 67.4).

Geochronological Interpretation

The weighted mean age of 1590 ± 5 Ma is interpreted to be the magmatic crystallisation age of this granite. No older inherited ages were identified.

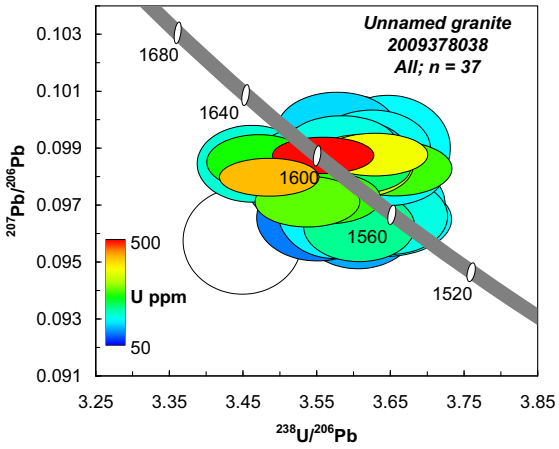

Figure 67.3. *Tera-Wasserburg concordia diagram of all zircon analyses from the unnamed granite, BRD 012 drillhole (2009371038), coloured according to U content. Open ellipse represents an analysis excluded from age interpretations.*

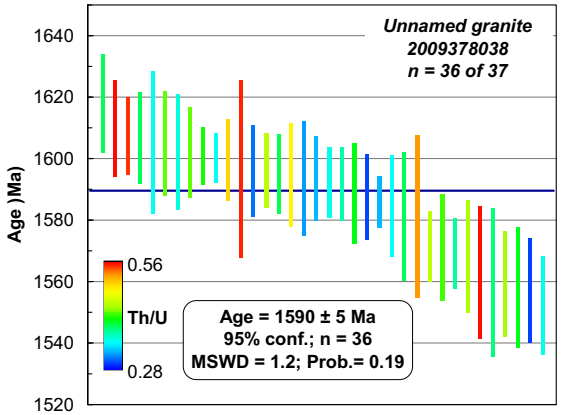

Figure 67.4. *Weighted mean age diagram of zircon analyses from the unnamed granite, BRD 012 drillhole (2009371038), coloured according to Th/U ratio.*

Table 67.1. SHRIMP U-Pb isotopic data for zircons from sample 2009378038 (1999987), unnamed granite, BRD012 drillhole.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
~1590 Ma ages (n = 36)											
987.22.1.1	0.08	138	52	0.39	3.58	1.5	.0997	0.9	1618	16	2
987.31.1.1	0.09	139	75	0.56	3.60	1.6	.0992	0.8	1610	16	2
987.13.1.1	-0.03	172	91	0.55	3.58	1.4	.0991	0.7	1607	13	1
987.35.1.1	0.10	156	59	0.39	3.57	1.6	.0991	0.8	1607	15	1
987.18.1.1	0.08	157	53	0.35	3.65	1.5	.0990	1.2	1605	23	3
987.26.1.1	0.14	164	68	0.43	3.62	1.4	.0990	0.9	1605	17	2
987.10.1.1	0.06	126	44	0.36	3.59	1.5	.0988	1.0	1602	19	1
987.34.1.1	0.03	130	54	0.43	3.59	1.4	.0988	0.8	1602	15	1
987.12.1.1	0.06	370	147	0.41	3.63	1.3	.0988	0.5	1601	9	2
987.37.1.1	0.07	498	169	0.35	3.56	1.3	.0987	0.4	1600	8	0
987.4.1.1	-0.01	182	89	0.50	3.54	1.4	.0987	0.7	1599	13	0
987.11.1.1	0.20	81	43	0.55	3.60	1.6	.0985	1.5	1597	29	1
987.19.1.1	0.08	162	48	0.31	3.55	1.4	.0985	0.8	1596	15	0
987.21.1.1	0.06	261	115	0.45	3.47	1.4	.0985	0.7	1596	12	-2
987.17.1.1	0.09	203	77	0.39	3.61	1.5	.0984	0.7	1595	13	1
987.29.1.1	0.19	178	84	0.49	3.46	1.4	.0984	0.9	1595	17	-3
987.9.1.1	0.19	95	29	0.32	3.63	1.5	.0984	1.0	1594	19	2
987.7.1.1	0.06	346	109	0.33	3.61	1.3	.0984	0.7	1593	14	1
987.8.1.1	0.03	223	76	0.35	3.60	1.4	.0983	0.6	1592	11	1
987.32.1.1	0.03	276	99	0.37	3.66	1.4	.0983	0.6	1592	12	2
987.16.1.1	0.13	115	45	0.40	3.59	1.5	.0981	0.9	1589	16	0
987.33.1.1	0.07	162	47	0.30	3.64	1.4	.0981	0.7	1587	14	2
987.30.1.1	0.07	428	135	0.33	3.48	1.3	.0980	0.5	1586	8	-3
987.20.1.1	0.08	146	49	0.35	3.57	1.6	.0979	0.9	1584	17	0
987.27.1.1	0.23	129	49	0.39	3.56	1.9	.0977	1.1	1581	21	-1
987.15.1.1	0.18	61	31	0.53	3.62	1.7	.0977	1.4	1581	26	1
987.6.1.1	0.09	273	120	0.45	3.56	1.3	.0972	0.6	1571	12	-1
987.36.1.1	0.19	135	55	0.42	3.60	1.4	.0972	0.9	1571	17	-1
987.25.1.1	0.10	286	104	0.38	3.54	1.3	.0971	0.6	1569	11	-2
987.3.1.1	0.10	155	67	0.45	3.64	1.4	.0970	1.0	1568	18	0
987.5.1.1	0.10	153	83	0.56	3.57	1.4	.0968	1.2	1563	22	-2
987.28.1.1	0.26	117	43	0.38	3.61	1.6	.0966	1.3	1560	24	-1
987.2.1.1	0.14	172	74	0.44	3.65	1.4	.0966	0.9	1559	17	0
987.23.1.1	0.12	99	38	0.40	3.55	1.5	.0965	1.0	1558	20	-3
987.14.1.1	0.14	156	45	0.30	3.64	1.7	.0965	0.9	1557	17	0
987.24.1.1	0.14	207	71	0.35	3.61	1.4	.0962	0.9	1552	16	-2
Analysis >5% discordant (n = 1)											
987.1.1.1	0.28	98	30	0.31	3.45	1.6	.0957	1.3	1542	25	-6

68. UNNAMED METASEDIMENT, ETMA5 1 DRILLHOLE: 2009378018

GA Sample ID:	**2009378018**
GA Sample Number:	**1999967**
Other Sample ID:	**ETMA5 1: 444.8 - 449.2 m depth**
1:250,000 Sheet:	**CURNAMONA SH 54-14**
Region:	**Curnamona Province, South Australia**
Grid Reference (WGS 84):	**427996 6522934 Zone 54**
Collector:	**A. Schofield**
Collection Date:	**07/2009**
Formal Name:	
Informal Name:	**Unnamed metasediment**
Lithology:	**Altered metasediment**
Geochronologist:	**N. L. Neumann**
Mount ID:	**GA6099**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**10 – 14/09/2009**
U-Pb Standard & reproducibility:	**TEMORA-2; 2.19% (2σ) [30 of 31]**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 Ma)**
Measured Value (±95% confidence):	**3468.4 ± 2.0 Ma [30 of 30]**
Interpreted Age:	**~1625 Ma and ~1705 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Unknown**

Sample Description

This sample was collected from the ETMA5 1 drill hole, between the 444.8 m to 449.2 m depth interval, within the Curnamona Province, South Australia. The sample is strongly altered and banded, and is interpreted to be a fine-grained metasedimentary rock (Figure 68.1)

Figure 68.1. *Unnamed metasediment from the 444.8 m to 449.2 m depth interval of drill hole ETMA5 1(sample 2009378018), with a pen for scale.*

Zircon Description

Only 10 zircons were recovered from this sample. All but two grains are fragments, colourless to light brown, and have euhedral morphologies with some prismatic terminations preserved (Figure 68.2). Cathodoluminescence images record oscillatory zoning within all grains.

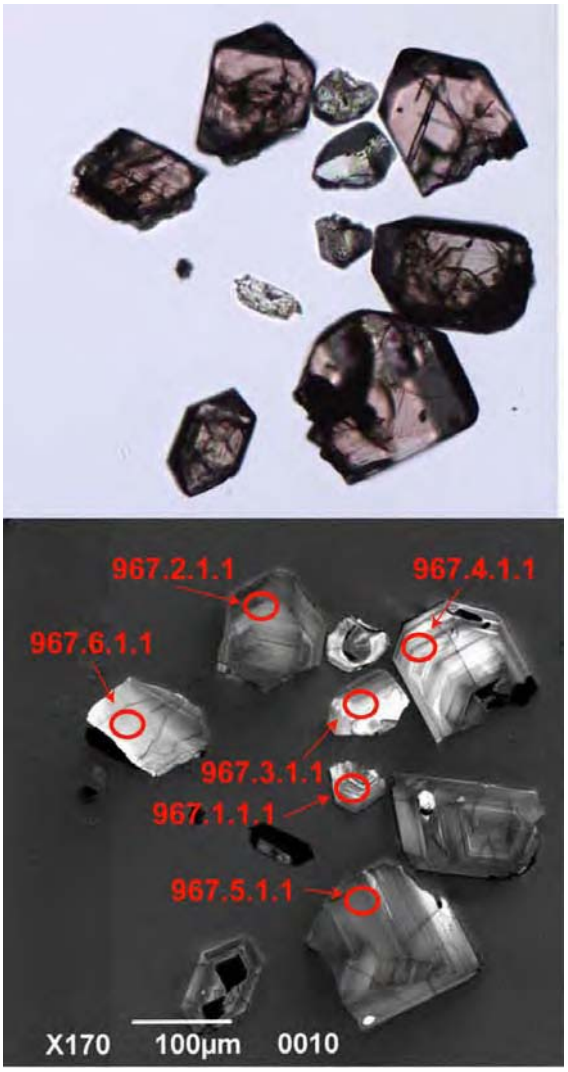

Figure 68.2. *Representative transmitted light and cathodoluminescence images of zircons from the unnamed metasediment, ETMA5 1 drillhole (2009378018), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

It was only possible to analyse six zircons from this sample. Two analyses are greater than 10% discordant and so have been excluded from further consideration (Figure 68.3). Of the remaining four analyses, the youngest age is 1623 ± 42 Ma (2σ). The other three analyses combine to provide a weighted mean age of 1705 ± 15 Ma (95% confidence).

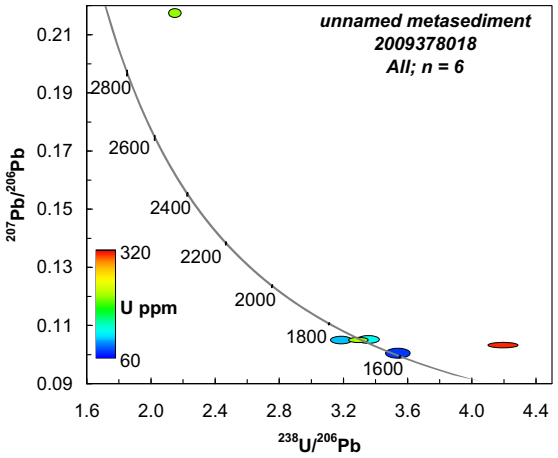

Figure 68.3. *Tera-Wasserburg concordia diagram of all zircon analyses from the unnamed metasediment, ETMA5 1 drillhole (2009378018), coloured according to U content.*

Geochronological Interpretation

As only 4 concordant ages were collected from this sample, a geochronological interpretation is not possible. However, the ages of ~1625 Ma and ~1705 Ma are different from the dominant age populations collected from the Bumbarlow 1 and SPH 1 drillhole samples during this study.

Table 68.1. SHRIMP U-Pb isotopic data for zircons from sample 2009378018 (1999967), unnamed metasediment, ETMA5 drillhole.

Spot name	$^{206}Pb_c$ %	U (ppm)	Th (ppm)	Th/U	$^{238}U/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$	± (%)	$^{207}Pb/^{206}Pb$ Age, Ma	± Ma (1σ)	Disc (%)
Detrital ages (n = 4)											
967.4.1.1	0.14	125	50	0.42	3.35	1.3	.1046	0.8	1708	16	1
967.6.1.1	0.13	104	37	0.36	3.18	1.4	.1045	0.8	1705	15	-3
967.5.1.1	0.07	210	92	0.45	3.29	1.2	.1044	0.6	1704	10	-1
967.3.1.1	0.15	72	80	1.14	3.53	1.4	.0999	1.1	1623	21	1
Analyses >10% discordant											
967.1.1.1	0.03	207	158	0.79	2.14	1.2	.2176	0.5	2963	8	16
967.2.1.1	0.24	313	232	0.77	4.19	1.5	.1027	0.6	1673	12	18

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