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Record

2011/14

GeoCat # 71585

APPLYING GEOSCIENCE TO AUSTRALIA'S MOST IMPORTANT CHALLENGES

New SHRIMP geochronology from the Arunta Region: 2009 - 2010

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by

Kositcin, N.[1], Magee, C.W.[1], Whelan, J.A.[2] and Champion, D.C.[1]

1. Onshore Energy and Minerals Division, Geoscience Australia, GPO Box 378, Canberra, ACT 2601, Australia
2. Northern Territory Geological Survey, GPO Box 3000, Darwin, NT, 0801, Australia

Department of Resources, Energy and Tourism
Minister for Resources and Energy: The Hon. Martin Ferguson, AM MP
Secretary: Mr Drew Clarke

Geoscience Australia
Chief Executive Officer: Dr Chris Pigram

ISSN: 1448-2177
ISBN (web): 978-1-921781-96-4
ISBN (print): 978-1-921781-97-1

GeoCat # 71585

Bibliographic reference: Kositcin, N., Magee, C.W., Whelan, J.A., Champion, D.C. 2011. New SHRIMP geochronology from the Arunta Region: 2009-2010. *Geoscience Australia*, *Record*, **2011/14**,75p.

Contents

INTRODUCTION

OVERVIEW

This record presents a compilation of new zircon U-Pb SHRIMP geochronological results for 16 samples from the eastern Aileron Province, Arunta Region, Northern Territory (Figures i-iv). These samples were collected in 2009-2010 as part of Geoscience Australia's Onshore Energy Security Program (OESP), in conjunction with, and in support of, the 2009 Georgina-Arunta Seismic Survey (seismic line 09GA-GA1, see Korsch et al., 2011), in addition to ongoing geoscientific investigations and regional mapping programs of these regions by the Northern Territory Geological Survey (NTGS). A significant proportion of the samples presented here were specifically targeted to provide timing constraints relevant to the interpretation of deep seismic reflection profile 09GA-GA1 (also shown in Figures iii and iv) thus, geographic coverage is biased towards areas along, or adjacent to, the seismic profile.

The samples analysed, from the Aileron Province, were obtained from the HUCKITTA and ILLOGWA CREEK 1:250 000 map sheet areas. A separate report for each sample is presented; these contain a brief description of the analysed sample, a summary of the data and a preferred geochronological interpretation, as well as information on sample location and geological context. The broader geological implications of the data will be published elsewhere. A summary of all results from this study is presented in Table i, and sample locations are shown in Figures iii and iv.

The samples collected come from the Arunta Region of the North Australia Craton (NAC; Figures i and ii). The southern portion of the North Australia Craton is characterised by the Paleoproterozoic to Mesoproterozoic basement of the Arunta Region to the south and the Paleoproterozoic basement of the Davenport Province (part of the Tennant Region) to the north (Figure ii). This basement is partially covered by the Neoproterozoic to Carboniferous Centralian Superbasin. The Centralian Superbasin is comprised of the variably deformed but relatively unmetamorphosed Amadeus, Ngalia and southern Georgina Basins, and the metamorphosed Irindina Basin (Walter et al., 1995).

The Arunta Region is one of the most geologically complex areas in Australia (Shaw et al., 1984). It comprises a 200,000 km^2 exposure of polydeformed Proterozoic rocks which record several overprinting geological events over a 1500 million year period from before 1800 Ma through to the Paleozoic (Collins and Shaw, 1995). The Arunta Region encompasses more than one separately evolved and geologically distinct terrane, and so is referred to as a geological Region, in preference to terms such as Province, Block or Inlier which infer a degree of geological continuity. The major part has an evolution similar to that observed to the north, in the Tanami and Tennant Regions, and is known as the Aileron Province (Scrimgeour, 2003).

The Arunta Region has been divided into three provinces with distinct protolith ages and histories: the 1860-1700 Ma Aileron Province, the 1690-1600 Ma Warumpi Province and the Neoproterozoic to Cambrian Irindina Province (Scrimgeour, 2003; Figure i). The Aileron Province (Scrimgeour, 2003), is defined as the Paleoproterozoic crust in the Arunta Region that formed part of the NAC prior to 1700 Ma. Almost all known metasedimentary successions in the Aileron Province are thought to have been deposited within the interval 1860-1740 Ma, with the majority of magmatism occurring in the interval 1820-1700 Ma. This contribution focuses primarily on magmatic units within the Aileron Province.

The Aileron Province was affected by a number of Paleoproterozoic tectonothermal events with varying spatial distributions, tectonic styles and intensity (Scrimgeour, 2003; Hand and Maidment, 2007). Pietsch (2001), Claoué-Long (2003), Scrimgeour (2003), and Claoué-Long et al. (2008a, b) have revised the event framework for the Aileron Province from newly dated chronologies of thermal events which generated magmatic and metamorphic rocks amenable to U–Pb isotopic dating.

Figure i. *Location of the Paleoproterozoic to Mesoproterozoic Arunta Region, with respect to other Paleoproterozoic to Mesoproterozoic sedimentary basins of the NAC.*

Table i. Summary of sample identifiers, locations, and results of rock units dated in the Aileron Province (MGA 94, Zone 53).

Unit	Sample ID	Sample No.	Easting	Northing	1:250000 sheet	1:100000 sheet	Rock type	Age (Ma)	Comments
Jinka Granite	2009087031	1999630	582273	7494150	HUCKITTA SF5311	JINKA 6052	feldspar porphyritic granite	1714 ± 3	Igneous crystallisation
Unnamed biotite granite (Pgk)	2009087042	1999646	539374	7501610	HUCKITTA SF5311	DNEIPER 5952	foliated biotite granite	1805 ± 4	Igneous crystallisation
Unnamed biotite granite (Pga)	2009087033	1999637	541593	7487465	HUCKITTA SF5311	DNEIPER 5952	biotite granite	1710 ± 5, 1720-1680	Metamorphic ages
Unnamed gneissic granite	2009087001	1999599	637955	7463280	HUCKITTA SF5311	JERVOIS RANGE 6152	coarse-grained gneissic granite	1779 ± 3	Igneous crystallisation
								1744 ± 4	Metamorphic age
Jervois Granite (Pge)	2009087003	1999601	647592	7482441	HUCKITTA SF5311	JERVOIS RANGE 6152	feldspar porphyritic granite	1746 ± 4	Igneous crystallisation
Unnamed granodiorite (Pgn)	2009087016	1999614	615443	7493058	HUCKITTA SF5311	JERVOIS RANGE 6152	biotite granodiorite	1773 ± 3	Igneous crystallisation
Unnamed granodiorite	2009087024	1999622	610475	7495067	HUCKITTA SF5311	JERVOIS RANGE 6152	biotite granodiorite-tonalite	1774 ± 5	Igneous crystallisation
Unnamed granodiorite	2009087027	1999626	609434	7487053	HUCKITTA SF5311	JERVOIS RANGE 6152	feldspar porphyritic granodiorite	1789 ± 3	Igneous crystallisation
Marshall Granite	2010080002	2115103	551201	7489806	HUCKITTA SF5311	DNEIPER 5952	Foliated biotite monzogranite	1791 ± 3	Igneous crystallisation
Unnamed quartz norite	2010080003	2115102	551220	7489799	HUCKITTA SF5311	DNEIPER 5952	quartz norite	1780 ± 6	Igneous crystallisation
Unnamed granite	HU10JAW037	2115099	564597	7369038	HUCKITTA SF5311	MACDONALD DOWNS 5953	Phillip 2 petroleum well granite	1802 ± 8	Igneous crystallisation
Illogwa Creek Shear Zone mylonite	2010080001	2115104	515585	7395780	ILLOGWA CREEK SF5315	QUARTZ 5951	well foliated quartz-biotite schist/mylonite	1794 ± 3	Igneous crystallisation
								1769 ± 3	Recrystallisation /contact metamorphism
Unnamed tourmaline granite	2010080009	2115101	503725	7397241	ILLOGWA CREEK SF5315	LIMBLA 5950	unnamed tourmaline-muscovite granite	~1740	Indicative age
Unnamed muscovite Granite	2010080010	2115100	503732	7397242	ILLOGWA CREEK SF5315	LIMBLA 5950	unnamed muscovite granite	1730 ± 8	Igneous crystallisation
Atneequa Granite	2010080011	2115098	511736	7394696	ILLOGWA CREEK SF5315	LIMBLA 5950	K-feldspar megacrystic biotite granodiorite	1743 ± 4	Igneous crystallisation
Mt Isabel mylonite	IC10GPW303	2115097	564597	7369038	ILLOGWA CREEK SF5315	ILLOGWA 6050	intense mylonite in granite	1748 ± 5	Igneous crystallisation

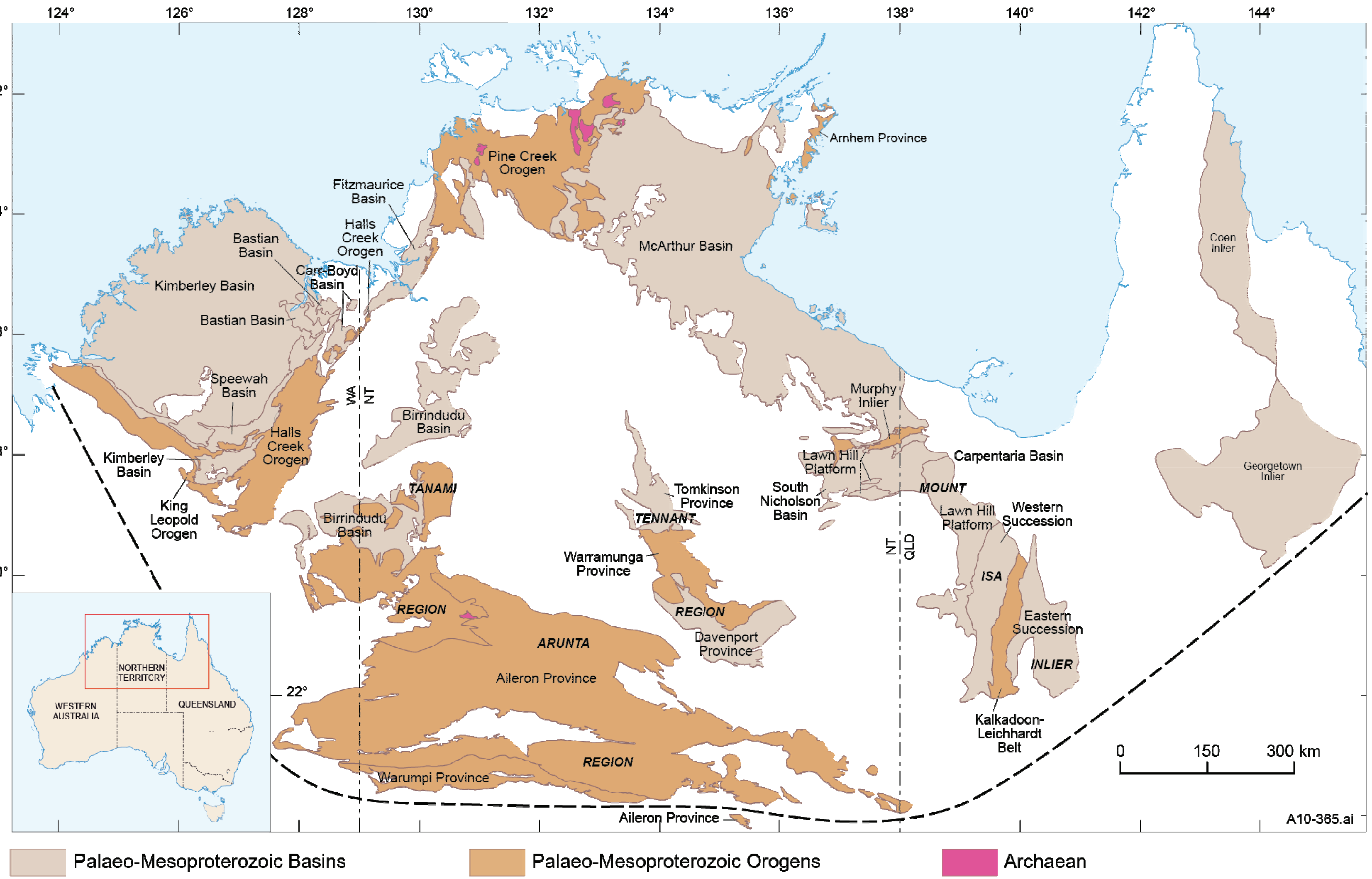

Figure ii. *Provinces and basins of the Northern Territory. Dashed line denotes limits of the North Australian Craton (NAC).*

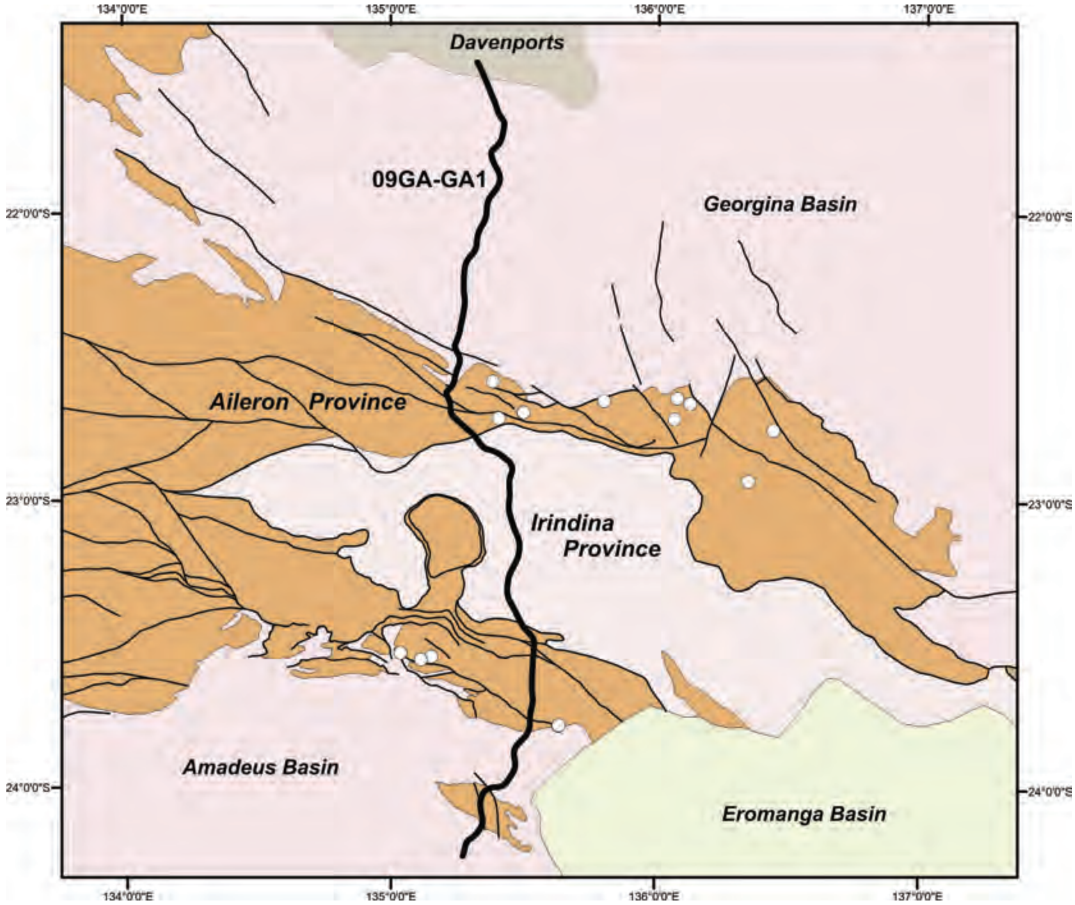

***Figure iii**. Simplified province and basin map of the region covered by seismic line 09GA-GA1 (bold black line), essentially perpendicular to the major geological basins, provinces and structures (fine black lines) in the region, from the northeastern Amadeus Basin to the southernmost Davenport Province, and the locations of samples (white circles) analysed in this study (refer to Figure iv for sample location detail).*

The earliest recognised event was the ca. 1810-1790 Ma Stafford Event (Collins and Shaw, 1995), affecting the north, central and eastern Aileron Province, involving bimodal magmatism, metamorphism in the north and central Aileron Province including localised high-temperature, low-pressure metamorphism (Scrimgeour, in prep) of preexisting Lander Package sedimentary sequences (cf. Claoué-Long and Edgoose, 2008), and the deposition of extensive units of the lower Strangways Metamorphic Complex and equivalents (Huston et al., 2006).

The ca. 1780-1770 Ma Yambah Event (Early Strangways Event of Collins and Shaw, 1995) is characterised by felsic and less abundant mafic magmatism, as well as variable metamorphism and deformation across much of the Aileron Province. Evidence of deformation and metamorphism associated with the Yambah Event is relatively sparse and is often poorly constrained particularly in the eastern Arunta Region where much of the Paleoproterozoic deformation is attributed to the younger Strangways Event. However, Maidment et al. (2005) interpreted metamorphism of the Bleechmore Granulite (in ALCOOTA) to have occurred during both events. There is also evidence of granulite facies metamorphism further to the south in the Central Zone of the Casey Inlier (Worden et al., 2008). In addition, Yambah Event-aged (ca. 1770 Ma) intermediate magmatism is also present in the Albarta Metamorphics (Carson et al., 2009).

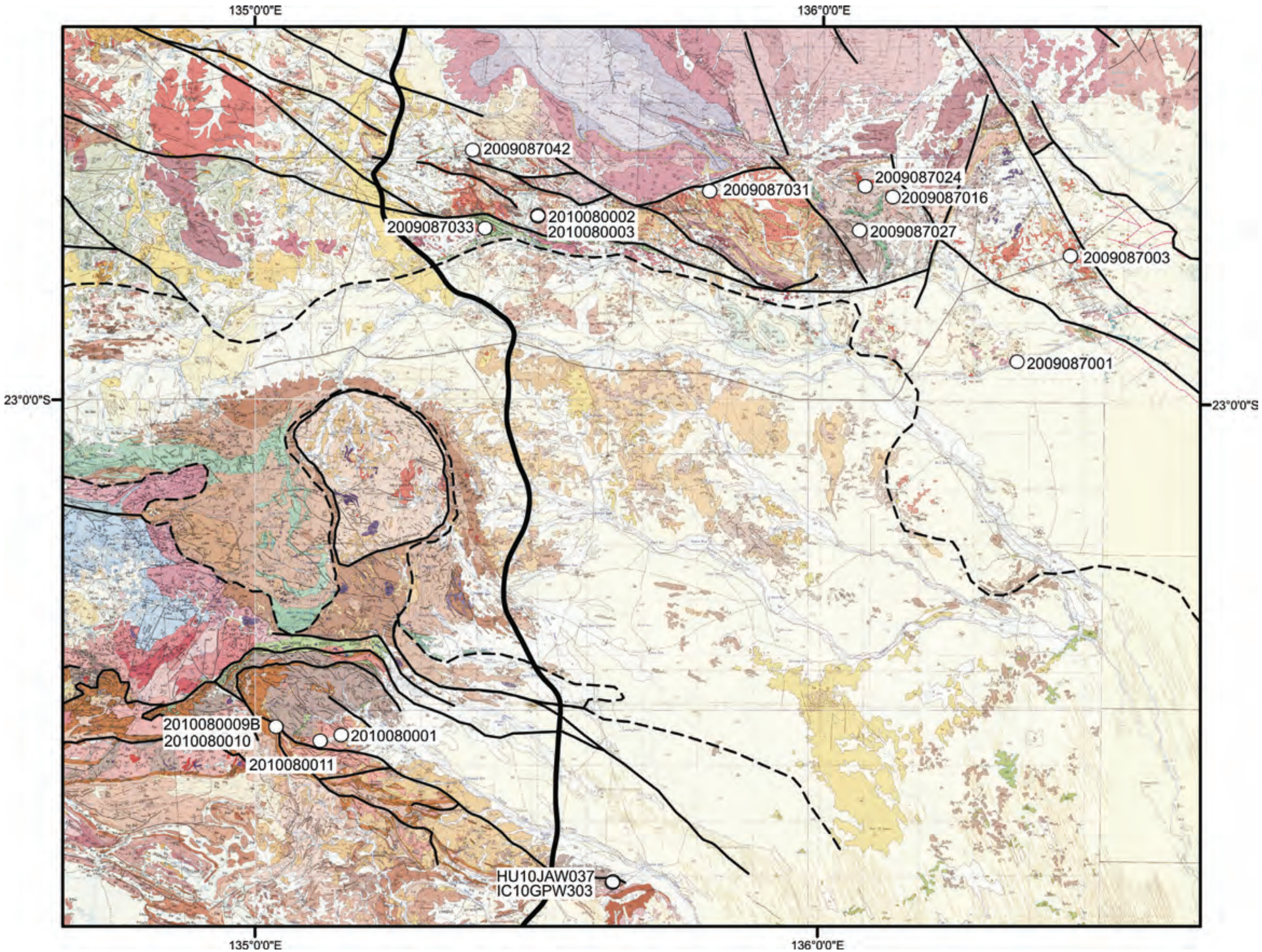

Figure iv. *Location of new SHRIMP geochronology (white circles) samples from the Aileron Province, Arunta Region, analysed as part of this study, over a composite geological map of the ILLOGWA CREEK and HUCKITTA 250k mapsheets. Seismic line (09GA-GA1) shown by the bold solid line. Major regional structures are shown by the black fine lines and the Aileron-Irindina province boundary is shown by the black dashed line.*

The Aileron Province contains abundant felsic to intermediate igneous rocks that intruded in the interval 1780-1750 Ma, synchronous with, or postdating, the Yambah Event. Zhao and Bennett (1995) documented extensive felsic magmatism of this age, and Zhao and McCulloch (1995) interpreted this magmatism to have formed by the melting of sources that have been produced in an earlier subduction environment. The 1780-1750 Ma granites from the Arunta Region have been divided into three major geochemical groups, a Calcalkaline-Trondhjemitic Group (CAT), a High-Heat-Production Group (HHP), and a volumetrically significant Main Group. The Main Group is further divided into geochemically distinctive High-Al and Low-Al types (see Zhao and McCulloch, 1995).

The Strangways Event (ca. 1735-1690 Ma, the Late Strangways Event of Collins and Shaw, 1995) is the dominant tectonothermal event that affected the eastern and south-eastern Aileron Province. It was characterised by granulite-facies metamorphism in the Strangways and Alooarjara ranges, amphibolite-facies south of the Illogwa and Harry Creek shear zones and lower amphibolite- to granulite-facies high-T, low-P metamorphism in a belt north of the Delny Shear Zone (Scrimgeour, in prep.) The Strangways Event was locally accompanied by partial melting and intrusion of felsic magmas in the eastern Arunta Region, during the period 1730-1710 Ma (Scrimgeour, 2003). Granites of this age characterise the High Heat Production (HHP) Group of Zhao and McCulloch (1995) which are thought to be re-melts of the 1780-1750 Main Group.

The Chewings Orogeny was also a significant metamorphic and deformational episode which affected parts of the central and southern Aileron Province, and the eastern Warumpi Province in the interval ~1590-1560 Ma (Hand and Buick, 2001; Scrimgeour, 2003). No significant associated magmatism is recognised during this long-lived event (Hand and Buick, 2001).

A variety of later geological systems extended into the Paleozoic (e.g., Scrimgeour, 2003; Claoué-Long and Hoatson, 2005). Much of the present configuration of Aileron Province geology, in which major regional-scale faults juxtapose low (up to greenschist facies) and high (granulite facies) metamorphic grade rocks, is an expression of the 450-300 Ma Alice Springs Orogeny, a long-lived, multiphase intraplate event of variable intensity that affected large regions of central Australia, particularly the Arunta Region and adjacent basins (Collins and Teyssier, 1989; Haines et al., 2001).

SHRIMP ZIRCON GEOCHRONOLOGY METHODOLOGY

All U-Pb isotopic results reported here were collected on the SHRIMP IIe instrument housed in the SHRIMP laboratory at Geoscience Australia, Canberra. Isotopic data were collected using a primary O_2^- ion beam of ~2 to 4 nA intensity and ~20-30 microns diameter. Before each analysis, the surface of the analysis site was pre-cleaned by rastering of the primary beam for 3 minutes, in order to reduce the amount of common Pb on the mount surface. Secondary ions were collected on a single electron multiplier via cycling of the magnet through 6 scans through a run table comprising the following ten nominal mass-stations and counting times: $^{196}Zr_2O$ (2 s), ^{204}Pb (20 s), background 204.1 (20 s), ^{206}Pb (15 s), ^{207}Pb (40 s), ^{208}Pb (5 s), ^{238}U (5 s), ^{248}ThO (2 s), ^{254}UO (2 s), and $^{270}OU_2$ (2 s).

Analyses were collected in a sequence comprising one analysis of a Temora-2 reference zircon and one measurement of an OG1 reference zircon after every fifth unknown sample analysis. Zircons with a range of morphologies and cathodoluminescence (CL) responses were analysed to determine a magmatic crystallisation age and to identify any inherited and/or metamorphic ages present. Reflected light, transmitted light and cathodoluminescence images were used to ensure that analyses were made on discrete growth phases.

Data processing used the SQUID-2 software of Ludwig (2009) and processed data were plotted via Isoplot 3.7 (April 2008 revision of Ludwig, 2003), with $^{206}Pb/^{238}Pb$ ratios calibrated using the Temora-2 reference zircon ($^{238}U/^{206}Pb$ age = 416.8 Ma; Black et al., 2004), $^{207}Pb/^{206}Pb$ ratios were monitored using the OG1 reference zircon ($^{207}Pb/^{206}Pb$ age = 3465.4 Ma; Stern et al., 2009), and U concentrations calibrated using the M257 reference zircon (840 ppm U; Nasdala et al., 2008). 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, and quoted at the

95% confidence level unless otherwise specified. 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, unless otherwise specified. Data in the data tables are quoted at the 1σ level.

Selection of zircon grains was made from transmitted and reflected light photographs and CL images, during the analytical process. In all cases, the area selected for analysis was in the clearest portion of each grain, free from cracks, inclusions and metamict regions. Although care was taken to target undamaged areas of zircon grains, some analyses produced poor data and were excluded from mean age calculations. There are many processes that can lead to Pb-loss or a reduction in the reliability of data for age determination in zircon. While the exact mechanisms for Pb-loss are not well understood, there are commonly used criteria to exclude data from zircon grains or parts of grains that are suspected of having lost radiogenic Pb. Wherever practical, the criteria outlined below were used in conjunction to assess the reliability of data.

After pre-cleaning of the analysis site via rastering of the primary beam, the isotopic composition of common Pb in the calibration standards was assumed to be of geological origin, so default common-Pb corrections for Temora-2 analyses were based on the isotopic composition calculated using the single stage Pb isotopic evolution model of Stacy and Kramers (1975) at 416.8 Ma (i.e. $^{206}Pb/^{204}Pb = 18.053$; $^{207}Pb/^{206}Pb = 0.864$; $^{208}Pb/^{206}Pb = 2.097$) in conjunction with measured ^{204}Pb. Common-Pb corrections for samples were based on measured ^{204}Pb and an isotopic composition calculated using the Pb isotopic evolution model of Stacy and Kramers (1975), and a time corresponding to a preliminary $^{238}Pb/^{206}Pb$ age calculated using the default common-Pb compositions. The result of this calculation is expressed in Tables throughout this report as common ^{206}Pb as a percentage of total measured ^{206}Pb. Analyses with high $^{206}Pb_c$ (i.e. >0.5%) are excluded from data interpretations.

Discordance is a measure of the internal agreement of the dates derived from the independent $^{207}Pb/^{206}Pb$ and $^{238}Pb/^{206}Pb$ isotopic systems within a single analysis. In zircons of Mesoproterozoic and older age, discordance values for single analyses (and discordance patterns within a population of analyses) can provide important information about the timing and extent of radiogenic Pb loss, and are usually a valuable indication of ‘geological’ data quality. Discordance was calculated by the default method used by the SQUID excel add-in: 100*[($^{207}Pb/^{206}Pb$ age - $^{206}Pb/^{238}U$ age)/$^{206}Pb/^{238}U$ age]. Analyses >5% discordant are excluded from data interpretations (Refer to data tables).

Instrumental mass fractionation (IMF) was monitored via regular analysis of the $^{207}Pb/^{206}Pb$ reference zircon OG1 (Stern et al., 2009) during each analytical session. The measured $^{207}Pb/^{206}Pb$ for OG1 did not differ significantly from the reference value, thus IMF corrections were not applied.

ACKNOWLEDGEMENTS

We would like to acknowledge the support and contributions of colleagues from the Department of Resources, Northern Territory Geological Survey (NTGS), in particular Dot Close and Gordon Webb, and the contributions of colleagues at Geoscience Australia, namely David Huston and Russell Korsch. 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 and David DiBugnara for the production of high quality zircon separates, mounts, photographs and cathodoluminescence images, without which this work would not have been possible. Patrick Burke was responsible for maintaining the SHRIMP instrument and greatly assisted with instrument tuning and troubleshooting. We also thank Simon Bodorkos, Andrew Cross and Chris Carson, for advice, technical assistance and discussions on various aspects of data collection, processing and interpretation. Chris Carson and Andrew Cross are thanked for their reviews of the manuscript.

HUCKITTA 1:250 000 SHEET AREA

1. JINKA GRANITE: 2009087031

GA Sample ID:	**2009087031**
GA Sample Number:	**1999630**
1:250,000 Sheet:	**HUCKITTA**
Region:	**Arunta, Northern Territory**
Grid Reference:	**582273 7494150 MGA94 Zone 53**
Collector:	**N. Kositcin, D. Champion, J. Whelan, D. Huston.**
Collection Date:	**20th June - 26th June 2009**
Formal Name:	**Jinka Granite**
Informal Name:	**Pgj**
Lithology:	**feldspar porphyritic granite**
Geochronologist:	**N. Kositcin**
Mount ID:	**GA6134**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**9-16/8/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.78% (1σ) (56 of 57)**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3463.4 ± 1.1 (56 of 57)**
Interpreted Age:	**1714 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

Joklik (1955) named this unit, which underlies the extensive Jinka Plain and extends west and east of the Elyuah Range. Outcrop is poor, a few scattered hills occur, but mostly the granite is weathered down to plain level. The Jinka Granite is a very pale, cream to yellowish-orange, biotite granite, with biotite, pale-pink K-feldspar, green sericitised plagioclase and yellow to pink K-feldspar phenocrysts. This sample is fine- to medium-grained, commonly porphyritic, with a gneissic fabric defined by the alignment of biotite and feldspar phenocrysts. Accessory minerals include magnetite.

Previous work

The Jinka Granite is classified as belonging to the high-heat production (HHP) granites of Zhao and McCulloch (1995), which fall in the age range 1730-1710 Ma. These granites are thought to have been derived from melting of Zhao and McCulloch's 1780-1750 Ma Main Group granites. This group is characterised by elevated levels of heat producing elements (Th, U, K), indicating their high heat producing capacity (see Warren, 1989). Other granites assigned to this group include the Mount Swan Suite (1713 ± 7 Ma, Zhao and Bennett, 1995; Mount Swan Granite - 1724 ± 6 Ma, Hollis et al., 2010), Barrow Creek suite (1713 Ma; Budd et al., 2002), and the Napperby, Wuluma (1726 ± 4 Ma; Collins and Williams, 1995; Lafrance et al., 1995) and Gumtree suites in the central and northern Aileron Province.

Zircon Description

The zircon separate comprises euhedral to subhedral zircon grains and fragments from ~50µm up to 200µm in size which are clear to colourless or pink-brown in colour. Aspect ratios are typically 1:1 and 1:2. Most grains are extensively cracked and contain numerous inclusions (Figure 1.1). In cathodoluminescence (CL) images, most grains record fine-scaled oscillatory zoning or sector zoning, while other grains have a relatively homogeneous very dark or very bright response. In most cases, the oscillatory zonation appears to have been subsequently modified to a mottled and/or patchy appearance. There is no morphological evidence of multiple stages of zircon growth, and no morphologically-distinct zircon cores that might represent inherited zircon were found in the separated fraction.

Analysed zircons from Jinka Granite sample 2009087031 have a wide range of Th/U values between 2.45 and 0.58. Concordant zircons have Th and U contents between 821-153 ppm and 474-88 ppm, respectively.

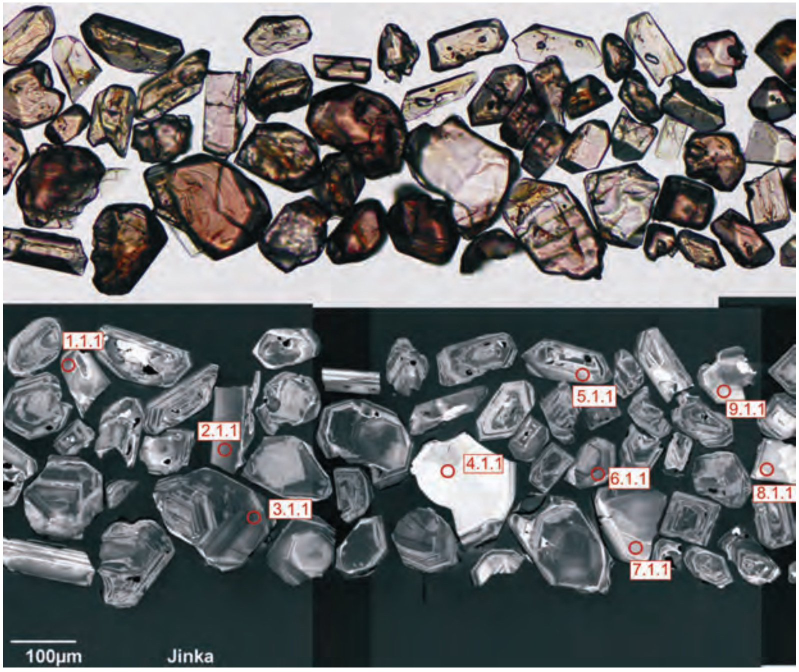

__Figure 1.1.__ Representative transmitted light and cathodoluminescence images of zircons from the Jinka Granite (2009087031), with locations of some SHRIMP analyses.

U-Pb Isotopic Results

A total of 40 analyses on 40 individual zircon grains were collected from this sample, the results of which are presented in Table 1.1 and illustrated in Figure 1.2. Common Pb ($^{206}Pb_c$) contents were generally low, between zero and 0.76%. Four analyses are >5% discordant, one of which also contains >0.5% $^{206}Pb_c$, and these are excluded from age calculations (Figure 1.2).

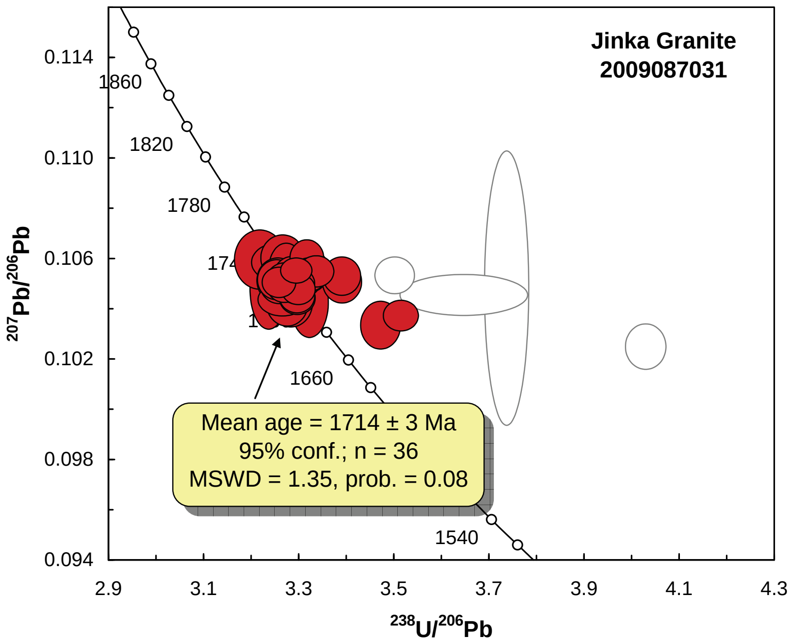

__Figure 1.2.__ Tera-Wasserburg concordia diagram showing results of all zircon data for the Jinka Granite (2009087031). Unfilled error ellipses are discordant and/or contain high common Pb, and not included in the mean age calculation.

Concordant data define a weighted mean $^{207}Pb/^{206}Pb$ age of 1714 ± 3 Ma (95% confidence; MSWD = 1.35; probability of fit = 0.08).

Geochronological Interpretation

The weighted mean age of 1714 ± 3 Ma is interpreted to be the crystallisation of this granite.

Table 1.1. SHRIMP U-Pb isotopic data for zircons from sample 2009087031, Jinka Granite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
630.17.1.1	0.15	349	346	1.02	3.3137	0.72	0.1060	0.44	1731	8	2
630.24.1.1	-0.02	151	210	1.43	3.2628	0.93	0.1060	0.57	1731	11	1
630.4.1.1	-0.06	88	153	1.79	3.2140	1.10	0.1059	0.74	1730	14	-1
630.19.1.1	0.01	221	274	1.28	3.2521	1.13	0.1058	0.48	1728	9	0
630.1.1.1	0.02	321	166	0.53	3.2701	0.74	0.1055	0.66	1723	12	0
630.12.1.1	0.01	474	367	0.80	3.2911	0.67	0.1055	0.32	1722	6	1
630.5.1.1	0.05	222	156	0.73	3.3176	0.85	0.1055	0.54	1722	10	2
630.38.1.1.1	0.03	376	536	1.47	3.3328	0.74	0.1054	0.39	1722	7	2
630.7.1.1	0.04	210	318	1.57	3.3084	0.82	0.1053	0.49	1720	9	1
630.11.1.1	0.02	236	288	1.26	3.3090	0.80	0.1053	0.47	1720	9	1
630.3.1.1	-0.03	298	499	1.73	3.3183	0.75	0.1053	0.42	1720	8	1
630.40.1.1.1	0.03	239	339	1.47	3.2834	0.83	0.1053	0.48	1719	9	0
630.18.1.1	0.09	254	392	1.60	3.3880	0.78	0.1052	0.48	1719	9	3
630.6.1.1	0.00	263	345	1.36	3.3018	0.78	0.1052	0.44	1717	8	1
630.35.1.1	0.05	219	296	1.40	3.2493	0.83	0.1051	0.50	1716	9	-1
630.27.1.1	-0.01	287	635	2.29	3.2667	0.77	0.1051	0.43	1716	8	0
630.8.1.1	0.04	159	307	2.00	3.2515	0.90	0.1051	0.56	1716	10	-1
630.36.1.1.1	0.15	269	329	1.26	3.3880	0.81	0.1050	0.53	1715	10	3
630.39.1.1.1	0.05	394	319	0.84	3.2891	0.73	0.1050	0.40	1714	7	0
630.20.1.1	0.02	347	623	1.86	3.2542	0.72	0.1050	0.38	1714	7	-1
630.22.1.1	0.03	199	256	1.33	3.2548	0.85	0.1050	0.51	1714	9	-1
630.2.1.1	0.03	277	583	2.17	3.2858	1.10	0.1050	0.42	1714	8	0
630.34.1.1	0.00	330	429	1.34	3.2821	0.73	0.1050	0.38	1714	7	0
630.28.1.1	0.05	346	821	2.45	3.2928	0.73	0.1050	0.40	1713	7	0
630.23.1.1	0.03	353	417	1.22	3.2656	0.72	0.1048	0.39	1711	7	-1
630.31.1.1	0.03	348	358	1.06	3.2917	0.73	0.1047	0.39	1710	7	0
630.14.1.1	0.03	366	387	1.09	3.2955	0.72	0.1047	0.39	1709	7	0
630.16.1.1	0.02	247	336	1.41	3.2325	0.80	0.1047	1.00	1709	18	-2
630.10.1.1	0.04	326	355	1.13	3.2928	0.74	0.1044	0.41	1704	8	0
630.25.1.1	0.03	317	720	2.34	3.2936	0.75	0.1044	0.41	1703	8	0
630.30.1.1	-0.01	314	177	0.58	3.2621	1.03	0.1043	0.42	1702	8	-1
630.32.1.1	0.38	266	475	1.85	3.3193	0.79	0.1042	0.89	1700	16	0
630.9.1.1	0.06	152	204	1.39	3.2807	0.92	0.1042	0.61	1700	11	-1
630.13.1.1	0.05	184	315	1.77	3.2726	0.87	0.1041	0.56	1699	10	-1
630.26.1.1	0.08	403	520	1.33	3.5129	0.70	0.1037	0.39	1691	7	5
630.21.1.1	0.23	228	288	1.30	3.4697	0.80	0.1033	0.61	1684	11	3
discordant and/or high common Pb											
630.33.1.1	0.15	315	391	1.28	3.6451	2.44	0.1045	0.52	1705	10	9
630.15.1.1	0.76	246	490	2.06	3.7360	0.83	0.1048	3.47	1710	64	12
630.37.1.1.1	0.04	277	314	1.17	3.4989	0.80	0.1053	0.47	1719	9	6
630.29.1.1	0.49	400	498	1.29	4.0311	0.71	0.1024	0.59	1668	11	16

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.
2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.
3. All errors quoted as 1σ.

2. UNNAMED BIOTITE GRANITE: 2009087042

GA Sample ID:	**2009087042**
GA Sample Number:	**1999646**
1:250,000 Sheet:	**HUCKITTA**
Region:	**Arunta, Northern Territory**
Grid Reference:	**539374 7501610 MGA94 Zone 53**
Collector:	**N. Kositcin, D. Champion, J. Whelan, D. Huston.**
Collection Date:	**20th June - 26th June 2009**
Formal Name:	**not defined**
Informal Name:	**Pgk**
Lithology:	**foliated biotite granite**
Geochronologist:	**N. Kositcin**
Mount ID:	**GA6134**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**9-16/8/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.78% (1σ) (56 of 57)**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3463.4 ± 1.1 (56 of 57)**
Interpreted Age:	**1805 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**Igneous crystallisation age**

Sample Description

Unnamed granite, Pgk, occurs north and northwest of Mopunga Range as boulder-strewn low rises intruding both the Cackleberry Metamorphics and Dneiper Granite (Shaw et al., 1984). This sample is a grey, foliated, porphyritic, partly gneissic to massive, biotite granite containing abundant microgranular mafic enclaves. It contains numerous white phenocrysts of K-feldspar, and in some outcrops, plagioclase, in a matrix of quartz, K-feldspar, plagioclase (almost entirely altered to fine-grained white phyllosilicate) and biotite (variably altered to chlorite). Accessory minerals include epidote and magnetite. It is reasonably magnetic (magnetic susceptibility values: 21.6, 26.1, 27.9, 21.8, 20.6, 27.8, 21.3×10^{-3} SI units). This granite is in contact with another granite type which is highly porphyritic and of low magnetic susceptibility (~2×10^{-3} SI units).

Zircon Description

Zircons from this sample range in length from ~50 µm up to 200 µm in size, but average ~100 µm, are often cracked and contain inclusions, and are translucent to colourless to light pink/brown in colour (Figure 2.1). Most grains look like broken fragments. Aspect ratios range from 1:1 to 1:4. Fewer grains are of dark brown colour and appear metamict. Few grains are euhedral, most are subhedral and/or broken, and appear to have been affected by post-crystallisation alteration. In cathodoluminescence (CL) images, the zircon grains are characterised by concentric oscillatory zoning that, in most cases, appears to have been subsequently modified to a mottled appearance, with some fine-scale oscillatory zones having become darker and broader, a texture indicative of secondary fluid alteration of metamict portions of the zircons (Figure 2.1). Rounded cores are obvious in several grains, and either exhibit bright or dark, generally featureless, CL responses.

Analysed zircons from the unnamed biotite granite sample 2009087042 have a range of Th/U values between 0.81 and 0.01. Th and U contents are between 218-0 ppm and 637-41 ppm, respectively.

U-Pb Isotopic Results

A total of 40 analyses were collected on 40 different zircon grains from sample 2009087042, the results of which are presented in Table 2.1, and illustrated in Figure 2.2. Common Pb ($^{206}Pb_c$) contents are generally low, between zero and 1.27%, with one analysis with 11.18% $^{206}Pb_c$. Six analyses were >5% discordant, 4 of which also have >0.5% $^{206}Pb_c$, and are excluded from mean age calculations.

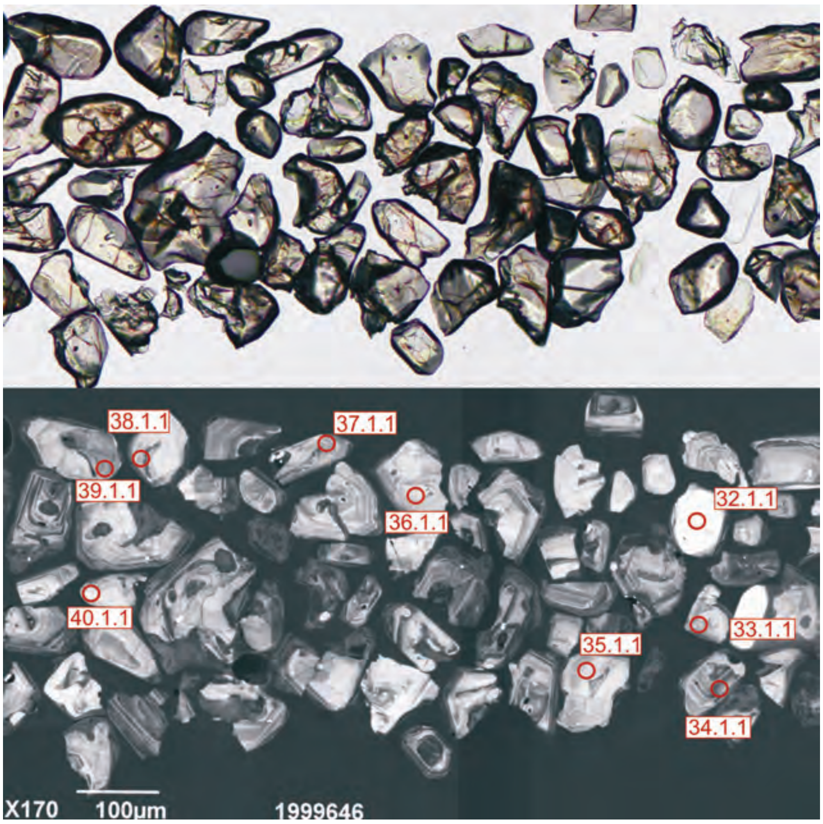

Figure 2.1. *Representative transmitted light and cathodoluminescence images of zircons from unnamed biotite granite (2009087042), with locations of some SHRIMP analyses.*

One analysis (32.1.1) came from an inherited, low Th/U core, with a $^{207}Pb/^{206}Pb$ age of 1893 ± 22 Ma. A single analysis (23.1.1.1) was collected from a dark CL region from zircon with the highest U content (637 ppm) and very low Th/U (0.08). This analysis gives an age of 1708 ± 6 Ma, and is interpreted to be of metamorphic origin, coincident with the Strangways Orogeny (~1730-1690 Ma).

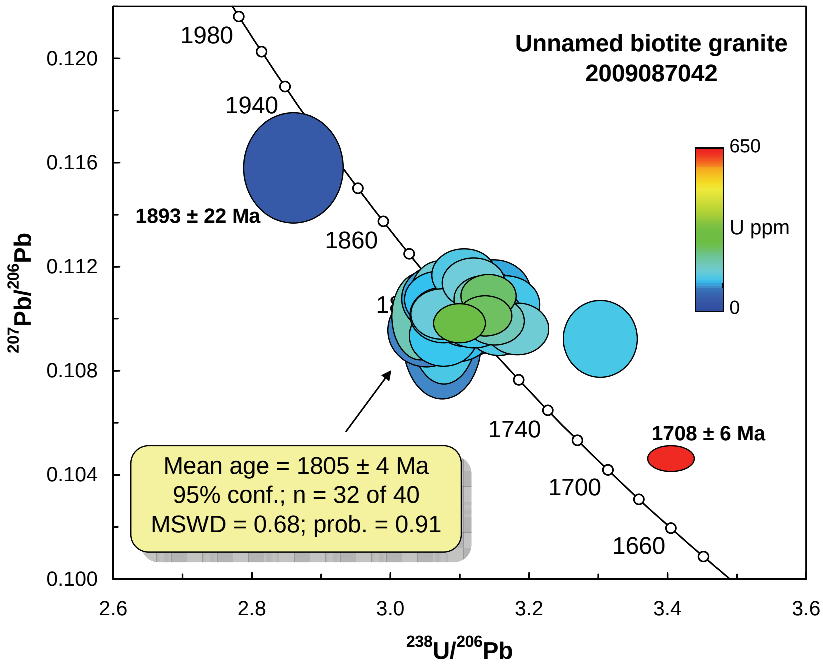

Figure 2.2. *Tera-Wasserburg concordia diagram showing results of near-concordant zircon analyses for unnamed biotite granite (2009087042), coloured according to U content, and with a weighted mean age for a grouping of 32 analyses.*

A total of 32 concordant analyses form a coherent group with a mean age of 1804.5 ± 4.2 Ma (95% confidence; MSWD = 0.68; probability of fit = 0.91) (Figure 2.2).

Geochronological Interpretation

The weighted mean age of 1805 ± 4 Ma is interpreted as the crystallisation age of this granite. Older cores indicate that minor inheritance is present. This is consistent with ages for similar intrusive bodies outcropping to the west on the ALCOOTA 1:250 000 mapsheet area (Beyer et al., 2010). Discordant analyses suggest a period of Pb-loss during the Alice Springs Orogeny. The single analysis at 1708 ± 6 Ma possibly records metamorphism associated with the Strangways Orogeny, although the textural evidence is not conclusive.

Table 2.1. SHRIMP U-Pb isotopic data for zircons from sample 2009087042, unnamed biotite granite.

Grain.area	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
magmatic grains											
646.2.1.1	0.01	134	74	0.57	3.1069	1.00	0.1117	0.60	1827	11	2
646.3.1.1	0.01	183	80	0.45	3.1357	0.90	0.1108	0.53	1812	10	2
646.4.1.1	0.03	172	109	0.65	3.0822	1.33	0.1106	0.56	1809	10	0
646.6.1.1	0.12	92	43	0.48	3.1035	1.69	0.1099	0.81	1798	15	0
646.7.1.1	0.03	128	63	0.51	3.1658	1.03	0.1105	0.66	1808	12	2
646.9.1.1	0.06	185	105	0.59	3.1514	0.90	0.1099	0.55	1798	10	1
646.10.1.1	0.06	142	83	0.60	3.1180	0.98	0.1111	0.62	1817	11	1
646.11.1.1	0.06	117	56	0.50	3.1198	1.07	0.1102	0.72	1802	13	1
646.12.1.1	0.05	246	153	0.64	3.1373	0.81	0.1101	0.46	1801	8	1
646.13.1.1	-0.01	155	121	0.81	3.1206	0.95	0.1114	0.57	1822	10	2
646.16.1.1	0.10	190	115	0.62	3.0445	0.89	0.1101	1.00	1801	18	-2
646.17.1.1	0.11	86	40	0.48	3.0754	1.20	0.1091	1.33	1785	24	-2
646.18.1.1	0.05	132	78	0.61	3.1436	1.01	0.1101	0.64	1801	12	1
646.19.1.1	0.09	108	56	0.54	3.0922	1.09	0.1105	0.71	1807	13	0
646.20.1.1	0.06	299	175	0.60	3.1005	0.78	0.1098	0.45	1797	8	0
646.21.1.1	0.18	134	71	0.55	3.1567	0.99	0.1097	0.67	1795	12	1
646.22.1.1	0.11	104	60	0.59	3.1496	1.12	0.1109	0.80	1815	14	2
646.24.1.1	0.02	124	73	0.60	3.1214	1.02	0.1099	0.63	1798	11	0
646.25.1.1	0.16	84	40	0.49	3.0534	1.20	0.1096	0.85	1792	15	-2
646.26.1.1	0.03	116	60	0.54	3.0712	1.06	0.1108	0.65	1812	12	0
646.27.1.1	0.11	121	54	0.46	3.0776	1.06	0.1093	0.71	1789	13	-2
646.28.1.1	0.07	119	64	0.56	3.1099	1.05	0.1101	0.68	1800	12	0
646.29.1.1	-0.11	93	43	0.48	3.1333	1.16	0.1107	0.75	1810	14	2
646.30.1.1	0.04	161	92	0.59	3.0717	0.94	0.1108	0.88	1812	16	0
646.31.1.1	0.10	114	53	0.48	3.0985	1.07	0.1096	0.73	1792	13	-1
646.33.1.1	0.00	127	74	0.60	3.0778	1.04	0.1102	0.64	1802	12	-1
646.34.1.1	0.08	242	179	0.77	3.1419	0.83	0.1109	0.49	1814	9	2
646.35.1.1	0.12	131	92	0.72	3.0782	1.02	0.1096	1.25	1793	23	-1
646.36.1.1	0.12	101	46	0.47	3.0692	1.12	0.1108	0.76	1812	14	0
646.37.1.1	0.04	150	87	0.60	3.0755	0.96	0.1102	0.58	1802	11	-1
646.38.1.1	0.11	159	91	0.59	3.1833	0.93	0.1096	0.59	1793	11	2
646.40.1.1	0.33	130	59	0.47	3.3027	1.06	0.1092	0.89	1787	16	5
inherited											
646.32.1.1	0.22	41	0	0.01	2.8620	1.65	0.1158	1.21	1893	22	-2
metamorphic?											
646.23.1.1	0.06	637	53	0.09	3.4040	0.65	0.1046	0.31	1708	6	3
discordant and/or high common Pb											
646.1.1.1	0.08	223	64	0.29	3.5279	0.85	0.1084	0.58	1773	11	10
646.5.1.1	0.69	288	218	0.78	4.9170	3.51	0.1096	1.07	1793	20	37
646.8.1.1	0.06	327	209	0.66	3.5025	1.73	0.1080	0.41	1765	7	9
646.14.1.1	1.27	472	137	0.30	4.1269	0.83	0.1037	2.51	1692	46	19
646.15.1.1	0.96	295	157	0.55	3.4047	1.59	0.1087	0.90	1777	16	7
646.39.1.1	11.18	543	129	0.25	7.4875	0.93	0.0933	7.05	1495	133	49

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.

2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.

3. All errors quoted as 1σ.

3. UNNAMED BIOTITE GRANITE: 2009087033

GA Sample ID:	**2009087033**
GA Sample Number:	**1999637**
1:250,000 Sheet:	**HUCKITTA**
Region:	**Arunta, Northern Territory**
Grid Reference:	**541593 7487465 MGA94 Zone 53**
Collector:	**N. Kositcin, D. Champion, J. Whelan, D. Huston.**
Collection Date:	**20th June - 26th June 2009**
Formal Name:	**not defined**
Informal Name:	**Pga**
Lithology:	**biotite granite**
Geochronologist:	**N. Kositcin**
Mount ID:	**GA6134**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**9-16/8/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.78% (1σ) (56 of 57)**
^{207}Pb/^{206}Pb Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3463.4 ± 1.1 (56 of 57)**
Interpreted Age:	**1710 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**metamorphic age**

Sample Description
Unnamed biotite granite, Pga, intrudes the Kanandra Granulite and forms numerous small tors and low hills, within and between the Delny-Mount Sainthill and Entire Point Shear zones (Shaw et al., 1984). Most outcrops are deeply weathered, silicified, and covered in spinifex. This sample is a red to red-brown, medium- to coarse-grained, biotite granite, locally porphyritic and strongly lineated (mica layering in places). The sample contains biotite, garnet, K-feldspar and lesser plagioclase (commonly altered to epidote). Garnet occurs as trails of rounded garnet crystals or aggregates.

Zircon Description
A wide variety of grain sizes and morphologies are evident in this sample. Grain size ranges from ~50 µm up to 300 µm in length, with aspect ratios between 1:1 and 1:4. Large, rounded grains and angular fragments, of light pink, brown and yellow colour, commonly pitted, fractured, and containing inclusions, form one dominant group.

In cathodoluminescence (CL) images, these grains have internal oscillatory or sector zoning, of light to medium CL response, rimmed by black CL (high U) rims of variable thickness. Some of these grains also contain older cores, possibly several generations, of bright or dark CL response, displaying oscillatory zoning or uniform response. In some cases, internal zonation appears to have been subsequently modified to leave a variably mottled and/or patchy internal zonation (Figure 3.1).

A large number of grains are clearly inherited. They are rounded and display surface pitting (characteristic of sedimentary transport), have a medium CL response, often with oscillatory or sector zoning. Another population of grains are small, ~50-100 µm in length, generally clear and colourless, subrounded to rounded grains of very dark, homogeneous (black in CL, high U) response (Figure 3.1).

Analysed zircons from the unnamed biotite granite sample 2009087033 have a range of Th/U values between 1.28 and 0.01. Th contents are between 601-7 ppm. U contents vary greatly, from 208 ppm up to values in excess of 8000 ppm (Table 3.1).

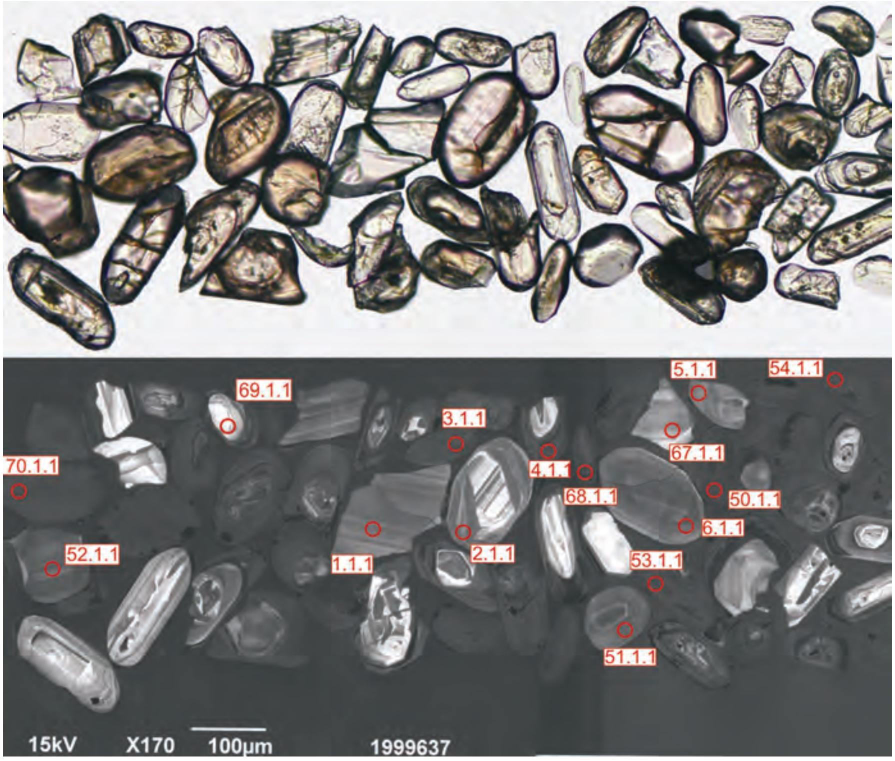

Figure 3.1. *Representative transmitted light and cathodoluminescence images of zircons from unnamed biotite granite (2009087033), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 72 analyses were collected from 71 different zircon grains for sample 2009087033, the results of which are shown in Table 3.1, and illustrated in Figures 3.2-3.3. All but one of these analyses are less than 5% discordant, and all but one contain less than 0.5% common Pb ($^{206}Pb_c$). Analyses 18.1.1 (also discordant, extreme U content - 13448 ppm, high $^{206}Pb_c$), and 29.1.1 are removed from interpretation due to low zirconium counts. The complete dataset, when plotted on a concordia diagram and as a histogram, forms a large spread and falls into several groups (Figures 3.2 and 3.3 below).

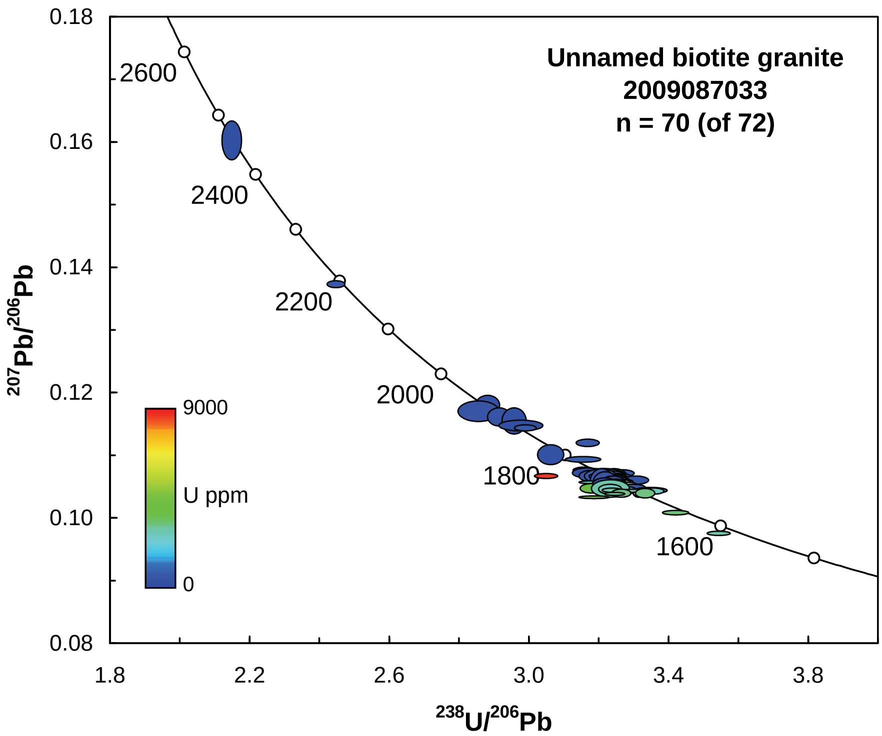

Figure 3.2. *Tera-Wasserburg concordia diagram showing results of near concordant zircon data for unnamed biotite granite (2009087033), coloured according to U content.*

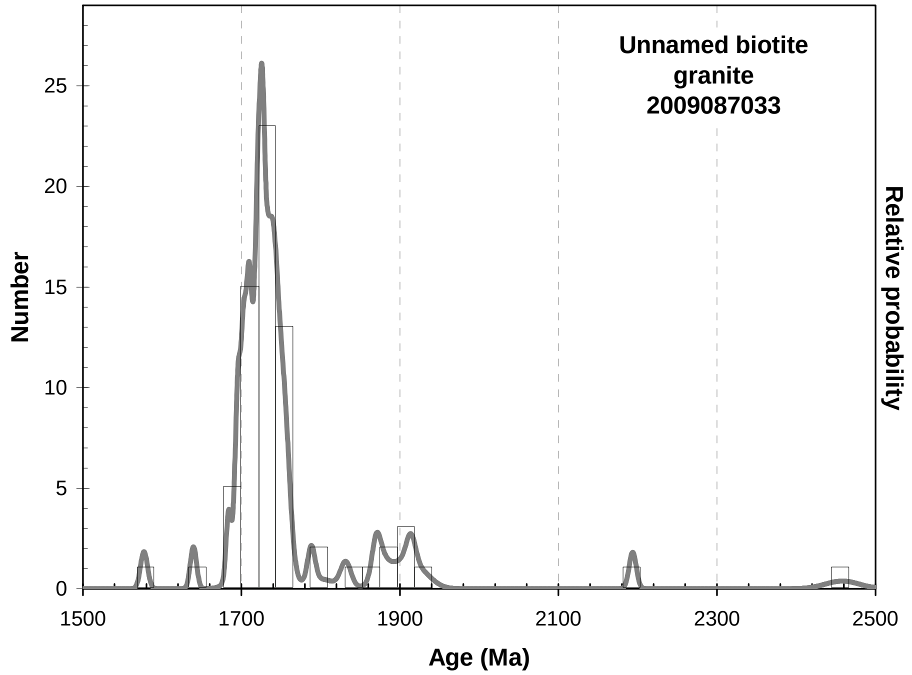

Figure 3.3. *Probability distribution diagram showing concordant ^{207}Pb/^{206}Pb ages for unnamed biotite granite (2009087033).*

A large number of analyses, both grains and rims, record extreme U concentrations. U concentrations range from 8722 ppm to 187 ppm, with Th/U between 1.24 and 0.01. As such, these analyses may not be truly concordant, and slight reverse discordance indicates matrix effects (Table 3.1). According to Williams and Hergt (2000), analyses above this U content (~2500 ppm, McLaren et al., 1994) show a progressive increase in apparent radiogenic ^{206}Pb/^{238}U with increasing U. Thus, as most accurate SHRIMP measurements are those made on zircon with relatively low U contents, a cut-off of ~2500 ppm U is used here (cf. Williams and Hergt, 2000; Butera et al., 2001). Removal of analyses with >2500 ppm U, leaves 54 analyses with a spread of ages from 1702 ± 5 Ma to 2458 ± 21 Ma.

Isolated inherited grains have ages of 2458 ± 21 Ma, 2194 ± 5 Ma, 5 analyses form a grouping with a weighted mean age of 1912 ± 10 Ma (MSWD = 0.86, probability = 0.49), 2 analyses combine with a mean age of 1872 ± 9 Ma (MSWD = 0.33, probability = 0.57), one grain gives a single isolated age of 1832 ± 7 Ma, and another 2 grains combine to produce a mean age of 1789 ± 9 Ma (MSWD = 0.46; probability = 0.50) (Figures 3.2, 3.3).

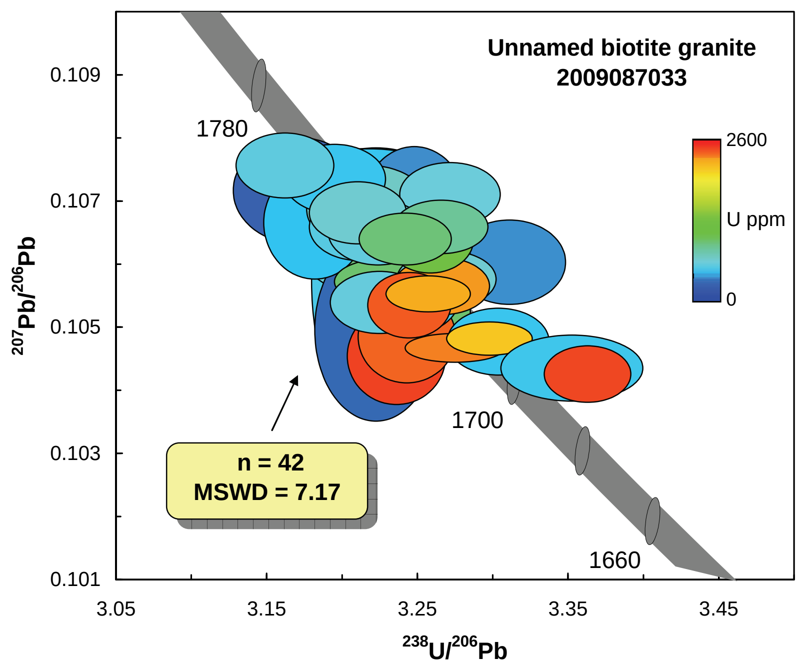

Figure 3.4. *Tera-Wasserburg concordia diagram showing results of near concordant zircon data (n = 42) for unnamed biotite granite (2009087033), coloured according to U content.*

With removal of analyses with >2500 ppm U, and removing those analyses which are clearly older inherited grains, we are left with 42 individual analyses which give a continuous spread of ages between 1702 ± 5 Ma and 1754 ± 6 Ma (MSWD = 7.17, probability 0.0; Figure 3.4). The MSWD of this group clearly indicates that more than one population is present (i.e. scatter is beyond that expected from analytical error alone), and mixture modelling (Unmix, Sambridge and Compston, 1994) for 3 components suggests ages at 1709 ± 1.8 Ma (1σ; 20% of the group), 1725 ± 2 Ma (1σ; 37% of the group) and 1743 ± 2 Ma (1σ; 43% of the group).

Seven analyses from the mix grouping at ~1709 Ma (1709 ± 3 Ma, MSWD = 0.64, probability = 0.70, n = 7, 95% confidence), are from the small black, homogenous (in CL) grains or the black rims (both comparable in U and Th). The older two groupings come from both rims and grains of variable CL response. However, as a number of analyses within the groupings at ~1725 Ma and ~1743 Ma come from grains interpreted to be inherited based on characteristics such as morphology, it is likely that all ages older than the ~1709 Ma grouping are inherited.

Geochronological Interpretation

This sample is difficult to interpret geologically. The apparent inherited nature of several grains within calculated populations at ~1725 Ma and ~1743 Ma, points to the crystallisation age of this sample being younger. Distinctive zircons with igneous zoning and shape cannot be confidently recognised, and it is suspected that most, if not all, grains in this sample (apart from the dark-CL grains and rims) are inherited. The youngest grouping at ~1710 Ma may represent the age of metamorphism, coincident with the Strangways Orogeny (1735-1690 Ma).

As outlined in the introduction, the Strangways Event is a major tectonothermal event and responsible for deformation and high-grade metamorphism of parts of the Arunta Region in central Australia, as a result many of the Paleoproterozoic sedimentary and volcanic lithologies now present as upper-amphibolite- to granulite-facies metamorphic complexes (e.g., Warren, 1983; Shaw et al., 1984; Goscombe, 1992; Scrimgeour and Raith, 2001). A review of available age evidence by Claoué-Long et al. (2008a) reveals some apparent contradictions in the timing of the Strangways Event. In the published literature, there is a range of ages spanning the period between ca. 1735 and 1690 Ma (Table 3.2).

For example, Zhao and Bennett (1995) calculated 1713 ± 7 Ma as the age of the Mount Swan Granite, however, the individual measured ages are dispersed with an MSWD of 2.4 and an age range from ca. 1740 to 1680 Ma, with an unexplained outlier at ca. 1630 Ma (Table 3.2). Maidment et al. (2005) dated the Huckitta Granodiorite with a crystallisation age of 1762 ± 3 Ma, but noted that 7 analyses of high U overgrowths yielded ages ranging from ca. 1720 to ca. 1680 Ma, consistent with metamorphism during the Late Strangways Event. For the Kanandra Granulite (Claoué-Long et al., 2008a), rare but distinctive zircons with igneous zoning and shape define a unimodal cluster of concordant isotopic compositions with a weighted mean $^{207}Pb/^{206}Pb$ age of 1734 ± 3 Ma, interpreted as a magmatic crystallisation age. Dark-CL phase overgrowths have extremely high uranium contents above 3000 ppm U, and their measured ages are dispersed over the interval ca. 1720-1670 Ma, interpreted to record high-grade metamorphic processes over an extended period (Claoué-Long et al., 2008a). In another example, $^{207}Pb/^{206}Pb$ ages for the Utnalanama quartz-garnet-biotite granulite (Claoué-Long et al., 2008a) are a continuum spanning from ca. 1740 Ma to 1690 Ma (MSWD = 9), supporting an extended 50 Myr range of metamorphic zircon ages.

Using the evidence assembled by Claoué-Long et al. (2008a), as summarised in Table 3.2, high-grade metamorphic conditions appear to have prevailed in the Strangways Metamorphic Complex over a 50 Myr period, from ca. 1740 to 1690 Ma, involving prolonged residence of a package of rocks at upper-amphibolite- to granulite-facies conditions, during which zircon formed both continually and episodically (Williams et al., 1996; Maidment et al., 2005; Claoué-Long et al., 2008a).

In light of the above evidence, the range of ages recorded for biotite granite sample 2009087033 is perhaps not unusual, and analyses with >2500 ppm U are included in the interpretation below.

Measured ages of dark-CL overgrowths and small, dark-CL grains, both of which have extremely high uranium contents, are dispersed over the interval ca. 1720-1690 Ma, with younger individual analyses, in some cases, coinciding with known tectonothermal events at 1684 ± 3 Ma, 1639 ± 4 Ma (1640-1630 Ma Liebig Orogeny in the Warumpi Province), and 1577 ± 4 Ma (1590-1570 Ma Chewings Event). Given the complexity of the continuum in the data, as in the previous interpretation, all grains older than the youngest grain (1719 ± 10 Ma) interpreted to be inherited based on characteristics such as morphology, and are excluded from interpretation. This leaves four rim analyses which combine to give a mean age of 1710 ± 5 Ma (MSWD = 0.56, probability = 0.64; Figure 3.5). Thirteen translucent, colourless, dark-CL grains, give a range of ages from 1715 ± 7 Ma to 1577 ± 4 Ma, and do not form a single population (Figure 3.5).

Table 3.2. Age measurements in the Arunta Region, related to the Strangways Event.

Rock unit/Source	Reported attribution	Age (Ma)	MSWD	No. of Analyses
Black and Shaw (1995)				
Strangways Range tonalite “rare low-U grains apparently 100Ma younger than 1778±5Ma”				
Lafrance et al. (1995)				
Wuluma Granite	Magmatic crystallisation	1728±3	2.4	10
Zhao and Bennett (1995)				
Mount Swan Granite	Magmatic crystallisation	1713±7	2.4	13
Dneiper Granite	Metamorphism	1670±42		2
Atneequa Complex	Metamorphism	1715±19		3
Randall Peak Metamorphics	Unattributed	1684±36		1
Compston (1995)				
Gosse River East granite	Magmatic crystallisation	1712±5	2	23
Page (1996)				
Devils Marbles Granite	Magmatic crystallisation	1711±11	1.7	4
Elkedra Granite	Magmatic crystallisation	1720±6	1.3	9
Scrimgeour et al. (2001)				
Deep Bore Metamorphics	Metamorphism	1730±7	0.8	12
Moller et al. (2003)				
M1 leucosome	Magmatic crystallisation	1732±7	1.5	7
M2 leucosome	Magmatic crystallisation	1717±2	1.2	9
Regional monazites	Metamorphism	1728–1712		6
Maidment et al. (2005)				
Mendip Metamorphics	Metamorphism	1723±9	0.8	30
Ledan Schist pegmatite	pegmatite crystallisation	1730±4	1	24
Huckitta Granodiorite	Metamorphism	1720-1680		7
Claoue-Long and Hoatson (2005)				
Strangways Range tonalite	Metamorphism	1685±20	0.6	9
Strangways Range dolerite	Magmatic	1689±8	1.2	30
Johannsen Metagabbro	Metamorphism	1696±8	0.8	18
Enbra Granulite	Metamorphism	1685±11	0.1	4
Mount Hay Granulite	Metamorphism	1700±17	1.3	10
Mount Chapple Metamorphics	Metamorphism	1725±11	1.8	5
Claoue-Long et al. (2008)				
Kanandra Granulite	Magmatic crystallisation	1734±3	1.3	13
	Metamorphism	ca. 1730–1670		6
Edwards Creek metasediment	Metamorphism	1716±3	1.1	14
Coles Hill gneiss	Metamorphism	1731±3	1.5	21
	Magmatic crystallisation	1708±6	1.3	14
Utnalanama metasediment	Metamorphism	ca. 1740–1700		17
Utnalanama garnet-cordierite granulte	Metamorphism	ca. 1745–1685		56
Kaidwalla granite	Magmatic crystallisation	1707±4	1.2	23
Unnamed lamprophyre	Magmatic crystallisation	1711±3	0.6	15
Carson et al. (2009)				
Albarta Metamorphics, Casey Inlier	Metamorphic monazite	1729±3	2.3	27
Anira Metamorphics, Casey Inlier	Metamorphism	1723±3	1.8	15

The data are not conclusive, but high-U zircon rims (1710 ± 5 Ma) and grains (ca. 1715-1575 Ma) are interpreted to record high-grade metamorphic conditions of the Strangways Event over a continuum from ~1720-1680 Ma. The youngest individual ages, 1639 ± 4 Ma and 1577 ± 4 Ma, can be matched to subsequent ‘events’ in the Arunta, for example, the Chewings (1590-1560 Ma) Orogeny. Magmatism spaning 1650-1600 Ma is also known in the Aileron Province, and includes the Andrew Young Igneous Complex (1633 ± 3 Ma, Claoué-Long and Hoatson, 2005) and granites in the Ennugan Mountains (1622 ± 7 Ma, Smith 2000, 2001).

There is no obvious crystallisation age. Distinctive zircons with igneous zoning and shape cannot be confidently recognised, and it is suspected that most, if not all, grains in this sample (apart from the dark-CL grains and rims) are inherited.

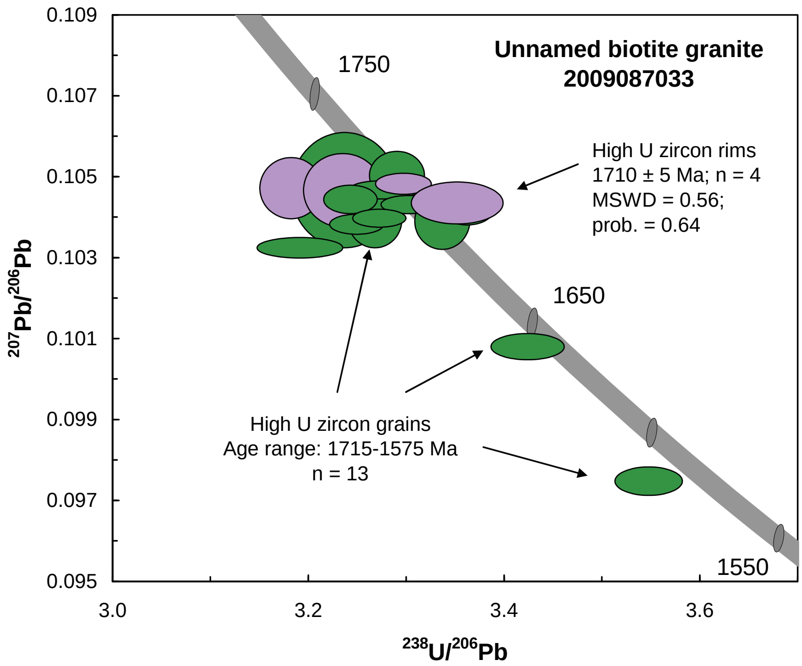

Figure 3.5. *Tera-Wasserburg concordia diagram showing results of near concordant zircon data for high-U zircon rims (purple ellipses) and high-U zircon grains (green ellipses) from unnamed biotite granite (2009087033).*

Table 3.1. SHRIMP U-Pb isotopic data for zircons from sample 2009087033, unnamed biotite granite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
637.56.1.1	-0.01	208	132	0.65	2.1567	0.87	0.1602	1.27	2458	21	0
637.37.1.1	0.02	543	324	0.62	2.4532	0.68	0.1373	0.26	2194	5	-1
637.69.1.1	0.03	288	58	0.21	2.8871	0.79	0.1181	0.86	1927	15	1
637.15.1.1	0.00	433	43	0.10	2.8780	0.99	0.1172	0.33	1914	6	-1
637.33.1.1	0.00	421	7	0.02	2.8602	1.34	0.1171	0.93	1912	17	-1
637.48.1.1	0.01	381	62	0.17	2.9187	0.74	0.1161	0.80	1897	14	0
637.27.1.1	0.02	275	86	0.32	2.9620	0.77	0.1155	1.20	1887	22	1
637.16.1.1	-0.01	208	89	0.44	2.9831	1.38	0.1147	0.47	1876	8	1
637.36.1.1	0.00	562	59	0.11	2.9937	0.68	0.1144	0.29	1870	5	1
637.66.1.1	0.17	541	195	0.37	3.1719	0.68	0.1120	0.36	1832	7	4
637.64.1.1	0.08	287	124	0.45	3.0679	0.80	0.1101	0.96	1800	17	-1
637.2.1.1	0.01	706	10	0.01	3.1587	1.07	0.1093	0.26	1788	5	1
637.45.1.1	0.00	566	208	0.38	3.1617	0.68	0.1076	0.31	1759	6	-1
637.59.1.1	0.02	488	224	0.47	3.1947	0.70	0.1074	0.34	1755	6	0
637.23.1.1	0.02	483	185	0.40	3.2177	1.10	0.1073	0.32	1754	6	1
637.42.1.1	0.03	210	245	1.21	3.1706	0.89	0.1072	0.52	1752	9	-1
637.62.1.1	0.02	606	244	0.42	3.2711	0.67	0.1071	0.31	1751	6	2
637.19.1.1	0.00	695	277	0.41	3.2172	0.84	0.1069	0.42	1747	8	0
637.22.1.1	0.02	354	135	0.39	3.2478	0.72	0.1068	0.63	1746	12	1

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb*$	± (%)	$^{207}Pb*/^{206}Pb*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
637.61.1.1	0.03	650	211	0.34	3.2104	0.66	0.1068	0.30	1746	6	0
637.29.1.1	0.00	8722	124	0.01	3.0535	0.72	0.1067	0.22	1744	4	-5
637.39.1.1	0.02	472	146	0.32	3.1816	0.70	0.1067	0.56	1743	10	-1
637.1.1.1	0.02	646	219	0.35	3.2222	1.20	0.1067	0.73	1743	13	0
637.10.1.1	0.05	187	211	1.17	3.2432	0.87	0.1066	0.54	1743	10	1
637.52.1.1	0.01	852	293	0.35	3.2652	0.63	0.1066	0.26	1742	5	1
637.44.1.1	0.03	549	172	0.32	3.2109	0.68	0.1066	0.33	1742	6	0
637.38.1.1	0.05	574	181	0.33	3.2235	0.67	0.1065	0.32	1741	6	0
637.9.1.1	-0.01	914	119	0.13	3.2242	0.61	0.1064	0.74	1739	14	0
637.65.1.1	0.01	927	353	0.39	3.2415	0.62	0.1064	0.25	1739	5	0
637.17.1.1	0.01	1278	601	0.49	3.2581	0.58	0.1064	0.33	1739	6	1
637.32.1.1	0.03	318	177	0.58	3.2513	0.77	0.1062	0.44	1735	8	0
637.4.1.1	0.02	2585	47	0.02	3.2341	0.68	0.1061	0.25	1733	5	0
637.8.1.1	0.02	360	447	1.28	3.3104	0.74	0.1060	0.41	1733	8	2
637.29.2.1	0.01	439	136	0.32	3.2517	0.69	0.1060	0.35	1732	6	0
637.30.1.1	0.00	882	454	0.53	3.2489	0.80	0.1059	0.38	1730	7	0
637.67.1.1	0.01	344	178	0.54	3.2556	0.78	0.1059	0.42	1730	8	0
637.25.1.1	0.02	647	235	0.38	3.2690	0.66	0.1058	0.28	1728	5	0
637.30.1.1(2)	0.01	526	181	0.36	3.2128	0.68	0.1058	1.30	1727	24	-1
637.6.1.1	0.03	950	316	0.34	3.2309	0.74	0.1057	0.23	1727	4	-1
637.31.1.1	0.04	445	222	0.52	3.2223	0.71	0.1057	1.03	1727	19	-1
637.24.1.1	0.00	2754	107	0.04	3.1787	0.61	0.1057	0.13	1727	2	-2
637.21.1.1	0.00	463	197	0.44	3.2453	0.67	0.1057	0.61	1726	11	0
637.49.1.1	0.00	2301	81	0.04	3.2654	0.64	0.1057	0.28	1726	5	0
637.60.1.1	0.00	2238	90	0.04	3.2566	0.57	0.1055	0.18	1724	3	0
637.35.1.1	0.05	600	262	0.45	3.2349	0.67	0.1055	0.36	1723	7	-1
637.12.1.1	0.03	2785	114	0.04	3.2385	0.67	0.1055	0.18	1723	3	-1
637.43.1.1	0.04	524	146	0.29	3.2429	0.69	0.1054	0.33	1722	6	-1
637.34.1.1	0.00	588	174	0.31	3.2246	0.67	0.1054	0.31	1721	6	-1
637.53.1.1	0.01	2432	74	0.03	3.2441	0.56	0.1054	0.32	1721	6	-1
637.63.1.1	0.01	2812	96	0.04	3.2655	0.69	0.1053	0.15	1719	3	0
637.51.1.1	0.00	955	251	0.27	3.2540	0.62	0.1053	0.56	1719	10	-1
637.55.1.1	0.01	2657	96	0.04	3.2903	0.56	0.1051	0.37	1715	7	0
637.40.1.1	0.08	247	258	1.08	3.2220	0.83	0.1050	0.91	1714	17	-2
637.20.1.1	0.06	2413	97	0.04	3.2426	0.65	0.1049	0.46	1712	8	-1
637.58.1.1	0.01	2122	73	0.04	3.2971	0.57	0.1048	0.16	1711	3	0
637.13.1.1	0.03	488	133	0.28	3.3029	0.67	0.1048	0.33	1711	6	0
637.28.1.1	0.00	3970	236	0.06	3.1821	0.66	0.1047	0.47	1710	9	-3
637.7.1.1	0.01	2354	89	0.04	3.2746	0.67	0.1047	0.14	1709	3	-1
637.3.1.1	0.00	2794	110	0.04	3.2367	1.10	0.1047	0.90	1709	17	-2
637.26.1.1	0.00	2486	106	0.04	3.2359	0.66	0.1046	0.48	1707	9	-2
637.50.1.1	0.00	2812	117	0.04	3.2423	0.55	0.1045	0.22	1705	4	-2
637.5.1.1	0.03	499	92	0.19	3.3517	0.92	0.1044	0.33	1703	6	1
637.57.1.1	0.00	2856	133	0.05	3.3020	0.56	0.1043	0.14	1703	3	0
637.54.1.1	0.08	2482	110	0.05	3.3621	0.56	0.1043	0.28	1702	5	2
637.41.1.1	0.00	2987	128	0.04	3.2719	0.55	0.1040	0.14	1697	3	-2
637.46.1.1	0.01	3107	157	0.05	3.2680	0.55	0.1039	0.43	1696	8	-2
637.68.1.1	0.01	3127	125	0.04	3.3366	0.55	0.1039	0.45	1695	8	0
637.70.1.1	0.00	3043	132	0.04	3.2492	0.56	0.1038	0.15	1694	3	-2
637.47.1.1	0.10	4364	324	0.08	3.1912	0.90	0.1033	0.16	1684	3	-5
637.11.1.1	0.00	3207	140	0.05	3.4236	0.72	0.1008	0.21	1639	4	-1
637.14.1.1	0.00	2847	123	0.04	3.5468	0.63	0.0975	0.24	1577	4	-2
discordant and/or high common Pb											
637.18.1.1	12.35	13448	311	0.02	18.2539	1.90	0.0891	1.16	1406	22	78

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.

2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.

3. All errors quoted as 1σ.

4. UNNAMED GNEISSIC GRANITE: 2009087001

GA Sample ID:	**2009087001**
GA Sample Number:	**1999599**
1:250,000 Sheet:	**HUCKITTA**
Region:	**Arunta, Northern Territory**
Grid Reference:	**637955 7463280 MGA94 Zone 53**
Collector:	**N. Kositcin, D. Champion, J. Whelan, D. Huston.**
Collection Date:	**20th June - 26th June 2009**
Formal Name:	**not defined**
Informal Name:	**P€d**
Lithology:	**coarse-grained gneissic granite**
Geochronologist:	**N. Kositcin**
Mount ID:	**GA6132**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**26-31/7/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.84% (1σ) (46 of 46)**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.0 ± 1.4 (45 of 46)**
Interpreted Age:	**1779 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**
Interpreted Age:	**1744 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**metamorphic age**

Sample Description

Unnamed gneissic granite, p€d, occurs some 35 km east of the Jervois Homestead (Shaw et al., 1984) as isolated outcrops surrounded by extensive soil and sand covered plains. The dominant rock type is quartzofeldspathic gneiss which commonly grades into biotite gneiss. Migmatite occurs as concordant and discordant leucosomes in both the quartzofeldspathic and biotite gneiss. This sample is a silicified, lineated, coarse-grained gneissic granite (Figure 4.1). It is reasonably magnetic (magnetic susceptibility values: 16.2, 28.8, 10.7, 16.1×10^{-3} SI units).

***Figure 4.1**. Outcrop photo of unnamed coarse-grained gneissic granite, 2009087001.*

Zircon Description

Zircon grains from this sample are mostly clear to colourless, with a smaller proportion of grains being light brown in colour (Figure 4.2). They are euhedral to subhedral, with few grains preserving sharp pointed terminations. There is a range of grain sizes from ~50 µm up to 200 µm in length, although most are ~100 µm euhedral to subhedral, blocky grains, with aspect ratios of 1:1 and 1:2. In cathodoluminescence (CL) images, most grains have a clear, relatively uniform, medium CL response, or patchy and sector zoned CL response, whereas other grains record subtle oscillatory zoning. A few grains show evidence of rounded, older cores, which were not analysed. A very small number of grains have a bright, thin, CL rim, but most of the grains in this sample are mantled by a rim with a very dark CL response, of variable thickness (5-30 µm, Figure 4.2). 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. The rims are, in most cases, too small for analysis, although several attempts were made on larger ones.

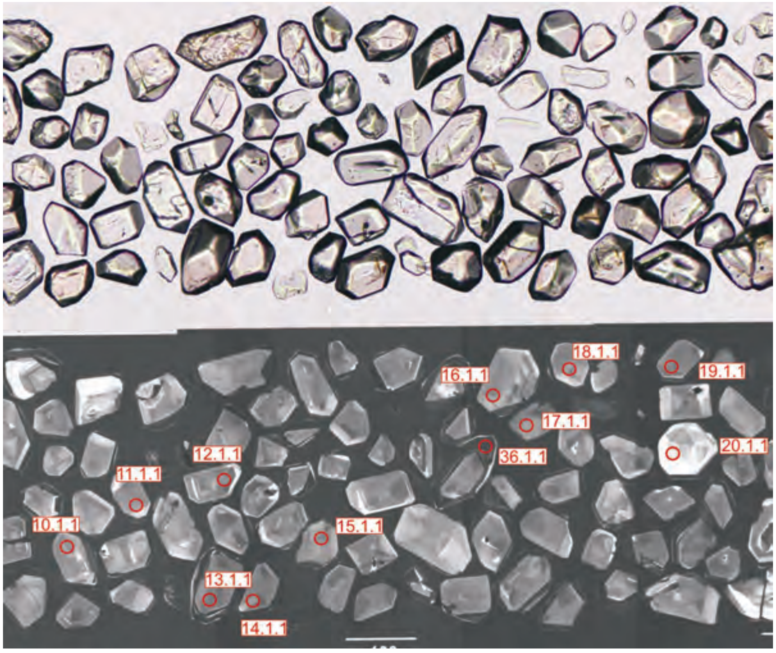

Figure 4.2. *Representative transmitted light and cathodoluminescence images of zircons from unnamed gneissic granite (2009087001), with locations of some SHRIMP analyses.*

Analysed zircons from unnamed gneissic granite sample 2009087001 have a range of Th/U values between 0.96 and 0.04. Core analyses have U concentrations ranging from 463 to 133 ppm, Th between 432 and 84 ppm, and Th/U ratios between 0.96 and 0.52. U and Th concentrations for zircon rims range between 1317 and 946 ppm, and 85-41ppm, respectively, with Th/U ratios between 0.07 and 0.04.

U-Pb Isotopic Results

A total of 48 analyses were collected from 47 different zircon grains from sample 2009087001, the results of which are shown in Table 4.1 and illustrated in Figures 4.3 and 4.4. Common Pb ($^{206}Pb_c$) contents are generally low, between zero and 1.15% (Table 4.1).

The 48 analyses can be divided into 34 analyses of zircon cores and 15 analyses of zircon rims. Two analyses (one rim and one core) are discordant (>5%) and both contain >0.5% common Pb, and are excluded from the mean age calculation. Of the remaining concordant analyses, 33 are cores and combine to produce a weighted mean $^{207}Pb/^{206}Pb$ age of 1778.7 ± 3 Ma (MSWD = 0.60; probability = 0.96) (Figures 4.3, 4.4).

A total of 14 zircon rims were analysed from this sample. Post-analysis viewing of the spot images indicates that several analyses thought to have been entirely rims, appear to have been mixtures (spots 28.1.1, 45.1.1, 35.1.1, 38.1.1, 37.1.1, 42.1.1), where the SHRIMP spot analysed mostly rim but also a tiny bit of core. These analyses, interpreted as 'mixtures', are not included in age calculations. In addition, two intended rim analyses missed the target (i.e., analysis of rim and epoxy, spots 47.1.1 and 43.1.1), and these are also excluded from interpretation. Of the initial 14 'rim' analyses, 6 were collected entirely on rims. These 6 analyses form a coherent group with a mean $^{207}Pb/^{206}Pb$ age of 1744 ± 4 Ma (MSWD = 0.94, probability = 0.45) (Figures 4.3, 4.4).

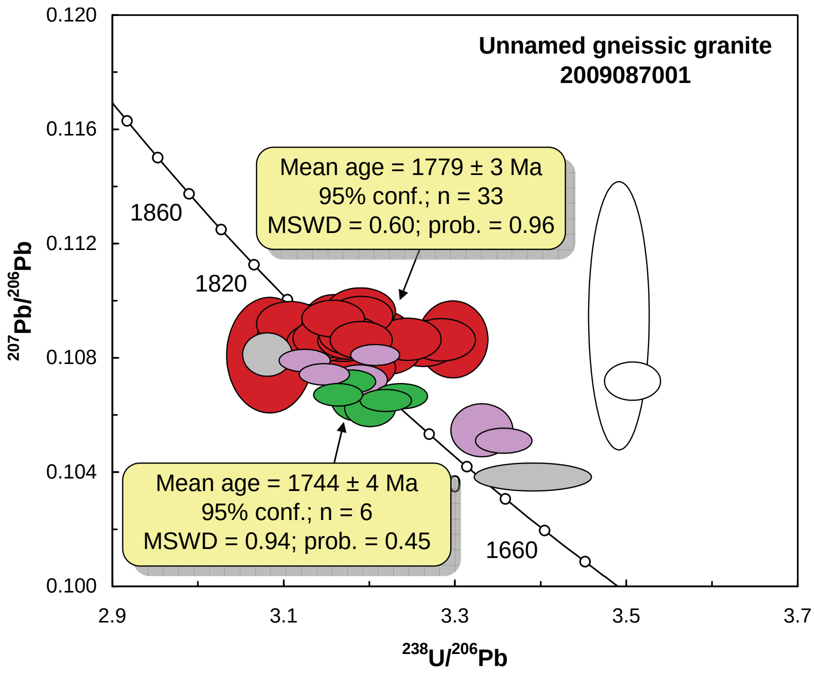

Figure 4.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from unnamed gneissic granite (2009087001). Unfilled ellipses represent analyses that have not been included in the mean age calculation (discordant and/or high common Pb). Green ellipses are rim analyses. Purple ellipses represent 'mixed' rim and core analyses. Grey analyses are those which missed the target (rim + epoxy). Both purple and grey analyses are excluded from mean age calculations.*

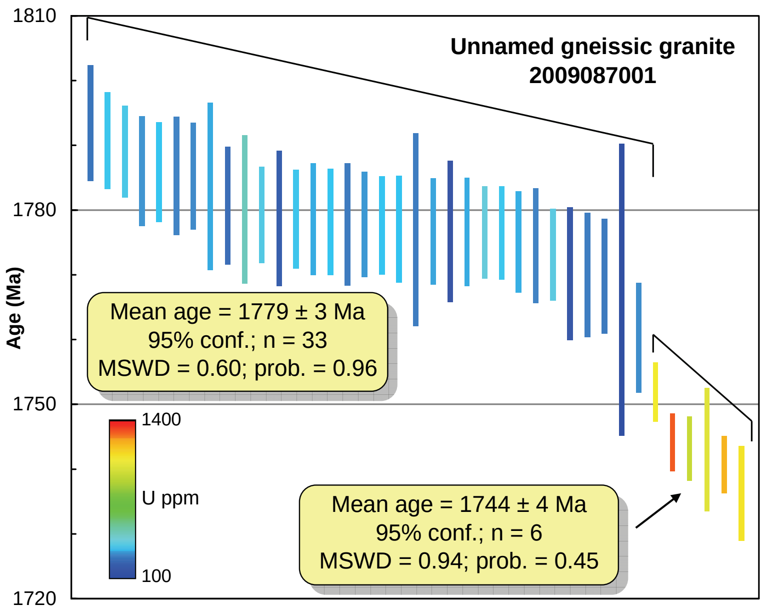

Figure 4.4. *Weighted mean age diagram showing $^{207}Pb/^{206}Pb$ ages of near-concordant zircon analyses from unnamed gneissic granite (2009087001), coloured according to U content.*

Geochronological Interpretation

The weighted mean age of 1779 ± 3 Ma is interpreted as the igneous crystallisation age of this granite. New zircon growth is recorded by thin zircon rims on the majority of zircon grains in this sample. Six concordant rim analyses yield a weighted mean age of 1744 ± 4 Ma, which is interpreted to record metamorphism of this granite. Similar ages for metamorphism are also reported for metasedimentary rocks and granitic gneiss along the southern margin of the eastern Aileron Province in ILLOGWA CREEK (Whelan et al., 2011).

Table 4.1. SHRIMP U-Pb isotopic data for zircons from sample 2009087001, gneissic granite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
zircon cores											
599.7.1.1	-0.046	248	155	0.644	3.1910	0.84	0.1096	0.49	1793	9	2
599.17.1.1	0.037	346	219	0.654	3.1911	0.77	0.1095	0.41	1791	8	2
599.13.1.1	0.004	363	283	0.807	3.1590	0.76	0.1094	0.39	1789	7	1
599.24.1.1	0.029	286	198	0.718	3.1090	0.83	0.1092	0.47	1786	8	-1
599.25.1.1	0.022	340	246	0.745	3.1770	0.79	0.1092	0.43	1786	8	1
599.34.1.1	0.036	268	175	0.675	3.1702	0.86	0.1091	0.50	1785	9	1
599.18.1.1	-0.005	275	175	0.657	3.1625	0.83	0.1091	0.46	1785	8	1
599.26.1.1	0.068	309	217	0.724	3.1593	0.81	0.1091	0.71	1784	13	1
599.30.1.1	0.019	234	134	0.591	3.2084	0.87	0.1089	0.50	1781	9	2
599.22.1.1	0.022	463	432	0.963	3.1257	0.76	0.1088	0.63	1780	11	-1
599.6.1.1	0.032	370	286	0.799	3.1793	0.76	0.1088	0.41	1779	7	1
599.21.1.1	0.061	199	103	0.535	3.1991	0.92	0.1088	0.57	1779	10	2
599.23.1.1	0.042	347	257	0.764	3.1700	0.78	0.1087	0.42	1778	8	1
599.10.1.1	0.006	311	203	0.674	3.1097	0.83	0.1087	0.47	1778	9	-1
599.33.1.1	0.048	339	229	0.698	3.1805	0.80	0.1087	0.45	1778	8	1
599.3.1.1	0.050	258	162	0.649	3.1630	0.88	0.1087	0.52	1778	9	0
599.15.1.1	0.015	289	198	0.709	3.1726	0.81	0.1087	0.45	1778	8	1
599.19.1.1	0.026	337	250	0.766	3.1491	0.78	0.1087	0.42	1778	8	0
599.31.1.1	0.102	335	218	0.672	3.2458	0.78	0.1087	0.45	1777	8	3
599.11.1.1	0.000	259	161	0.642	3.2979	0.82	0.1086	0.82	1777	15	4
599.27.1.1	0.047	302	210	0.718	3.2847	0.80	0.1086	0.45	1777	8	4
599.1.1.1	0.000	168	84	0.520	3.1286	1.00	0.1086	0.60	1777	11	-1
599.32.1.1	-0.005	310	201	0.669	3.1713	0.82	0.1086	0.46	1777	8	1
599.4.1.1	-0.019	395	311	0.814	3.1917	0.75	0.1086	0.39	1776	7	1
599.14.1.1	0.016	346	253	0.755	3.1778	0.76	0.1086	0.40	1776	7	1
599.12.1.1	0.022	313	234	0.772	3.1427	0.79	0.1085	0.43	1775	8	0
599.16.1.1	0.050	267	171	0.662	3.2635	0.83	0.1085	0.49	1774	9	3
599.5.1.1	0.026	377	310	0.851	3.1953	1.01	0.1084	0.39	1773	7	1
599.9.1.1	0.000	176	99	0.583	3.1670	0.94	0.1082	0.57	1770	10	0
599.2.1.1	0.074	260	158	0.627	3.1543	0.87	0.1082	0.53	1770	10	0
599.29.1.1	0.006	255	152	0.617	3.2190	0.84	0.1082	0.49	1770	9	2
599.20.1.1	0.055	133	90	0.700	3.0858	1.07	0.1081	1.24	1768	23	-3
599.8.1.1	0.060	277	183	0.682	3.1921	0.82	0.1077	0.47	1760	9	0
zircon rims											
599.40.1.1	0.042	1080	71	0.068	3.1787	0.62	0.1072	0.25	1752	5	-1
599.41.1.1	0.056	1317	85	0.067	3.1646	0.60	0.1067	0.24	1744	4	-2
599.39.1.1	0.020	946	41	0.044	3.2369	0.64	0.1067	0.27	1743	5	0
599.44.1.1	0.035	1010	51	0.052	3.1861	0.63	0.1066	0.52	1743	10	-1
599.36.1.1	0.011	1197	54	0.046	3.2197	0.61	0.1065	0.24	1740	4	0
599.5.2.1	0.060	1095	54	0.051	3.2019	0.61	0.1062	0.40	1736	7	-1
mixtures (rim and core)											
599.45.1.1	0.172	1413	102	0.074	3.2077	0.59	0.1081	0.22	1768	4	1
599.38.1.1	0.030	1043	44	0.043	3.1260	0.62	0.1079	0.24	1764	4	-2
599.37.1.1	0.014	1152	75	0.067	3.1489	0.61	0.1074	0.23	1756	4	-1
599.42.1.1	0.022	671	39	0.061	3.1903	0.66	0.1072	0.32	1753	6	0
599.28.1.1	0.010	521	110	0.218	3.3318	0.71	0.1055	0.58	1722	11	2
599.35.1.1	0.011	900	40	0.046	3.3572	0.64	0.1051	0.27	1716	5	2
missed (epoxy and rim)											
599.47.1.1	0.093	1220	124	0.105	3.0828	0.62	0.1081	0.46	1768	8	-3
599.43.1.1	0.193	827	48	0.06	3.3909	1.32	0.1038	0.31	1694	6	2
discordant and/or high common Pb											
599.46.1.1	0.938	1116	86	0.08	3.5066	0.61	0.1072	0.41	1752	8	9
599.48.1.1	1.145	843	86	0.106	3.4908	0.67	0.1095	2.84	1791	52	11

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.
2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.
3. All errors quoted as 1σ.

5. JERVOIS GRANITE: 2009087003

GA Sample ID:	**2009087003**
GA Sample Number:	**1999601**
1:250,000 Sheet:	**HUCKITTA**
Region:	**Arunta, Northern Territory**
Grid Reference:	**647592 7482441 MGA94 Zone 53**
Collector:	**N. Kositcin, D. Champion, J. Whelan, D. Huston.**
Collection Date:	**20th June - 26th June 2009**
Formal Name:	**not defined**
Informal Name:	**Pge**
Lithology:	**feldspar porphyritic granite**
Geochronologist:	**N. Kositcin**
Mount ID:	**GA6132**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**26-31/7/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.84% (1σ) (46 of 46)**
^{207}Pb/^{206}Pb Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.0 ± 1.4 (45 of 46)**
Interpreted Age:	**1746 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**

Sample Description

Smith (1964) applied the name Jervois Granite to isolated outcrops which occur over a large area of southeast HUCKITTA. The Jervois Granite is a composite body consisting of a variety of granites, each of which are highly weathered and form small isolated hills separated by extensive plains. The Jervois Granite intrudes the Bonya Schist and is cut by numerous pegmatite and quartz veins.

The most abundant rock type is a fine- to medium-grained equigranular biotite granodiorite. Variations include leucocratic granites, medium-grained and coarse-grained and locally porphyritic types. This sample was collected at the same general location as a sample collected by Zhao and McCulloch (1995; samples 89-565, 89-567; Main Group). There is several granite phases present at this location (Figure 5.1), the one sampled by Zhao and McCulloch is very silica rich and has a distinctive sugary texture.

Figure 5.1. *(left) Outcrop photo showing intrusive relationship between equigranular granite and feldspar porphyritic granite (2009087003). (below) Three granite types at this location.*

Other phases include more mafic varieties and feldspar porphyritic varieties (Figure 5.1). Clear contacts between all three phases are evident. The collected sample is a feldspar porphyritic granite. Subhedral to euhedral, pink-grey and green feldspars, up to 5cm long, are aligned in some places, but variable. Biotite (~10%) defines elongated enclaves, and a gneissic fabric in locally developed. This rock is intruded by equigranular medium-grained granite (sampled by Zhao and McCulloch, 1995) and late mafic dykes. This granite is weakly magnetic (magnetic susceptibility values: 8.75, 8.9, 6.3, 9.0×10^{-3} SI units).

Previous Work

Based primarily on geochemical criteria, a number of granite suites throughout the North Australian Craton, including the Jervois Granite, were assigned to the ~1880-1850 Ma Barramundi Association of Wyborn (1988). However, studies by Zhao and Bennett (1995) indicated that the Jervois Granite (and Dneiper Granite) were some 100 m.y. younger than the Barramundi Association. Rb-Sr isotopic studies by Black (1980) produced a whole-rock isochron age of 1775 ± 25 Ma for the Jervois Granite. Zhao and Bennett (1995) derived a weighted mean zircon SHRIMP $^{207}Pb/^{206}Pb$ age of 1771 ± 6 Ma (n = 23 of 26, 95% confidence, no MSWD given), from a range of ages from ~1818 Ma to ~1725 Ma, with the entire dataset yielding a lower intercept age of ~300 Ma, coincident with the Alice Springs Orogeny. The latter study did not use cathodoluminescence imaging.

Zircon Description

Zircons from this sample show a large range of morphologies (Figure 5.2). Most zircons from this sample occur as euhedral to subhedral grains and fragments, with size ranging up to 400 µm in the long dimension (most are 100-200 µm in length). Aspect ratios vary from 1:1 to 1:6. Grains are optically clear to extremely metamict, and are colourless to dark brown in colour. Cathodoluminescence images reveal a number of different responses. Many grains exhibit concentric, oscillatory internal zonation typical of magmatic zircon, or sector zoning. In many cases, oscillatory zoning in these grains appears to have broadened and the zone boundaries have become more diffuse, suggesting secondary fluid alteration of primary igneous grains (Figure 5.2). 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 to reflect radiation damage, or subsequent modification by alteration. Some grains exhibit a homogeneous very dark CL response, others with a heterogeneous dark grey response. Quite a few grains have a relatively bright featureless CL response and very thin black rims. A small number of grains contain rounded cores in which internal zonation in truncated by euhedral rims, suggesting the presence of some zircon inheritance.

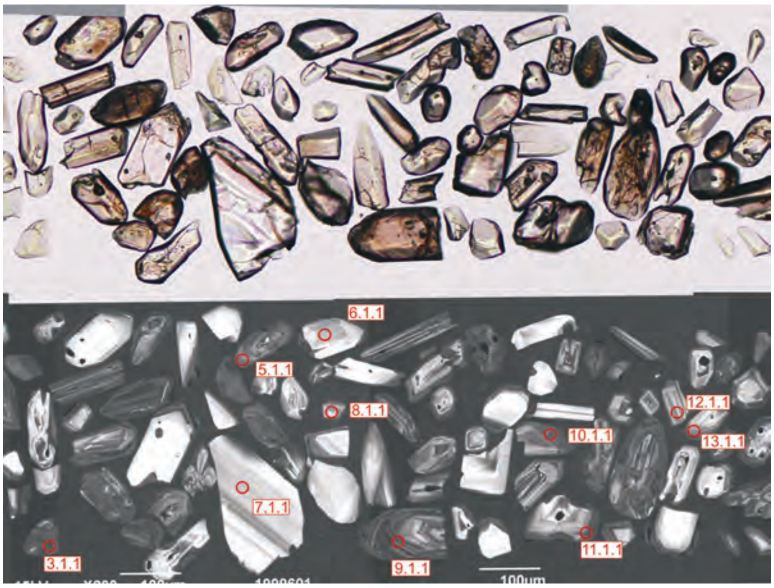

Figure 5.2. *Representative transmitted light and cathodoluminescence images of zircons from feldspar porphyritic granite (Jervois Granite, 2009087003), with locations of some SHRIMP analyses.*

Analysed zircons from Jervois Granite sample 2009087003 have a range of Th/U values between 1.79 and 0.06. Th and U contents are between 410-11 ppm and 611-7 ppm, respectively.

U-Pb Isotopic Results

A total of 37 analyses were collected on 37 different zircon grains from sample 2009087003, the results of which are shown in Table 5.1, and illustrated in Figure 5.3. Common Pb ($^{206}Pb_c$) contents are generally low, but range between zero and 3.11%. Five discordant (>5%) analyses (four of these also have high common Pb), and one concordant analysis with high common Pb, are not included in the mean age calculation.

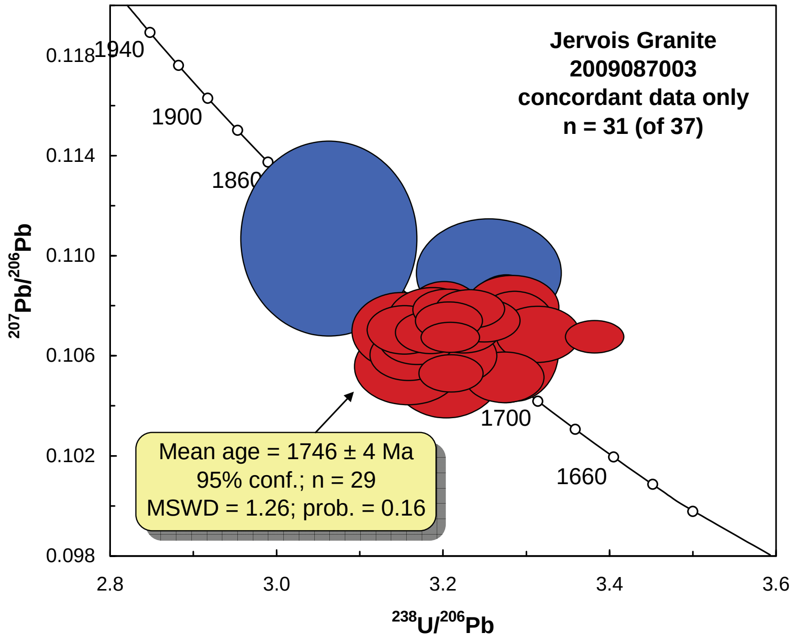

Figure 5.3. *Tera-Wasserburg concordia diagram showing results of near-concordant zircon analyses from feldspar porphyritic granite (Jervois Granite, 2009087003). Blue ellipses are interpreted as inherited grains, and are not included in the mean age calculation.*

The remaining 31 analyses form a coherent age group with a weighted $^{207}Pb/^{206}Pb$ mean age of 1746.2 ± 4.2 Ma (MSWD = 1.26; probability = 0.09; Figure 5.3).

Geochronological Interpretation

The preferred interpretation for this dataset is that it represents an igneous rock with a crystallisation age of 1746 ± 4 Ma. This is within error of the age of metamorphism for sample 2009087001 (detailed earlier) an unnamed gneissic granite outcropping approximately 21 km to the southwest of the Jervois Granite. Inherited grains give poorly constrained ages of 1811 ± 42 Ma and 1788 ± 24 Ma.

Table 5.1. SHRIMP U-Pb isotopic data for zircons from sample 2009087003, Jervois Granite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
601.37.1.1	-0.03	132	95	0.74	3.2833	1.12	0.1079	0.78	1765	14	3
601.11.1.1	-0.01	243	327	1.39	3.2330	0.84	0.1079	0.47	1764	9	2
601.15.1.1	0.02	233	325	1.44	3.2062	0.86	0.1078	0.50	1763	9	1
601.1.1.1	0.14	121	78	0.67	3.1883	1.13	0.1074	0.81	1756	15	0
601.28.1.1	0.02	233	190	0.84	3.2496	0.87	0.1074	0.52	1756	10	2
601.27.1.1	-0.01	288	216	0.78	3.2077	0.82	0.1074	0.46	1756	8	0
601.5.1.1	0.04	200	156	0.80	3.2296	0.90	0.1073	0.55	1753	10	1
601.31.1.1	0.02	130	206	1.65	3.2022	1.09	0.1072	1.10	1752	20	0
601.2.1.1	0.40	146	119	0.84	3.2861	0.98	0.1072	0.88	1752	16	3
601.20.1.1	0.09	190	165	0.90	3.1545	0.92	0.1070	0.60	1749	11	-2
601.25.1.1	0.02	216	375	1.79	3.2248	0.90	0.1070	0.55	1749	10	1
601.23.1.1	0.16	85	96	1.16	3.1519	1.26	0.1070	0.95	1749	17	-2
601.26.1.1	0.05	218	217	1.03	3.1856	0.88	0.1069	0.52	1748	10	-1
601.4.1.1	0.13	151	94	0.64	3.3140	0.99	0.1069	0.70	1746	13	3
601.19.1.1	0.44	735	200	0.28	3.3820	0.68	0.1068	0.41	1745	7	5
601.3.1.1	0.04	450	25	0.06	3.2092	0.72	0.1067	0.37	1744	7	0

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
601.36.1.1	0.12	93	148	1.65	3.2465	1.25	0.1067	0.93	1744	17	1
601.10.1.1	-0.01	410	201	0.51	3.2473	1.70	0.1067	0.73	1744	13	1
601.7.1.1	0.01	98	157	1.66	3.2757	1.17	0.1067	1.58	1744	29	2
601.16.1.1	0.06	167	135	0.83	3.1695	0.96	0.1066	0.62	1743	11	-2
601.32.1.1	0.17	164	267	1.68	3.2083	0.98	0.1065	0.68	1740	12	-1
601.12.1.1	0.16	152	251	1.70	3.2582	1.00	0.1063	0.73	1736	13	1
601.6.1.1	0.10	127	239	1.94	3.2865	1.05	0.1063	1.29	1736	24	2
601.21.1.1	0.09	174	215	1.28	3.1593	0.96	0.1060	0.63	1732	12	-3
601.35.1.1	0.22	224	410	1.89	3.2202	0.90	0.1060	0.67	1732	12	-1
601.29.1.1	0.48	63	65	1.06	3.2046	1.46	0.1057	1.38	1727	25	-2
601.17.1.1	0.06	74	102	1.42	3.1588	1.34	0.1056	0.96	1724	18	-3
601.9.1.1	0.06	305	214	0.72	3.2103	0.79	0.1053	0.46	1720	9	-2
601.8.1.1	0.10	163	261	1.66	3.2739	0.96	0.1051	0.63	1717	12	0
Inherited grains											
601.34.1.1	0.19	611	136	0.23	3.0639	2.26	0.1107	2.32	1811	42	-1
601.14.1.1	-0.11	37	52	1.44	3.2550	1.76	0.1093	1.30	1788	24	4
discordant and/or high common Pb											
601.30.1.1	0.71	33	51	1.58	3.2245	1.99	0.1057	2.16	1726	40	-1
601.13.1.1	0.55	523	261	0.51	3.7230	2.71	0.1074	3.27	1756	60	14
601.18.1.1	2.67	89	121	1.41	3.6368	1.26	0.1066	2.25	1742	41	11
601.24.1.1	0.01	309	106	0.35	3.6110	1.12	0.1060	0.77	1731	14	10
601.33.1.1	0.58	24	39	1.67	3.1997	2.34	0.1025	2.51	1669	46	-6
601.22.1.1	3.11	7	11	1.48	3.4870	4.11	0.0846	10.6	1307	207	-28

1. %$^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.

2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.

3. All errors quoted as 1σ.

6. UNNAMED GRANODIORITE: 2009087016

GA Sample ID:	**2009087016**
GA Sample Number:	**1999614**
1:250,000 Sheet:	**HUCKITTA**
Region:	**Arunta, Northern Territory**
Grid Reference:	**615443 7493058 MGA94 Zone 53**
Collector:	**N. Kositcin, D. Champion, J. Whelan, D. Huston.**
Collection Date:	**20th June - 26th June 2009**
Formal Name:	**not defined**
Informal Name:	**Pgn**
Lithology:	**biotite granodiorite**
Geochronologist:	**N. Kositcin**
Mount ID:	**GA6132**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**26-31/7/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.84% (1σ) (46 of 46)**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.0 ± 1.4 (45 of 46)**
Interpreted Age:	**1773 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**

Sample Description

Unnamed granodiorite, Pgn, intrudes the Bonya Schist and occurs as isolated tors on plains in the Northern Bonya Hills (Shaw et al., 1984; Figure 6.1). This sample is a white-grey-green, medium- to coarse-grained biotite granodiorite. It is slightly foliated, contains pink K-feldspar, is locally hornblende-bearing and contains magnetite (magnetic susceptibility values: 20.7, 15.4, 18.5, 18.9, 20.4, 16.8×10^{-3} SI units). Previous work consists of a Rb-Sr isochron age of 1812 ± 85 Ma (Black, 1980). Black (1980) regarded Pgn as a phase of the Jinka Granite (Pgi), however, these two granites are lithologically distinct.

Figure 6.1. *Outcrop photo of unnamed granodiorite, sample 2009087016.*

Zircon Description

Zircons from this sample range from ~30 μm to 300 μm in length, and are translucent, colourless, or, more typically, various shades of red-brown in colour (Figure 6.2). Zircons from this sample occur as euhedral to subhedral grains and fragments, typically with aspect ratios between 1:1 and 1:3. Cathodoluminescence (CL) imaging shows concentric, oscillatory internal zonation in most grains. In many cases, oscillatory zoning in these grains appears to have broadened, and the zone boundaries have become more diffuse, suggesting secondary fluid alteration of primary igneous grains (Figure 6.2). Some grains show evidence for small, older cores.

Analysed zircons from unnamed granodiorite sample 2009087016 have a small range of Th/U values between 0.72 and 0.21. Th and U contents are between 473-50 ppm and 813-137 ppm, respectively.

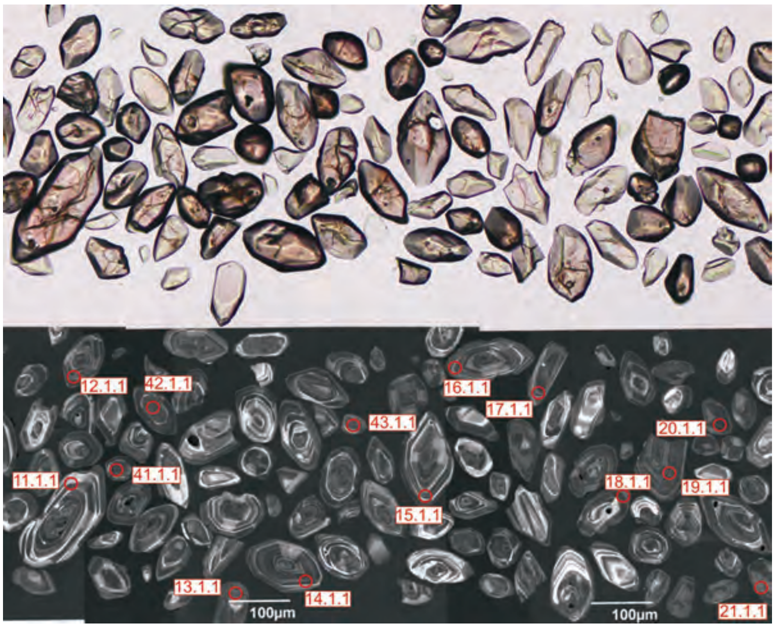

Figure 6.2. *Representative transmitted light and cathodoluminescence images of zircons from unnamed granodiorite (2009087016), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 46 analyses were collected from 46 individual zircon grains from sample 2009087016, the results of which are shown in Table 6.1 and illustrated in 6.3 and 6.4. Common Pb ($^{206}Pb_c$) contents are generally low, but range between zero and 0.88 %. Seven analyses are discordant, and trend away from the main cluster in a trajectory consistent with minor Pb-loss. Two analyses on older, inherited grains (43.1.1, 1912 ± 6 Ma; and 8.1.1, 1854 ± 8 Ma), are excluded from age calculations. Excluding only the two inherited grains, the remaining 44 analyses define a discordia with upper and lower intercept ages of 1772.6 ± 3.4 Ma and 381 ± 84 Ma (95% confidence, MSWD = 1.07; probability = 0.36) (Figure 6.4).

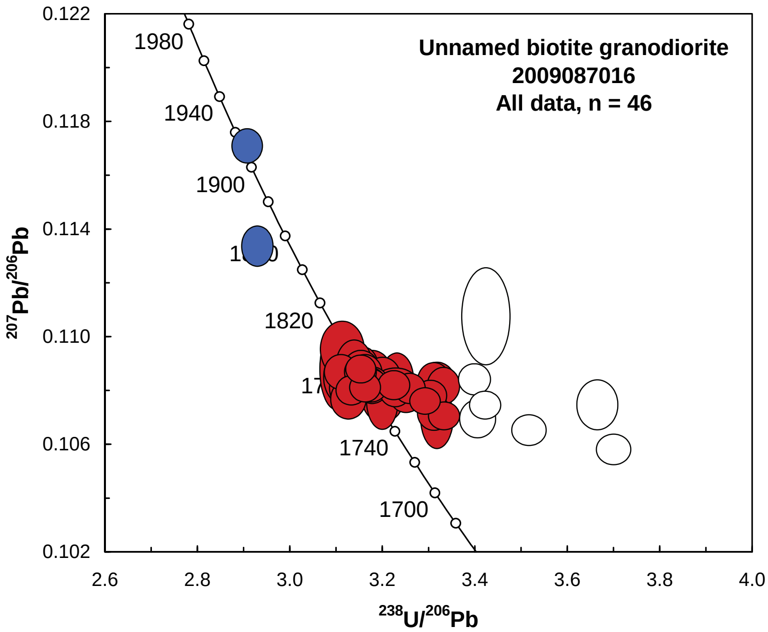

Figure 6.3. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from unnamed granodiorite (2009087016). Unfilled ellipses represent analyses that have not been included in the mean age calculation (discordant and/or high common Pb). Blue ellipses are inherited grains, and are not included in the mean age calculation.*

The 37 concordant analyses form a coherent group with a weighted $^{207}Pb/^{206}Pb$ mean age of 1768 ± 3 Ma (95% confidence, MSWD = 1.18, probability = 0.21). Despite the acceptable statistical grouping of these 37 analyses, the evidence for non-zero Pb-loss suggests this mean age is likely to be a slight underestimate of the true age.

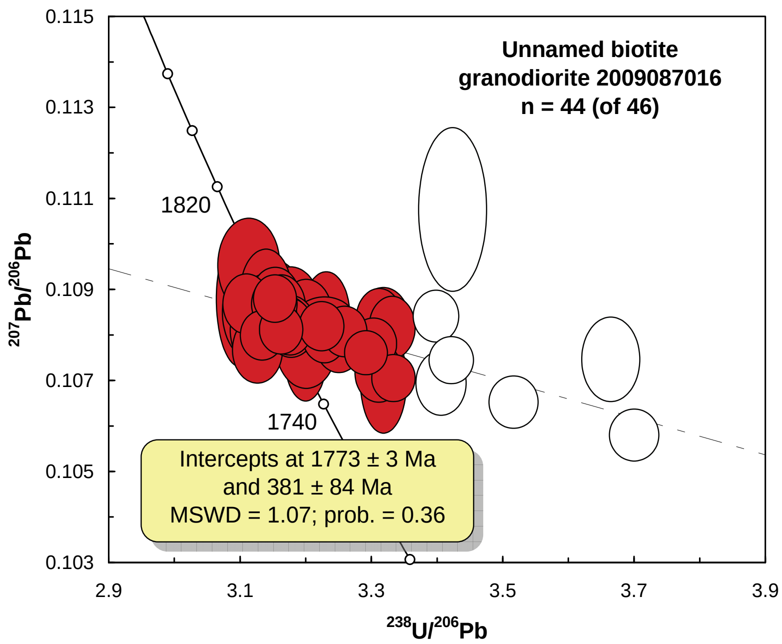

Figure 6.4. *Tera-Wasserburg concordia diagram showing results of all zircon analyses from unnamed granodiorite sample 2009087016.*

Geochronological Interpretation

The upper intercept age of 1773 ± 3 Ma is interpreted as the igneous crystallisation age of this rock. A lower intercept age defined by discordant analyses is suggestive of isotopic disturbance during the Alice Springs Orogeny (450-300 Ma). Minor older inheritance is indicated with ages of 1912 ± 6 Ma and 1854 ± 8 Ma.

Table 6.1. SHRIMP U-Pb isotopic data for sample 2009087016, unnamed granodiorite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
614.34.1.1	0.22	391	186	0.49	3.1018	0.76	0.1088	0.90	1779	16	-1
614.16.1.1	0.04	382	129	0.35	3.1120	0.76	0.1087	0.40	1778	7	-1
614.38.1.1	0.05	172	72	0.43	3.1150	0.99	0.1095	0.63	1792	11	0
614.2.1.1	0.01	137	50	0.38	3.1256	1.07	0.1085	0.67	1774	12	-1
614.28.1.1	0.10	249	99	0.41	3.1280	0.86	0.1081	0.52	1768	10	-1
614.37.1.1	0.06	334	131	0.41	3.1283	0.80	0.1077	0.45	1760	8	-2
614.36.1.1	0.03	574	202	0.36	3.1352	0.70	0.1080	0.34	1766	6	-1
614.13.1.1	0.02	250	100	0.41	3.1411	0.88	0.1085	0.54	1774	10	-1
614.6.1.1	0.02	689	383	0.57	3.1414	0.82	0.1089	0.58	1782	10	0
614.27.1.1	0.02	527	244	0.48	3.1537	0.72	0.1087	0.36	1777	7	0
614.46.1.1	0.03	526	181	0.36	3.1544	0.71	0.1084	0.36	1773	7	0
614.20.1.1	0.02	645	246	0.39	3.1548	0.68	0.1088	0.32	1779	6	0
614.21.1.1	0.01	315	132	0.43	3.1552	0.80	0.1088	0.44	1779	8	0
614.18.1.1	0.08	534	183	0.35	3.1636	0.71	0.1085	0.69	1774	13	0
614.26.1.1	0.04	364	158	0.45	3.1644	0.78	0.1086	0.43	1776	8	0
614.23.1.1	0.04	606	281	0.48	3.1645	0.69	0.1081	0.33	1768	6	0
614.42.1.1	0.04	399	118	0.31	3.1737	0.74	0.1082	0.39	1770	7	0
614.39.1.1	0.09	459	236	0.53	3.1780	0.71	0.1082	0.38	1769	7	0
614.32.1.1	0.10	188	83	0.45	3.1786	0.96	0.1085	0.62	1774	11	1
614.45.1.1	0.03	343	170	0.51	3.1797	0.77	0.1082	0.42	1769	8	0

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
614.3.1.1	0.03	621	239	0.40	3.2015	0.68	0.1076	0.65	1759	12	0
614.7.1.1	0.05	304	109	0.37	3.2024	0.83	0.1084	0.49	1773	9	1
614.41.1.1	0.03	505	208	0.43	3.2025	0.95	0.1078	0.58	1762	11	1
614.14.1.1	0.01	574	242	0.44	3.2257	0.69	0.1082	0.33	1769	6	2
614.29.1.1	0.10	542	318	0.61	3.2297	0.71	0.1080	0.39	1766	7	2
614.25.1.1	0.03	543	234	0.45	3.2299	0.96	0.1083	0.34	1771	6	2
614.31.1.1	0.04	476	170	0.37	3.2331	0.72	0.1084	0.58	1773	11	2
614.15.1.1	0.07	455	154	0.35	3.2520	0.73	0.1078	0.39	1763	7	2
614.30.1.1	0.03	587	271	0.48	3.2606	0.69	0.1081	0.34	1767	6	3
614.33.1.1	0.05	750	294	0.40	3.2931	0.66	0.1076	0.30	1759	5	3
614.19.1.1	-0.01	545	191	0.36	3.3046	0.70	0.1078	0.35	1763	6	4
614.11.1.1	0.12	469	204	0.45	3.3126	0.72	0.1072	0.40	1752	7	3
614.24.1.1	0.19	484	205	0.44	3.3130	0.72	0.1083	0.43	1772	8	5
614.12.1.1	0.05	568	235	0.43	3.3192	0.70	0.1070	0.71	1749	13	3
614.4.1.1	0.04	337	117	0.36	3.3198	0.80	0.1083	0.47	1771	9	5
614.1.1.1	0.23	545	186	0.35	3.3327	0.69	0.1082	0.42	1769	8	5
614.44.1.1	0.07	644	299	0.48	3.3344	0.66	0.1071	0.32	1750	6	4
inherited grains											
614.43.1.1	0.00	380	167	0.45	2.9110	0.75	0.1171	0.36	1912	6	1
614.8.1.1	0.04	602	422	0.72	2.9319	0.76	0.1134	0.44	1854	8	-2
discordant and/or high common Pb											
614.5.1.1	0.12	715	355	0.51	3.3992	0.67	0.1084	0.35	1773	6	7
614.17.1.1	0.11	417	161	0.40	3.4064	0.74	0.1069	0.44	1748	8	6
614.9.1.1	0.10	813	473	0.60	3.4221	0.65	0.1074	0.32	1757	6	7
614.35.1.1	0.88	173	61	0.36	3.4239	1.00	0.1108	1.07	1812	20	10
614.10.1.1	0.05	539	249	0.48	3.5170	0.69	0.1065	0.35	1741	6	8
614.22.1.1	0.12	414	85	0.21	3.6637	0.80	0.1075	0.57	1757	10	13
614.40.1.1	0.14	581	229	0.41	3.6992	0.67	0.1058	0.36	1728	7	12

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.

2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.

3. All errors quoted as 1σ.

7. UNNAMED GRANODIORITE: 2009087024

GA Sample ID:	**2009087024**
GA Sample Number:	**1999622**
1:250,000 Sheet:	**HUCKITTA**
Region:	**Arunta, Northern Territory**
Grid Reference:	**610475 7495067 MGA94 Zone 53**
Collector:	**N. Kositcin, D. Champion, J. Whelan, D. Huston.**
Collection Date:	**20th June - 26th June 2009**
Formal Name:	**not defined**
Informal Name:	**Pgf**
Lithology:	**biotite granodiorite**
Geochronologist:	**N. Kositcin**
Mount ID:	**GA6132**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**26-31/7/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.84% (1σ) (46 of 46)**
^{207}Pb/^{206}Pb Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.0 ± 1.4 (45 of 46)**
Interpreted Age:	**1774 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**

Sample Description

Unnamed biotite granodiorite, Pgf, intrudes the Bonya Schist and Mascotte Gneiss Complex, and occurs in the Northern Bonya Hills, occupying low-lying areas, dotted with low irregular and rough hills. The sample is a cream-coloured, medium-grained, foliated, locally porphyritic non-magnetic muscovite granodiorite. The specimen is visually estimated to consist of alkali feldspar (>60%), quartz (~25%), plagioclase, commonly altered to sericite (~5%), muscovite and biotite (~4%) and secondary chlorite.

Zircon Description

Zircon grains in this sample are euhedral to subhedral grains and fragments, typically 50 µm to 200 µm in length (Figure 7.1). Aspect ratios vary between 1:1 and 1:4.

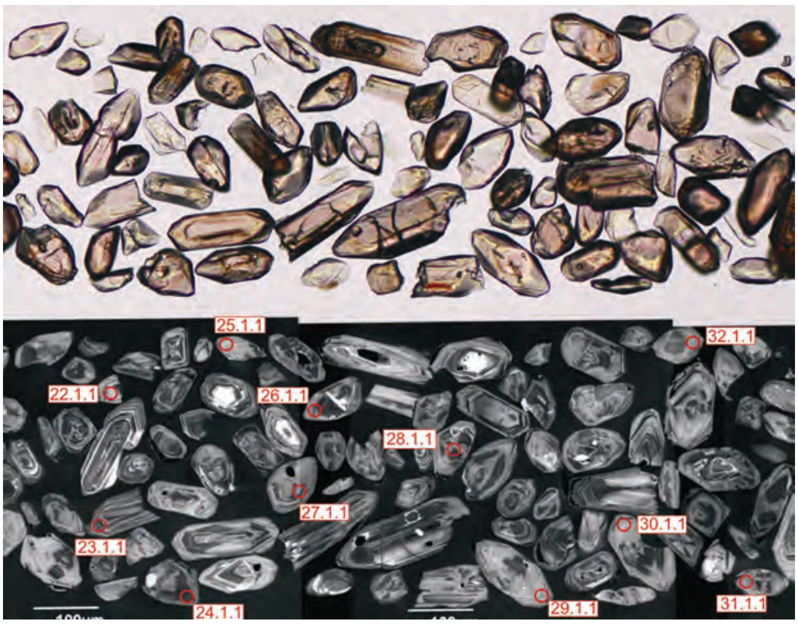

Figure 7.1. *Representative transmitted light and cathodoluminescence images of zircons from unnamed granodiorite (2009087024), with locations of some SHRIMP analyses.*

A small portion of zircon grains are clear to colourless in transmitted light, but the majority are varying shades of red-brown in colour. Most grains are cracked and contain inclusions. In cathodoluminescence (CL) images, the zircon grains have patterns characterised by concentric oscillatory zoning that, in most cases, appears to have been subsequently modified to a rather mottled appearance, with some fine-scale oscillatory zones having become darker and broader, a texture suggestive of secondary fluid alteration of metamict portions of the zircons. Thus, internal zoning appears to have been modified by internal recrystallisation (Figure 7.1).

Analysed zircons from unnamed granodiorite sample 2009087024 have a small range of Th/U values between 0.62 and 0.27. Th and U contents are between 460-121 ppm and 1278-343 ppm, respectively.

U-Pb Isotopic Results

A total of 37 analyses were collected on 37 different zircon grains from sample 2009087024, the results of which are shown in Table 7.1 and illustrated in Figure 7.2. Common Pb ($^{206}Pb_c$) contents are low, ranging between 0.63 and 0.01%. Nineteen of these 37 analyses are discordant and/or contain high common Pb. These analyses trend away from the main cluster defining a trajectory consistent with Pb-loss (and are higher in U and Th compared to concordant analyses, see Table 7.1), and all grains define a discordia with upper and lower discordia intercepts of 1773.7 ± 4.8 Ma and 456 ± 25 Ma (95% confidence, MSWD = 1.5, probability = 0.025) (Figure 7.2).

The 18 concordant analyses define a weighted mean $^{207}Pb/^{206}Pb$ age of 1768.1 ± 3.3 Ma (95% confidence, MSWD = 1.17, probability = 0.28). Near-concordant zircons from this sample contain between 817 and 343 ppm U, with Th/U ratios between 0.604 and 0.347.

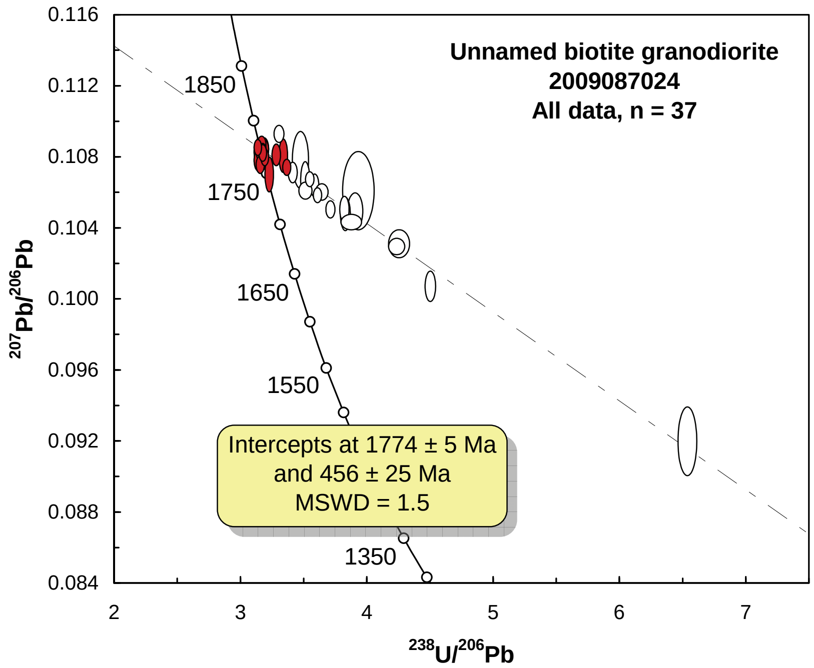

Figure 7.2. Tera-Wasserburg concordia diagram showing results of all zircon analyses from unnamed granodiorite sample 2009087024.

Geochronological Interpretation

The upper intercept age of 1774 ± 5 Ma is interpreted as the crystallisation age of this rock, given the evidence for non-zero Pb-loss. Ancient lead loss during the Alice Springs Orogeny is indicated by the lower intercept age (~450 Ma).

Table 7. SHRIMP U-Pb isotopic data for zircons from sample 2009087024, unnamed granodiorite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
622.27.1.1	0.01	606	366	0.62	3.1792	0.67	0.1087	0.30	1777	6	1
622.20.1.1	0.02	817	453	0.57	3.1464	0.64	0.1085	0.27	1775	5	0
622.6.1.1	0.02	445	175	0.41	3.1984	0.72	0.1085	0.37	1774	7	1
622.2.1.1	0.02	611	223	0.38	3.2033	0.67	0.1084	0.31	1773	6	1
622.24.1.1	0.02	623	218	0.36	3.1651	0.67	0.1083	0.31	1771	6	0
622.14.1.1	0.03	343	121	0.36	3.1564	0.77	0.1083	0.42	1771	8	0
622.10.1.1	0.01	655	381	0.60	3.1873	0.66	0.1083	0.30	1770	5	1
622.19.1.1	0.02	661	277	0.43	3.1528	0.66	0.1082	0.49	1770	9	0
622.34.1.1	0.05	366	154	0.44	3.1647	0.76	0.1082	0.41	1770	8	0
622.21.1.1	0.03	784	302	0.40	3.1891	0.64	0.1082	0.28	1770	5	1
622.15.1.1	0.13	564	196	0.36	3.2935	0.68	0.1081	0.37	1768	7	4
622.23.1.1	0.25	679	256	0.39	3.3490	0.66	0.1081	0.57	1767	10	5
622.36.1.1	0.04	748	270	0.37	3.2053	0.65	0.1080	0.29	1766	5	1
622.1.1.1	0.06	373	187	0.52	3.1695	0.74	0.1079	0.40	1764	7	0
622.37.1.1	0.01	418	181	0.45	3.1528	0.74	0.1078	0.38	1763	7	-1
622.5.1.1	0.02	619	264	0.44	3.1678	0.67	0.1076	0.31	1758	6	-1
622.4.1.1	0.01	778	382	0.51	3.3783	0.67	0.1074	0.28	1756	5	5
622.8.1.1	0.05	614	364	0.61	3.2401	0.67	0.1070	0.61	1749	11	1
discordant and/or high common Pb											
622.28.1.1	0.07	502	251	0.52	3.4248	0.70	0.1071	0.35	1751	6	6
622.9.1.1	0.63	417	243	0.60	3.4857	1.17	0.1078	0.98	1763	18	9
622.35.1.1	0.25	1108	357	0.33	3.3163	0.77	0.1093	0.29	1788	5	6
622.25.1.1	0.02	1070	460	0.44	3.5594	0.61	0.1067	0.25	1745	5	10
622.7.1.1	0.03	470	127	0.28	3.5222	0.70	0.1067	0.64	1744	12	9
622.31.1.1	0.16	798	309	0.40	3.5965	0.64	0.1064	0.40	1739	7	10
622.26.1.1	0.01	733	314	0.44	3.5231	0.96	0.1061	0.29	1734	5	8
622.22.1.1	0.57	1149	299	0.27	3.9413	2.06	0.1061	1.38	1733	25	18
622.18.1.1	0.02	795	268	0.35	3.6500	0.88	0.1060	0.29	1732	5	11
622.30.1.1	0.04	939	421	0.46	3.6190	0.63	0.1058	0.27	1729	5	10
622.33.1.1	0.04	802	445	0.57	3.7200	0.64	0.1051	0.30	1715	6	12
622.12.1.1	0.03	917	426	0.48	3.8322	0.62	0.1050	0.47	1715	9	14
622.16.1.1	0.09	676	204	0.31	3.9162	1.04	0.1050	0.64	1714	12	16
622.13.1.1	0.03	825	339	0.42	3.8395	0.65	0.1048	0.59	1711	11	14
622.32.1.1	0.03	917	399	0.45	3.8854	1.32	0.1043	0.28	1702	5	15
622.11.1.1	0.02	908	357	0.41	4.2645	1.30	0.1031	0.50	1681	9	21
622.29.1.1	0.04	986	406	0.42	4.2449	0.97	0.1030	0.29	1678	5	21
622.17.1.1	0.03	997	398	0.41	4.5094	0.62	0.1007	0.57	1637	11	23
622.3.1.1	0.50	1278	426	0.34	6.5313	0.75	0.0920	1.39	1467	26	40

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.

2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.

3. All errors quoted as 1σ.

8. UNNAMED GRANODIORITE: 2009087027

GA Sample ID:	**2009087027**
GA Sample Number:	**1999626**
1:250,000 Sheet:	**HUCKITTA**
Region:	**Arunta, Northern Territory**
Grid Reference:	**609434 7487053 MGA94 Zone 53**
Collector:	**N. Kositcin, D. Champion, J. Whelan, D. Huston.**
Collection Date:	**20th June - 26th June 2009**
Formal Name:	**not defined**
Informal Name:	**not defined**
Lithology:	**feldspar porphyritic granodiorite**
Geochronologist:	**N. Kositcin**
Mount ID:	**GA6134**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**9-16/8/2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.78% (1σ) (56 of 57)**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3463.4 ± 1.1 (56 of 57)**
Interpreted Age:	**1789 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**

Sample Description

This sample was collected from a previously unmapped, unnamed granodiorite outcrop, situated adjacent to the Bonya Vein Cu Deposit. This sample is a deformed, fine-grained, sparsely feldspar-porphyritic biotite granodiorite. This granite contains sulphides (chalcopyrite appears to be vein-related, at least in one case), is chloritic in places, and is relatively non-magnetic (magnetic susceptibility values: 5.3, 5.9, 6.6, 7.9 $\times 10^{-3}$ SI units).

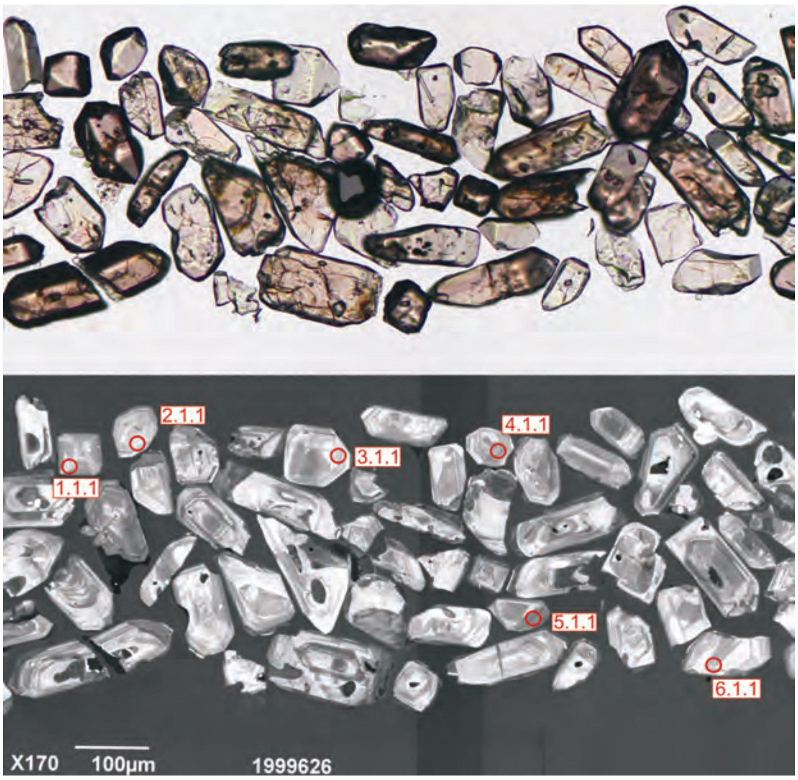

Figure 8.1. Representative transmitted light and cathodoluminescence images of zircons from unnamed granodiorite (2009087027), with locations of some SHRIMP analyses.

Zircon Description

Zircons from this sample average 100-200 µm in length, with some up to 300 µm in length, and have a common tabular morphology. Aspect ratios are typically 1:2 and 1:3. The zircons are euhedral to subhedral, tabular grains, and contain numerous inclusions. Grains range from relatively colourless and light pink varieties to darker pink and brown grains (Figure 8.1). In cathodoluminescence (CL) imaging, the majority of grains exhibit fine-scaled oscillatory zonation, with sector zoning evident in some grains. Angular or rounded cores, typically of medium to darker CL response, occur in numerous grains. Fine-scale oscillatory zones have become darker and broader in some cases, this mottled texture suggestive of secondary fluid alteration of metamict portions of the zircons (Figure 8.1).

Analysed zircons from unnamed granodiorite sample 2009087027 have a small range of Th/U values between 0.66 and 0.35. Th and U concentrations are between 188-47 ppm and 317-93 ppm, respectively.

U-Pb Isotopic Results

A total of 40 analyses were collected from 40 individual zircon grains from sample 2009087027, the results of which are shown in Table 8.1 and illustrated in Figure 8.2. Common Pb ($^{206}Pb_c$) contents are uniformly low, ranging between 0.26 and 0.00%. All analyses are concordant and contain <0.3% $^{206}Pb_c$. All 40 analyses define a single age population with a weighted mean $^{207}Pb/^{206}Pb$ age of 1788.5 ± 3.1 Ma (95% confidence; MSWD = 1.11, probability = 0.29) (Figure 8.2).

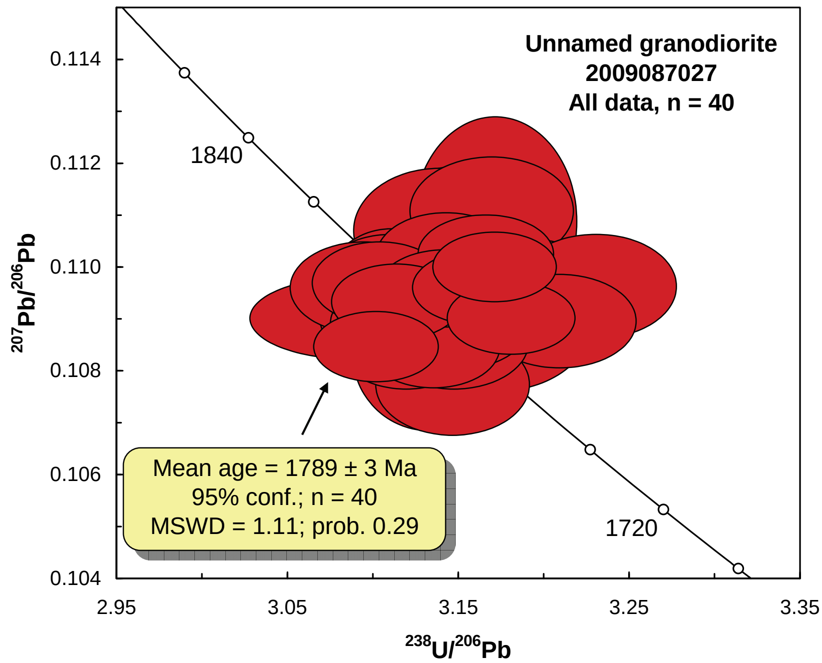

Figure 8.2. *Tera-Wasserburg concordia diagram showing results of concordant zircon analyses for unnamed granodiorite sample 2009087027.*

Geochronological Interpretation

The weighted mean $^{207}Pb/^{206}Pb$ age of 1789 ± 3 Ma is interpreted as the crystallisation age of this granodiorite.

Table 8.1. SHRIMP U-Pb isotopic data for zircons from sample 2009087027, unnamed granodiorite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
626.7.1.1	-0.04	140	52	0.38	3.1697	0.99	0.1111	0.62	1817	11	3
626.3.1.1	0.13	136	56	0.42	3.1717	0.99	0.1109	1.20	1814	22	3
626.29.1.1	0.13	120	40	0.35	3.1390	1.05	0.1107	0.72	1811	13	2
626.34.1.1	-0.02	168	84	0.52	3.1467	0.93	0.1103	0.99	1804	18	2
626.10.1.1	0.01	250	153	0.63	3.1662	0.82	0.1103	0.45	1804	8	2

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb*$	± (%)	$^{207}Pb*/^{206}Pb*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
626.20.1.1	0.05	210	126	0.62	3.1430	0.85	0.1102	0.50	1803	9	1
626.26.1.1	0.06	317	149	0.49	3.1712	0.75	0.1100	0.40	1799	7	2
626.38.1.1	-0.05	263	157	0.61	3.1044	0.83	0.1097	0.48	1794	9	0
626.1.1.1	0.03	160	79	0.51	3.2304	0.95	0.1096	0.60	1793	11	3
626.5.1.1	0.04	283	174	0.63	3.1617	0.79	0.1096	0.43	1793	8	1
626.21.1.1	0.01	170	77	0.47	3.0955	0.92	0.1096	0.53	1793	10	-1
626.33.1.1	0.00	175	80	0.47	3.1424	0.93	0.1096	0.55	1793	10	1
626.24.1.1	0.04	137	71	0.53	3.1401	0.98	0.1096	0.59	1793	11	1
626.37.1.1	0.02	264	155	0.61	3.1421	0.81	0.1096	0.45	1793	8	1
626.17.1.1	0.13	144	54	0.39	3.1112	0.96	0.1096	0.63	1793	11	0
626.35.1.1	0.04	152	64	0.44	3.1261	0.96	0.1096	0.59	1792	11	0
626.22.1.1	0.08	130	52	0.41	3.1103	1.00	0.1095	0.63	1791	11	0
626.2.1.1	0.10	156	73	0.48	3.1930	0.96	0.1095	0.63	1791	11	2
626.16.1.1	-0.02	154	64	0.43	3.1586	0.96	0.1095	0.59	1791	11	1
626.36.1.1	0.04	170	78	0.47	3.1186	0.93	0.1095	0.57	1791	10	0
626.32.1.1	-0.02	197	97	0.51	3.1201	0.88	0.1094	0.51	1789	9	0
626.28.1.1	0.04	259	154	0.62	3.1143	0.80	0.1093	0.44	1788	8	0
626.6.1.1	0.05	142	68	0.50	3.1868	0.99	0.1093	0.63	1788	11	2
626.12.1.1	0.04	172	74	0.44	3.1113	0.91	0.1093	0.88	1788	16	-1
626.9.1.1	0.10	216	115	0.55	3.1388	0.87	0.1093	0.54	1787	10	0
626.25.1.1	0.05	173	77	0.46	3.1210	0.90	0.1092	0.54	1786	10	0
626.40.1.1	0.05	268	170	0.65	3.1179	0.82	0.1092	0.47	1786	9	0
626.18.1.1	0.01	171	69	0.42	3.1263	0.91	0.1091	0.54	1784	10	0
626.31.1.1	0.26	93	47	0.52	3.1740	1.15	0.1091	0.88	1784	16	1
626.15.1.1	0.05	293	188	0.66	3.1808	0.77	0.1090	0.42	1783	8	1
626.4.1.1	0.04	225	125	0.57	3.0898	1.30	0.1090	0.48	1783	9	-2
626.8.1.1	0.01	173	68	0.41	3.2089	0.91	0.1090	0.55	1782	10	2
626.23.1.1	0.09	183	74	0.42	3.1496	0.89	0.1089	0.55	1782	10	0
626.19.1.1	0.04	227	106	0.48	3.1150	0.84	0.1089	0.50	1781	9	-1
626.14.1.1	0.06	170	69	0.42	3.1476	0.91	0.1086	0.55	1775	10	0
626.30.1.1	0.04	301	180	0.62	3.1023	0.77	0.1085	0.41	1774	8	-2
626.39.1.1	0.05	241	133	0.57	3.1198	0.83	0.1084	0.49	1774	9	-1
626.11.1.1	0.09	262	138	0.54	3.1356	0.81	0.1084	0.47	1773	9	-1
626.13.1.1	0.13	162	80	0.51	3.1327	0.94	0.1083	0.92	1772	17	-1
626.27.1.1	0.09	158	75	0.49	3.1468	0.94	0.1077	0.60	1761	11	-1

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.

2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.

3. All errors quoted as 1σ.

9. MARSHALL GRANITE: 2010080002

GA Sample ID:	**2010080002**
GA Sample Number:	**2115103**
1:250,000 Sheet:	**HUCKITTA**
Region:	**Arunta, Northern Territory**
Grid Reference:	**551201 7489806 AGD84 Zone 53**
Collector:	**J. Whelan, D. Close, R. Korsch, D. Huston, N. Kositcin**
Collection Date:	**June 2010**
Formal Name:	**Marshall Granite**
Informal Name:	**Pgm**
Lithology:	**foliated biotite monzogranite**
Geochronologist:	**C. Magee**
Mount ID:	**GA6149**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**12-13 December 2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.64% (1σ) (31 of 32)**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.3 ± 2.1 (22 of 23)**
Interpreted Age:	**1791 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**

Sample Description

The term Marshall Granite was applied by Smith (1964) to a weathered, pink, slightly foliated granite which crops out 5-15 km northwest of Mount Sainthill. The Marshall Granite crops out in steep-sided, blocky hills capped by partly silicified rock and covered by spinifex (Figure 9.1). It intrudes both the Deep Bore and Cackleberry Metamorphics, and is intruded by a small plug of diorite (sample 2010080003) and overlain by the basal unit of the Georgina Basin (Shaw et al., 1984).

Figure 9.1. (left) *Hills of Marshall Granite.*

The sample taken for SHRIMP analysis was a weakly foliated to massive, pink, medium-grained biotite-hornblende granite, containing pink K-feldspar, quartz, yellow-orange plagioclase and dark brown hornblende, with rare biotite and epidote. Dykes and veins of aplite, pegmatite and quartz are common.

Zircon Description

Sample 2010080002 consists of euhedral equant to prismatic zircon crystals, with occasional fragments. Grainsize is 90-350 µm, and aspect ratios range between 1:1 and 1:4. Cathodoluminescence (CL) is moderate. Igneous concentric oscillatory zoning is present, but is often overprinted by a chaotic, randomly oriented CL pattern (Figure 9.2). Zircons are yellow to brown in transmitted light, with numerous cracks and rare small inclusions. There are no signs of multiple populations, overgrowth, or inheritance. Analysed zircons from Marshall Granite sample 2010080002 have a range of Th/U values between 0.72 and 0.14. Th and U concentrations are between 978-124 ppm and 2153-267 ppm, respectively.

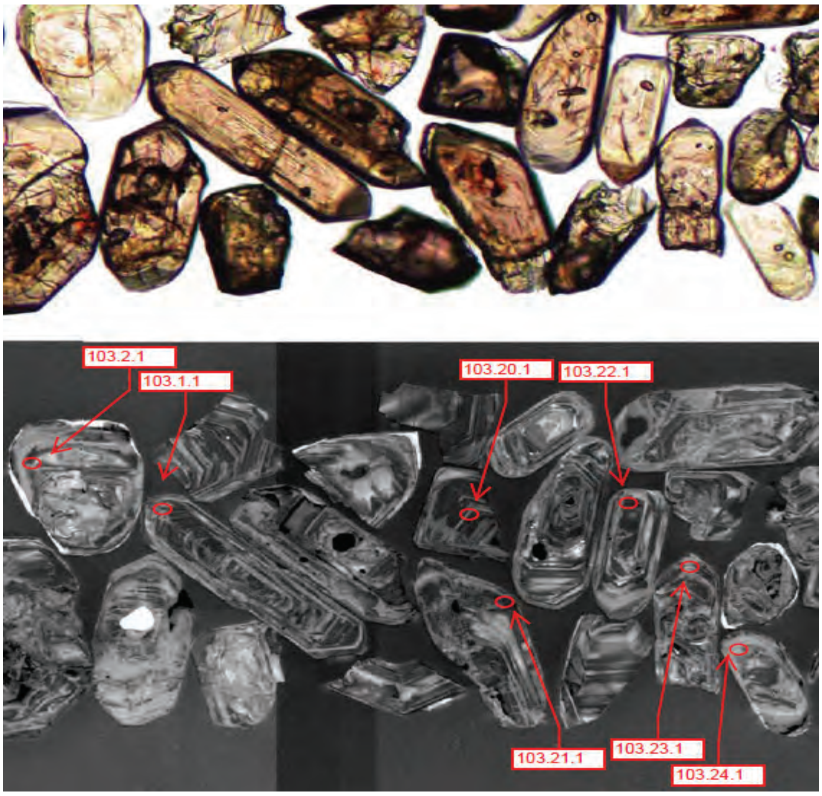

Figure 9.2. *Representative transmitted light and cathodoluminescence images of zircons from the Marshall Granite (2010080002), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 37 analyses were collected from 37 individual zircons grains from sample 2010080002, the results of which are shown in Table 9.1 and illustrated in Figure 9.3. Common Pb ($^{206}Pb_c$) contents are generally low, ranging between 0.71 and 0.01%. Ten analyses were greater than 5% discordant, and are not included in the mean age calculation.

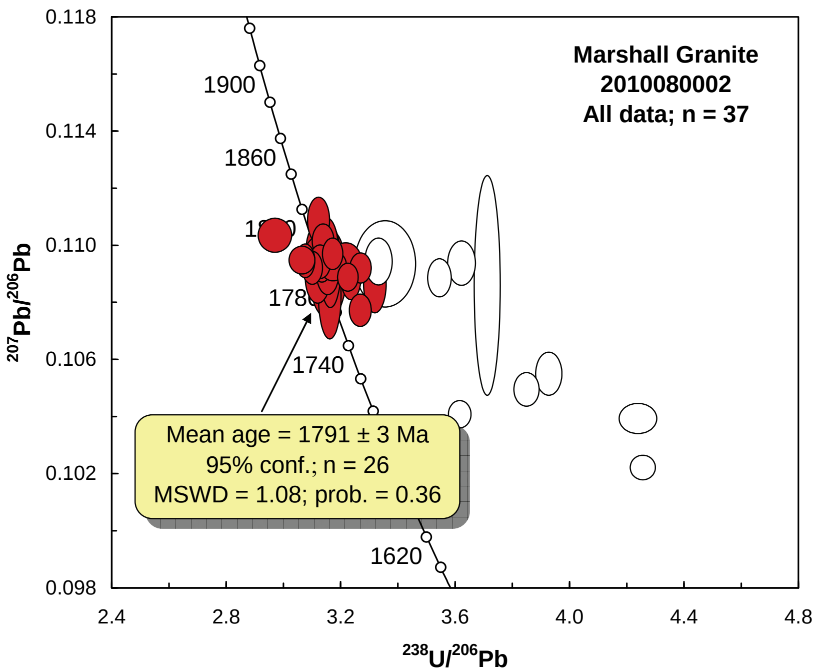

Figure 9.3. *Tera-Wasserburg concordia diagram showing all data for sample 2010080002, Marshall Granite. White error ellipses are excluded from interpretation due to excess discordance or common lead.*

Twenty-six of the remaining 27 grains form a coherent group with a weighted mean age ^{207}Pb /^{206}Pb age of 1790.9 ± 2.9 Ma (95% confidence, MSWD = 1.08; probability = 0.36; Figure 9.3). This MSWD is consistent with a single population. The remaining grain was younger, at 1762 Ma. The reason for this discrepancy is not clear (e.g., Pb loss).

Geochronological interpretation

The weighted mean age of 1791 ± 3 Ma is interpreted as the crystallisation age of this granite.

Table 9.1. SHRIMP U-Pb isotopic data for zircons from sample 2010080002, Marshall Granite.

Spot name	^{206}Pb$_c$ (%)	U (ppm)	Th (ppm)	^{232}Th/^{238}U	^{238}U/^{206}Pb*	± (%)	^{207}Pb*/^{206}Pb*	± (%)	^{207}Pb/^{206}Pb Age (Ma)	± (1σ)	Disc. %
103.2.1.1	0.05	420	165	0.41	3.1401	0.82	0.1096	0.43	1792	8	1
103.3.1.1	0.44	628	297	0.49	3.1467	1.35	0.1090	0.97	1783	18	0
103.4.1.1	0.07	524	244	0.48	3.2097	1.13	0.1095	0.38	1790	7	3
103.5.1.1	0.14	399	161	0.42	3.1529	0.82	0.1083	0.93	1770	17	0
103.6.1.1	0.12	770	537	0.72	3.2604	0.74	0.1092	0.32	1786	6	4
103.7.1.1	0.01	560	256	0.47	3.0917	0.78	0.1092	0.35	1786	6	-1
103.8.1.1	0.09	569	303	0.55	2.9602	1.31	0.1104	0.36	1805	7	-5
103.9.1.1	0.06	647	235	0.38	3.2603	0.79	0.1077	0.35	1762	6	2
103.10.1.1	0.09	267	150	0.58	3.1113	0.89	0.1089	0.53	1780	10	-1
103.11.1.1	0.05	652	369	0.58	3.1642	0.76	0.1097	0.33	1795	6	2
103.13.1.1	0.23	801	496	0.64	3.0678	0.74	0.1095	0.35	1791	6	-2
103.14.1.1	0.04	795	373	0.48	3.0561	0.97	0.1095	0.29	1791	5	-2
103.16.1.1	0.05	501	226	0.47	3.1247	0.80	0.1094	0.39	1789	7	0
103.17.1.1	0.52	548	250	0.47	3.1295	1.06	0.1096	0.53	1794	10	0
103.20.1.1	0.04	662	319	0.50	3.1165	1.03	0.1098	0.33	1796	6	0
103.22.1.1	0.09	713	371	0.54	3.1062	0.76	0.1098	0.56	1796	10	0
103.23.1.1	0.02	691	330	0.49	3.1638	0.98	0.1093	0.32	1788	6	1
103.26.1.1	0.25	466	211	0.47	3.1126	0.81	0.1109	0.48	1814	9	1
103.27.1.1	0.03	552	269	0.50	3.1301	0.81	0.1102	0.36	1802	7	1
103.28.1.1	0.09	564	339	0.62	3.3105	0.78	0.1087	0.63	1777	12	5
103.29.1.1	0.05	548	247	0.47	3.1552	0.79	0.1093	0.88	1787	16	1
103.30.1.1	0.02	573	262	0.47	3.1182	0.78	0.1094	0.35	1790	6	0
103.31.1.1	0.04	449	231	0.53	3.1419	0.84	0.1099	0.67	1797	12	1
103.32.1.1	0.06	367	146	0.41	3.1271	0.84	0.1095	0.45	1791	8	0
103.34.1.1	0.06	684	347	0.52	3.2282	0.76	0.1090	0.54	1783	10	3
103.35.1.1	0.03	382	146	0.40	3.1455	0.84	0.1090	0.46	1784	8	0
103.37.1.1	0.06	891	599	0.69	3.2163	0.74	0.1089	0.29	1781	5	2
discordant and/or high common Pb											
103.1.1.1	0.71	681	329	0.50	3.7070	0.80	0.1086	2.34	1776	43	15
103.12.1.1	0.39	637	344	0.56	3.6164	0.91	0.1094	0.47	1789	9	14
103.15.1.1	0.54	632	178	0.29	3.3247	0.96	0.1094	0.49	1790	9	6
103.18.1.1	0.03	886	124	0.14	3.6094	0.73	0.1041	0.30	1698	6	8
103.19.1.1	0.55	760	232	0.32	3.3479	2.10	0.1094	0.92	1789	17	7
103.21.1.1	0.16	547	190	0.36	3.9230	0.78	0.1055	0.47	1723	9	17
103.24.1.1	0.27	712	475	0.69	3.5390	0.75	0.1089	0.41	1781	7	11
103.25.1.1	0.08	948	398	0.43	4.2366	1.03	0.1039	0.34	1696	6	22
103.33.1.1	0.09	783	462	0.61	3.8449	0.75	0.1050	0.37	1714	7	15
103.36.1.1	0.29	2153	978	0.47	4.2542	0.69	0.1022	0.27	1665	5	20

1. %^{206}Pb$_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.
2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.
3. All errors quoted as 1σ.

10. UNNAMED QUARTZ NORITE: 2010080003

GA Sample ID:	**2010080003**
GA Sample Number:	**2115102**
1:250,000 Sheet:	**HUCKITTA**
Region:	**Arunta, Northern Territory**
Grid Reference:	**551220 7489799 AGD84 Zone 53**
Collector:	**J. Whelan, D. Close, R. Korsch, D. Huston, N. Kositcin**
Collection Date:	**June 2010**
Formal Name:	**not defined**
Informal Name:	**not defined**
Lithology:	**quartz norite**
Geochronologist:	**C. Magee**
Mount ID:	**GA6149**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**9-11 December 2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.64% (1σ) (31 of 32)**
^{207}Pb/^{206}Pb Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.3 ± 2.1 (22 of 23)**
Interpreted Age:	**1780 ± 6 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**

Sample Description

This sample was collected from a small body (~200 m across) of what was previously mapped as a quartz norite intruding the Marshall Granite (sample 2010080002). In outcrop the diorite is a blocky, brown, even grained rock consisting of altered plagioclase, biotite and hornblende. In thin section, the rock consists of pervasively sericitised plagioclase, hornblende, biotite, chlorite, apatite and epidote with minor quartz. Primary igneous textures are preserved, however, there is no indication of relict pyroxene, and the sample is more accurately described as a quartz diorite.

Zircon Description

Quartz norite sample 2010080003 consists of euhedral to anhedral prismatic to equant zircon crystals (Figure 10.1). Rounded zircon fragments are common. Grainsize ranges from 100 µm to 300 µm, and aspect ratios are typically 1:1 and 1:2. Cathodoluminescence (CL) is moderate to bright, with concentric zoning. Zircons are colourless, yellow, and brown in transmitted light, with occasional cracks and small inclusions. There are occasional inherited cores.

Analysed zircons from unnamed quartz norite sample 2010080003 have a small range of Th/U values between 0.81 and 0.35. Th and U concentrations are between 780-67 ppm and 1078-142 ppm, respectively. The grains with higher U and Th values were generally discordant.

U-Pb Isotopic Results

A total of 25 analyses were collected on 25 individual zircon grains from sample 2010080003, the results of which are shown in Table 10.1 and illustrated in Figures 10.2 and 10.3. Post analytical images show that all spots landed on their target grains, generally within one spot diameter of the intended target site.

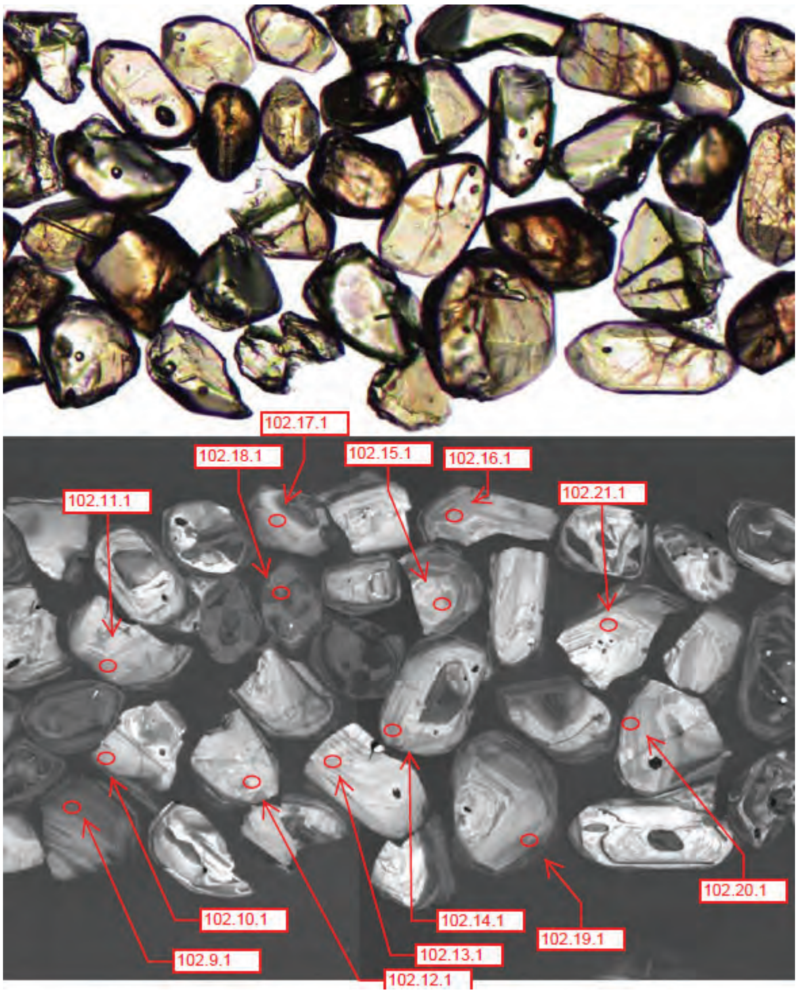

Figure 10.1. *Representative transmitted light and cathodoluminescence images of zircons from unnamed quartz norite (2010080003), with locations of some SHRIMP analyses.*

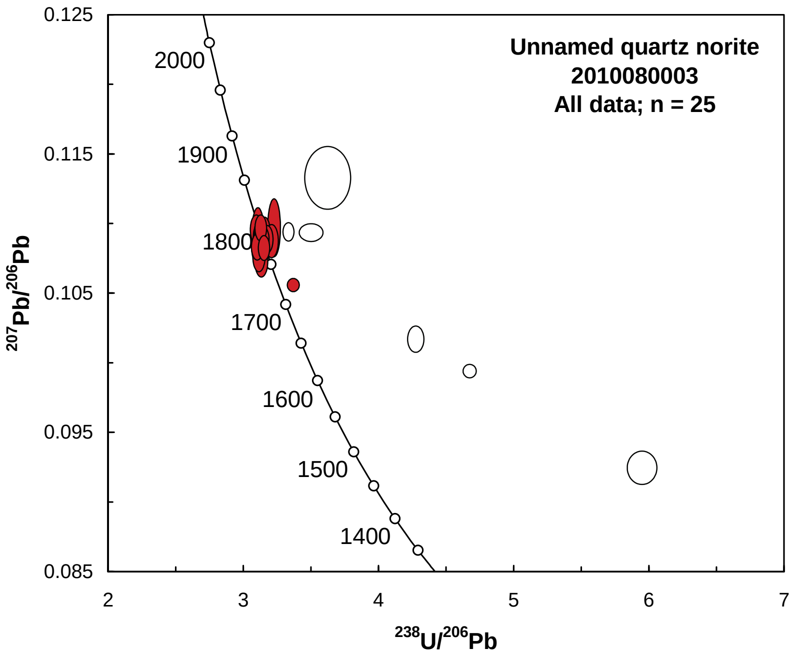

Figure 10.2. *Tera-Wasserburg concordia diagram showing all data for sample 2010080003, unnamed quartz norite. White error ellipses are excluded from interpretation due to excess discordance or common lead.*

Common Pb ($^{206}Pb_c$) contents are uniformly low for all analyses, ranging between 0.22 and 0.01%. Of the 25 analyses collected, 6 were discarded due to discordance of 5% or greater, and are not discussed further. Eighteen analyses form a coherent group yielding a weighted mean age ^{207}Pb /^{206}Pb age of

1779.7 ± 5.6 Ma (95% confidence, MSWD = 0.90; probability = 0.58, Figure 10.3). A single analysis (24.1.1) gives a $^{207}Pb/^{206}Pb$ age of 1725 ± 5 Ma. The significance of this single analysis is not obvious as the analysis site is within a grain centre with no evidence of metamorphic rims, however, it is clearly distinguished from the main group on the basis of U and Th (Figure 10.3).

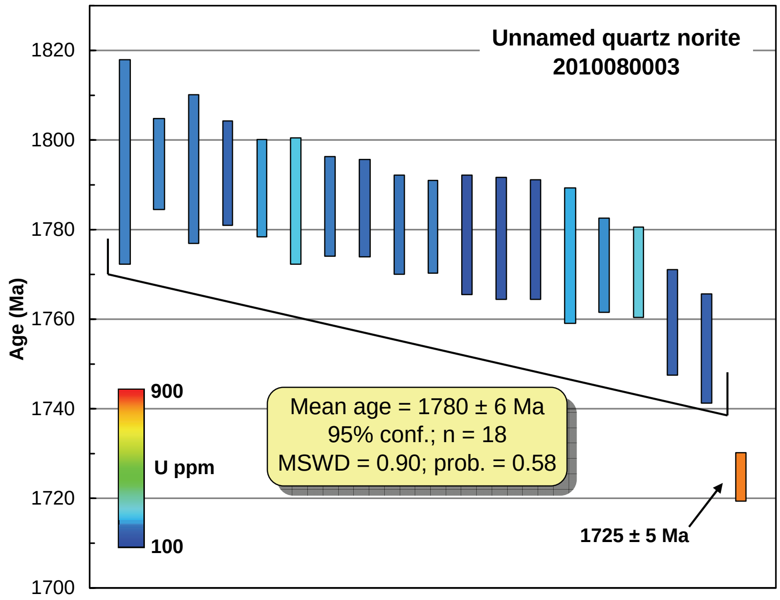

Figure 10.3. *Weighted mean age diagram showing $^{207}Pb/^{206}Pb$ ages of near-concordant zircon analyses from unnamed quartz norite (2010080003), coloured according to U content.*

Geochronological Interpretation

The weighted mean age of 1780 ± 6 Ma is interpreted as the crystallisation age of this quartz norite. The single zircon with higher U and Th and a younger age than the main population, at 1725 ± 5 Ma, may record a metamorphic age (i.e. Strangways), although texturally, this is not conclusive.

Table 10.1. SHRIMP U-Pb isotopic data for zircons from sample 2010080003, unnamed quartz norite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
102.1.1.1	0.16	279	210	0.78	3.1312	0.88	0.1083	0.55	1770	10	-1
102.2.1.1	0.03	174	82	0.49	3.0735	1.00	0.1096	0.64	1792	12	-1
102.4.1.1	0.12	219	111	0.52	3.1013	0.93	0.1094	0.59	1789	11	-1
102.5.1.1	0.10	166	79	0.49	3.1093	1.00	0.1073	0.66	1753	12	-3
102.6.1.1	0.15	150	67	0.46	3.1264	1.03	0.1087	0.73	1778	13	-1
102.7.1.1	0.09	202	72	0.37	3.2052	1.00	0.1097	1.25	1795	23	3
102.10.1.1	0.02	181	68	0.39	3.0999	0.96	0.1091	0.60	1785	11	-1
102.11.1.1	0.02	205	91	0.46	3.1050	0.94	0.1097	0.56	1794	10	0
102.12.1.1	0.09	142	68	0.49	3.1891	1.04	0.1088	0.73	1779	13	1
102.13.1.1	0.07	190	96	0.52	3.1535	0.95	0.1089	0.60	1781	11	0
102.14.1.1	0.02	266	123	0.48	3.1366	0.88	0.1092	0.78	1786	14	0
102.15.1.1	0.09	196	94	0.50	3.1193	0.95	0.1091	0.61	1785	11	0
102.16.1.1	0.03	212	101	0.49	3.0817	0.94	0.1084	0.57	1772	10	-3
102.17.1.1	0.01	197	78	0.41	3.0862	0.95	0.1096	0.91	1793	17	-1
102.19.1.1	0.05	232	94	0.42	3.0812	0.91	0.1085	0.83	1774	15	-2
102.20.1.1	0.02	200	96	0.49	3.1230	0.94	0.1089	0.57	1781	10	-1
102.21.1.1	0.17	150	73	0.50	3.1346	1.55	0.1087	0.75	1778	14	0
102.22.1.1	0.09	168	90	0.56	3.0933	0.99	0.1076	0.64	1759	12	-3
102.24.1.1	0.01	825	342	0.43	3.3475	0.91	0.1056	0.30	1725	5	3
discordant and/or high common Pb											
102.3.1.1	0.04	1004	338	0.35	4.6575	0.72	0.0994	0.33	1613	6	24

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
102.8.1.1	0.04	426	188	0.45	3.3138	0.80	0.1094	0.40	1790	7	6
102.9.1.1	0.22	495	222	0.46	3.6055	3.12	0.1133	1.31	1853	24	17
102.18.1.1	0.13	1078	407	0.39	5.9350	1.24	0.0925	0.85	1477	16	35
102.23.1.1	0.02	498	271	0.56	3.4786	1.68	0.1094	0.39	1789	7	10
102.37.1.1	0.08	990	780	0.81	4.2561	0.90	0.1017	0.61	1655	11	20

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.

2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.

3. All errors quoted as 1σ.

11. UNNAMED GRANITE: HU10JAW037

GA Sample ID:	**HU10JAW037**
GA Sample Number:	**2115099**
1:250,000 Sheet:	**HUCKITTA**
Region:	**Arunta, Northern Territory**
Grid Reference :	**564597 7369038 AGD84 Zone 53**
Collector:	**J. Whelan**
Collection Date:	**29 July 2010**
Formal Name:	**not defined**
Informal Name:	**BOH Phillip 2 borehole granite**
Lithology:	**granite**
Drillhole	**Phillip 2 borehole (1489.1 – 1493.1 m)**
Geochronologist:	**C. Magee**
Mount ID:	**GA6148**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**7-9 December 2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.02% (1σ) (30 of 30)**
^{207}Pb/^{206}Pb Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.1 ± 2.1 (22 of 22)**
Interpreted Age:	**1802 ± 8 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**

Sample Description

This sample was taken from the bottom of petroleum well Phillip 2 drillhole, at a depth of 1489.1 – 1493.1 m. The petroleum well was drilled through the Georgina Basin succession into the basement where it intersected a strongly foliated, pink biotite granite. In hand specimen the granite comprises biotite, muscovite, pink K-feldspar, sericitised plagioclase and quartz (Figure 11.1). The well-developed fabric in the rock is defined by the alignment of biotite and elongate K-feldspar porphyroblasts.

Figure 11.1. *Representative core of unnamed granite HU10JAW037 in Phillip 2 drillhole.*

Zircon Description

Sample HU10JAW037 consists of euhedral to subhedral prismatic zircon crystals, and angular zircon fragments (Figure 11.2). Grain size ranges from 70 µm to 300 µm, with aspect ratios between 1:1 and 1:3. Cathodoluminescence (CL) is modest, laminar concentric banding, with occasional bright grains and numerous dark inclusions. Inclusions and cracks are common in transmitted light. There are no signs of multiple populations, inheritance, or alteration.

Analysed zircons from unnamed granite sample HU10JAW037 have Th/U values between 0.97 and 0.47. Th and U concentrations are between 240-38 ppm and 288-83 ppm, respectively.

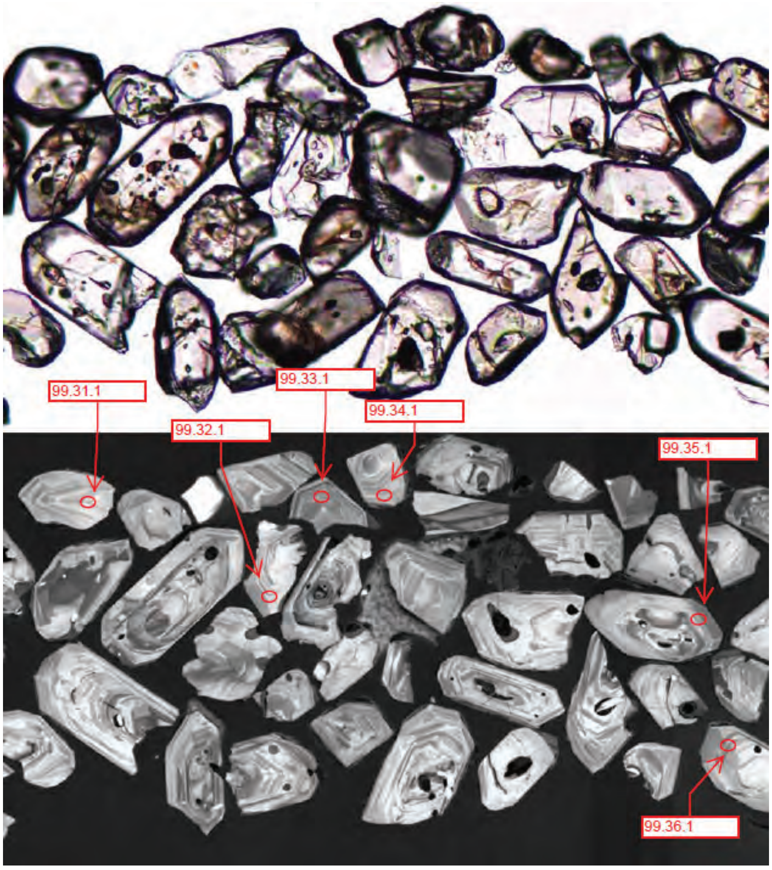

Figure 11.2. *Representative transmitted light and cathodoluminescence images of zircons from unnamed granite (HU10JAW037), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 37 analyses were collected on 37 individual zircon grains from unnamed granite sample HU10JAW037, the results of which are shown in Table 11.1 and illustrated in Figures 11.3-11.4.

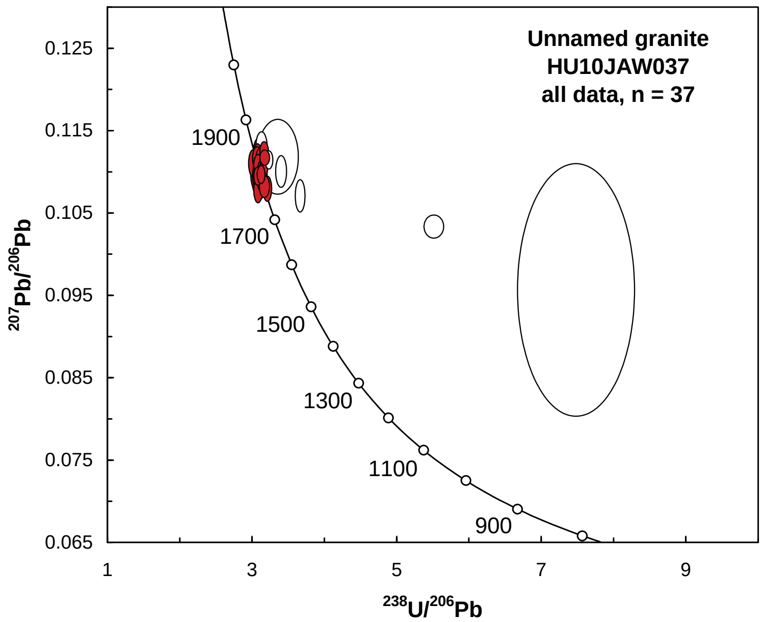

Figure 11.3. *Tera-Wasserburg concordia diagram for all data from unnamed granite (HU10JAW037). White error ellipses are excluded from interpretation due to excess discordance or common Pb.*

Common Pb ($^{206}Pb_c$) contents are reasonably low, and range between 1.52 and 0.01%. Of the 37 analyses collected, 6 were discarded due to discordance of 5% or greater, and four additional grains were discarded due to high (>0.5% ^{206}Pb) common Pb, or spot targeting issues (Figure 11.3, Table 11.1). The remaining 27 concordant analyses form a group with a weighted mean age ^{207}Pb/^{206}Pb age of 1801.8 ± 7.5 Ma (95% confidence, MSWD = 1.5; probability = 0.05; Figure 11.4).

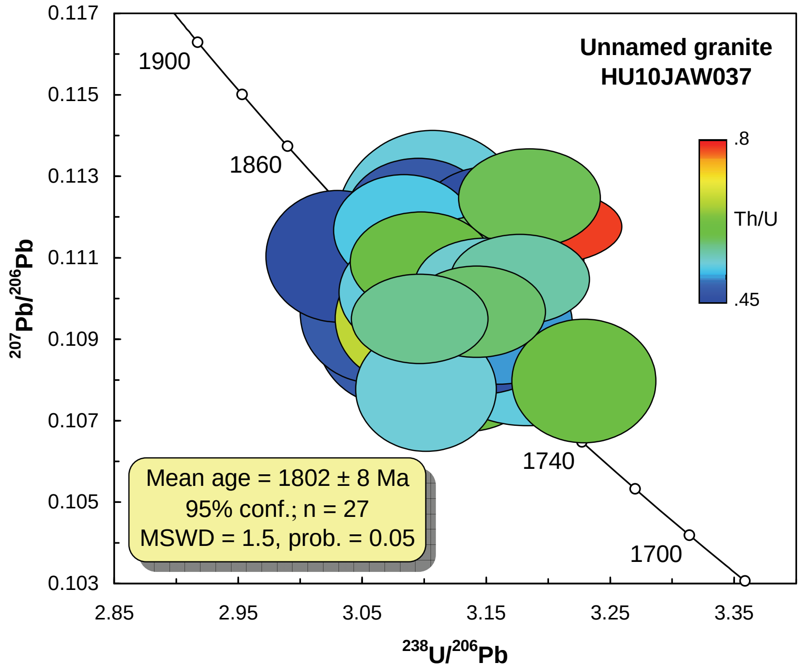

***Figure 11.4.** Tera-Wasserburg concordia diagram for 27 concordant, low common Pb analyses from unnamed granite (HU10JAW037), colour coded by Th/U ratio. No evidence exists for heterogeneous inherited grains or low-Th metamorphic grains.*

Geochronological interpretation

The weighted mean age of 1802 ± 8 Ma is interpreted as the crystallisation age of this granite.

Table 11.1. SHRIMP U-Pb isotopic data for zircons from sample HU10JAW037, unnamed granite.

Spot name	^{206}Pb$_c$ (%)	U (ppm)	Th (ppm)	^{232}Th/^{238}U	^{238}U/^{206}Pb*	± (%)	^{207}Pb*/^{206}Pb*	± (%)	^{207}Pb/^{206}Pb Age (Ma)	± (1σ)	Disc. %
1.1.1	0.12	106	56	0.55	3.1068	1.66	0.1117	1.42	1828	26	+2
2.1.1	0.15	115	60	0.54	3.0840	1.21	0.1117	0.81	1827	15	+1
3.1.1	0.41	125	67	0.55	3.1018	1.20	0.1078	0.93	1762	17	-3
4.1.1	0.30	88	42	0.49	3.0598	1.27	0.1097	1.05	1794	19	-2
5.1.1	0.43	95	45	0.49	3.0719	1.26	0.1092	1.09	1786	20	-2
7.1.1	0.25	83	38	0.47	3.0308	1.25	0.1110	0.96	1817	17	-1
8.1.1	0.32	130	69	0.55	3.0876	1.18	0.1102	0.83	1802	15	-0
9.1.1	0.44	130	87	0.69	3.0841	1.19	0.1095	0.95	1791	17	-1
13.1.1	0.04	84	38	0.47	3.1536	1.27	0.1100	0.87	1799	16	+2
15.1.1	0.10	111	59	0.54	3.1830	1.48	0.1082	0.82	1770	15	+1
16.1.1	-0.01	138	84	0.63	3.0978	1.21	0.1109	0.73	1814	13	+1
17.1.1	0.06	91	43	0.49	3.0956	1.24	0.1120	0.83	1833	15	+2
22.1.1	0.05	105	48	0.47	3.1541	1.23	0.1119	0.80	1830	14	+3
24.1.1	0.03	138	74	0.56	3.1489	1.18	0.1103	0.69	1805	13	+2
25.1.1	0.08	123	71	0.60	3.1473	1.20	0.1108	0.76	1812	14	+2
26.1.1	0.05	163	91	0.58	3.1771	1.16	0.1105	0.66	1807	12	+3
27.1.1	0.07	91	42	0.48	3.1473	1.26	0.1091	0.88	1785	16	+0
28.1.1	0.01	108	56	0.53	3.1458	1.50	0.1117	0.76	1827	14	+3
29.1.1	0.07	90	42	0.48	3.1400	1.86	0.1109	1.46	1815	27	+2
30.1.1	0.16	86	40	0.48	3.1313	1.26	0.1095	0.95	1791	17	+0
31.1.1	0.05	92	47	0.52	3.1604	1.25	0.1106	0.84	1809	15	+2
32.1.1	0.13	99	45	0.47	3.1441	1.60	0.1101	0.87	1801	16	+1
33.1.1	0.07	145	88	0.62	3.1349	1.39	0.1087	1.19	1778	22	-0

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
34.1.1	0.20	109	55	0.52	3.1603	1.23	0.1094	0.90	1789	16	+1
35.1.1	0.05	155	88	0.59	3.0966	1.16	0.1095	0.66	1791	12	-1
36.1.1	0.07	159	92	0.60	3.1422	1.16	0.1097	0.67	1794	12	+1
37.1.1	0.40	173	104	0.62	3.2282	1.18	0.1080	0.93	1765	17	+2
discordant and/or high common Pb											
6.1.1	0.27	166	107	0.67	3.3719	5.60	0.1118	2.69	1830	49	+10
10.1.1	0.63	138	71	0.53	3.4181	1.48	0.1101	1.15	1801	21	+9
11.1.1	0.63	171	144	0.87	3.1066	1.17	0.1113	1.50	1820	27	+1
12.1.1	0.65	137	74	0.56	3.1465	1.54	0.1131	1.07	1849	19	+4
14.1.1	0.07	132	77	0.61	3.1846	1.18	0.1125	0.71	1840	13	+5
18.1.1	1.52	288	240	0.86	7.4689	7.11	0.0957	10.57	1541	199	+50
19.1.1	0.00	201	158	0.81	3.1941	1.34	0.1118	0.55	1828	10	+5
20.1.1	0.23	123	115	0.97	5.5206	1.64	0.1034	0.91	1685	17	+39
21.1.1	0.04	129	107	0.86	3.6750	1.17	0.1071	1.19	1751	22	+13
23.1.1	0.05	165	109	0.68	3.2488	1.16	0.1115	0.65	1823	12	+6

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.

2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.

3. All errors quoted as 1σ.

ILLOGWA CREEK 1:250 000 SHEET AREA

12. ILLOGWA SHEAR ZONE MYLONITE: 2010080001

GA Sample ID:	**2010080001**
GA Sample Number:	**2115104**
1:250,000 Sheet:	**ILLOGWA CREEK**
Region:	**Arunta, Northern Territory**
Grid Reference :	**515585 7395780 AGD84 Zone 53**
Collector:	**R. Korsch, D. Huston, J. Whelan, D. Close**
Collection Date:	**10 June 2010**
Formal Name:	**not defined**
Informal Name:	**Illogwa shear zone mylonite**
Lithology:	**well foliated quartz-biotite schist/mylonite**
Geochronologist:	**C. Magee**
Mount ID:	**GA6148**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**7 December 2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.02% (1σ) (30 of 30)**
^{207}Pb/^{206}Pb Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.1 ± 2.1 (22 of 22)**
Interpreted Age:	**1794 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**
Interpreted Age:	**1769 ± 3 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**zircon recrystallisation event or contact metamorphism**

Sample Description

This is a sample of well foliated quartz-biotite schist/mylonite taken from the Illogwa Shear Zone (Figure 12.1). The Illogwa Shear Zone is a 3-4 km wide north-dipping shear zone which strikes east to southeast over a distance of more than 25 km, south of the Harts Range.

The shear zone, hosted by Paleoproterozoic basement, has been interpreted to have been active during the Alice Springs Orogeny. The protolith has been interpreted to be dominantly igneous and has been intruded by the Aremra Suite (1762 ± 6 Ma, Hollis et al., in prep). This sample comprises biotite, quartz and feldspar, and the fabric is defined by the alignment of biotite.

Figure 12.1 *(left). Outcrop photo of mylonite within Illogwa shear zone.*

Zircon Description

Sample 2010080001 consists of euhedral prismatic zircon crystals, with rounded to angular zircon fragments (Figure 12.2). Grainsize is 50-200 µm, with aspect ratios of 1:1 up to 1:3. Cathodoluminescence (CL) is moderate, with oscillatory concentric zoning. Some CL dark or CL light cores are also present. Zircons are colourless to yellow in transmitted light, with numerous acicular inclusions and occasional cracks. Many zircons have a thin (<5 micron) rim, and some zircons have dark embayments which appear to be recrystallised zircon (Figure 12.3).

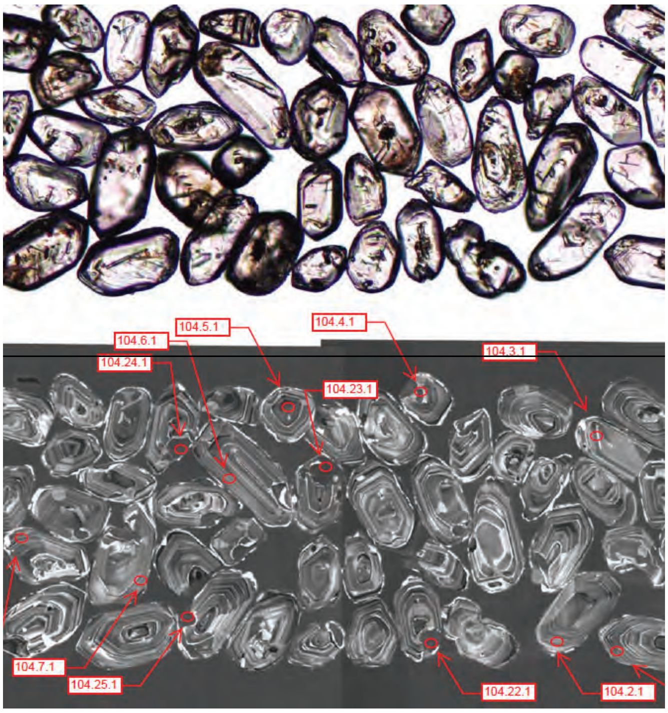

Figure 12.2. *Representative transmitted light and cathodoluminescence images of zircons from Illogwa Shear Zone mylonite (2010080001), with locations of some SHRIMP analyses.*

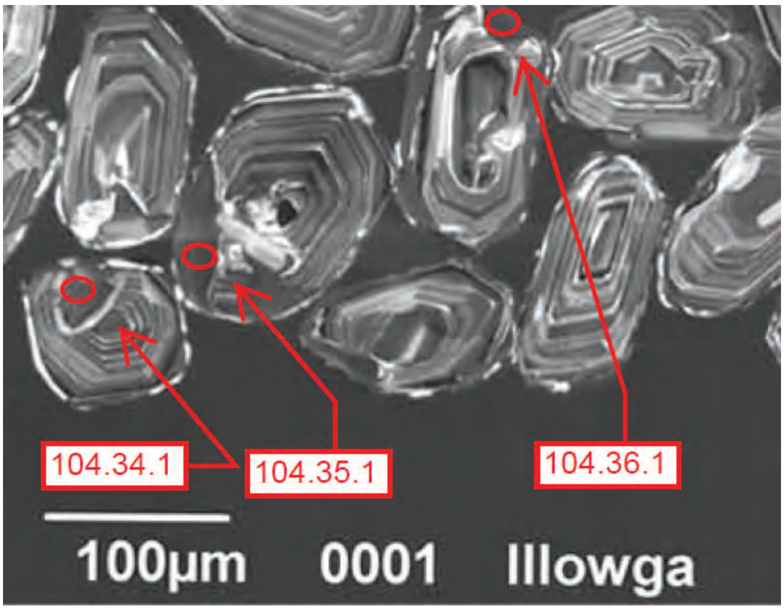

Figure 12.3. *CL-dark embayments in zircons from Illogwa Shear Zone mylonite (2010080001). Note the crosscutting relationship to the oscillatory concentric zoning. The age of these embayments is discussed below.*

Concentrically-zoned zircons showed a large range in Th and U contents, to moderately high values. Th ranged from 1072 ppm to 83 ppm, while U ranged from 1173ppm to 412 ppm. Th/U ratios were between 0.98 and 0.08 (Figure 12.4). Zircon embayments had a very different U and Th composition, with high U values and moderate to low Th contents, yielding very low Th/U ratios. Th in concordant grains ranged between 101 ppm and 16 ppm. Uranium contents of concordant grains ranged between 1702 ppm and 965 ppm. Th/U ratios ranged from 0.1 to 0.01 (Figure 12.4).

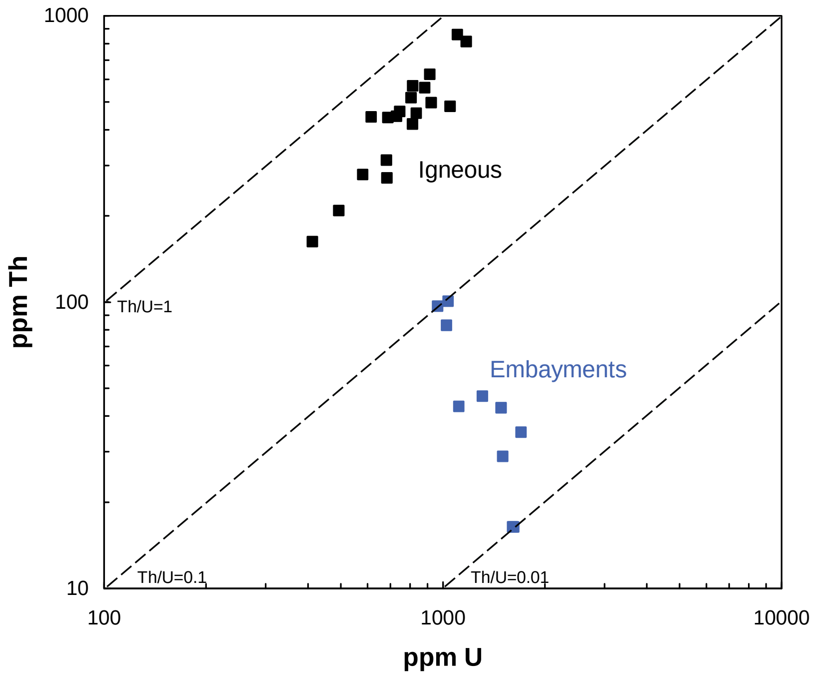

__Figure 12.4.__ U versus Th concentrations for sample 2010080001, Illogwa Shear Zone mylonite.

U-Pb Isotopic Results

A total of 35 analyses were collected from 35 individual zircon grains from sample 2010080001, the results of which are shown in Table 12.1 and illustrated in Figure 12.5. Common Pb ($^{206}Pb_c$) contents are generally <0.1%, but range between 2.27 and 0.02%. Of the 35 analyses, 14 targeted the embayments, while 21 targeted the igneous grains (Figure 12.4 and 12.5).

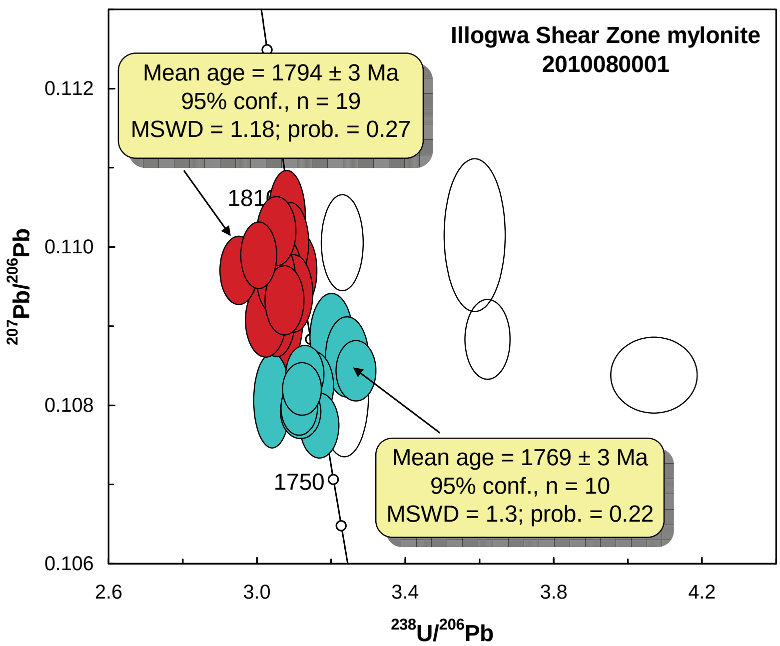

__Figure 12.5.__ Tera-Wasserburg Concordia diagram for 35 analyses from sample 2010080001, Illogwa Shear Zone mylonite. White error ellipses are excluded from interpretation due to excess discordance or common Pb. Blue ellipses are embayments, red are igneous.

Of the 21 igneous analyses, one was discarded due to discordance of 5% or greater. An additional analysis was discarded due to high common Pb (>0.5% $^{206}Pb_c$). The remaining 19 analyses combine to form a group with a weighted mean age $^{207}Pb/^{206}Pb$ age of 1793.8 ± 2.9 Ma (95% confidence, MSWD = 1.18; probability = 0.27; (Figure 12.5). Of the 14 embayment analyses, analysis 34.1.1 may have missed the embayment, and has an igneous age (not shown on Figure 12.5). Two analyses were discarded due to discordance of 5% or greater. An additional analysis was discarded due to high common Pb (>0.5% $^{206}Pb_c$). The remaining 10 analyses have a weighted mean age of 1769.3 ± 2.8 Ma (95% confidence, MSWD = 1.32, probability = 0.22; Figure 12.5).

Geochronological Interpretation

The weighted mean age of 1794 ± 3 Ma is interpreted as the crystallisation age of sample 2010080001. The weighted mean age of 1769 ± 3 Ma is interpreted as an alteration age, which has resulted in partial recrystallisation and resetting of the zircon. The nature of this event is not immediately obvious from the grain mount, and can hopefully be deduced from petrologic investigations. As noted above, the mylonite is intruded by the Aremra Suite (1762 ± 6 Ma, Hollis et al in prep), possibly indicating that the interpreted recrystallisation event is recording contact metamorphism of the Arema Suite.

Table 12.1. SHRIMP U-Pb isotopic data for zircons from sample 2010080001, Illogwa Shear Zone mylonite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
igneous analyses											
1.1.1	0.07	836	456	0.56	0.3215	1.2	0.1097	0.30	1794	6	-0
2.1.1	0.03	684	271	0.41	0.3240	1.1	0.1096	0.32	1793	6	-1
3.1.1	0.04	615	443	0.75	0.3271	1.2	0.1100	0.33	1799	6	-2
4.1.1	0.05	925	497	0.55	0.3249	1.1	0.1093	0.26	1788	5	-2
5.1.1	0.19	1104	859	0.80	0.3257	1.0	0.1094	0.71	1790	13	-2
6.1.1	0.04	731	446	0.63	0.3254	1.1	0.1096	0.30	1793	6	-1
7.1.1	0.06	493	209	0.44	0.3250	1.1	0.1091	0.38	1784	7	-2
8.1.1	0.05	747	463	0.64	0.3254	1.2	0.1095	0.30	1791	6	-2
9.1.1	0.11	1173	813	0.72	0.3223	1.1	0.1094	0.30	1790	5	-1
10.1.1	0.04	689	441	0.66	0.3262	1.1	0.1097	0.31	1794	6	-2
11.1.1	0.02	915	625	0.71	0.3273	1.1	0.1102	0.26	1803	5	-1
12.1.1	0.07	813	419	0.53	0.3233	1.1	0.1101	0.31	1800	6	-0
13.1.1	0.04	682	313	0.47	0.3271	1.1	0.1091	0.31	1785	6	-3
14.1.1	0.02	806	518	0.66	0.3274	1.1	0.1096	0.28	1793	5	-2
15.1.1	0.04	412	163	0.41	0.3244	1.1	0.1101	0.41	1801	8	-1
16.1.1	0.03	1052	483	0.47	0.3323	1.0	0.1099	0.25	1798	5	-3
17.1.1	0.03	581	279	0.50	0.3242	1.1	0.1104	0.34	1806	6	-0
20.1.1	0.03	814	569	0.72	0.3303	1.2	0.1091	0.28	1784	5	-4
21.1.1	0.03	884	560	0.65	0.3383	1.1	0.1097	0.26	1794	5	-5
embayment analyses											
22.1.1	0.03	1607	16	0.01	0.3205	1.1	0.1079	0.21	1765	4	-2
24.1.1	0.03	1503	29	0.02	0.3208	1.0	0.1080	0.21	1765	4	-2
26.1.1	0.05	965	97	0.10	0.3082	1.2	0.1086	0.31	1776	6	+3
28.1.1	0.03	1702	35	0.02	0.3200	1.1	0.1082	0.20	1769	4	-1
29.1.1	0.04	1308	47	0.04	0.3059	1.1	0.1084	0.23	1773	4	+3
30.1.1	0.19	1695	45	0.03	0.3121	1.2	0.1089	0.34	1780	6	+2
32.1.1	0.09	1620	16	0.01	0.3192	1.1	0.1084	0.22	1773	4	-1
33.1.1	0.02	1037	101	0.10	0.3154	1.1	0.1077	0.25	1762	5	-0
34.1.1	0.17	1025	83	0.08	0.3182	1.0	0.1099	0.30	1799	5	+1
35.1.1	0.12	1487	43	0.03	0.3172	1.2	0.1082	0.27	1770	5	-0
36.1.1	0.05	1115	43	0.04	0.3284	1.1	0.1081	0.36	1767	7	-4
discordant and/or high common Pb											
18.1.1	2.27	1132	1072	0.98	0.2787	1.5	0.1101	0.58	1802	10	+14
19.1.1	0.75	1159	986	0.88	0.3093	1.2	0.1101	0.36	1800	7	+4
23.1.1	0.67	1632	62	0.04	0.3088	1.3	0.1081	0.47	1768	9	+2
25.1.1	0.19	1447	262	0.19	0.2457	1.9	0.1084	0.29	1772	5	+22
27.1.1	0.53	1520	247	0.17	0.2761	1.1	0.1088	0.31	1780	6	+13

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.

2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.

3. All errors quoted as 1σ.

13. UNNAMED TOURMALINE GRANITE: 2010080009

GA Sample ID:	**2010080009**
GA Sample Number:	**2115101**
NTGS Sample Number:	**IC10JAW1265**
1:250,000 Sheet:	**ILLOGWA CREEK**
Region:	**Arunta, Northern Territory**
Grid Reference :	**503725 7397241 AGD84 Zone 53**
Collector:	**J Whelan, D Huston, G Webb, D Close.**
Collection Date:	**19^{th} June 2010**
Formal Name:	**not defined**
Informal Name:	**not defined**
Lithology:	**tourmaline-muscovite granite**
Geochronologist:	**C. Magee**
Mount ID:	**GA6149**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**10 December 2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.64% (1σ) (31 of 32)**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.3 ± 2.1 (22 of 23)**
Interpreted Age:	**1740 ± 30 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**indicative age**

Sample Description

This is a sample of foliated tourmaline granite comprising tourmaline, muscovite, pink K-feldspar, minor sericitised plagioclase and quartz (Figure 13.1). Alignment and elongation of tourmaline defines the regional fabric in this rock which is crosscut by numerous thin, steeply dipping quartz and/or hematite veins of varying orientation. Spectrometer analysis of a sample of tourmaline granite in situ yielded 5.9% K, 9.3 ppm U and 20.4 ppm Th.

Figure 13.1. *Hand sample of unnamed tourmaline granite sample 2010080009.*

Zircon Description

Only four ~100 micron zircons were separated from 2010080009. All are pyramidal fragments. Cathodoluminescence (CL) is dark, with two grains showing muted concentric oscillatory zoning and the other two showing mottling. Zircons are colourless to dark brown in transmitted light, with three of the four grains heavily fractured (Figure 13.2).

The zircons have moderate to high Th and U contents, with very high U values (5000 ppm) for the most metamict grain analysed. The two concordant analyses have U contents of 522 and 393 ppm, and Th contents of 383 and 219 ppm, respectively.

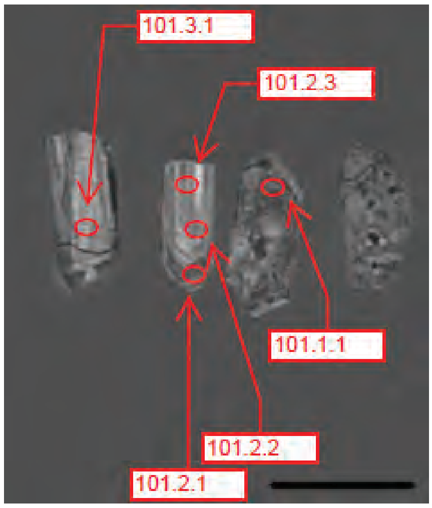

Figure 13.2. *Transmitted light (below) and cathodoluminescence (right) images of zircons from unnamed tourmaline granite (2010080009), with locations of some SHRIMP analyses. Scale bar is 100 µm.*

U-Pb Isotopic Results

This sample produced only four zircon grains, and only five analytical spots were undertaken on three individual zircon grains, the results of which are shown in Table 13.1.

Of these five analyses, three were discarded due to discordance of greater than 5%. The remaining two grains had ^{207}Pb /^{206}Pb ages of 1722 ± 11 Ma and 1758 ± 16 Ma. No useful geochronological interpretation can be made from this data.

Table 13.1. SHRIMP U-Pb isotopic data for zircons from sample 2010080009, tourmaline granite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	^{232}Th/ ^{238}U	^{238}U/ ^{206}Pb*	± (%)	^{207}Pb*/ ^{206}Pb*	± (%)	^{207}Pb/^{206}Pb Age (Ma)	± (1σ)	Disc. %
101.2.2.1	0.11	522	383	0.76	3.4203	0.78	0.1054	0.62	1722	11	4
101.2.3.1	0.07	393	219	0.58	3.3684	0.83	0.1075	0.89	1758	16	5
discordant and/or high common Pb											
101.1.1.1	1.50	5307	48	0.01	7.3344	1.04	0.0819	0.37	1243	7	36
101.2.1.1	2.43	2114	192	0.09	7.3119	1.04	0.0824	1.13	1255	22	36
101.3.1.1	0.77	551	326	0.61	5.0264	1.27	0.1019	1.23	1659	23	32

1. %$^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.
2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.
3. All errors quoted as 1σ.

14. UNNAMED MUSCOVITE GRANITE: 2010080010

GA Sample ID:	**2010080010**
GA Sample Number:	**2115100**
NTGS Sample Number:	**IC10GPW004**
1:250,000 Sheet:	**ILLOGWA CREEK**
Region:	**Arunta, Northern Territory**
Grid Reference:	**503732 7397242 AGD84 Zone 53**
Collector:	**G Webb, D Huston, J Whelan, D Close.**
Collection Date:	**19th June 2010**
Formal Name:	**not defined**
Informal Name:	**not defined**
Lithology:	**muscovite granite**
Geochronologist:	**C. Magee**
Mount ID:	**GA6149**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**10 and 13 December 2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.64% (1σ) (31 of 32)**
^{207}Pb/^{206}Pb Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.3 ± 2.1 (22 of 23)**
Interpreted Age:	**1730 ± 8 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**

Sample Description
This is a sample of fine-grained equigranular muscovite granite comprising muscovite, pale-pink to dark-pink K-feldspar, sericitised plagioclase, and quartz (Figure 14.1). The granite pervasively altered and is cross-cut by very thin, late stage hematite-bearing veins. Spectrometer analysis of the granite in-situ yielded a K content of 6.5%, U = 18 ppm and Th = 53 ppm.

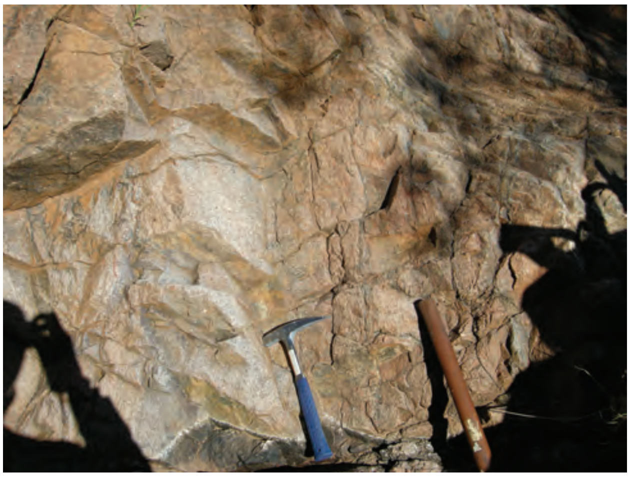

Figure 14.1. *Outcrop photo of unnamed muscovite granite sample, 2010080010.*

Zircon Description
Sample 2010080010 consists of 30 prismatic to anhedral zircon fragments, fragments are angular, and there are few whole grains (Figure 14.2). Grainsize is 50-150 µm. Cathodoluminescence (CL) is moderate to dim, and zoning is muted in most samples. A few grains have concentric, oscillatory zoning. Zircons are pink to brown in transmitted light, with numerous cracks and few inclusions (Figure 14.2). The zircons have moderate Th and U contents. With the exception of grain 3, which had more than 1000 ppm of U and Th, Th ranged between 187 and 26 ppm, while U ranged between 634 ppm to 106 ppm. Th/U ratios were between 0.78 and 0.1.

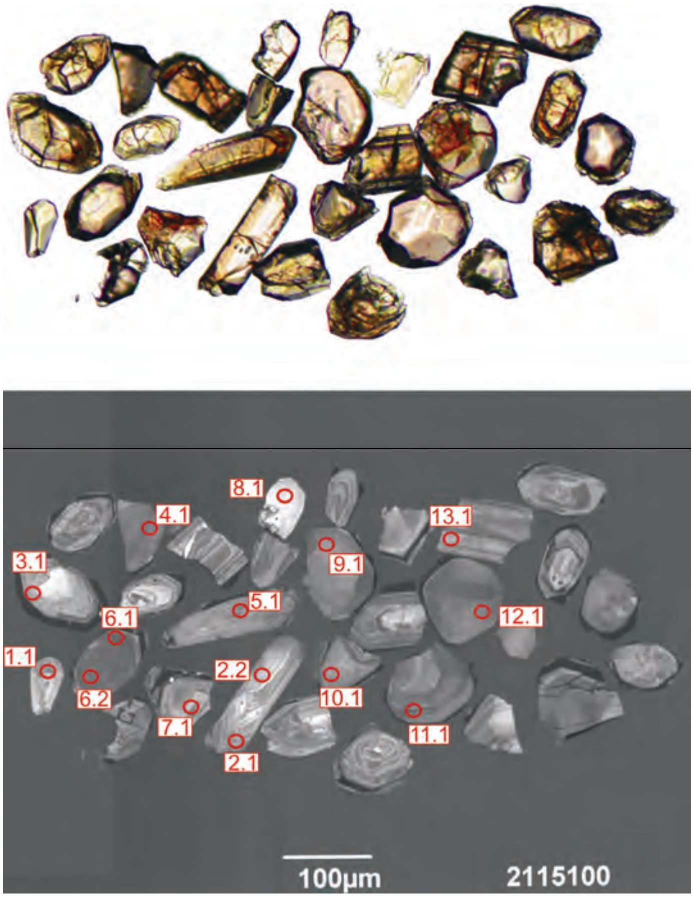

Figure 14.2. *Transmitted light and cathodoluminescence images of zircons from unnamed muscovite granite (2010080010), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

This sample returned a poor yield of ~30 zircon grains. A total of 15 analyses were collected on 13 individual zircon grains from sample 2010080010, the results of which are presented in Table 14.1 and illustrated in Figure 14.3. Common Pb ($^{206}Pb_c$) contents are generally <0.2%, with one exception at 6.44%, which was removed from further consideration.

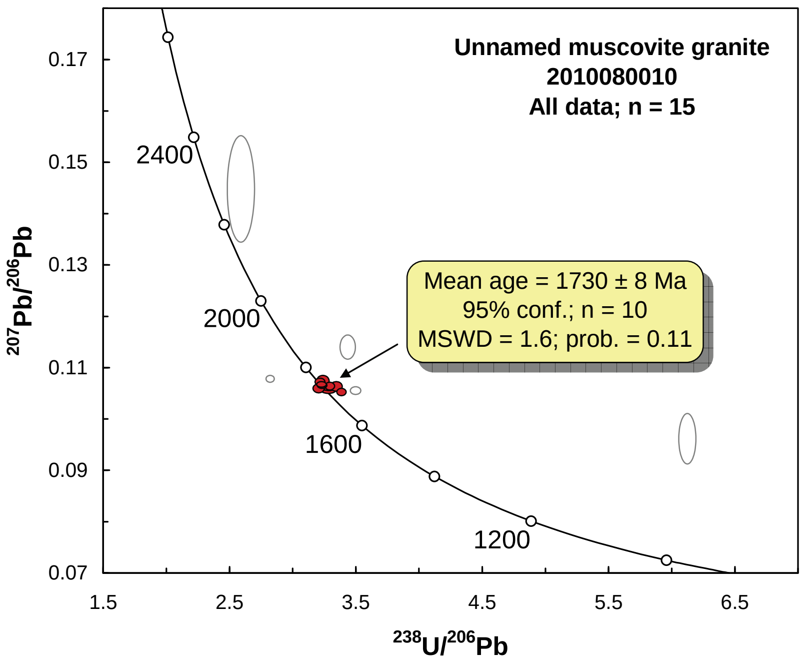

Figure 14.3. *Tera-Wasserburg concordia diagram for all data collected from sample 2010080010, unnamed muscovite granite. White error ellipses are excluded from interpretation due to excess discordance or common lead.*

Of the 15 analyses collected, 5 were discarded due to discordance of 5% or greater (Figure 14.3). The remaining 10 analyses had a weighted mean age $^{207}Pb/^{206}Pb$ age of 1729.6 ± 7.6 Ma (95% confidence, MSWD = 1.6, probability = 0.11).

Geochronological Interpretation

The weighted mean age of 1730 ± 8 Ma is interpreted as the crystallisation age of this granite.

Table 14.1. SHRIMP U-Pb isotopic data for zircons from sample 2010080010, muscovite granite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
100.1.1.1	0.04	338	60	0.18	3.1978	0.82	0.1068	0.44	1745	8	-1
100.2.2.1	0.08	186	26	0.14	3.2202	1.00	0.1069	0.69	1748	13	0
100.4.1.1	0.01	433	187	0.45	3.2136	0.80	0.1061	0.40	1733	7	-1
100.6.1.1	0.04	578	72	0.13	3.2679	1.22	0.1056	0.37	1725	7	0
100.6.2.1	0.01	634	80	0.13	3.2086	0.80	0.1062	0.36	1735	7	-1
100.9.1.1	0.12	296	82	0.29	3.1860	0.93	0.1055	0.57	1723	10	-2
100.10.1.1	0.11	277	71	0.27	3.3258	0.90	0.1058	0.57	1729	10	2
100.11.1.1	0.08	371	170	0.47	3.2737	0.84	0.1059	0.48	1731	9	1
100.12.1.1	0.08	295	134	0.47	3.2628	1.33	0.1053	0.54	1720	10	0
100.13.1.1	0.11	566	141	0.26	3.3668	0.80	0.1047	0.44	1710	8	2
discordant and/or high common Pb											
100.2.1.1	0.13	395	68	0.18	3.4804	0.81	0.1050	0.50	1715	9	6
100.3.1.1	6.44	1186	2813	2.45	6.1157	0.77	0.0955	3.42	1539	64	39
100.5.1.1	0.25	586	56	0.10	2.8021	0.78	0.1073	0.40	1755	7	-14
100.8.1.1	0.86	106	80	0.78	3.4169	1.18	0.1135	1.38	1857	25	12
100.7.1.1	0.10	259	147	0.58	2.5675	2.81	0.1447	4.76	2284	82	8

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.
2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.
3. All errors quoted as 1σ.

15. ATNEEQUA GRANITE: 2010080011

GA Sample ID:	**2010080011**
GA Sample Number:	**2115098**
NTGS sample Number:	**IC10JAW1267**
1:250,000 Sheet:	**ILLOGWA CREEK**
Region:	**Arunta, Northern Territory**
Grid Reference :	**511736 7394696 AGD84 Zone 53**
Collector:	**J. Whelan, G. Webb, D. Close, D. Huston.**
Collection Date:	**19th June 2010**
Formal Name:	**Atneequa Granite**
Informal Name:	**not defined**
Lithology:	**K-feldspar megacrystic biotite granodiorite**
Geochronologist:	**C. Magee**
Mount ID:	**GA6149**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**11-12 December 2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 0.64% (1σ) (31 of 32)**
^{207}Pb/^{206}Pb Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.3 ± 2.1 (22 of 23)**
Interpreted Age:	**1743 ± 4 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**

Sample Description

This is a sample of coarse-grained porphyritic biotite granite collected from the Atneequa Granitic Complex in the vicinity of Zhao and Bennett's (1995) geochronology site. The Atneequa Granitic Complex outcrops as north-west trending low hills littered with torrs and pavements (Figure 15.1). Fine-grained equigranular late-stage granites through to coarse-grained equigranular biotite granites and granodiorites occur, however, the sample location is dominated by coarse-grained porphyritic types. The Atneequa Granite locally incorporates rafts of metasedimentary rock (likely part of the Albarta Metamorphics), typically foliated calc-silicate, although appears to be relatively undeformed itself.

Figure 15.1. *Outcrop photo of granite boulder from the Atneequa Granitic Complex.*

Previous Work

The Atneequa Granite was previously dated using U-Pb SHRIMP by Zhao and Bennett (1995), producing an interpreted ^{207}Pb /^{206}Pb magmatic crystallisation age of 1762 ± 9 Ma (n = 9), with another

3 grains interpreted as recording a Strangways age of 1715 ± 19 Ma. This sample was analysed without CL imaging.

Zircon Description

Sample 2010080011 consists of prismatic to equant euhedral zircon crystals. Grainsize is 80-300 µm, with aspect ratios of 1:1 up to 1:4. Cathodoluminescence (CL) is moderate to bright, with concentric oscillatory zoning. Occasional inherited cores are also present. Zircons are yellow, pink, and brown in transmitted light, with occasional cracks and small inclusions (Figure 15.2).

Analysed zircons from Atneequa Granite sample 2010080011 have Th/U values between 1.01 and 0.12. Th and U concentrations are between 268-43 ppm and 414-114 ppm, respectively. The single inherited core analysed had Th and U concentrations of 16 ppm and 548 ppm, respectively (Th/U ratio = 0.03).

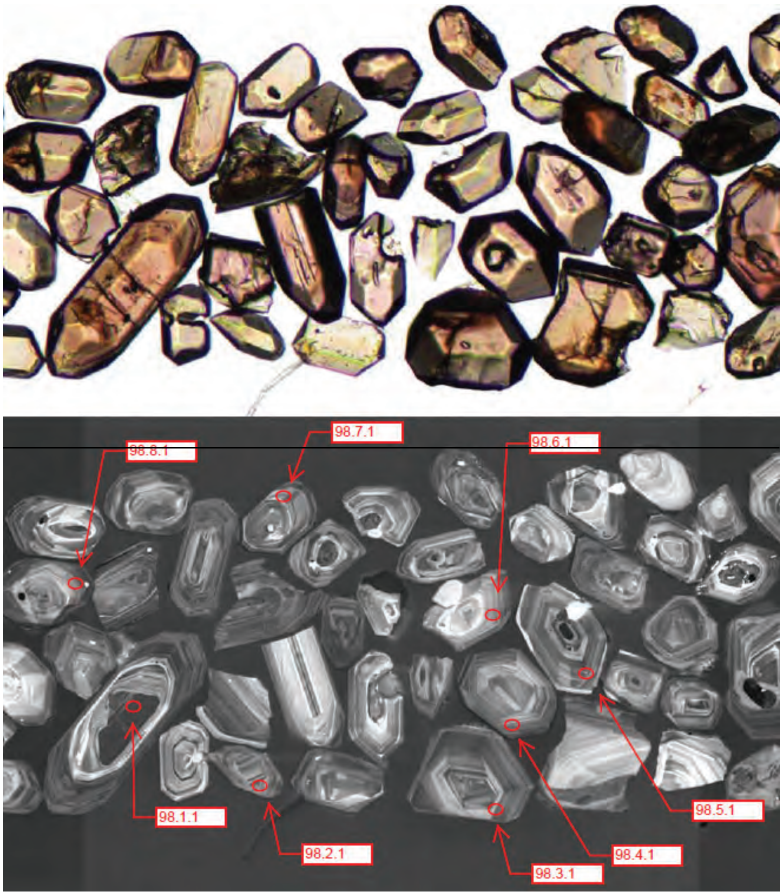

Figure 15.2. *Representative transmitted light and cathodoluminescence images of zircons from sample 2010080011, Atneequa Granite, with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 29 analyses were conducted in 29 individual zircon grains from Atneequa Granite sample 2010080011, the results of which are presented in Table 15.1 and illustrated in Figure 15.3. Common Pb ($^{206}Pb_c$) contents are generally low, ranging between 0.24 and 0.04% for concordant analyses, with higher values recorded for discordant analyses (Table 15.1).

Of the 29 analyses collected, three were discarded due to discordance of 5% or greater. An inherited core with an age of 1931 ± 6 Ma was not included in calculating the igneous age. The remaining 25 grains combined to give a weighted mean age $^{207}Pb/^{206}Pb$ age of 1742.8 ± 4.3 Ma (95% confidence; MSWD = 0.85; probability = 0.68; Figure 15.3).

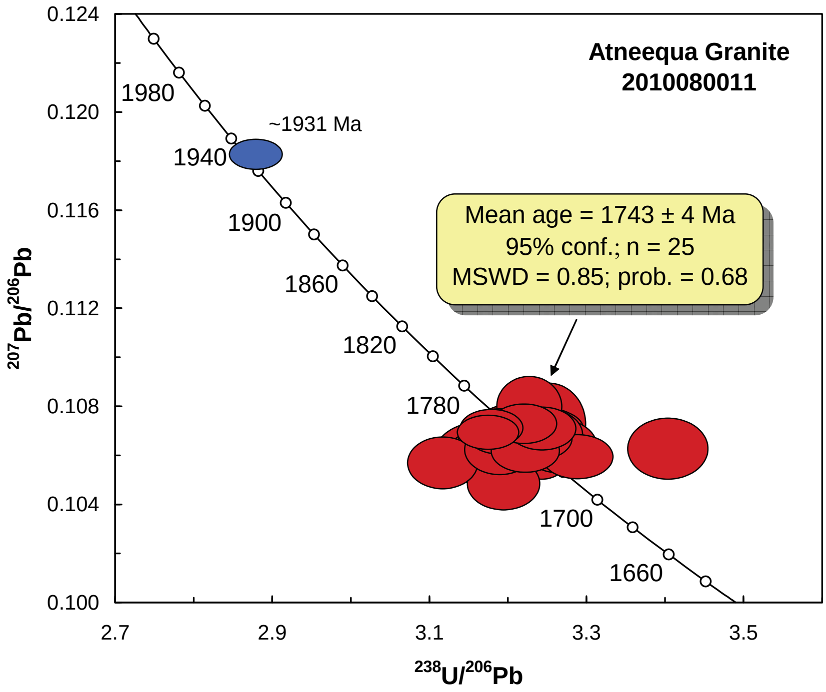

Figure 15.3. *Tera-Wasserburg concordia diagram for concordant analyses from sample 2010080011, Atneequa Granite. Blue ellipse is an inherited grain.*

Geochronological Interpretation

The weighted mean age of 1743 ± 4 Ma is interpreted as the crystallisation age of this granite. An inherited core of 1931 ± 6 Ma suggests the presence of pre-existing crust in the source region.

Table 15.1. SHRIMP U-Pb isotopic data for zircons from sample 2010080011, Atneequa Granite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
098.1.1.1-c	0.07	548	16	0.03	2.8755	0.77	0.1183	0.34	1931	6	0
098.3.1.1	0.08	270	265	1.01	3.2413	0.89	0.1071	0.54	1751	10	1
098.4.1.1	0.16	221	146	0.68	3.1874	0.93	0.1062	0.63	1736	12	-2
098.5.1.1	0.15	333	268	0.83	3.2252	0.85	0.1080	0.75	1766	14	2
098.6.1.1	0.22	160	106	0.68	3.1772	1.48	0.1063	0.75	1736	14	-2
098.7.1.1	0.09	263	160	0.63	3.2317	1.28	0.1071	0.55	1751	10	1
098.8.1.1	0.15	197	127	0.66	3.1143	0.96	0.1057	0.66	1726	12	-5
098.9.1.1	0.07	347	43	0.13	3.1766	0.84	0.1071	0.46	1751	8	-1
098.10.1.1	0.06	239	212	0.92	3.2869	0.91	0.1060	0.56	1731	10	1
098.11.1.1	0.04	243	125	0.53	3.1869	0.92	0.1070	0.56	1749	10	-1
098.12.1.1	0.05	305	186	0.63	3.2188	0.86	0.1073	0.49	1754	9	1
098.13.1.1	0.11	158	119	0.78	3.1680	1.03	0.1059	0.73	1730	13	-3
098.14.1.1	0.17	114	89	0.80	3.1957	1.14	0.1065	0.90	1741	16	-1
098.15.1.1	0.24	173	65	0.39	3.4025	1.00	0.1063	0.77	1737	14	5
098.16.1.1	0.09	299	209	0.72	3.2029	1.44	0.1065	0.52	1741	10	-1
098.17.1.1	0.08	259	212	0.84	3.2367	0.89	0.1067	0.54	1744	10	1
098.19.1.1	0.15	199	106	0.55	3.1921	0.96	0.1049	0.67	1712	12	-3
098.20.1.1	0.15	185	91	0.51	3.2641	0.97	0.1064	0.68	1738	12	1
098.21.1.1	0.18	177	115	0.67	3.1798	0.99	0.1063	0.72	1738	13	-2
098.22.1.1	0.08	289	61	0.22	3.2205	0.89	0.1062	0.55	1735	10	-1
098.23.1.1	0.05	414	115	0.29	3.1726	0.82	0.1069	0.43	1748	8	-1
098.24.1.1	0.05	311	180	0.60	3.2176	1.30	0.1067	0.49	1745	9	0
098.25.1.1	0.10	181	74	0.42	3.2034	1.00	0.1070	0.69	1749	13	0
098.26.1.1	0.06	202	118	0.60	3.2498	0.96	0.1073	1.02	1754	19	2
098.27.1.1	0.13	199	124	0.64	3.2465	0.96	0.1068	0.66	1746	12	1
098.28.1.1	0.08	361	43	0.12	3.2415	0.85	0.1064	0.84	1739	15	0

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
discordant and/or high common Pb											
098.2.1.1	0.07	334	128	0.40	2.4697	1.11	0.1537	0.58	2387	10	10
098.18.1.1	51.24	199	49	0.26	3.0992	11.27	0.0373	225.76	-534	6053	506
098.29.1.1-c	5.41	583	606	1.07	5.0697	0.91	0.0962	5.86	1552	110	28

“c” is a core analysis

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.

2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.

3. All errors quoted as 1σ.

16. MT ISABEL MYLONITE: IC10GPW303

GA Sample ID:	**IC10GPW303**
GA Sample Number:	**2115097**
1:250,000 Sheet:	**ILLOGWA CREEK**
Region:	**Arunta, Northern Territory**
Grid Reference:	**564597 7369038 AGD84 Zone 53**
Collector:	**G. Webb, J. Whelan, S. Bodorkos**
Collection Date:	**22 August 2010**
Formal Name:	**not defined**
Informal Name:	**Mt Isabel mylonite**
Lithology:	**intense mylonite in granite**
Geochronologist:	**C. Magee**
Mount ID:	**GA6148**
Instrument:	**SHRIMP IIe Geoscience Australia**
Acquisition Date:	**6 and 9 December 2010**
U-Pb Standard & reproducibility:	**TEMORA-2; 1.02% (1σ) (30 of 30)**
$^{207}Pb/^{206}Pb$ Standard:	**OG1 (3465.4 ± 0.6 Ma)**
Measured Value (±95% confidence):	**3464.1 ± 2.1 (22 of 22)**
Interpreted Age:	**1748 ± 5 Ma**
IMF correction applied?	**No**
Interpreted Age Type:	**igneous crystallisation age**

Sample Description

The sample is a porphyroclastic mylonite (Figure 16.1a) from a broad zone (greater than 300 m wide) of mylonite and ultramylonite within a porphyritic granite protolith. The shear fabric dips 84 degrees to 013 with a stretching lineation oriented 78 degrees towards 317. The shear sense is down-dip reverse. The shear zone occurs to the north of a relatively continuous quartzite ridge that strikes ~east-west across the Mount Isabel area (and of which Mount Isabel itself is comprised). This quartzite is interpreted to be deformed/metamorphosed Heavitree Quartzite. The rocks to the south of this ridge are protomylonitic, granitic orthogneiss with well developed anastomosing ribbon quartz domains and augen feldspar porphyroclasts (Figure 16.1b).

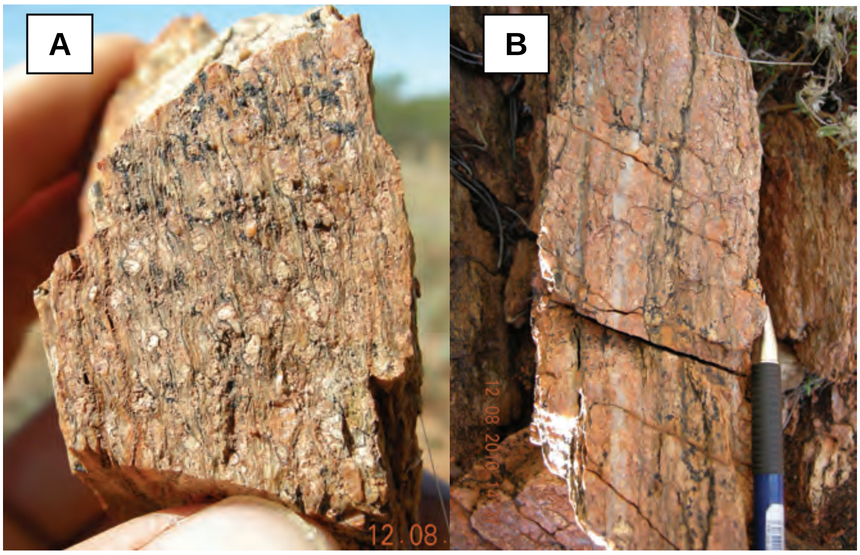

Figure 16.1.
(a) hand sample of porphyroclastic mylonite; (b) outcrop photo of IC10GPW303 showing well developed anastomosing ribbon quartz domains and augen feldspar porphyroclasts.

Zircon Description

Sample IC10GPW303 consists of euhedral to subhedral prismatic zircon crystals, and subangular zircon fragments. Grainsize ranges from 50 μm to 200 μm, and aspect ratios are typically between 1:1

and 1:3. Cathodoluminescence (CL) is moderate to dim, with laminar concentric banding. Some sector zoned or uniform grains are also present (Figure 16.2). Zircons are pink, purple, and brown in transmitted light, with occasional cracks and small inclusions. There are no signs of multiple populations, inheritance, or alteration.

Zircons analysed from the Mt Isabel mylonite sample IC10GPW303 have a range of Th/U values between 1.19 and 0.22. Th and U concentrations are between 903-44 ppm and 1105-95 ppm, respectively.

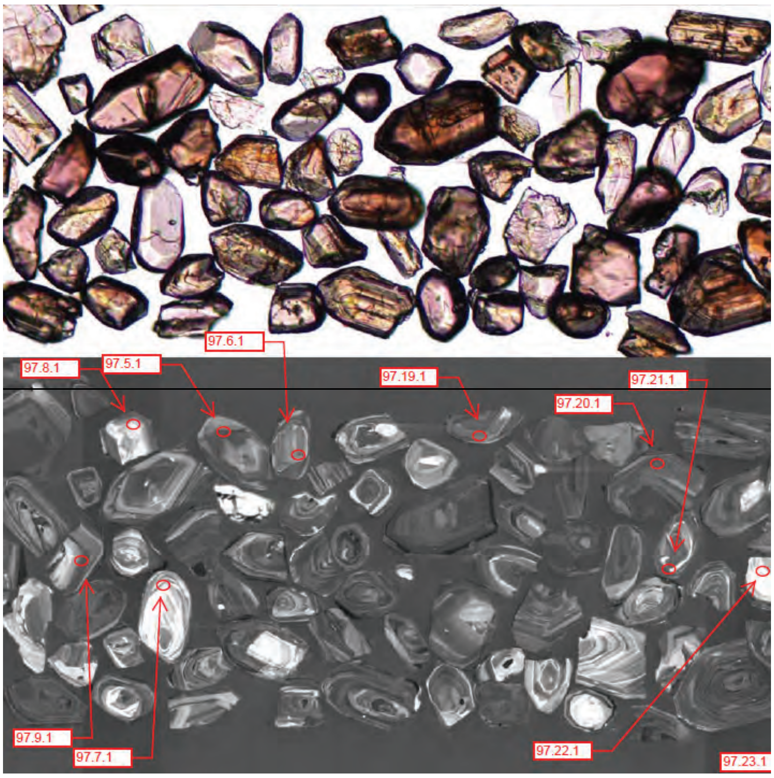

Figure 16.2. *Representative transmitted light and cathodoluminescence images of zircons from Mt Isabel Mylonite (IC10GPW303), with locations of some SHRIMP analyses.*

U-Pb Isotopic Results

A total of 25 analyses were conducted on 25 individual zircon grains, the results of which are presented in Table 16.1 and illustrated in Figure 16.3.

The analytical session included two primary beam dropouts, both of which occurred after the analysis of grain 21, but before the last 4 grains were analysed. The old (Paleoproterozoic) nature of sample IC10GPW303 means that the $^{207}Pb/^{206}Pb$ age was used instead of the $^{206}Pb/^{238}Pb$ age, so this uncertainty in the calibration is not considered to be critical to the geochronological interpretation.

Of these 25 analyses, 7 were discarded due to discordance of 4% or greater (Figure 16.3). Common Pb ($^{206}Pb_c$) contents are uniformly low, and all are <0.5% (Table 15.1).The remaining 18 analyses combine to produce a weighted mean age $^{207}Pb/^{206}Pb$ age of 1748.2 ± 5.0 Ma (95% confidence, MSWD = 1.4, probability = 0.14; Figure 16.3). This MSWD is somewhat higher than ideal for an 18 grain sample, but still yields an acceptable probability of fit.

Geochronological Interpretation

The weighted mean age of 1748 ± 5 Ma is interpreted as the crystallisation age of this mylonite.

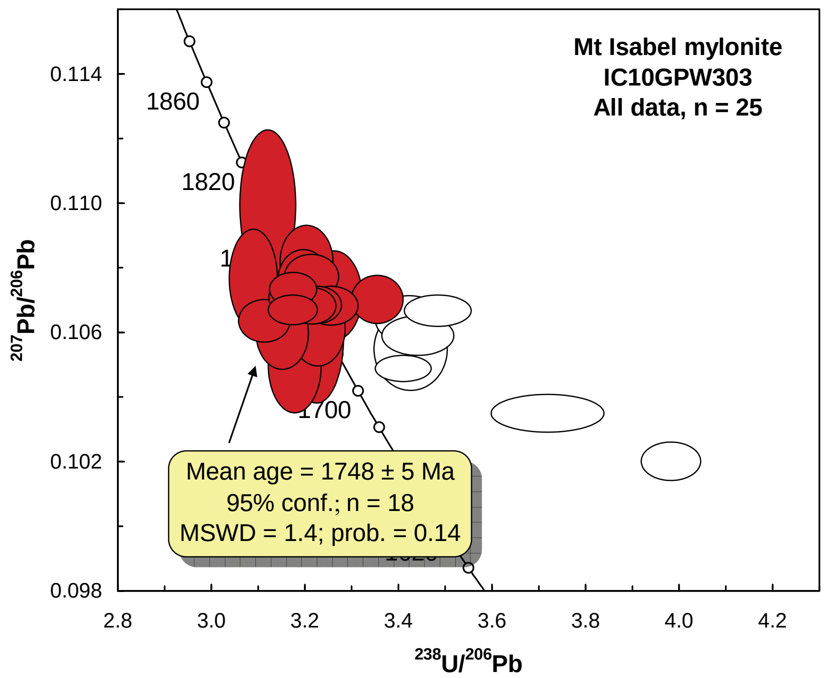

Figure 16.3. *Tera-Wasserburg concordia diagram for all analyses from sample (IC10GPW303), from Mt Isabel Mylonite. White error ellipses are excluded from interpretation due to excess discordance or common Pb.*

Table 16.1. SHRIMP U-Pb isotopic data for zircons from sample IC10GPW303, Mt Isabel Mylonite.

Spot name	$^{206}Pb_c$ (%)	U (ppm)	Th (ppm)	$^{232}Th/^{238}U$	$^{238}U/^{206}Pb^*$	± (%)	$^{207}Pb^*/^{206}Pb^*$	± (%)	$^{207}Pb/^{206}Pb$ Age (Ma)	± (1σ)	Disc. %
1.1.1	0.04	567	532	0.97	3.2293	1.06	0.1068	0.35	1746	6	+0
3.1.1	0.25	95	70	0.76	3.1235	1.25	0.1099	1.39	1798	25	+0
5.1.1	0.10	625	191	0.31	3.2580	1.16	0.1068	0.37	1746	7	+1
6.1.1	0.03	390	418	1.11	3.1776	1.08	0.1071	0.41	1750	8	-1
7.1.1	0.12	153	125	0.84	3.2285	1.17	0.1058	1.26	1729	23	-1
8.1.1	0.22	135	103	0.79	3.2647	1.20	0.1071	0.85	1751	16	+2
9.1.1	0.07	414	89	0.22	3.1158	1.16	0.1064	0.41	1738	8	-4
10.1.1	0.04	866	903	1.08	3.1773	1.09	0.1067	0.28	1744	5	-1
11.1.1	0.39	154	56	0.38	3.1806	1.18	0.1050	0.93	1714	17	-3
12.1.1	0.04	303	250	0.85	3.0925	1.10	0.1077	0.94	1760	17	-3
13.1.1	0.13	173	186	1.11	3.2061	1.15	0.1082	0.69	1769	13	+1
14.1.1	0.05	713	245	0.35	3.1780	1.06	0.1073	0.32	1755	6	-1
15.1.1	0.09	152	44	0.30	3.1547	1.17	0.1060	0.70	1731	13	-3
16.1.1	0.12	252	204	0.83	3.1993	1.12	0.1076	0.58	1760	11	+0
17.1.1	0.12	429	229	0.55	3.3566	1.08	0.1070	0.46	1749	8	+4
18.1.1	0.11	163	77	0.49	3.2304	1.17	0.1061	0.72	1734	13	-0
19.1.1	0.05	610	705	1.19	3.2165	1.07	0.1068	0.35	1746	6	+0
24.1.1	0.05	392	236	0.62	3.2168	1.18	0.1077	0.42	1761	8	+1
discordant and/or high common Pb											
2.1.1	0.18	757	307	0.42	3.7187	2.14	0.1035	0.38	1688	7	+10
4.1.1	0.43	1017	249	0.25	3.9818	1.04	0.1020	0.38	1661	7	+15
20.1.1	0.13	455	314	0.71	3.4247	1.38	0.1064	0.45	1739	8	+6
21.1.1	0.08	588	207	0.36	3.4426	1.47	0.1059	0.38	1730	7	+6
22.1.1	0.10	125	83	0.69	3.4277	1.51	0.1055	0.80	1723	15	+5
23.1.1	0.03	1105	398	0.37	3.4125	1.14	0.1049	0.26	1712	5	+4
25.1.1	0.08	918	49	0.06	3.4856	1.34	0.1067	0.30	1743	5	+8

1. $\%^{206}Pb_c$ indicates the proportion of common ^{206}Pb in the total measured ^{206}Pb.
2. Pb isotopic ratios corrected for common Pb by reference to the measured ^{204}Pb.
3. All errors quoted as 1σ.

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