Unravelling the Fowler Domain: new geochronological data from the western Gawler Craton, South Australia

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Report Book 2008/10

Government of South Australia
Primary Industries and Resources SA

080741

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Katherine Howard[1], Rian Dutch[2], Martin Hand[1], Karin Barovich[1] and Anthony Reid[2]

1. Continental Evolution Research Group, School of Earth and Environmental Sciences, University of Adelaide

2. Geological Survey Branch, Division of Minerals and Energy Resources, PIRSA

July 2008

Report Book 2008/10

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Division of Minerals and Energy Resources
Primary Industries and Resources South Australia
7th floor, 101 Grenfell Street, Adelaide
GPO Box 1671, Adelaide SA 5001

Phone	National	(08) 8463 3204
	International	+61 8 8463 3204
Fax	National	(08) 8463 3229
	International	+61 8 8463 3229
Email	pirsa.minerals@saugov.sa.gov.au	
Website	www.minerals.pir.sa.gov.au	

Preferred way to cite this publication
Howard, K., Dutch, R., Hand, M., Barovich, K. and Reid, A., 2008. Unravelling the Fowler Domain: new geochronological data from the western Gawler Craton, South Australia. *South Australia. Department of Primary Industries and Resources. Report Book* 2008/10.

CONTENTS

FIGURES

Unravelling the Fowler Domain: new geochronological data from the western Gawler Craton, South Australia

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INTRODUCTION

This report book contains a compilation of zircon and monazite U-Pb geochronological data together with geochemical data from the Fowler Domain of the Gawler Craton (Fig. 1). This study has been undertaken as part of the Australian Research Council and Primary Industry and Resources South Australia (PIRSA) co-funded Linkage Grant (LP0454301) 'Developing a Tectonic Framework for the Gawler Craton: Paving the Way for Successful Mineral Exploration'.

The aim of this study is to provide constraints on the depositional ages and provenance of metasedimentary units together with direct geochronological constraints on the timing of deformation and metamorphism from the poorly exposed and studied western Gawler Craton, with the view to developing a coherent model of the tectonic setting and evolution of the Fowler Domain.

This is a technical report describing samples analysed and presenting the analytical results obtained with a brief discussion of their geochronological interpretation. This data forms part of the primary author's Ph.D studies at the University of Adelaide and therefore the broader geological interpretation and implications will be discussed at length in later publications.

Due to the extremely limited exposure of basement lithologies in the western Gawler Craton (Fig. 2), all analysed samples presented here were obtained from drill core stored at PIRSA's core library in Adelaide. Because of the limited amount of core available for sampling, sample sizes are correspondingly small, limiting the number of analyses able to be obtained. The locations of all analysed drill holes are presented in Figure 2.

GEOLOGICAL BACKGROUND

The Fowler Domain forms a geophysically distinctive NE trending belt of highly magnetic metasedimentary and igneous rocks which are dissected by a network of anastamosing shear zones (Fig. 3: Daly et al., 1998; Teasdale, 1997). The domain is bounded to the north by the Archaean to Palaeoproterozoic rocks of the Christie Domain and to the east by the Palaeo-Mesoproterozoic Wilgena and Nuyts Domains.

Outcrop of the Fowler basement is extremely limited (Fig. 2), meaning geological studies have been primarily restricted to using existing Mines and Energy, South Australia (MESA: e.g. Daly et al., 1994; Morris et al., 1994) and company exploration drill holes (e.g. North, 1997; Poseidon, 1992) which intersected basement lithologies. Previous studies have focused on the geophysical character and the timing of igneous intrusions and metamorphism and the metamorphic evolution of the Fowler Domain (Daly et al., 1998; Fanning et al., 2007; Teasdale, 1997; Thomas, 2004; Thomas et al., In Press). There have been no studies looking at the provenance or depositional history of the Fowler Domain protolith.

Teasdale (1997) divided the Fowler Domain into four blocks bounded by major shear zones (the Nundroo, Central, Barton and Colona blocks, Fig. 1). Geophisically these domains are broadly similar (Fig. 2), with the intense magnetic signature being ascribed to a combination of mafic,

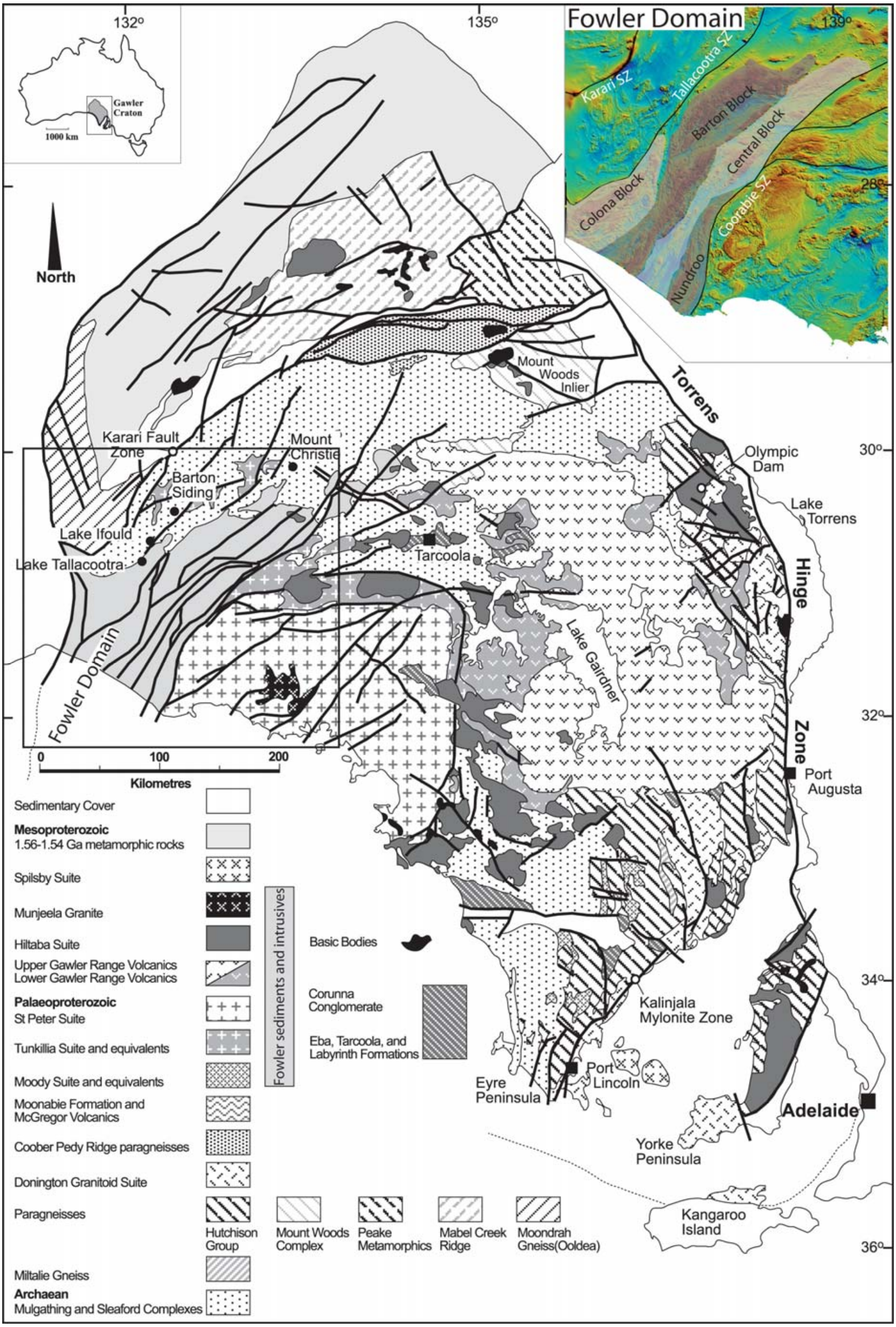

Figure 1. Interpreted subsurface geology of the Gawler Craton, South Australia (after Daly et al., 1998; Ferris et al., 2002) with the location of the Fowler Domain in the western Gawler Craton. Insert; Fowler Domain blocks after Teasdale (1997).

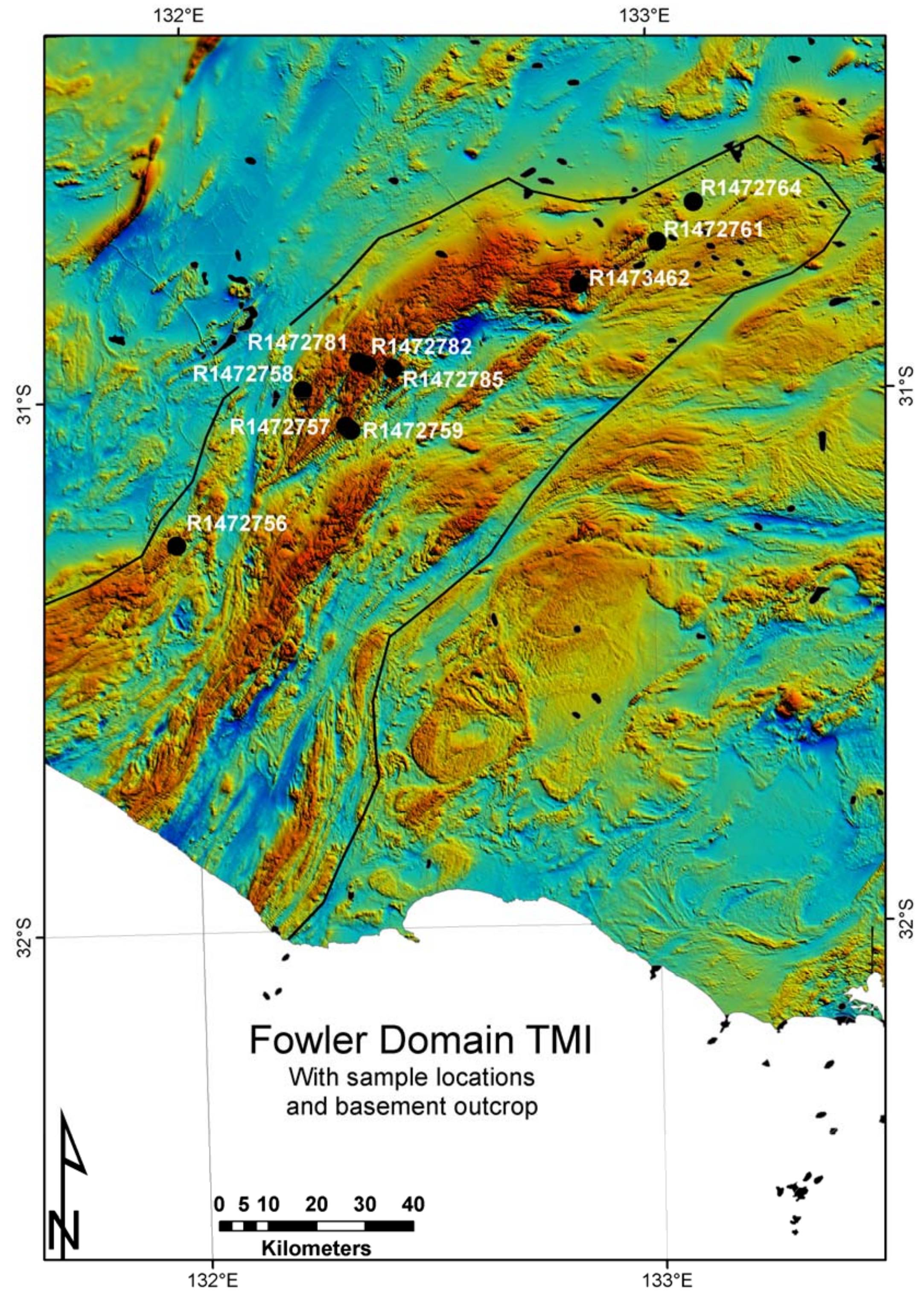

Figure 2. Regional TMI image of the Fowler Domain including geochronological sample locations. The limited basement outcrop is marked by the black polygons.

ultramafic, intermediate-felsic igneous and metasedimentary lithologies. However, the geological character of these blocks differs considerably, containing different metamorphic and geochronological records. The geological descriptions and data presented below are taken largely from Teasdale (1997) except where referenced otherwise.

The Nundroo Block forms an arcuate belt of highly magnetic lithologies bounded by two splays of the Coorabie Shear Zone (Fig. 1). The block is dominated by a range of intermediate to mafic lithologies interlayered with metapelitic gneisses. The metasedimentary units consist of medium-grained, foliated, garnet – sillimanite – biotite – plagioclase – feldspar – quartz ± magnetite assemblages. The mafic lithologies are interpreted to be intrusive sills and range from coarse grained diorites and gabbros through high-grade two pyroxene mafic granulites to hornblende and/or biotite rich amphibolites. The mafic lithologies in the Nundroo Block are interpreted to be derived from a series of tonalitic to gabbroic cumulus intrusives. Peak Metamorphic conditions reached the granulite-facies with temperatures up to 800 °C at up to 9 kbar at c. 1540 Ma (Fanning et al., 2007; Thomas, 2004). This was followed by retrogression at amphibolite-facies conditions at c. 1500 Ma (Thomas, 2004).

The Central Block forms a linear belt ~10–20 km wide and 200 km long, bounded by the Coorabie and Colona shear zones (Fig. 1). The Central Block displays a more subdued and homogeneous magnetic signature than the other Fowler Domain blocks and it is therefore interpreted to contain little variation in lithology. The observed lithologies are dominated by variably deformed granitoids which Teasdale (1997) divided into two suites based on geochronological and geophysical evidence. The older suite (Tunkillia Suite) consists of variably deformed, medium grained, equigranular, leucocratic granite and adamellite. SHRIMP U-Pb zircon ages produced a concordant age of 1670 ± 9 Ma (Fanning et al., 2007) which is considered to be the crystallisation age. The younger granitoid suite is more biotite rich and contains variable amounts of mafic enclaves. Zircons from this suite give an interpreted magmatic crystallisation age of 1568 ± 11 Ma with inherited components at c. 1620 and c. 1680 Ma (Fanning et al., 2007). No metamorphic constraints have been reported from the Central Block.

The Barton Block is a prominent geophysical feature which dominates the Fowler Domain (Figs 1, 2). The block forms a sigmoidal belt up to 200 km long and 30 km wide, bounded by the Colona and Tallacootra shear zones to the east and west. The Barton Block contains a number of different lithologies including mafics, granitoids and metasedimentary units. Similar to the Nundroo Block, the Barton Block contains a number of mafic and ultramafic lithologies ranging from olivine-chromite bearing peridotites to two-pyroxene metagabbros and hornblende – garnet ± biotite gneisses (Daly et al., 1994). These units are interlayered with the metasedimentary units and are interpreted to be intrusive sills. The metasedimentary units consist of fine-medium grained, foliated and layered, biotite ± sillimanite ± garnet – feldspar – quartz – magnetite ± plagioclase gneisses and schists. The block also contains numerous felsic to intermediate granitoids which are interpreted to have intruded the metasedimentary sequences but their relation with the mafic units is unknown. These granitoids are variable deformed and contain a basic assemblage of quartz – plagioclase – biotite ± feldspar – zircon – magnetite ± ilmenite. Peak metamorphic conditions, recorded in the metasedimentary and mafic lithologies, reached transitional granulite-facies conditions of between 650 to 850 °C at pressures of 7 to 10 kbar (Thomas, 2004). SHRIMP U-Pb dating of metamorphic monazite produced an age of 1712 ± 10 Ma for the timing of peak metamorphism.

The Colona Block is a strongly magnetic belt ~30 km wide and 90 km long and is bounded by two splays of the Tallacootra Shear Zone (Fig. 1). The Colona Block comprises variably deformed and metamorphosed, layered, intermediate to mafic intrusive lithologies together with garnet – biotite bearing metasedimentary units. The intrusive igneous rocks range from biotite-rich tonalites and granodiorites to gabbros. SHRIMP U-Pb zircon geochronology from a mildly deformed hornblende gabbro gives an interpreted crystallisation age of 1727 ± 8 Ma (Fanning et al., 2007). The metamorphic conditions recorded in the metasedimentary units reached the amphibolite-facies with temperatures of c. 550 °C at pressures of c. 5 kbar.

The structures of the Fowler Domain record a complex history of deformation and reactivation. As discussed above, each block records different deformation and metamorphic histories at different times. The most striking feature of the Fowler Domain is the anastamosing shear zones which cross cut all lithologies and the terrane scale shear zones which divide up the different tectonic blocks (Figs 1, 2). Potential field geophysical modelling across the different blocks suggests that the majority of the shear zones are steeply dipping to near vertical (Thomas, 2004). Limited geochronology indicates that these structures record a prolonged deformation history with multiple reactivations. Swain et al. (2005) presented EPMA monazite geochronology which indicates the Tallacootra Shear Zone records dextral transpression related to the Kimban Orogeny at c. 1680 Ma with Ar-Ar thermochronology on micas indicating reactivation at c. 1450 Ma (Fraser and

Lyons, 2006). EPMA monazite data from the Coorabie Shear Zone (Fig. 1) records deformation and reactivation at c. 1520 Ma and 1460 Ma (Swain et al., 2005). Ar-Ar cooling ages of K-feldspar (<150 °C) by 1350 Ma in the major shear zones indicates the Fowler Domain has not experienced reworking associated with the c. 1200 Ma Musgravian/Grenvillian event (Fraser and Lyons, 2006). Orogeny The geophysical modelling and pattern of metamorphism recorded in the different blocks are consistent with the latter exhumation event being transpressional in nature, however this late transpression does not need to be genetically related to the earlier events which created the geological character of the exhumed blocks (Thomas, 2004).

ANALYTICAL PROCEDURES

Sample preparation and mineral separates for geochronology were conducted at the University of Adelaide using standard panning, magnetic and density techniques. Separated zircon and monazite grains were mounted in epoxy and imaged by CL (zircon) and BSE (monazite) on a Phillips XL-20 SEM equipped with a Gatan CL at Adelaide Microscopy in the University of Adelaide.

Single-grain U-Pb dating of zircon and monazite was undertaken using an Argilent 7500cs ICP-MS coupled with a New Wave 213 mm Nd-YAG laser at Adelaide Microscopy following the methods outlined in Reid et al. (2006) Payne et al. (2006) and Payne (2008). All data used in age calculations were within 10% concordance with the exception of sample R1472764, where a 20% concordance cut off has been used.

Whole rock core samples for geochemical analysis were crushed and milled in a tungsten carbide mill at the University of Adelaide. Major, trace and RE elemental analysis was conducted by AMDEL using standard acid digestion and ICP-MS analysis.

GEOCHRONOLOGICAL RESULTS

The following geochronological results are presented in order of ascending sample number and grouped by geological block (Fig. 1). Where both zircon and monazite data have been collected for a single sample the data are presented together and are both incorporated into the discussion of the sample.

Metapelite, Colona Block: R1472756

Sample Number:	R1472756		
Collector:	Howard, K.E.		
Location GDA94:	211002 E	6536180 N	Zone 53
Location Lat-Long:	-31.272866	131.964753	
250K map sheet	NULLARBOR		
Location:	Drillhole COL 20D, 46.6–47.5 m		
Analytical method:	LA-ICP-MS U–Pb zircon		
Interpreted age:	1770 ± 12 Ma		
Age type:	Maximum Depositional Age		
Analytical method:	LA-ICP-MS U-Pb monazite		
Interpreted age:	1690 ± 9 Ma		
Age type:	Metamorphic Crystallisation		
Age calculation method:	Weighted mean $^{207}Pb/^{206}Pb$ age		

Sample description

The sample is a weakly foliated metapelite containing quartz – garnet – biotite – plagioclase – sillimanite – muscovite, with minor amounts of zircon, monazite, ilmenite and magnetite.

Zircon characteristics

Zircons from this sample are sub- to euhedral, 70–200 μm in size, have an average aspect ratio of 2 and are largely metamict (Fig. 3). The bulk of the zircons are colourless some contain black, opaque or other inclusions.

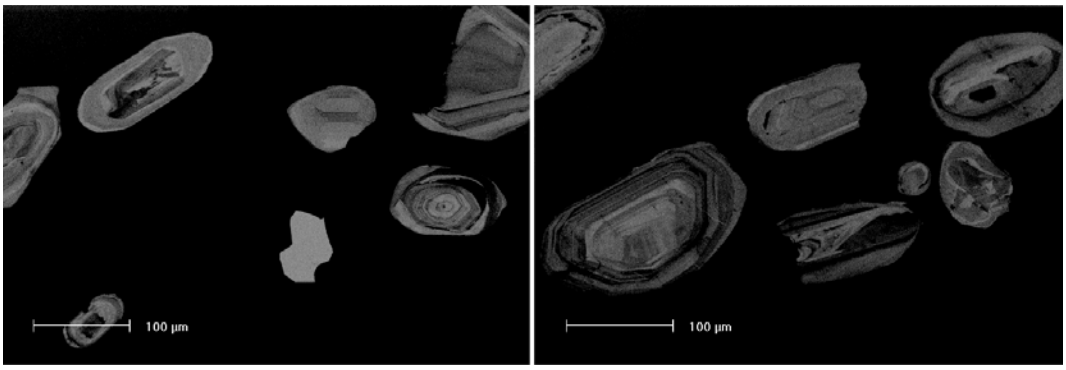

Figure 3. Representative CL images of zircons from sample R1472756

Monazite characteristics

Monazite grains are an- to subhedral and range in size from c. 80–150 µm in diameter. The monazites contain complex zoning patterns in BSE images with up to three different zones (Fig. 4).

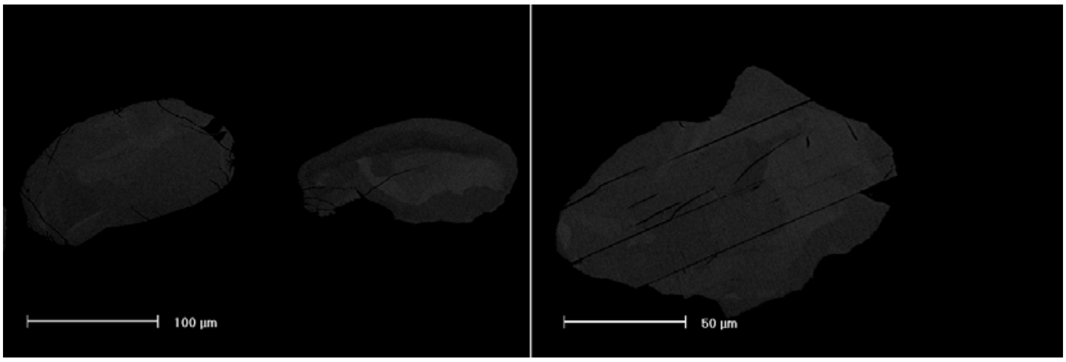

Figure 4. Representative BSE images of monazites from sample R1472756

Sample results

Fifty zircon analyses were obtained; thirteen analyses are strongly discordant (>10% discordant) and were rejected from age calculation (Fig. 5a). The relative probability plot (Fig. 5b) highlights the bimodal dominant grouping of analyses peaking at about 1736 Ma and 1774 Ma. A subordinate peak exists at around 1960 Ma with older scattered grains ranging up to 3131 Ma. The youngest group of detrital zircons give a weighted mean $^{207}Pb/^{206}Pb$ age of 1770 ± 12 Ma (MSWD = 0.99), based on twelve analyses (Fig. 5c).

The seven youngest zircons ranging in age from 1730 ± 19 to 1676 ± 21 are interpreted to give metamorphic ages due to metamorphic rims and recrystallisation fronts viewed from CL images.

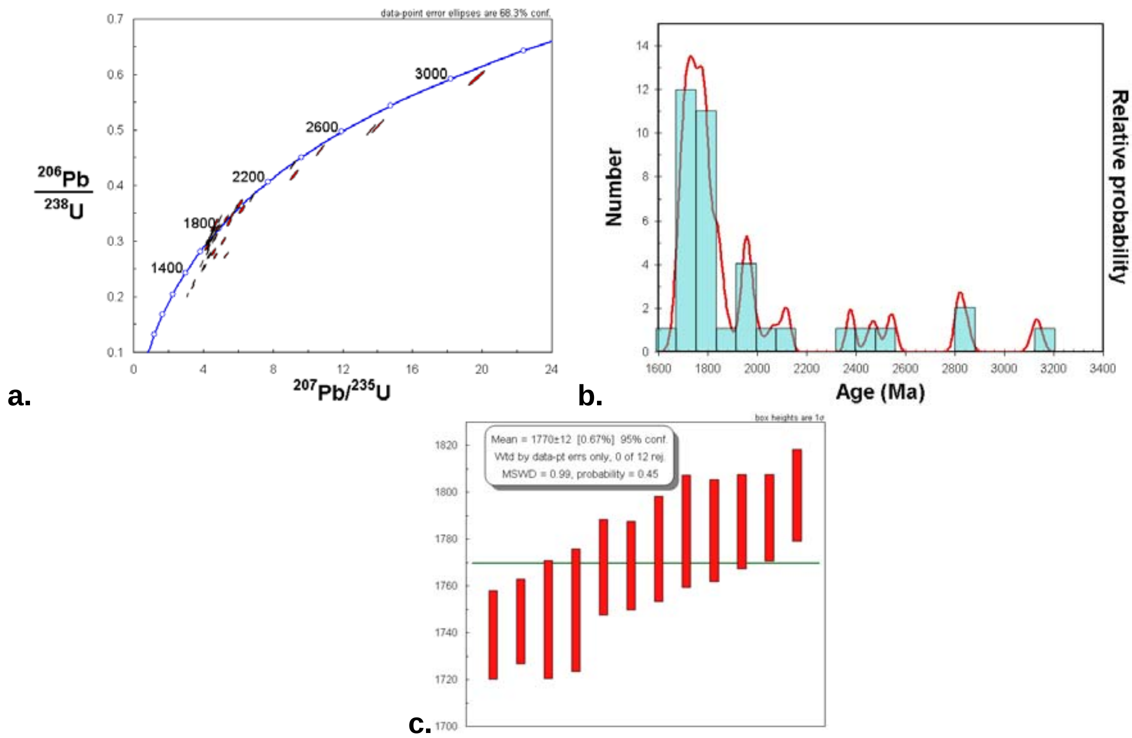

Figure 5. a. Zircon Concordia plot of all analyses from sample R1472756. b. Relative probability plot of concordant zircon data from sample R1472756. c. Weighted average plot of youngest detrital zircon population from sample R1472756.

Twenty monazite analyses were obtained from 10 different grains. All analyses are concordant to slightly reversely discordant (Fig. 6a). The weighted mean $^{207}Pb/^{206}Pb$ for all 20 analyses produces an age of 1690 ± 9 Ma (MSWD = 0.73: Fig. 6b).

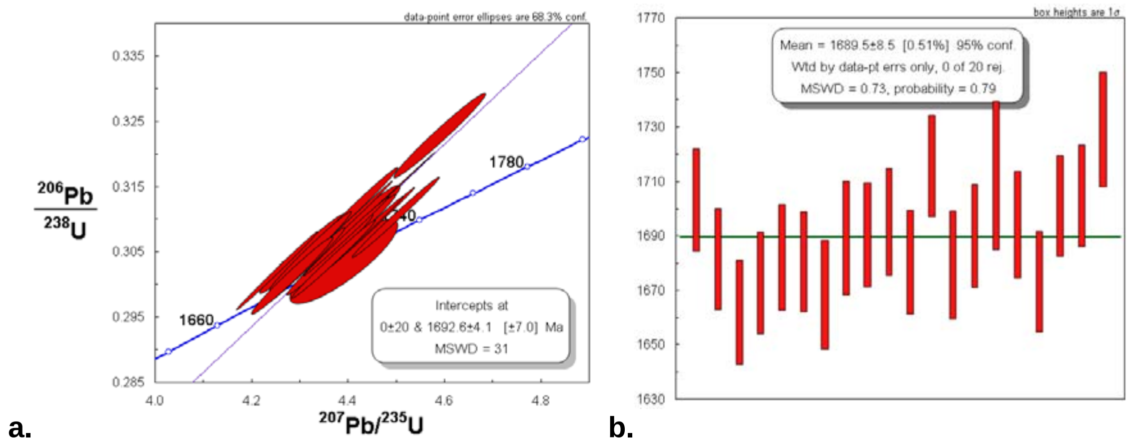

Figure 6. a. Monazite Concordia plot of all analyses from sample R1472756. b. Weighted average $^{207}Pb/^{206}Pb$ plot of monazite analyses from sample R1472756.

Geochronological interpretation

Detrital zircon analyses from this sample place a constraint on the maximum age of deposition for this metapelite at 1770 ± 12 Ma. The age of 1690 ± 9 Ma obtained from monazite is interpreted to constrain the timing of amphibolite-facies metamorphism. The spread of ages between 1730 and 1680 Ma recorded in a small population of zircons suggests these grains have been metamorphically disturbed.

Orthogneiss, Barton Block: R1472757

Sample Number:	R1472757		
Collector:	Howard, K.E.		
Location GDA94:	246028 E	6561171 N	Zone 53
Location Lat-Long:	-31.0557798	132.338566	
250K map sheet	FOWLER		
Location:	Drill hole TAL 4, 25.5–26.2 m		
Analytical method:	LA-ICPMS U–Pb zircon		
Interpreted age:	1706 ± 8 Ma		
Age type:	Magmatic crystallisation age		
Age calculation method:	Weighted mean $^{207}Pb/^{206}Pb$ age		

Sample description

This sample is a foliated orthogneiss containing porphyroblastic, euhedral garnet up to 0.6 mm in diameter. The matrix consists of a fine grained plagioclase – quartz – biotite ± opaques within a schistose fabric.

Zircon characteristics

Zircons from this sample are mostly subhedral and between 80 and 200 µm in length with rounded crystal apices (Fig. 7). These zircons are largely metamict. Grains typically display oscillatory zoning with locally patchy and resorbed cores.

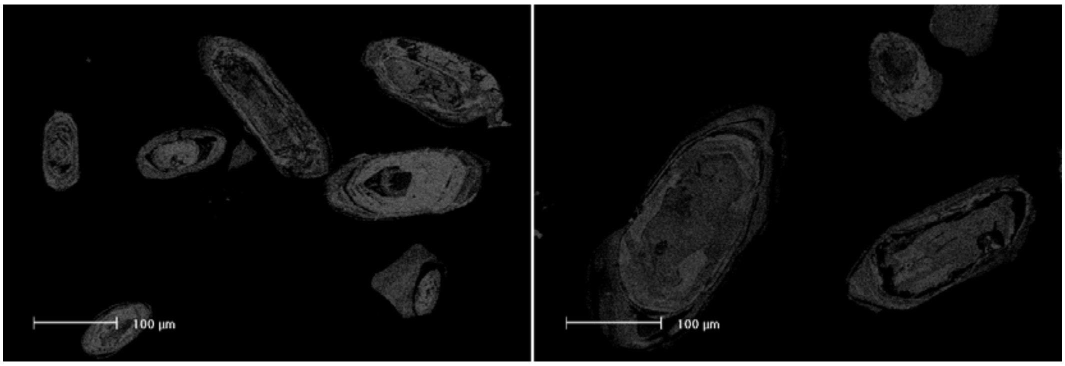

Figure 7. Representative CL images of zircons from sample R1472757

Sample results

Fifty-five analyses were obtained; nineteen analyses are strongly discordant (>10% discordant) and were rejected from age calculation (Fig. 8a). The relative probability plot shows a dominant age group at about 1710 Ma with one older grain at 2195 Ma (Fig. 8b). The weighted $^{207}Pb/^{206}Pb$ age of the dominant population is 1706 ± 8 Ma with an MSWD of 0.97 (Fig. 8c). A U/Pb Concordia plot anchored through the origin (to account for recent Pb loss through metamictisation) indicates an intercept age of 1714 ± 12 (MSWD of 15: Fig. 8d).

Geochronological interpretation

Analyses constrain the magmatic crystallisation age at c. 1706 ± 8 Ma. This orthogneiss is interpreted to be syn-tectonic with the 1725–1690 Ma Kimban Orogeny.

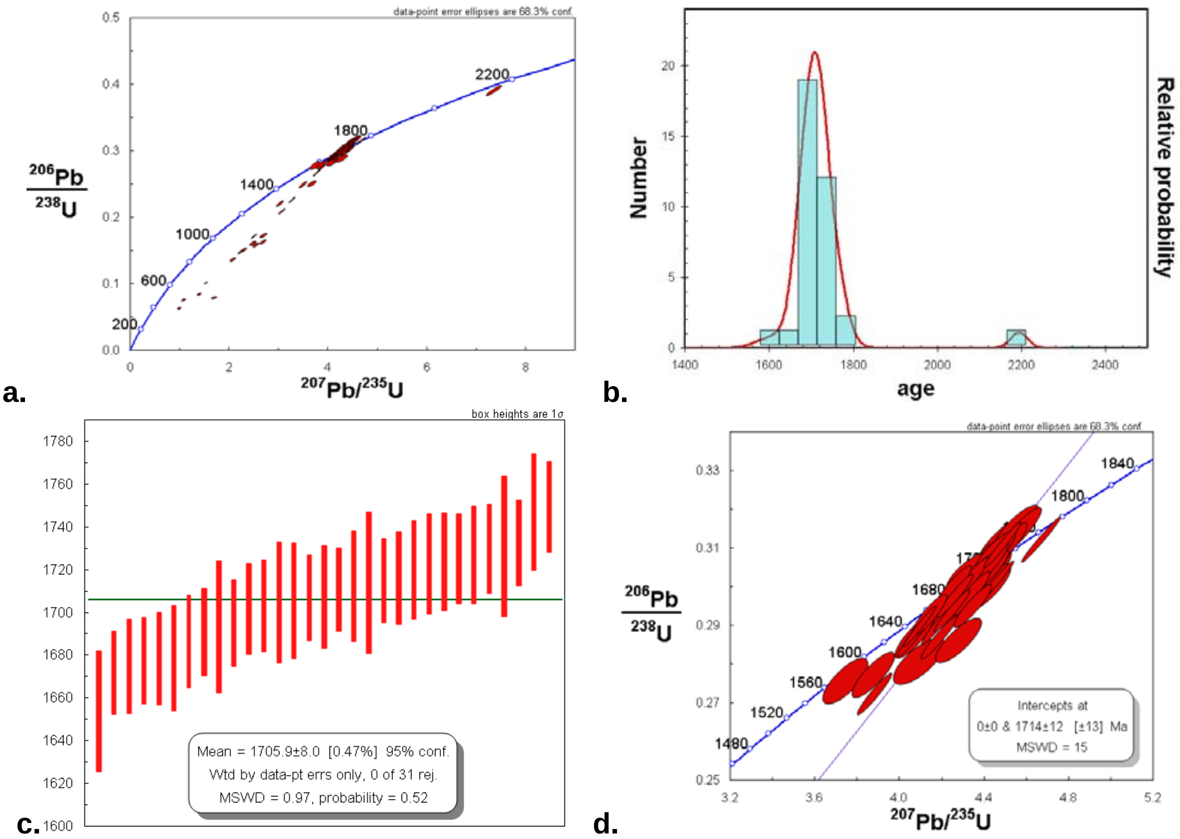

Figure 8. **a. Zircon Concordia plot of all analyses from sample R1472757. b. Relative probability plot of concordant zircon data from sample R1472757. c. Weighted average plot of concordant zircon population from sample R1472757. d. Concordia plot and intercept age of concordant zircon data excluding the inherited grain.**

Orthogneiss, Barton Block: R1472758

Sample Number:	1472758		
Collector:	Howard, K.E.		
Location GDA94:	237128 E	6568571 N	Zone 53
Location Lat-Long:	-30.9871284	132.2473098	
250K map sheet	BARTON		
Location:	Drill hole TAL 9, 21.8–22.5 m		
Analytical method:	LA-ICPMS U–Pb zircon		
Interpreted age:	1707 ± 8 Ma		
Age type:	Magmatic crystallisation, possible metamorphic resetting		
Age calculation method:	Weighted mean ^{207}Pb/^{206}Pb age		

Sample description

This sample is a well banded fine biotite gneiss consisting of a fine grained plagioclase – quartz – K feldspar – biotite ± opaques assemblage. It is interpreted to be an orthogneiss but is impossible to define genetically.

Zircon characteristics

Zircons from this sample are sub- to euhedral, between 200 and 1600 µm in length with an average aspect ratio of 2:1 (Fig. 9). Some grains contain recrystalisation fronts and rounded rim zones suggesting some metamorphic zircon growth.

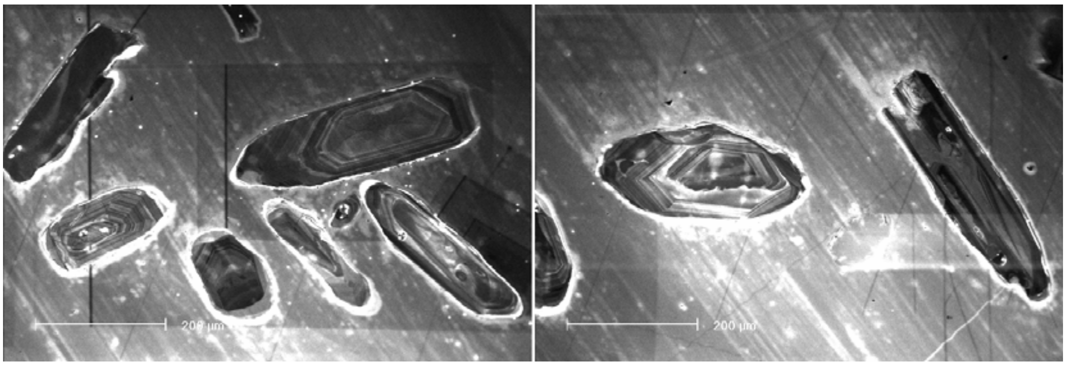

Figure 9. Representative CL images of zircons from sample R1472757

Sample results

Thirty analyses were obtained; three analyses are strongly discordant (>10% discordant) and were rejected from age calculation (Fig. 10a). The relative probability plot (Fig. 10b) shows a broad peak at c. 1707 Ma, with a spread of ages between 1720–1680 Ma and two older zircons at about 1770 Ma. There is no clear morphological distinction between younger and older grains and therefore the weighted mean $^{207}Pb/^{206}Pb$ age of 1707 ± 8 Ma (MSWD = 0.6: Fig. 10c) is interpreted to record the timing of magmatic crystallisation.

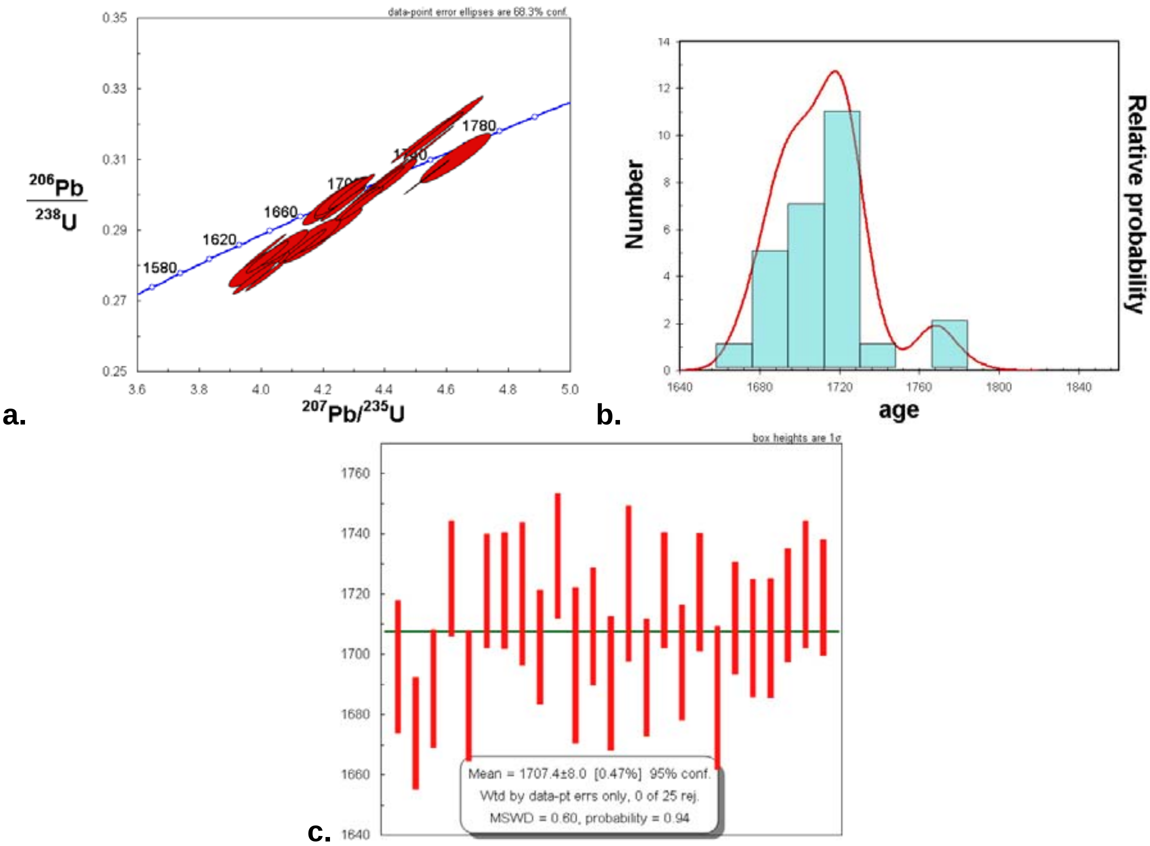

Figure 10. a. Zircon Concordia plot of all analyses from sample R1472758. b. Relative probability plot of concordant zircon data from sample R1472758. c. Weighted average plot of concordant zircon population from sample R1472758.

Geochronological interpretation

Analyses constrain the magmatic crystallisation age at c. 1707 ± 8 Ma. This age is regarded as a minimum crystallisation age as the intrusion is interpreted to be a pre- to syntectonic, with the ensuing Kimban Orogeny metamorphism resulting in the spread of ages between c. 1720–1680 Ma.

Metapelite, Barton Block: R1472759

Sample Number:	R1472759		
Collector:	Howard, K.E.		
Location GDA94:	247028 E	6560271 N	Zone 53
Location Lat-Long:	-31.064108	132.34881	
250K map sheet	FOWLER		
Location:	Drill hole TAL 20, 57–57.5 m		
Analytical method:	LA-ICPMS U–Pb monazite		
Interpreted age:	1673 ± 9 Ma		
Age type:	Metamorphic crystallisation		
Age calculation method:	Weighted mean $^{207}Pb/^{206}Pb$ age		

Sample description

This sample consists of a banded, high-grade semi-pelitic gneissic assemblage of garnet – sillimanite – biotite – plagioclase – K feldspar – quartz ± magnetite.

Monazite characteristics

Monazite grains are anhedral and range in size from c. 80 to 200 µm in diameter. The monazites are often cracked and complexly zoned in BSE images with up to two different domains.

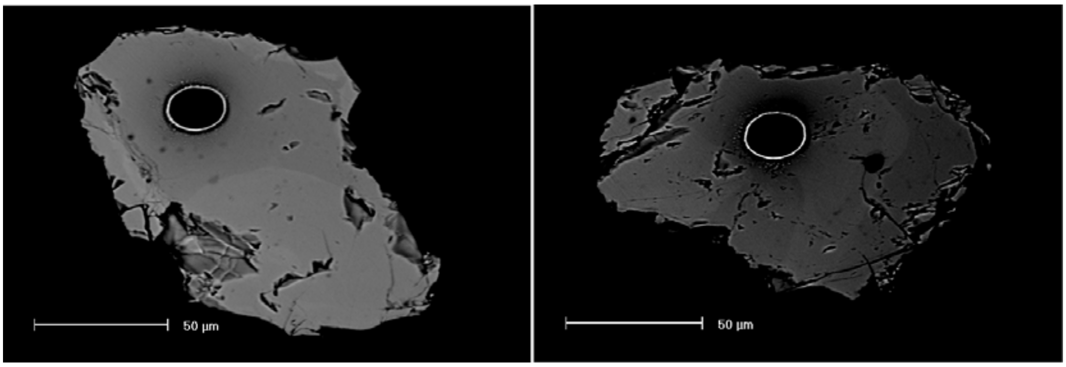

Figure 11. Representative BSE images of monazites from sample R1472759

Sample results

20 analyses from 17 individual grains were collected that were concordant. The weighted mean $^{207}Pb/^{206}Pb$ age is 1673 ± 9 Ma (MSWD 0.59). There was no geochronological distinction between the different monazite zones.

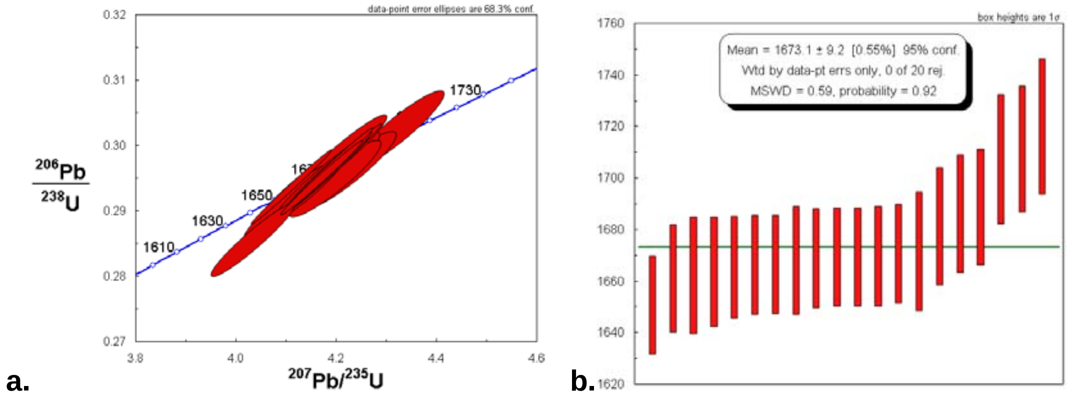

Figure 12. a. Monazite Concordia plot of all analyses from sample R1472759. b. Weighted average $^{207}Pb/^{206}Pb$ plot of monazite analyses from sample R1472759.

Geochronological interpretation

The age of 1673 ± 9 Ma is interpreted to be too young to date the wanning stages of the 1730–1690 Ma Kimban Orogeny. This age may reflect thermal metamorphic monazite growth as a consequence of Tunkillia Suite magmatism which has been dated to be late to post Kimban between c. 1690–1670 Ma in the Fowler and Nuyts Domains.

Orthogneiss, Barton Block: R1472761

Sample Number:	R1472761		
Collector:	Howard, K.E.		
Location GDA94:	310203 E	6599549 N	Zone 53
Location Lat-Long:	-30.7218208	133.017816	
250K map sheet	BARTON		
Location:	Drill hole TAL 60, 42.0–43.5 m		
Analytical method:	LA-ICPMS U–Pb zircon		
Interpreted age:	c. 2480–2385 Ma		
Age type:	Mixed Magmatic and Metamorphic Crystallisation		
Age calculation method:	Weighted mean $^{207}Pb/^{206}Pb$ age		

Sample description

This sample consists of a homogeneous quartz – plagioclase rock with a weak foliation defined by chlorite. There sample also contains minor garnet, biotite and epidote. The rock is interpreted to be an orthogneiss with an igneous protolith assemblage of quartz – plagioclase – hornblende.

Zircon characteristics

Zircons in this sample are between c. 100 and 200 µm in length and are typically rounded with aspect ratios between 1:1 and 1:3. Many grains contain broad oscillatory zoned cores with resorbed and recrystallised faces and all grains have thin, rounded metamorphic overgrowths. Many grains are cracked and some are clearly metamict.

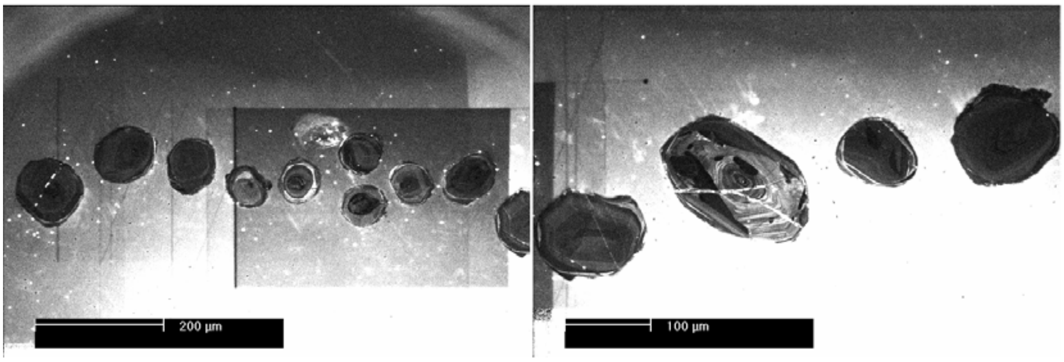

Figure 13. Representative CL images of zircons from sample R1472761

Sample results

Seventy analyses were obtained: twenty-three were outside 10% discordance and have been rejected from age calculations (Fig. 14a). The relative probability plot (Fig. 14b) shows three older grains at 3006, 2965 and 2839 Ma. Two dominant peaks at c. 2480 and 2385 Ma constrain the bulk of the data with a scatter of seven younger grains down to 1924 Ma. Due to the nature of the data no single age can be interpreted from this sample.

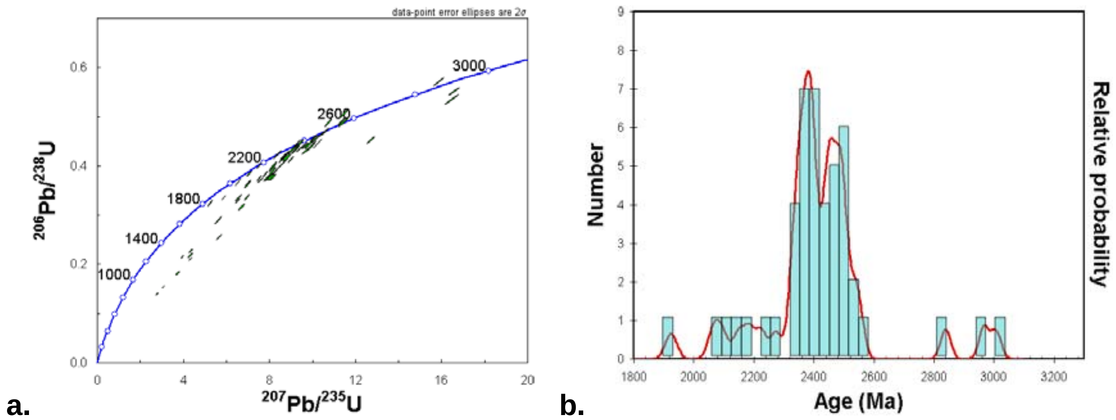

Figure 14. a. Zircon Concordia plot of all analyses from sample R1472761. b. Relative probability plot of concordant zircon data from sample R1472761.

Geochronological interpretation

The spread of ages in this sample pose a problem for interpreting this data. The three older grains are interpreted to be inheritance. The bulk of the data are contained within two distinct peaks at 2480 and 2385 Ma. These groups of data provide intercept ages of c. 2500 and c. 2400 Ma and probably reflect initial magmatic crystallisation and subsequent resetting and metamorphic growth during the 2450–2420 Ma Sleafordian Orogeny. A scatter of younger grains are likely to form a discord between these ages and 1700 Ma representing subsequent minor reworking during the Kimban Orogeny. All the data displays a discordant spread towards the origin suggesting some modern Pb loss probably due to minor metamictisation of some grains.

Orthogneiss, Barton Block: R1472764

Sample Number:	R1472764		
Collector:	Howard, K.E.		
Location GDA94:	317818 E	6607834 N	Zone 53
Location Lat-Long:	-30.648284	133.098772	
250K map sheet	BARTON		
Location:	Drill hole TAL 67, 86.0–88.5 m		
Analytical method:	LA-ICPMS U–Pb zircon		
Interpreted age:	2539 ± 15 Ma		
Age type:	Magmatic crystallisation, intrusive		
Interpreted age:	2450 ± 37 Ma		
Age type:	Metamorphic crystallisation		
Age calculation method:	Weighted mean $^{207}Pb/^{206}Pb$ age		

Sample description

This sample is a fine-grained, homogeneous quartz – plagioclase – biotite – muscovite rock with a schistosity defined by aligned micas. There is also some late muscovite growth. The protolith of this rock is ambiguous but it is interpreted to be meta-igneous due to its homogeneous nature.

Zircon characteristics

Zircons in this sample are between 80 to 150 µm in length. This sample contains a mixture of igneous, pyramidal, oscillatory zoned cores with clearly resorbed edges and metamorphic overgrowths. There is also a subset of round grains with patchy zoning which are interpreted to be metamorphic in origin.

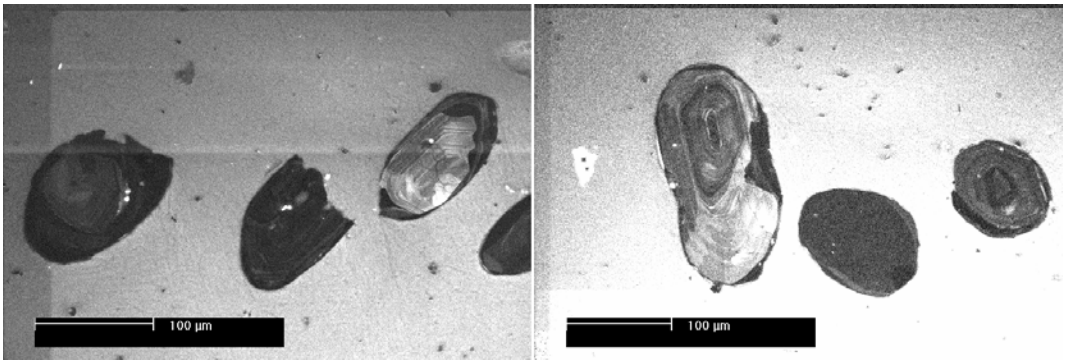

Figure 15. Representative CL images of zircons from sample R1472764

Sample results

30 analyses were obtained but only 10 grains were within 10% concordance (Fig. 16a). The suggestion of modern Pb loss in this sample and the small number of concordant grains has meant that a cut off of 20% concordance has been used in the calculation of the weighted average ages (15 grains within 20% concordance).

The distribution of ages shows the dominant igneous and metamorphic peaks, with a scatter of older inherited grains at c. 2816, 3000 and 3200 Ma (Fig. 16b). The weighted average age from the six igneous grains produced an age of 2539 ± 15 Ma (MSWD 0.3: Fig. 17a) which is consistent with the Concordia intercept age of 2540 ± 15 Ma (MSWD 18).

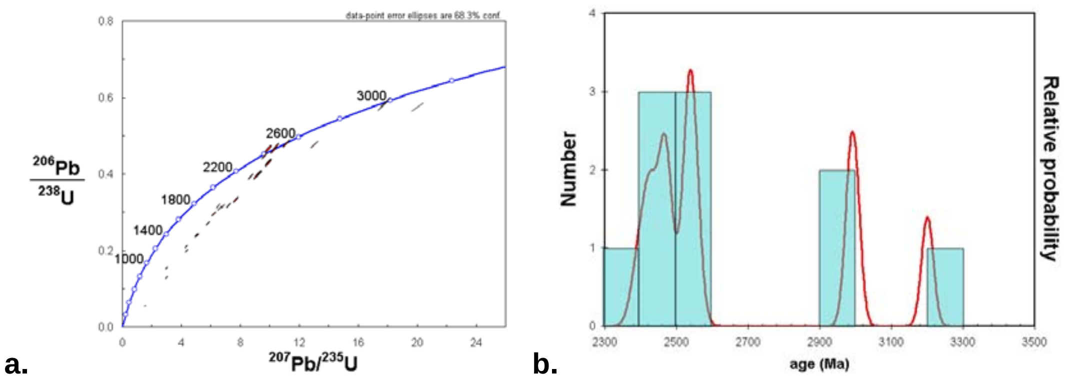

Figure 16. a. Zircon Concordia plot of all analyses from sample R1472764. b. Relative probability plot of concordant zircon data from sample R1472764.

The weighted average of the five metamorphic analyses from grains and rims produced an age of 2450 ± 37 Ma (MSWD 2.4: Fig. 17b) which is consistent with the Concordia intercept age of 2458 ± 39 Ma (MSWD 88).

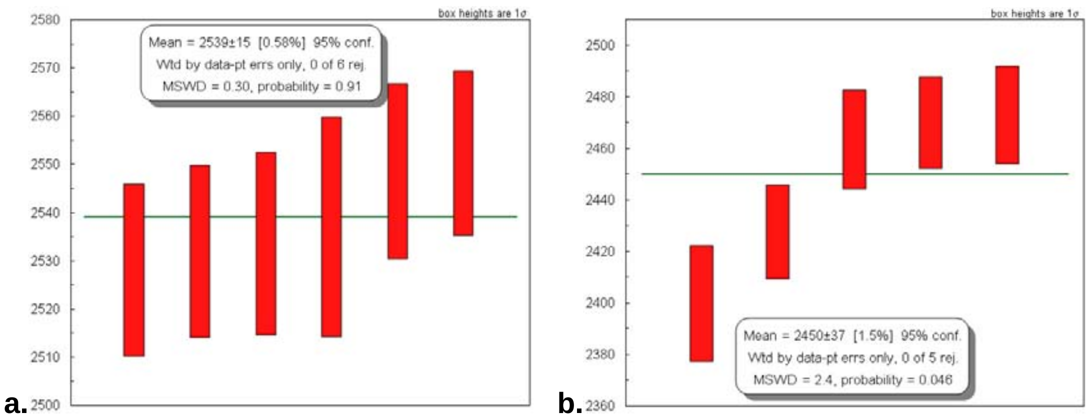

Figure 17. a. Weighted average plot of concordant igneous zircon population from sample R1472764. b. Weighted average plot of concordant metamorphic zircon population from sample R1472764.

Geochronological interpretation

Analyses from igneous zircons constrain the timing of igneous crystallisation to 2539 ± 15 Ma. This sample was then subject to high-grade metamorphism during the Sleafordian Orogeny at 2450 ± 37 Ma. The presence of these older ages suggests this sample forms part of the Archaean to Palaeoproterozoic Mulgathing Complex and is either not part of the Fowler Domain or is basement to it.

Metapelite, Barton Block: R1472781

Sample Number:	R1472780		
Collector:	Howard, K.E.		
Location GDA94:	248614 E	6574437 N	Zone 53
Location Lat-Long:	-30.936769	132.368926	
250K map sheet	BARTON		
Location:	Drill hole BAC 18, EOH 48 m		
Analytical method:	LA-ICPMS U–Pb zircon		
Interpreted age:	1738 ± 15 Ma		
Age type:	Maximum depositional age		
Analytical method:	LA-ICPMS U-Pb monazite		
Interpreted age:	1727 ± 6 and 1681 ± 5 Ma		
Age type:	Metamorphic crystallisation age		
Age calculation method:	Concordia upper-intercept ages		

Sample description

This sample is a fine-grained schistose quartz – biotite – garnet – sillimanite – plagioclase semi-pelitic unit with garnets occasionally up to 3 mm in diameter. The assemblage also contains some fine-grained disseminated oxides. This sample is interpreted to be sedimentary in origin.

Zircon characteristics

Zircons in this sample are between 80 to 150 µm in length with aspect ratios between 1:1 and 2:1 (Fig. 18). The sample contains possible original igneous, pyramidal, oscillatory zoned grains often with clearly resorbed edges and possible thin metamorphic overgrowths.

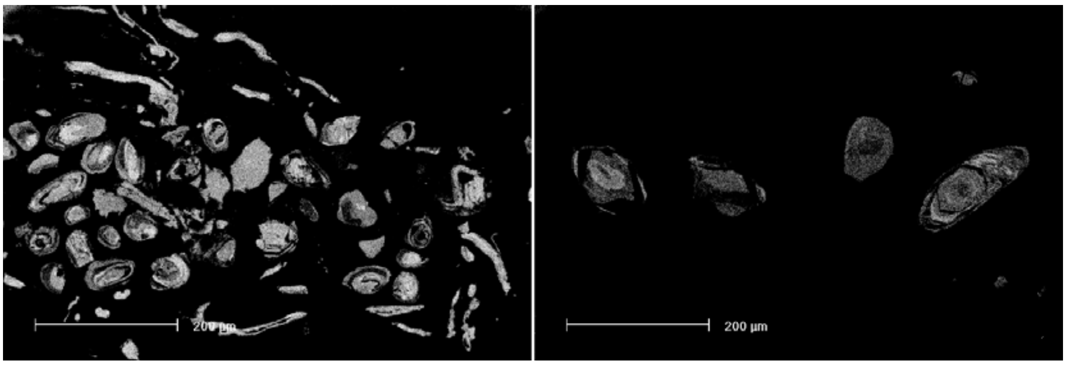

Figure 18. Representative CL images of zircons from sample R1472781

Monazite characteristics

Monazite grains are an- to subhedral in shape, between 80 and 200 µm in diameter and contain multiple fractures (Fig. 19). Minor complex zoning can be seen in BSE images with up to two different domains.

Sample results

Fifty zircon analyses were obtained and only seven are within 10% concordancy (Fig. 20a). Due to the poor data, all seven analyses were used to calculate a weighted mean age of 1738 ± 15 Ma (MSWD 0.73) which is interpreted as a maximum depositional age (Fig. 20b).

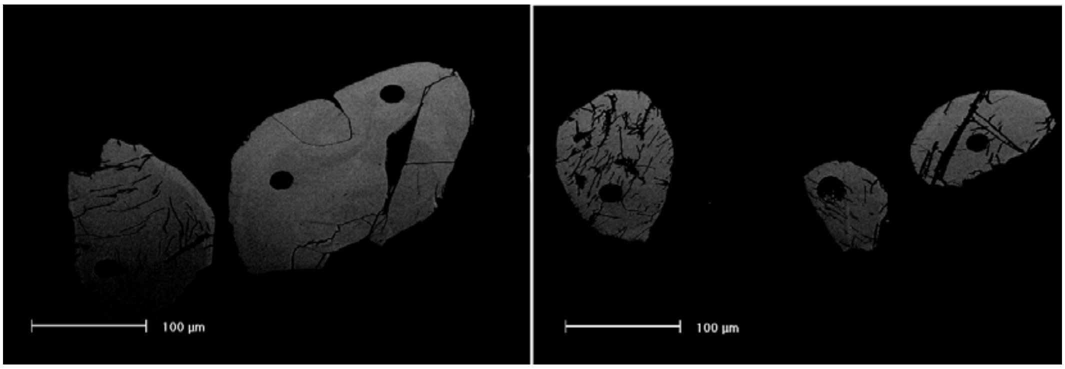

Figure 19. Representative BSE images of monazites from sample R1472759

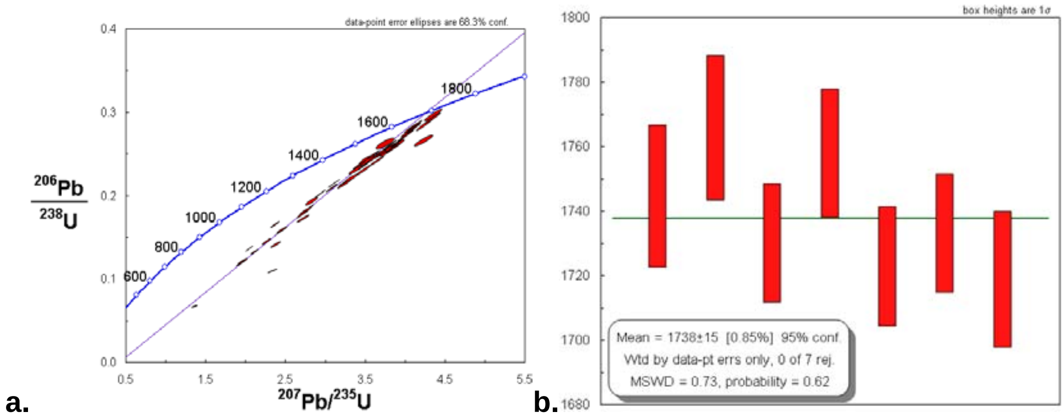

Figure 20. a. Zircon Concordia plot of all analyses from sample R1472781. b. Weighted average plot of concordant zircon population from sample R1472781.

Twenty monazite analyses were obtained from 18 individual grains. All analyses were concordant to slightly discordant (Fig. 21a–b), with four analyses being composites of two domains and were therefore excluded. The relative probability plot (Fig. 21c) suggests two peaks which are close together. Upper-intercept ages on each of these peaks (defined by individual grains) indicate two periods of monazite growth at 1727 ± 6 (Fig. 21a) and 1681 ± 5 Ma (Fig. 21b).

Geochronological interpretation

The weighted average age obtained from detrital zircons in this sample constrain a maximum depositional age of 1738 ± 15 Ma. The age of 1727 ± 6 Ma obtained from monazite is interpreted to be the timing of peak amphibolite-facies metamorphism during the Kimban Orogen, followed by a second period of monazite growth during the emplacement of the post Kimban Tunkillia Suite at 1681 ± 5 Ma.

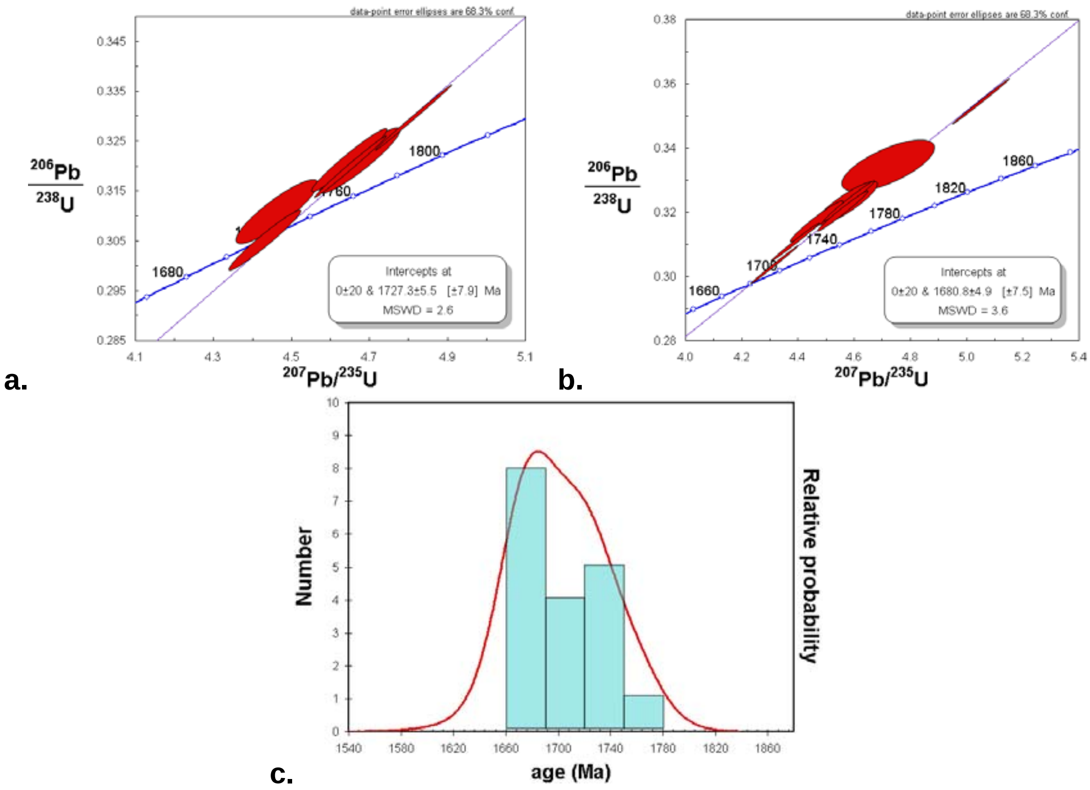

Figure 21. **a. Monazite Concordia plot of older peak analyses from sample R1472781.**
b. Monazite Concordia plot of younger peak analyses from sample R1472781.
c. Relative probability plot of concordant monazite population from sample R1472781.

Metapelite, Barton Block: R1472782

Sample Number:	R1472782		
Collector:	Howard, K.E.		
Location GDA94:	250374 E	6573841 N	Zone 53
Location Lat-Long:	-30.942506	132.387184	
250K map sheet	BARTON		
Location:	Drill hole BAC 23, EOH 57 m		
Analytical method:	LA-ICPMS U–Pb zircon		
Interpreted age:	1753 ± 19 Ma		
Age type:	Maximum depositional age		
Interpreted age:	1685 ± 25 Ma		
Age type:	Metamorphic crystallisation		
Age calculation method:	Weighted mean $^{207}Pb/^{206}Pb$ age		

Sample description

This sample consists of a mildly foliated, banded, pelitic gneiss containing a quartz – K feldspar – plagioclase – biotite – garnet – sillimanite assemblage.

Zircon characteristics

Zircons in this sample are between 50 to 100 µm in length (Fig. 22). This sample contains a mixture of rounded and pyramidal grains often with large dark cores and light rims. The grains are often oscillatory zoned with clearly resorbed edges and metamorphic overgrowth.

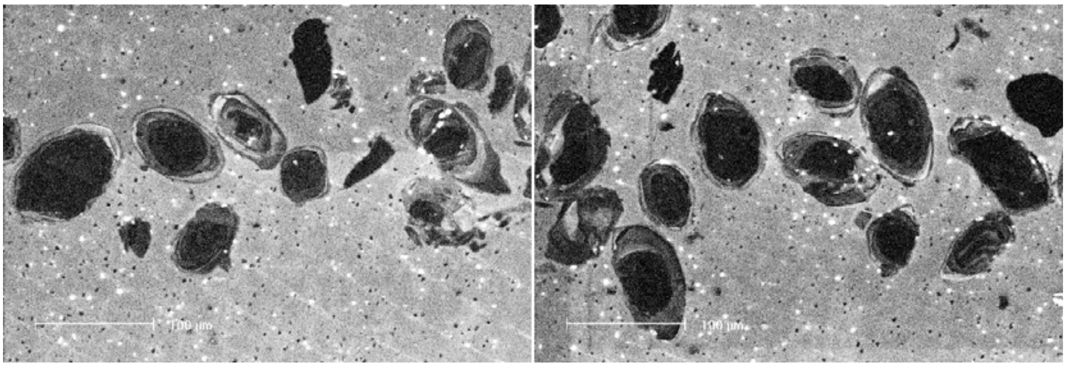

Figure 22. Representative CL images of zircons from sample R1472782

Sample results

Thirty analyses were obtained; nineteen analyses are strongly discordant (>10% discordant) and were rejected from age calculation (Fig. 23a). The relative probability plot (Fig. 23b) shows peaks at 1690 Ma and 1755 Ma, with minor inherited peaks at 1910 Ma and 2280 Ma. Zircon morphologies of the three youngest zircons suggest recrystallisation fronts and are therefore considered as metamorphic. The three metamorphic zircons give a weighted mean $^{207}Pb/^{206}Pb$ age of 1685 ± 25 Ma (MSWD = 0.21: Fig. 23c).

The youngest five detrital zircons give a weighted mean $^{207}Pb/^{206}Pb$ age of 1753 ± 19 (MSWD = 0.52: Fig. 23d) which is considered the maximum depositional age.

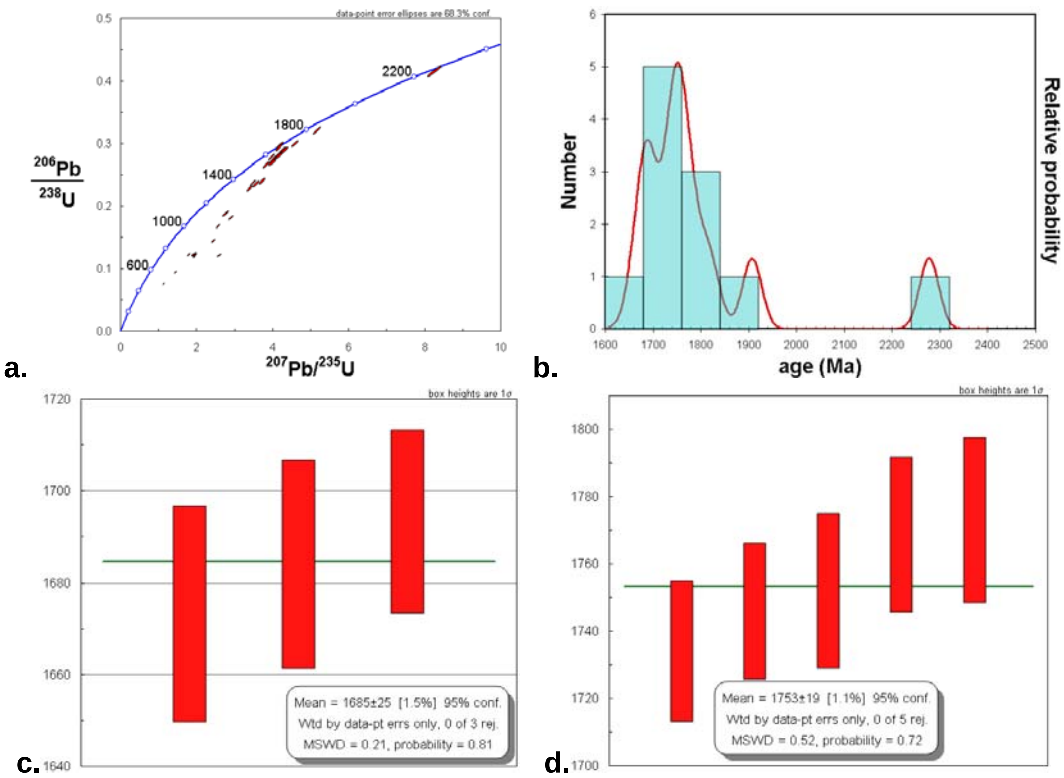

Figure 23. a. Zircon Concordia plot of all analyses from sample R1472782. b. Relative probability plot of concordant zircon data from sample R1472782. c. Weighted average plot of concordant metamorphic zircon population from sample R1472782. d. Weighted average plot of concordant detrital zircon population from sample R1472782.

Geochronological interpretation

The weighted average age obtained from the youngest population of detrital zircons in this sample suggest a maximum depositional age of 1753 ± 19 Ma. This sample was then metamorphosed during the Kimban Orogeny at c. 1685 ± 25 Ma as recorded by the small subset of zircons which contain metamorphic recrystallisation fronts.

Metapelite, Barton Block: R1472785

Sample Number:	R1472785		
Collector:	Howard, K.E.		
Location GDA94:	255670 E	6573106 N	Zone 53
Location Lat-Long:	-30.95024	132.442393	
250K map sheet	BARTON		
Location:	Drill hole BAC 41, EOH 45 m		
Analytical method:	LA-ICPMS U–Pb zircon		
Interpreted age:	1730 ± 8 Ma		
Age type:	Maximum depositional age		
Analytical method:	LA-ICPMS U-Pb monazite		
Interpreted age:	1665 ± 7 Ma		
Age type:	Metamorphic		
Age calculation method:	Weighted mean $^{207}Pb/^{206}Pb$ age		

Sample description

This sample is a plagioclase – biotite – quartz – sillimanite – garnet – ilmenite pelitic-gneiss.

Zircon characteristics

Zircons in this sample are between 50 to 200 µm in length, are broken, abraded and often rounded. Grains range from oscillatory zoned to patchy, resorbed and recrystallised grains with evidence for metamorphic overgrowths.

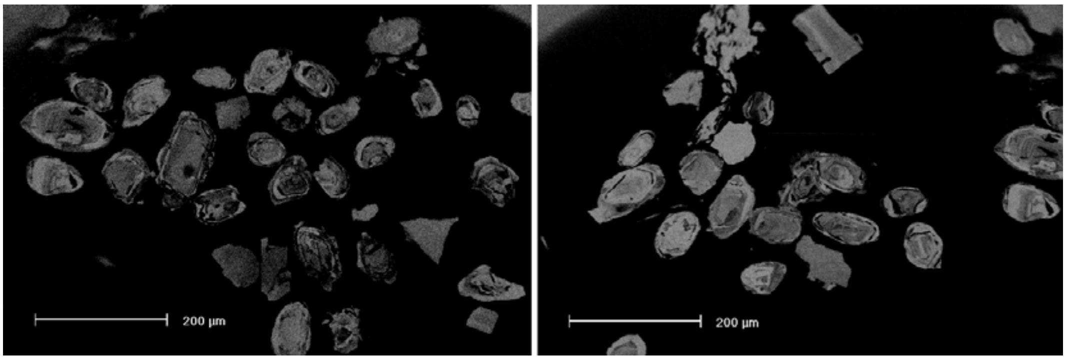

Figure 24. Representative CL images of zircons from sample R1472785

Monazite characteristics

Monazites from this sample are between 50 to 200 µm in size and are typically sub- to anhedral. The grains are often fractured. BSE imaging reveals some complex zoning in grains with typically two different domains.

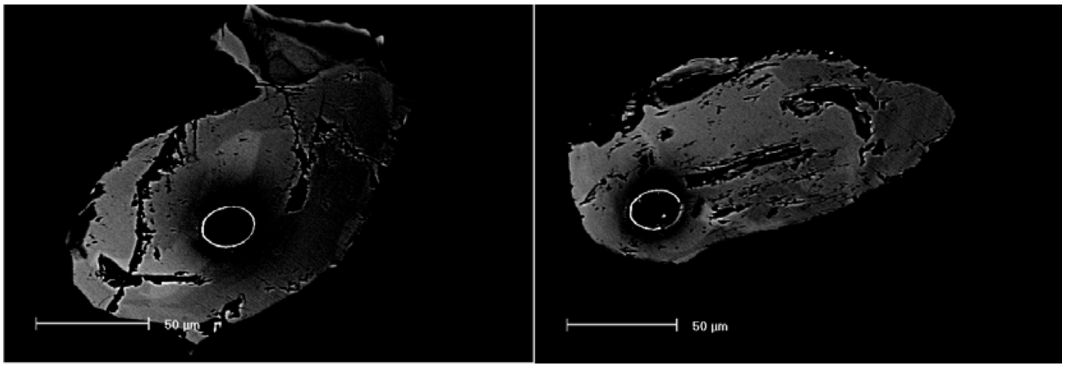

Figure 25. Representative BSE images of monazites from sample R1472785

Sample results

Forty zircon analyses were obtained; fifteen analyses are strongly discordant (>10% discordant) and were rejected from age calculation (Fig. 26a). The relative probability plot (Fig. 26b) shows a uni-modal peak at approximately 1730 Ma. The weighted mean $^{207}Pb/^{206}Pb$ age of all the concordant grains is 1730 ± 8 Ma (MSWD 0.45: Fig. 26c).

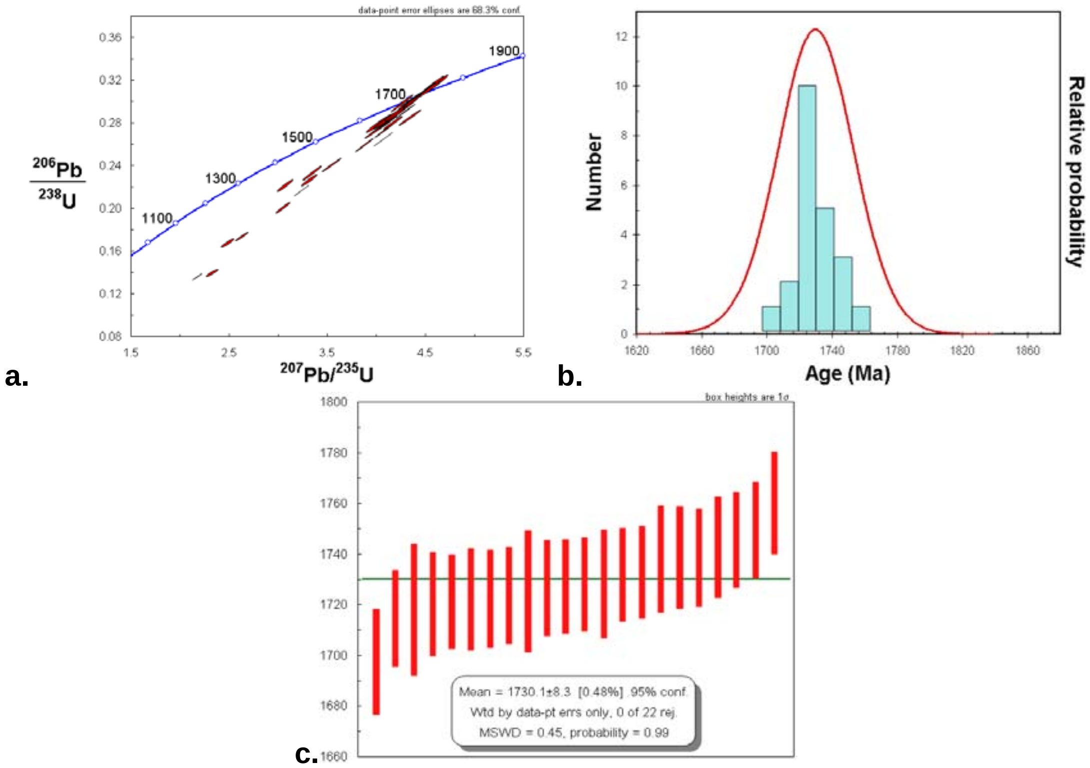

Figure 26. a. Zircon Concordia plot of all analyses from sample R1472785. b. Relative probability plot of concordant zircon data from sample R1472785. c. Weighted average plot of concordant zircon population from sample R1472785.

Thirty monazite analyses were obtained from twenty individual grains. All analyses were concordant to slightly reversely discordant (Fig. 27a). The relative probability plot (Fig. 27b) shows a uni-modal population ranging from c. 1632 to 1684 Ma. The weighted mean $^{207}Pb/^{206}Pb$ age of all the analyses is 1665 ± 7 Ma (MSWD 0.52: Fig. 27c).

Geochronological interpretation

Zircons from this sample define a unimodal distribution, suggesting that the material was derived from a single proximal source region. The maximum depositional age constrained by this peak is given at 1730 ± 8 Ma. Monazites from the same sample are interpreted to reflect metamorphic

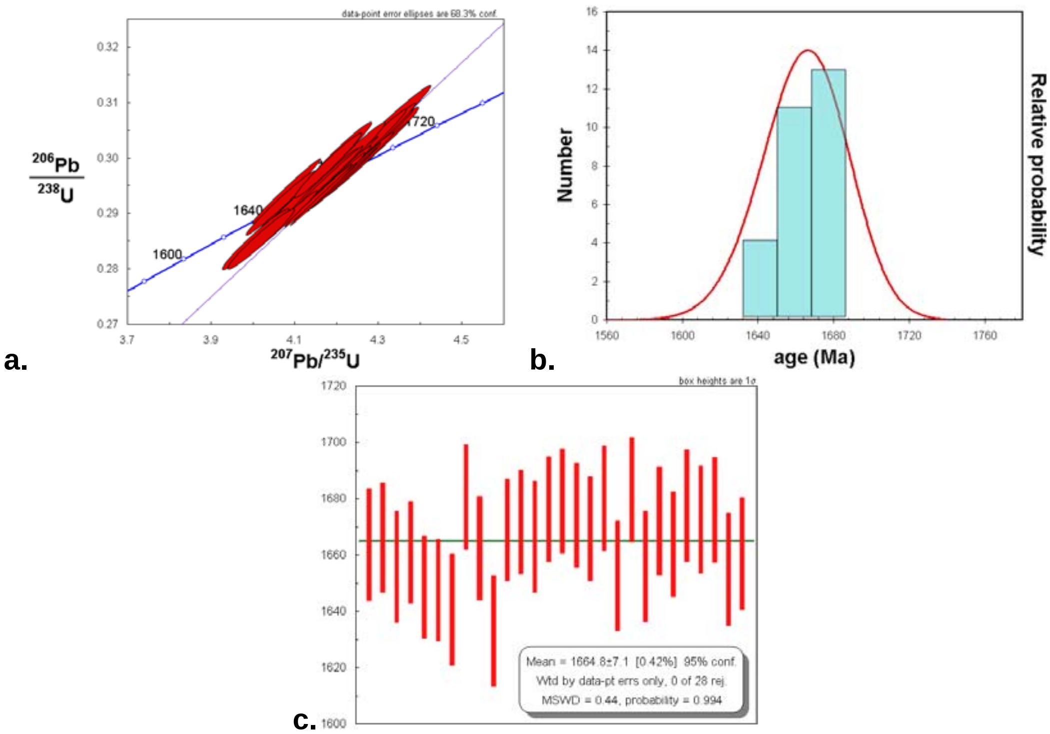

Figure 27. a. Monazite Concordia plot of all analyses from sample R1472785. b. Relative probability plot of concordant monazite data from sample R1472785. c. Weighted average plot of concordant monazite population from sample R1472785.

growth. The weighted average age of this sample of 1665 ± 7 Ma is interpreted to be too young for the accepted age range of the Kimban Orogeny. This age may reflect thermal reworking associated with Tunkillia Suite magmatism.

Metagabbro, Barton Block: R1473462

Sample Number:	R1473462		
Collector:	Howard, K.E.		
Location GDA94:	294128 E	6590672 N	Zone 53
Location Lat-Long:	-30.799196	132.8482487	
250K map sheet	BARTON		
Location:	Drill hole BAT 4, 44.0–56.0 m		
Analytical method:	LA-ICPMS U–Pb zircon		
Interpreted age:	1690 ± 9 Ma		
Age type:	Magmatic crystallisation, intrusive		
Age calculation method:	Weighted mean ^{207}Pb/^{206}Pb age		

Sample description

This sample is a fine to medium-grained plagioclase – biotite – hornblende – clinopyroxene – ilmenite bearing meta-gabbro.

Zircon characteristics

Zircons from this sample are sub- to euhedral and between 100 to 300 µm in length (Fig. 28). They typically have aspect ratios of 2:1 with some up to 3:1. The grains typically contain dark cores in CL images with coarse oscillatory zoned rims. The grains are interpreted to be magmatic in origin.

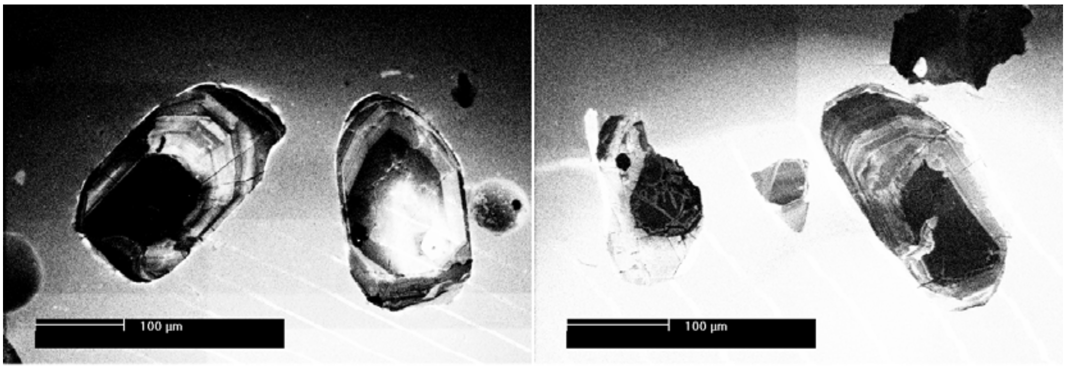

Figure 28. Representative CL images of zircons from sample R1472785

Sample results

Thirty seven analyses were obtained; three were strongly discordant (>10% discordant) and rejected from age calculation (Fig. 29a). The remaining grains were concordant to slightly reversely discordant. The relative probability plot (Fig. 29b) shows a bell shaped curve peaking at c. 1700 Ma. The thirty four zircon grains give a weighted mean $^{207}Pb/^{206}Pb$ age of 1690 ± 9 Ma (MSWD 1.3: Fig. 29c).

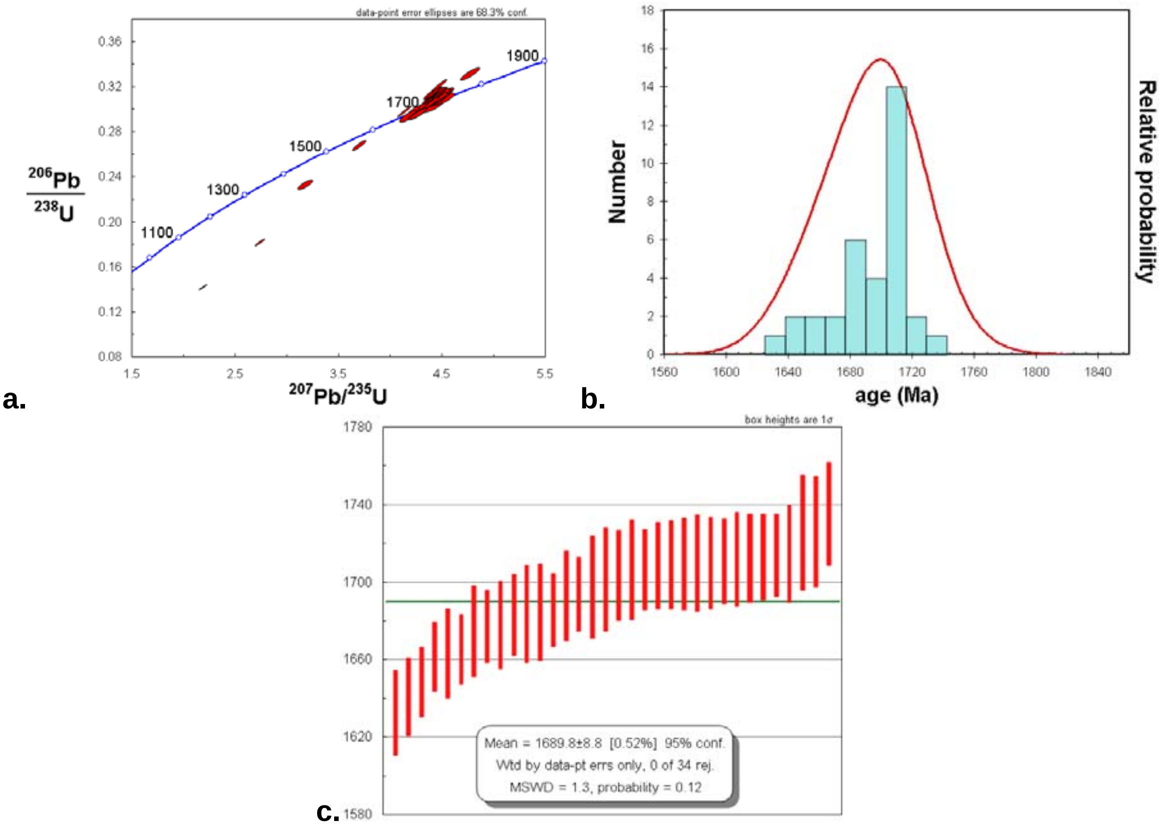

Figure 29. a. Zircon Concordia plot of all analyses from sample R1473426. b. Relative probability plot of concordant zircon data from sample R1473462. c. Weighted average plot of concordant zircon population from sample R1473462.

Geochronological interpretation

The weighted mean $^{207}Pb/^{206}Pb$ age of 1690 ± 9 Ma is interpreted to be the magmatic crystallisation age of this sampled metagabbro. This suggests this unit forms part of the c. 1690–1670 Ma magmatic Tunkillia Suite.

APPENDIXES

1. Whole rock geochemistry

Sample No.	Drill-Hole	Location		Map Sheet	Interval (m)	Lithology
		Easting	*Northing*			
R1472756	COL 20D	211002	6536180	Nullarbor	46.6–47.5	qtz-gt-bi-pl-sill-mu pelite
R1472755	TAL 1	248328	6559171	Fowler	13–13.2	qtz-mag-hbd-ged BIF
R1472757	TAL 4	246028	6561171	Fowler	25.5–26.2	qtz-pl-bi-gt pelite
R1472758	TAL 9	237128	6568571	Barton	21.8–22.5	qtz-pl-Ksp-bi orthogneiss
R1472759	TAL 20	247028	6560271	Fowler	57–57.5	qtz-ksp-pl-bi-sill-gt semipelite
R1472760	TAL 57	343610	6582129	Barton	74–76	qtz-pl-mu-bi-gt-tml metasediment?
R1472761	TAL 60	310203	6599549	Barton	42–43.5	qtz-pl-chl-gt-bi-ep orthogneiss
R1472762	TAL 62	313735	6598901	Barton	62–67	qtz-bi-cumm-pl metasediment
R1472763	TAL 65	313982	6609001	Barton	56–59.5	qtz-pl-bi-gt ± hbd metasediment
R1472764	TAL 67	317818	6607834	Barton	86–88.5	qtz-pl-bi-mu orthogneiss
R1472780	BAC 14	247371	6574759	Barton	47	qtz-hbd-pl amphibolite
R1472781	BAC 18	248614	6574437	Barton	48	qtz-pl-ksp-bi-gt-sill metapelite
R1472782	BAC 23	250374	6573841	Barton	57	qtz-ksp-pl-bi-gt-sill metapelite
R1472783	BAC 28	251864	6573519	Barton	57	qtz-bi-ksp-pl-sill ± gt ilm metapelite
R1472784	BAC 33	253552	6573288	Barton	51	qtz-bi-gt-sill metapelite
R1472785	BAC 41	255670	6573106	Barton	45	qtz-ksp-pl-bi-sill-gt-ilm metapelite

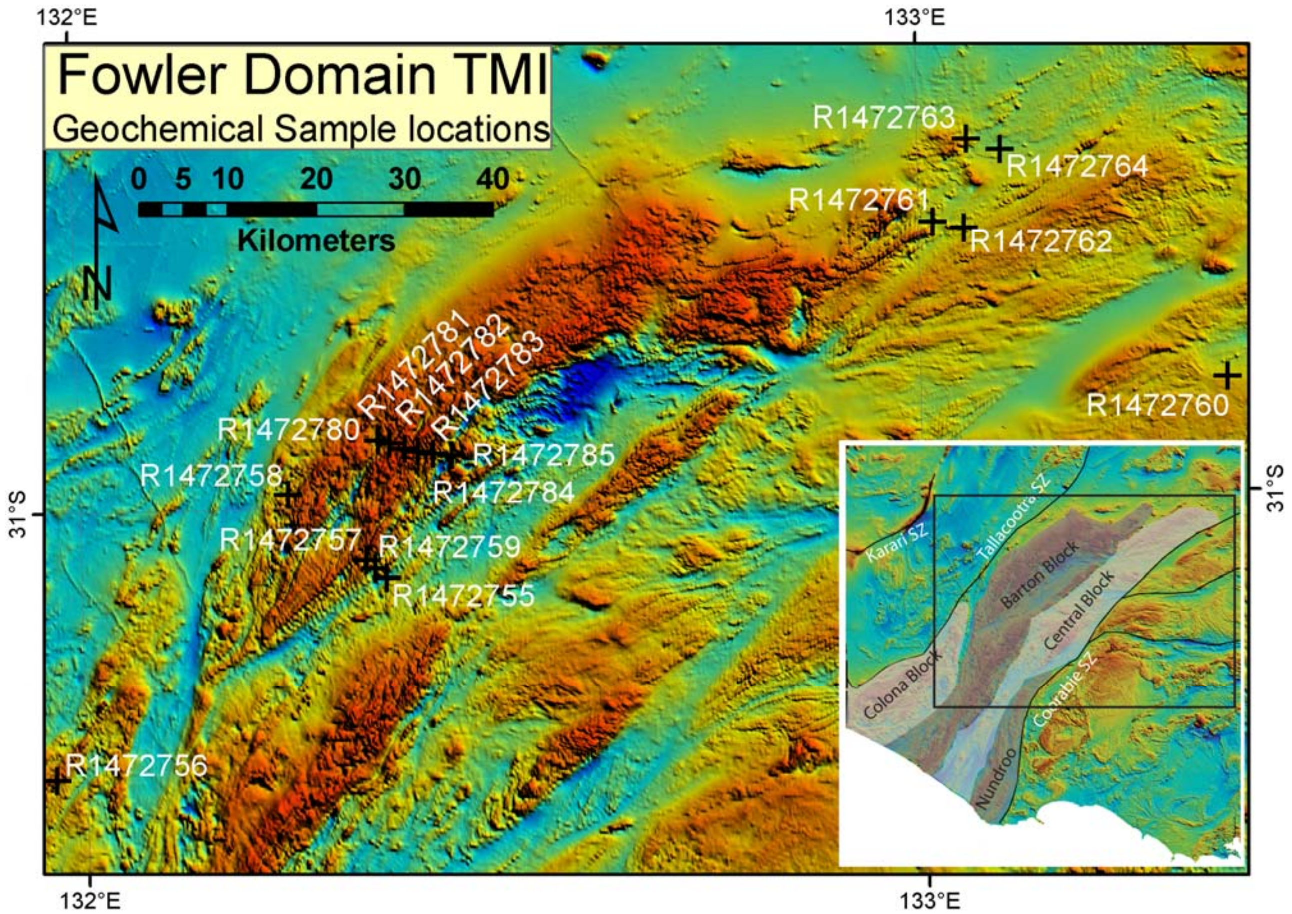

Figure 30. Geochemical sample locations. Insert; Location of samples within the Fowler Domain and Fowler Domain blocks after Teasdale (1997)

Sample No. (R)	1472756	1472755	1472757	1472758	1472759	1472760	1472761	1472762	1472763	1472764	1472780	1472781	1472782	1472783	1472784	1472785
Drill-hole	COL 20D	TAL 1	TAL 4	TAL 9	TAL 20	TAL 57	TAL 60	TAL 62	TAL 65	TAL 67	BAC 14	BAC 18	BAC 23	BAC 28	BAC 33	BAC 41
Majors (wt%)																
Al_2O_3	15.00	1.73	14.60	17.60	18.30	17.70	16.80	18.90	15.80	13.90	16.00	15.00	16.50	17.90	19.20	14.30
CaO	1.65	0.05	3.06	3.40	0.20	0.72	1.89	4.60	1.28	1.03	0.06	0.38	0.16	0.20	0.09	0.22
K_2O	3.27	0.08	2.35	3.23	4.85	3.55	2.22	1.20	1.87	2.52	1.01	4.60	3.55	3.94	3.08	4.56
Fe_2O_3	10.60	34.20	8.89	3.84	9.12	2.37	9.17	7.97	8.62	3.53	13.20	12.30	8.35	8.40	13.80	5.02
MgO	2.93	0.17	3.58	1.20	2.74	0.56	4.14	3.82	4.69	1.76	1.35	3.37	2.17	2.56	5.30	1.37
MnO	0.21	0.05	0.25	0.04	0.17	0.11	0.10	0.09	0.08	0.04	0.01	0.19	0.06	0.20	0.36	0.05
Na_2O	1.64	0.13	1.82	3.75	0.56	2.11	3.37	4.14	2.79	3.44	0.17	0.58	0.40	0.56	0.16	0.70
P_2O_5	0.09	0.18	0.01	0.17	0.03	0.07	0.03	0.04	0.16	0.04	0.22	0.10	0.06	0.02	0.03	0.06
SiO_2	61.60	58.60	64.20	64.70	58.40	69.30	57.20	56.20	59.10	70.40	57.70	59.00	65.80	60.60	53.60	70.50
TiO_2	0.84	0.05	0.74	0.60	0.73	0.47	0.85	0.69	0.85	0.47	1.27	1.04	0.82	0.75	1.20	0.55
LOI	1.66	1.77	0.69	1.10	4.50	2.93	3.86	3.12	4.81	2.06	8.60	3.31	2.36	5.01	2.43	2.13
Total	99.49	97.01	100.19	99.63	99.60	99.88	99.62	100.77	100.05	99.18	99.59	99.87	100.23	100.14	99.25	99.46
REE (ppm)																
La	58.0	120.0	17.0	18.5	39.0	39.0	26.0	41.0	185.0	52.0	26.0	92.0	76.0	41.0	86.0	58.0
Ce	115.0	220.0	33.0	34.0	86.0	92.0	43.0	72.0	400.0	115.0	74.0	180.0	170.0	90.0	170.0	115.0
Pr	14.0	19.5	4.1	5.5	11.5	11.5	6.0	8.5	48.0	15.0	9.0	22.5	23.0	11.5	22.5	15.5
Nd	50.0	44.0	14.5	22.5	42.5	43.5	20.5	27.0	170.0	54.0	30.0	80.0	86.0	42.0	80.0	56.0
Sm	8.5	4.8	2.5	4.2	7.5	8.5	3.6	3.6	27.0	8.0	5.0	15.0	15.0	8.0	14.0	9.5
Eu	1.5	0.5	1.2	2.3	1.5	1.6	1.7	1.6	4.1	2.0	1.1	2.2	2.5	1.4	2.1	1.7
Gd	5.0	2.1	2.6	2.9	5.0	5.5	3.9	2.0	16.5	4.8	2.8	10.0	9.5	5.5	9.5	6.5
Tb	0.6	0.3	0.6	0.4	0.8	0.8	0.7	0.3	2.2	0.7	0.4	1.4	1.3	0.8	1.3	0.9
Dy	3.1	1.2	4.9	2.1	3.9	4.0	5.0	1.7	12.5	3.6	2.2	7.5	6.5	3.9	7.0	4.7
Ho	0.5	0.1	1.2	0.4	0.6	0.7	1.3	0.3	2.7	0.7	0.3	1.4	1.0	0.6	1.3	0.8
Er	1.4	0.3	3.5	0.9	1.4	2.1	4.1	0.9	8.5	1.8	0.7	4.3	2.3	1.3	3.7	2.0
Tm	0.2	bd	0.6	0.1	0.2	0.4	0.6	0.2	1.2	0.3	0.1	0.7	0.3	0.2	0.5	0.3
Yb	1.2	0.3	3.8	0.7	0.9	2.9	4.0	1.0	8.0	1.6	0.5	4.6	1.2	0.7	3.1	1.5
Lu	0.2	0.0	0.5	0.1	0.2	0.4	0.6	0.1	1.2	0.2	0.1	0.7	0.2	0.1	0.5	0.2

Sample No. (R)	1472756	1472755	1472757	1472758	1472759	1472760	1472761	1472762	1472763	1472764	1472780	1472781	1472782	1472783	1472784	1472785
Drill-hole	COL 20D	TAL 1	TAL 4	TAL 9	TAL 20	TAL 57	TAL 60	TAL 62	TAL 65	TAL 67	BAC 14	BAC 18	BAC 23	BAC 28	BAC 33	BAC 41
Trace (ppm)																
Sc	8.0	bd	16.0	bd	14.0	10.0	20.0	8.0	18.0	6.0	18.0	12.0	10.0	14.0	26.0	10.0
V	100.0	30.0	100.0	50.0	70.0	40.0	150.0	90.0	150.0	70.0	220.0	100.0	60.0	60.0	120.0	40.0
Cr	120.0	bd	150.0	bd	80.0	30.0	250.0	270.0	440.0	110.0	70.0	100.0	110.0	70.0	160.0	60.0
Co	56.0	90.0	74.0	49.5	42.0	90.0	66.0	98.0	105.0	115.0	46.5	72.0	80.0	68.0	70.0	78.0
Ni	45.0	8.0	80.0	5.0	39.0	7.0	165.0	105.0	220.0	49.0	29.0	54.0	36.0	36.0	68.0	16.0
Cu	30.0	23.0	46.5	12.5	9.5	36.0	82.0	62.0	80.0	27.5	35.0	78.0	9.0	8.0	13.5	5.0
Zn	130.0	45.0	105.0	60.0	105.0	54.0	115.0	84.0	175.0	80.0	70.0	105.0	90.0	125.0	240.0	60.0
Ga	27.5	5.5	21.5	21.5	29.0	24.5	23.5	28.0	25.0	18.5	22.5	25.0	20.5	29.0	31.5	18.5
As	1.0	3.0	1.0	bd	bd	1.0	1.0	1.0	1.0	bd	1.0	0.5	bd	1.0	0.5	0.5
Se	bd	1.5	bd	1.0	bd	0.5	bd	bd	1.0	bd	1.0	0.5	0.5	bd	bd	bd
Rb	100.0	1.7	90.0	58.0	120.0	120.0	56.0	38.5	36.5	54.0	38.5	170.0	82.0	115.0	135.0	130.0
Sr	140.0	600.0	200.0	400.0	82.0	160.0	500.0	650.0	350.0	330.0	420.0	84.0	120.0	76.0	34.0	125.0
Y	14.0	1.9	33.0	7.5	14.0	16.5	37.5	9.5	96.0	18.5	3.6	42.5	24.5	15.5	36.0	20.0
Zr	240.0	20.0	180.0	90.0	190.0	170.0	280.0	70.0	170.0	170.0	100.0	330.0	350.0	160.0	280.0	270.0
Nb	13.0	bd	14.0	10.5	19.0	16.0	9.5	13.5	15.0	4.0	11.5	18.0	10.5	10.5	23.5	9.5
Mo	0.5	4.7	1.1	0.7	0.5	1.1	3.7	2.0	4.0	2.4	0.6	0.7	0.8	0.5	0.5	0.7
Ag	0.1	0.5	0.2	0.1	0.2	0.3	0.1	0.2	0.3	bd	bd	0.2	bd	bd	0.4	bd
In	bd	bd	0.1	bd	0.1	0.1	bd	bd	0.1	bd	0.1	0.1	0.1	0.1	0.2	0.1
Cs	2.0	bd	1.1	0.5	2.8	5.5	1.2	3.5	0.5	0.8	3.3	2.5	0.7	2.4	2.1	1.9
Ba	650.0	60.0	700.0	1800.0	1050.0	700.0	800.0	230.0	750.0	750.0	330.0	950.0	1000.0	750.0	700.0	950.0
W	190.0	250.0	280.0	200.0	110.0	430.0	160.0	155.0	210.0	550.0	190.0	290.0	360.0	250.0	200.0	270.0
Tl	0.5	bd	0.5	0.3	0.8	0.5	0.3	0.6	0.3	0.3	0.2	0.8	0.4	0.7	0.7	0.7
Pb	17.5	4.5	5.5	11.5	20.0	29.0	8.5	20.5	33.5	17.0	7.0	20.5	22.0	19.5	10.5	25.5
Bi	bd	0.5	bd	bd	bd	0.3	bd	0.1	bd	bd	bd	bd	bd	bd	bd	bd
Th	31.0	11.0	3.0	0.3	22.5	17.0	8.0	7.0	52.0	20.5	2.5	47.0	38.0	22.5	45.5	29.0
U	1.2	1.1	0.3	0.2	1.1	5.0	0.7	2.4	2.2	0.7	1.4	1.4	0.9	0.5	1.0	1.8

bd = Below Detection Limits

2. Zircon isotopic data

Analysis	Isotopic Ratios						Age (Ma)				%
	207Pb/206Pb (±)		207Pb/235U (±)		206Pb/238U (±)		207Pb/206Pb (±)		206Pb/238U (±)		Conc
Sample R1472756											
Z1	0.10678	0.0015	4.19940	0.0706	0.28560	0.0044	1745	25	1674	14	93
Z2	0.13152	0.0013	6.81705	0.0902	0.37605	0.0050	2118	18	2088	12	97
Z4	0.10640	0.0011	4.32110	0.0574	0.29464	0.0039	1739	19	1697	11	96
Z5	0.16859	0.0019	10.71146	0.1554	0.46096	0.0066	2544	19	2498	13	96
Z6	0.16122	0.0022	9.22827	0.1536	0.41558	0.0065	2469	23	2361	15	91
Z7	0.11452	0.0015	5.31170	0.0785	0.33658	0.0045	1872	23	1871	13	100
Z8	0.11763	0.0014	4.39098	0.0623	0.27080	0.0036	1921	21	1711	12	80
Z9	0.11367	0.0013	3.10201	0.0436	0.19796	0.0027	1859	20	1433	11	63
Z10	0.11593	0.0013	4.31197	0.0627	0.26980	0.0039	1894	20	1696	12	81
Z12	0.10812	0.0012	4.46675	0.0660	0.29965	0.0043	1768	21	1725	12	96
Z13	0.11975	0.0014	5.66670	0.0793	0.34341	0.0045	1952	21	1926	12	97
Z16	0.11230	0.0011	4.61628	0.0606	0.29816	0.0040	1837	18	1752	11	92
Z17	0.12774	0.0020	6.21715	0.0994	0.35304	0.0047	2067	27	2007	14	94
Z19	0.10674	0.0011	4.94545	0.0654	0.33604	0.0045	1745	18	1810	11	107
Z20	0.10937	0.0011	4.64336	0.0611	0.30793	0.0041	1789	19	1757	11	97
Z21	0.11989	0.0012	5.86326	0.0763	0.35476	0.0047	1955	18	1956	11	100
Z22	0.12135	0.0019	6.08325	0.1010	0.36354	0.0052	1976	27	1988	14	101
Z23	0.11110	0.0012	3.90536	0.0559	0.25500	0.0036	1818	20	1615	12	81
Z24	0.10815	0.0011	4.42031	0.0603	0.29648	0.0040	1769	19	1716	11	95
Z25	0.10409	0.0012	4.27970	0.0588	0.29822	0.0040	1698	21	1690	11	99
Z27	0.11912	0.0014	4.08477	0.0600	0.24888	0.0035	1943	21	1651	12	74
Z28	0.12038	0.0021	5.48172	0.0958	0.33037	0.0046	1962	30	1898	15	94
Z29	0.11470	0.0014	3.38030	0.0508	0.21383	0.0031	1875	22	1500	12	67
Z31	0.11224	0.0014	4.68291	0.0684	0.30283	0.0041	1836	23	1764	12	93
Z33	0.10458	0.0012	4.40298	0.0577	0.30533	0.0038	1707	21	1713	11	101
Z34	0.10996	0.0012	4.31350	0.0526	0.28446	0.0034	1799	20	1696	10	90
Z36	0.10703	0.0016	4.33357	0.0716	0.29380	0.0043	1749	26	1700	14	95
Z37	0.19848	0.0020	13.61793	0.1727	0.49777	0.0064	2814	17	2724	12	93
Z39	0.10589	0.0011	4.53874	0.0576	0.31089	0.0039	1730	19	1738	11	101
Z40	0.24169	0.0033	19.70710	0.3097	0.59212	0.0090	3131	22	3077	15	96
Z41	0.14242	0.0017	5.31218	0.0754	0.27067	0.0037	2257	21	1871	12	68
Z42	0.10928	0.0012	4.55555	0.0644	0.30252	0.0041	1787	20	1741	12	95
Z43	0.10588	0.0012	4.62715	0.0586	0.31698	0.0039	1730	20	1754	11	103
Z44	0.10355	0.0011	4.18630	0.0522	0.29320	0.0035	1689	20	1671	10	98
Z45	0.11726	0.0017	3.99377	0.0669	0.24730	0.0038	1915	25	1633	14	74
Z46	0.12118	0.0020	4.61549	0.0859	0.27620	0.0044	1974	29	1752	16	80
Z47	0.10857	0.0014	4.77207	0.0668	0.31898	0.0041	1776	23	1780	12	101
Z48	0.15281	0.0015	9.15348	0.1092	0.43453	0.0053	2378	17	2354	11	98
Z49	0.11180	0.0013	4.25480	0.0584	0.27637	0.0037	1829	20	1685	11	86
Z50	0.11300	0.0013	3.44158	0.0480	0.22136	0.0030	1848	21	1514	11	70
Z51	0.20182	0.0026	14.00757	0.2190	0.50435	0.0078	2841	21	2750	15	93
Z52	0.10488	0.0012	4.51983	0.0579	0.31263	0.0038	1712	20	1735	11	102
Z53	0.12588	0.0017	4.68155	0.0693	0.26966	0.0035	2041	24	1764	12	75
Z54	0.10486	0.0014	4.76524	0.0694	0.32984	0.0043	1712	24	1779	12	107
Z55	0.11221	0.0013	4.96460	0.0668	0.32111	0.0041	1836	20	1813	11	98
Z56	0.10905	0.0013	4.83023	0.0656	0.32131	0.0041	1784	22	1790	11	101
Z57	0.10903	0.0015	4.29732	0.0632	0.28603	0.0037	1783	24	1693	12	91
Z58	0.10281	0.0012	4.52888	0.0592	0.31952	0.0040	1676	21	1736	11	107
Z59	0.12628	0.0019	5.15206	0.0846	0.29612	0.0043	2047	26	1845	14	82
Z60	0.10457	0.0012	4.59992	0.0573	0.31905	0.0038	1707	20	1749	10	105
Sample R1472757											
Z1	0.10646	0.0011	3.26918	0.0414	0.22273	0.0028	1740	19	1296	15	75
Z2	0.10547	0.0014	4.42015	0.0695	0.30400	0.0043	1723	24	1711	21	99
Z3	0.10735	0.0011	4.45026	0.0572	0.30070	0.0038	1755	19	1695	19	97
Z4	0.10811	0.0012	3.06183	0.0399	0.20544	0.0025	1768	20	1205	14	68
Z5	0.11354	0.0020	2.08168	0.0393	0.13298	0.0019	1857	31	805	11	43
Z6	0.11483	0.0020	2.48516	0.0448	0.15705	0.0021	1877	30	940	12	50
Z7	0.10701	0.0013	4.34728	0.0587	0.29472	0.0036	1749	21	1665	18	95
Z8	0.10340	0.0013	3.49920	0.0496	0.24553	0.0031	1686	22	1415	16	84
Z9	0.11600	0.0017	2.70045	0.0431	0.16892	0.0022	1896	26	1006	12	53

Analysis	Isotopic Ratios						Age (Ma)				%
	207Pb/206Pb (±)		207Pb/235U (±)		206Pb/238U (±)		207Pb/206Pb (±)		206Pb/238U (±)		Conc
Z10	0.10862	0.0016	4.27949	0.0714	0.28579	0.0039	1776	27	1621	19	91
Z11	0.11958	0.0017	2.54059	0.0411	0.15412	0.0021	1950	25	924	12	47
Z12	0.10257	0.0011	4.09418	0.0519	0.28947	0.0036	1671	19	1639	18	98
Z13	0.12363	0.0031	0.99601	0.0244	0.05845	0.0008	2009	44	366	5	18
Z14	0.11240	0.0014	2.22595	0.0304	0.14362	0.0018	1839	22	865	10	47
Z15	0.10456	0.0012	4.19001	0.0573	0.29058	0.0038	1707	20	1644	19	96
Z16	0.10377	0.0018	4.33296	0.0760	0.30292	0.0038	1693	31	1706	19	101
Z17	0.10748	0.0016	3.67176	0.0580	0.24777	0.0031	1757	27	1427	16	81
Z18	0.10561	0.0012	4.33754	0.0593	0.29785	0.0038	1725	21	1681	19	97
Z19	0.11030	0.0020	1.07765	0.0203	0.07087	0.0010	1804	32	441	6	24
Z20	0.11326	0.0018	2.30213	0.0400	0.14740	0.0020	1852	29	886	11	48
Z21	0.10604	0.0012	4.18798	0.0577	0.28650	0.0038	1732	20	1624	19	94
Z22	0.10687	0.0016	4.40660	0.0771	0.29921	0.0043	1747	27	1687	21	97
Z23	0.10859	0.0012	2.51046	0.0339	0.16770	0.0022	1776	19	999	12	56
Z24	0.10274	0.0013	4.14071	0.0561	0.29235	0.0035	1674	22	1653	18	99
Z25	0.11444	0.0014	1.53417	0.0218	0.09724	0.0013	1871	22	598	7	32
Z26	0.16571	0.0037	1.69964	0.0382	0.07437	0.0011	2515	37	462	7	18
Z27	0.10289	0.0012	4.07644	0.0570	0.28733	0.0039	1677	21	1628	19	97
Z28	0.10552	0.0013	4.56774	0.0681	0.31412	0.0042	1723	23	1761	21	102
Z29	0.10448	0.0016	4.41532	0.0725	0.30657	0.0041	1705	27	1724	20	101
Z30	0.10530	0.0013	4.50105	0.0668	0.31009	0.0041	1720	23	1741	20	101
Z31	0.12677	0.0021	1.39973	0.0241	0.08009	0.0010	2054	29	497	6	24
Z32	0.12281	0.0017	2.69663	0.0413	0.15927	0.0021	1998	24	953	12	48
Z33	0.10099	0.0013	3.02788	0.0461	0.21752	0.0030	1642	24	1269	16	77
Z34	0.10294	0.0012	4.25230	0.0588	0.29963	0.0038	1678	22	1690	19	101
Z35	0.10364	0.0012	3.88163	0.0542	0.27171	0.0036	1690	21	1550	18	92
Z36	0.13741	0.0016	7.36729	0.1012	0.38899	0.0050	2195	20	2118	23	97
Z37	0.10340	0.0012	4.17302	0.0595	0.29274	0.0039	1686	22	1655	19	98
Z38	0.10425	0.0012	4.33141	0.0593	0.30144	0.0039	1701	21	1698	19	100
Z39	0.10443	0.0016	4.48214	0.0759	0.31134	0.0042	1704	28	1747	21	103
Z40	0.10588	0.0012	4.42238	0.0623	0.30302	0.0040	1730	21	1706	20	99
Z41	0.10458	0.0014	4.44567	0.0668	0.30835	0.0040	1707	24	1733	20	102
Z42	0.10486	0.0015	4.54810	0.0732	0.31463	0.0042	1712	26	1763	21	103
Z43	0.10495	0.0019	4.39876	0.0864	0.30388	0.0044	1713	33	1711	22	100
Z44	0.10571	0.0013	4.30821	0.0626	0.29560	0.0038	1727	23	1670	19	97
Z45	0.10294	0.0014	4.06929	0.0619	0.28673	0.0037	1678	25	1625	19	97
Z46	0.10433	0.0012	4.34643	0.0597	0.30218	0.0039	1703	21	1702	19	100
Z47	0.10157	0.0016	3.87523	0.0669	0.27672	0.0040	1653	28	1575	20	95
Z48	0.10405	0.0011	3.77672	0.0483	0.26330	0.0033	1698	19	1507	17	89
Z49	0.10593	0.0019	4.09238	0.0800	0.28031	0.0040	1731	33	1593	20	92
Z50	0.10502	0.0011	4.24857	0.0554	0.29347	0.0037	1715	20	1659	18	97
Z51	0.10477	0.0011	4.48646	0.0579	0.31064	0.0039	1710	20	1744	19	102
Z52	0.10853	0.0012	4.66910	0.0600	0.31206	0.0039	1775	19	1751	19	99
Z53	0.10389	0.0012	4.26052	0.0563	0.29749	0.0038	1695	20	1679	19	99
Z54	0.09871	0.0019	3.74315	0.0709	0.27512	0.0039	1600	35	1567	20	98
Z55	0.10508	0.0013	4.42268	0.0602	0.30534	0.0039	1716	22	1718	19	100
Sample R1472758											
Z1	0.10393	0.00126	4.07222	0.05231	0.28437	0.00336	1696	22	1613	17	95
Z2	0.10269	0.00104	4.01439	0.04481	0.28358	0.00318	1673	19	1609	16	96
Z3	0.10806	0.0011	4.53668	0.04845	0.3045	0.00325	1767	19	1714	16	97
Z4	0.10574	0.00116	3.72067	0.03989	0.25519	0.00259	1727	20	1465	13	83
Z5	0.10352	0.00112	4.02016	0.04491	0.28168	0.00304	1688	20	1600	15	94
Z6	0.12849	0.00189	3.67657	0.05061	0.20756	0.00228	2077	26	1216	12	55
Z7	0.10561	0.00112	4.3245	0.04729	0.29699	0.00317	1725	19	1676	16	97
Z8	0.10339	0.00123	4.25716	0.05455	0.29893	0.00355	1686	22	1686	18	100
Z9	0.10538	0.0011	4.01428	0.04362	0.27631	0.00296	1721	19	1573	15	90
Z10	0.10538	0.00113	4.31322	0.04757	0.29689	0.00317	1721	20	1676	16	97
Z11	0.10533	0.00138	4.17262	0.05486	0.28749	0.00327	1720	24	1629	16	94
Z12	0.1043	0.00109	4.26607	0.04719	0.29665	0.00323	1702	19	1675	16	98
Z13	0.10773	0.00141	3.88498	0.05493	0.26154	0.00329	1761	24	1498	17	83
Z14	0.10605	0.00121	4.2459	0.05409	0.2904	0.0035	1733	21	1644	17	94
Z15	0.10396	0.00148	3.99137	0.06378	0.279	0.00395	1696	26	1586	20	93
Z16	0.1047	0.00112	3.97834	0.04558	0.2756	0.00308	1709	20	1569	16	91

Analysis	Isotopic Ratios						Age (Ma)				%
	207Pb/206Pb (±)		207Pb/235U (±)		206Pb/238U (±)		207Pb/206Pb (±)		206Pb/238U (±)		Conc
Z17	0.10362	0.00127	4.2586	0.05587	0.29807	0.00356	1690	22	1682	18	99
Z18	0.10552	0.00151	4.15329	0.06642	0.28583	0.00403	1723	26	1621	20	93
Z19	0.10373	0.00111	4.29441	0.04957	0.30027	0.00338	1692	20	1693	17	100
Z20	0.10539	0.00111	4.14199	0.04575	0.28504	0.00309	1721	19	1617	16	93
Z21	0.10402	0.00109	4.51689	0.06277	0.31496	0.00436	1697	19	1765	21	105
Z22	0.10535	0.00114	4.30514	0.06169	0.29644	0.00419	1720	20	1674	21	97
Z23	0.10835	0.00142	4.63128	0.07541	0.30998	0.00466	1772	24	1741	23	98
Z24	0.10336	0.00135	4.24048	0.0701	0.29765	0.00459	1685	24	1680	23	100
Z25	0.10486	0.00108	4.38535	0.06155	0.3034	0.00427	1712	19	1708	21	100
Z26	0.10448	0.00112	4.55925	0.06403	0.31652	0.00439	1705	20	1773	21	105
Z27	0.10447	0.00113	4.61884	0.06552	0.32068	0.00448	1705	20	1793	22	106
Z28	0.1051	0.00109	4.52918	0.0634	0.31258	0.00438	1716	19	1753	22	103
Z29	0.1055	0.00122	4.41107	0.06285	0.30329	0.00413	1723	21	1708	20	99
Z30	0.10525	0.00112	4.37159	0.06155	0.30125	0.00421	1719	19	1698	21	99
Sample R1472761											
Z1	0.16458	0.00165	11.46835	0.17798	0.50544	0.00803	2503	17	2637	34	105
Z2	0.14957	0.00151	8.14988	0.12916	0.39522	0.00643	2341	17	2147	30	92
Z3	0.14862	0.00147	8.20917	0.12622	0.40064	0.00631	2330	17	2172	29	93
Z4	0.15377	0.00152	9.4311	0.1456	0.44487	0.00707	2388	17	2372	32	99
Z5	0.15446	0.00153	9.2007	0.14218	0.43206	0.00686	2396	17	2315	31	97
Z6	0.14142	0.00147	5.61622	0.09071	0.28805	0.00476	2245	18	1632	24	73
Z7	0.15197	0.0015	9.07937	0.14002	0.43334	0.00689	2368	17	2321	31	98
Z8	0.15207	0.0015	8.1482	0.12822	0.38868	0.00632	2369	17	2117	29	89
Z9	0.16091	0.00158	9.82457	0.15154	0.44287	0.00705	2465	17	2364	31	96
Z10	0.16975	0.00169	11.44794	0.17725	0.48916	0.0078	2555	17	2567	34	100
Z11	0.14005	0.00168	4.39077	0.07502	0.22739	0.00376	2228	21	1321	20	59
Z12	0.15103	0.00155	8.65059	0.13891	0.41544	0.00678	2358	17	2240	31	95
Z13	0.16341	0.00178	9.9903	0.16063	0.44345	0.0071	2491	18	2366	32	95
Z14	0.11787	0.00132	5.27949	0.08597	0.32486	0.00519	1924	20	1813	25	94
Z15	0.12967	0.00139	6.56618	0.10486	0.36729	0.00586	2094	19	2017	28	96
Z16	0.15443	0.00204	6.73245	0.11749	0.31625	0.00511	2396	22	1771	25	74
Z17	0.14046	0.00195	7.0182	0.12871	0.3629	0.0063	2233	24	1996	30	89
Z18	0.16391	0.00164	9.91576	0.15404	0.43877	0.00698	2496	17	2345	31	94
Z19	0.14542	0.00183	2.81747	0.04749	0.14056	0.00224	2293	21	848	13	37
Z20	0.14251	0.00145	6.59073	0.10311	0.33543	0.00534	2258	17	1865	26	83
Z21	0.15073	0.00155	8.76519	0.13701	0.42182	0.00671	2354	17	2269	30	96
Z22	0.14525	0.00199	4.37109	0.0807	0.21835	0.00377	2291	23	1273	20	56
Z23	0.15455	0.00181	8.59595	0.14776	0.40353	0.00684	2397	20	2185	31	91
Z24	0.15396	0.00178	8.00464	0.13665	0.37723	0.00638	2390	20	2063	30	86
Z25	0.22345	0.00251	16.46068	0.25927	0.53444	0.00837	3006	18	2760	35	92
Z26	0.15255	0.00181	9.10617	0.15604	0.43299	0.00726	2375	20	2319	33	98
Z27	0.16139	0.00168	5.69008	0.09021	0.25573	0.00411	2470	18	1468	21	59
Z28	0.1672	0.00183	10.26061	0.1662	0.44512	0.0072	2530	18	2374	32	94
Z29	0.14386	0.00155	8.3934	0.13648	0.4232	0.00692	2274	19	2275	31	100
Z30	0.15127	0.00224	3.79763	0.07282	0.18214	0.00319	2360	25	1079	17	46
Z31	0.16373	0.00163	10.60897	0.12316	0.46999	0.00553	2495	17	2484	24	100
Z32	0.15856	0.00158	9.02546	0.10546	0.41285	0.0049	2440	17	2228	22	91
Z33	0.15054	0.00166	6.98103	0.08715	0.33641	0.00404	2352	19	1869	19	79
Z34	0.1548	0.00154	8.79816	0.10451	0.41222	0.00499	2400	17	2225	23	93
Z35	0.15558	0.00213	8.09493	0.12012	0.37762	0.00481	2408	23	2065	23	86
Z36	0.15436	0.00164	9.22823	0.11732	0.43363	0.00542	2395	18	2322	24	97
Z37	0.16313	0.00185	9.67376	0.12724	0.43016	0.0054	2488	19	2307	24	93
Z38	0.1532	0.00157	9.43511	0.1124	0.44674	0.00532	2382	17	2381	24	100
Z39	0.15268	0.00174	7.89022	0.10723	0.37486	0.00491	2376	19	2052	23	86
Z40	0.15195	0.00157	9.33381	0.1128	0.4456	0.00536	2368	18	2376	24	100
Z41	0.15357	0.00205	8.81669	0.13342	0.41659	0.00562	2386	23	2245	26	94
Z42	0.14994	0.00152	8.66499	0.10339	0.41918	0.00504	2345	17	2257	23	96
Z43	0.13366	0.00152	3.98528	0.053	0.21628	0.00273	2147	20	1262	14	59
Z44	0.15779	0.00183	8.19148	0.11227	0.37673	0.00491	2432	20	2061	23	85
Z45	0.21791	0.00219	16.54949	0.19774	0.55089	0.00666	2965	16	2829	28	95
Z46	0.20154	0.00211	15.84199	0.19911	0.57016	0.00713	2839	17	2909	29	102
Z47	0.16041	0.00164	10.08511	0.1232	0.45604	0.00556	2460	17	2422	25	98
Z48	0.13382	0.00145	7.08556	0.0882	0.38406	0.00462	2149	19	2095	22	98

Analysis	Isotopic Ratios						Age (Ma)				%
	207Pb/206Pb (±)		207Pb/235U (±)		206Pb/238U (±)		207Pb/206Pb (±)		206Pb/238U (±)		Conc
Z49	0.15806	0.00161	9.6291	0.11326	0.44184	0.00521	2435	17	2359	23	97
Z50	0.15749	0.00159	9.43713	0.11192	0.43462	0.00518	2429	17	2327	23	96
Z51	0.13973	0.00144	7.03236	0.09134	0.36528	0.00481	2224	18	2007	23	90
Z52	0.12749	0.00134	5.8888	0.07628	0.33513	0.00437	2064	18	1863	21	90
Z53	0.14586	0.00146	7.55623	0.09163	0.37576	0.00464	2298	17	2056	22	89
Z54	0.14413	0.00143	6.54791	0.08115	0.32948	0.00417	2277	17	1836	20	81
Z55	0.14661	0.00152	3.11156	0.03927	0.15393	0.00196	2307	18	923	11	40
Z56	0.15158	0.0015	8.78313	0.1045	0.4203	0.00511	2364	17	2262	23	96
Z57	0.14093	0.00141	5.71755	0.06899	0.29427	0.00361	2239	17	1663	18	74
Z58	0.15433	0.00155	9.26685	0.1135	0.43555	0.00544	2395	17	2331	24	97
Z59	0.14868	0.00148	7.60257	0.08979	0.3709	0.00447	2331	17	2034	21	87
Z60	0.15963	0.00161	10.73435	0.13256	0.48778	0.00619	2452	17	2561	27	104
Z61	0.16181	0.0016	10.12863	0.1217	0.45404	0.00559	2475	17	2413	25	98
Z62	0.15991	0.00158	10.06414	0.11736	0.45652	0.00543	2455	17	2424	24	99
Z63	0.14998	0.00151	4.35709	0.05363	0.21071	0.00264	2346	17	1233	14	53
Z64	0.16274	0.00161	10.41308	0.12473	0.46414	0.00568	2484	17	2458	25	99
Z65	0.1545	0.00154	8.30153	0.09642	0.38974	0.00461	2396	17	2122	21	89
Z66	0.14838	0.00146	7.83568	0.09314	0.38306	0.00466	2327	17	2091	22	90
Z67	0.1593	0.00157	9.68166	0.11804	0.44086	0.00551	2448	17	2355	25	96
Z68	0.20387	0.00203	12.71289	0.15208	0.45233	0.00552	2858	16	2406	24	84
Z69	0.13662	0.00139	7.53881	0.09241	0.40027	0.00495	2185	18	2170	23	99
Z70	0.16781	0.00167	11.34011	0.13641	0.49021	0.006	2536	17	2572	26	101
Sample R1472764											
Z1	0.16946	0.00173	9.3576	0.11163	0.40055	0.0048	2552	17	2172	22	85
Z2	0.17123	0.00218	3.12533	0.04267	0.13232	0.00166	2570	21	801	9	31
Z3	0.20871	0.00273	1.67535	0.02378	0.05823	0.00078	2896	21	365	5	13
Z4	0.15501	0.00162	6.68885	0.08333	0.31302	0.00389	2402	18	1756	19	73
Z5	0.15413	0.0018	5.14975	0.06735	0.24232	0.003	2392	20	1399	16	58
Z6	0.15109	0.00182	4.42821	0.05697	0.2126	0.00255	2358	20	1243	14	53
Z7	0.16742	0.00179	9.93133	0.12575	0.43029	0.00538	2532	18	2307	24	91
Z8	0.16097	0.00186	4.47308	0.05996	0.20156	0.00259	2466	19	1184	14	48
Z9	0.16793	0.00229	9.97635	0.14957	0.4309	0.00588	2537	23	2310	26	91
Z10	0.16759	0.0019	9.1459	0.1184	0.39584	0.00493	2534	19	2150	23	85
Z11	0.1563	0.00168	5.87759	0.07123	0.27284	0.00323	2416	18	1555	16	64
Z12	0.15796	0.00164	6.88288	0.08313	0.31613	0.0038	2434	17	1771	19	73
Z13	0.16932	0.00199	7.77328	0.09866	0.3331	0.004	2551	20	1853	19	73
Z14	0.19878	0.00208	13.09035	0.16605	0.47773	0.00607	2816	17	2517	26	89
Z15	0.15377	0.00173	6.29015	0.0777	0.29671	0.00351	2388	19	1675	17	70
Z16	0.25252	0.00264	20.04663	0.24782	0.57584	0.00712	3201	16	2932	29	92
Z17	0.16136	0.00172	8.79067	0.10843	0.39514	0.0048	2470	18	2147	22	87
Z18	0.16855	0.00192	7.78797	0.09638	0.3352	0.00397	2543	19	1864	19	73
Z19	0.16548	0.00176	7.3029	0.09003	0.32006	0.00389	2512	18	1790	19	71
Z20	0.16703	0.00178	9.29371	0.11544	0.40351	0.00494	2528	18	2185	23	86
Z21	0.15738	0.00171	9.73041	0.12297	0.44841	0.00557	2428	18	2388	25	98
Z22	0.14549	0.00168	3.12653	0.03944	0.15584	0.00186	2294	20	934	10	41
Z23	0.22059	0.00233	17.89535	0.21928	0.58846	0.0072	2985	17	2983	29	100
Z24	0.15248	0.00173	5.0975	0.06508	0.24252	0.00298	2374	19	1400	15	59
Z25	0.14996	0.00156	6.57387	0.08143	0.318	0.00395	2345	18	1780	19	76
Z26	0.16165	0.00182	10.33013	0.13139	0.46354	0.00572	2473	19	2455	25	99
Z27	0.16908	0.00185	11.19559	0.13934	0.48031	0.00588	2549	18	2529	26	99
Z28	0.16075	0.00184	10.47174	0.13451	0.47255	0.00586	2464	19	2495	26	101
Z29	0.15482	0.00207	9.96129	0.14152	0.46669	0.00599	2400	23	2469	26	103
Z30	0.22244	0.00234	17.66599	0.21221	0.57605	0.00693	2999	17	2933	28	98
Sample R1472781											
Z1	0.10605	0.00133	3.38166	0.05403	0.23131	0.00346	1733	23	1341	18	77
Z2	0.10543	0.00172	3.52332	0.06569	0.24244	0.00381	1722	30	1399	20	81
Z3	0.10379	0.00178	3.75624	0.07635	0.2626	0.00454	1693	31	1503	23	89
Z4	0.10917	0.00118	3.25024	0.05006	0.21598	0.0033	1786	20	1261	17	71
Z5	0.10615	0.00147	2.82863	0.04933	0.19332	0.00306	1734	25	1139	17	66
Z6	0.10752	0.00149	3.81985	0.06671	0.25772	0.00407	1758	25	1478	21	84
Z7	0.1072	0.00114	3.65179	0.05609	0.24713	0.00378	1752	19	1424	20	81
Z8	0.10684	0.00134	3.67642	0.0582	0.24971	0.00367	1746	23	1437	19	82
Z9	0.10764	0.00123	3.80167	0.06072	0.25621	0.00397	1760	21	1470	20	84

Analysis	Isotopic Ratios						Age (Ma)				%
	207Pb/206Pb (±)		207Pb/235U (±)		206Pb/238U (±)		207Pb/206Pb (±)		206Pb/238U (±)		Conc
Z10	0.10675	0.00129	4.35601	0.07198	0.29611	0.00467	1745	22	1672	23	96
Z11	0.10607	0.00112	3.80905	0.0571	0.26054	0.00392	1733	19	1493	20	86
Z12	0.11178	0.00141	2.45617	0.04202	0.15941	0.00263	1829	23	954	15	52
Z13	0.12132	0.00164	2.37654	0.04219	0.14211	0.0024	1976	24	857	14	43
Z14	0.11039	0.00127	2.70697	0.04117	0.17794	0.00263	1806	21	1056	14	58
Z15	0.10838	0.00139	3.78682	0.06497	0.25354	0.00414	1772	23	1457	21	82
Z16	0.108	0.00133	4.24893	0.07256	0.28549	0.00477	1766	22	1619	24	92
Z17	0.1098	0.00141	3.23971	0.05648	0.21414	0.0036	1796	23	1251	19	70
Z18	0.10986	0.00129	2.7855	0.04636	0.18396	0.00302	1797	21	1089	16	61
Z19	0.10672	0.00123	4.00284	0.06791	0.27182	0.00465	1744	21	1550	24	89
Z20	0.10513	0.00116	3.10968	0.04929	0.21459	0.0034	1717	20	1253	18	73
Z21	0.11723	0.0018	1.95864	0.03758	0.12124	0.00218	1915	27	738	13	39
Z22	0.10949	0.0013	3.47949	0.05567	0.2305	0.00356	1791	21	1337	19	75
Z23	0.10846	0.0015	3.88837	0.07104	0.26005	0.00456	1774	25	1490	23	84
Z24	0.10556	0.00113	2.93778	0.04446	0.20185	0.00306	1724	20	1185	16	69
Z25	0.11285	0.00141	2.26321	0.03687	0.14545	0.00225	1846	22	875	13	47
Z26	0.10673	0.00113	3.08047	0.04731	0.20934	0.00324	1744	19	1225	17	70
Z27	0.1059	0.00106	4.03762	0.0596	0.27652	0.00416	1730	18	1574	21	91
Z28	0.11459	0.0016	2.72574	0.05001	0.17253	0.00307	1873	25	1026	17	55
Z29	0.1177	0.00153	1.94049	0.03405	0.11956	0.00206	1922	23	728	12	38
Z30	0.11267	0.00126	2.4367	0.03913	0.15683	0.00252	1843	20	939	14	51
Z31	0.10504	0.00117	3.42756	0.05228	0.23678	0.00356	1715	20	1370	19	80
Z32	0.10691	0.00119	3.60959	0.05382	0.24499	0.00357	1747	20	1413	18	81
Z33	0.11536	0.00128	2.10779	0.03037	0.13256	0.00186	1885	20	803	11	43
Z34	0.10734	0.00111	3.9015	0.05558	0.26367	0.00377	1755	19	1509	19	86
Z35	0.10752	0.00118	4.34638	0.06355	0.29325	0.00421	1758	20	1658	21	94
Z36	0.11567	0.00165	4.23294	0.07356	0.26611	0.00426	1890	26	1521	22	80
Z37	0.10548	0.00106	4.12604	0.05785	0.28377	0.00401	1723	18	1610	20	93
Z38	0.10609	0.00107	4.11041	0.05741	0.2811	0.00396	1733	18	1597	20	92
Z39	0.10726	0.00113	3.48499	0.04994	0.23572	0.00336	1753	19	1364	18	78
Z40	0.14573	0.00196	1.35637	0.0225	0.06766	0.00106	2296	23	422	6	18
Z41	0.10497	0.00114	3.5995	0.05271	0.24872	0.00361	1714	20	1432	19	84
Z42	0.10375	0.00107	2.36758	0.0342	0.16555	0.00243	1692	19	988	13	58
Z43	0.10526	0.00121	4.08265	0.0623	0.28135	0.00419	1719	21	1598	21	93
Z44	0.10896	0.00138	3.32728	0.05066	0.22139	0.0031	1782	23	1289	16	72
Z45	0.10878	0.00118	3.85188	0.05578	0.25682	0.00367	1779	20	1474	19	83
Z46	0.11009	0.00145	2.74415	0.04259	0.18075	0.00254	1801	24	1071	14	59
Z47	0.10862	0.00113	2.04788	0.02879	0.13673	0.00192	1776	19	826	11	47
Z48	0.10648	0.00118	3.66936	0.05437	0.24994	0.00363	1740	20	1438	19	83
Z49	0.154	0.00179	2.34068	0.03616	0.11024	0.00169	2391	20	674	10	28
Z50	0.10951	0.00121	3.64586	0.0535	0.24144	0.00348	1791	20	1394	18	78
Sample R1472782											
Z1	0.10818	0.00137	4.1676	0.0571	0.27945	0.00343	1769	23	1589	17	90
Z2	0.10724	0.00118	3.4826	0.04342	0.23558	0.00283	1753	20	1364	15	78
Z3	0.12136	0.00143	1.94369	0.02488	0.11621	0.00139	1976	21	709	8	36
Z4	0.11325	0.0015	3.71769	0.05308	0.23809	0.003	1852	24	1377	16	74
Z5	0.15783	0.00195	2.58661	0.03511	0.11888	0.00151	2433	21	724	9	30
Z6	0.10806	0.00132	2.78886	0.03681	0.18724	0.00225	1767	22	1106	12	63
Z7	0.1158	0.0016	1.9056	0.02732	0.11938	0.00146	1892	25	727	8	38
Z8	0.10614	0.00123	4.00239	0.05275	0.27357	0.0034	1734	21	1559	17	90
Z9	0.12503	0.0016	2.4379	0.03609	0.14145	0.00192	2029	23	853	11	42
Z10	0.11067	0.0015	3.5632	0.05548	0.23338	0.00323	1811	24	1352	17	75
Z11	0.11855	0.00164	1.94536	0.03044	0.11914	0.00168	1935	25	726	10	38
Z12	0.10329	0.00128	4.16581	0.05745	0.29243	0.00368	1684	23	1654	18	98
Z13	0.14414	0.00169	8.24941	0.11413	0.41541	0.00553	2278	20	2240	25	98
Z14	0.10785	0.00149	3.98612	0.0578	0.26835	0.00336	1763	25	1532	17	87
Z15	0.10683	0.00119	4.25616	0.05511	0.28893	0.00361	1746	20	1636	18	94
Z16	0.10515	0.00134	3.83518	0.05695	0.2649	0.00365	1717	23	1515	19	88
Z17	0.10843	0.00147	4.30406	0.06622	0.28825	0.004	1773	25	1633	20	92
Z18	0.10718	0.00136	4.1197	0.06041	0.27915	0.00379	1752	23	1587	19	91
Z19	0.10784	0.00134	2.74177	0.03689	0.18451	0.00225	1763	23	1092	12	62
Z20	0.10269	0.00132	4.18971	0.05944	0.29598	0.00378	1673	24	1671	19	100
Z21	0.10861	0.0014	1.78939	0.02444	0.11955	0.00145	1776	23	728	8	41

Analysis	Isotopic Ratios						Age (Ma)				%
	207Pb/206Pb (±)		207Pb/235U (±)		206Pb/238U (±)		207Pb/206Pb (±)		206Pb/238U (±)		Conc
Z22	0.10882	0.0014	3.39043	0.0497	0.2262	0.00304	1780	23	1315	16	74
Z23	0.11742	0.00138	2.90193	0.03834	0.17925	0.00223	1917	21	1063	12	55
Z24	0.11676	0.00133	5.15436	0.06574	0.3202	0.00389	1907	20	1791	19	94
Z25	0.11398	0.00128	1.13857	0.01455	0.07245	0.00089	1864	20	451	5	24
Z26	0.11235	0.00133	2.56329	0.03416	0.16549	0.00206	1838	21	987	11	54
Z27	0.11681	0.0014	1.94374	0.02597	0.12072	0.0015	1908	21	735	9	39
Z28	0.10382	0.00113	3.96879	0.04951	0.27728	0.00335	1693	20	1578	17	93
Z29	0.11383	0.00153	1.43678	0.02083	0.09152	0.00117	1862	24	565	7	30
Z30	0.11113	0.00133	4.57528	0.05965	0.2987	0.00362	1818	22	1685	18	93
Sample R1472785											
Z1	0.11227	0.00118	4.07413	0.06362	0.26319	0.00411	1836	19	1506	21	82
Z2	0.10405	0.00117	4.26465	0.07601	0.2973	0.00534	1698	21	1678	27	99
Z3	0.10563	0.00139	4.08822	0.07792	0.28075	0.00518	1725	24	1595	26	92
Z4	0.11123	0.00129	4.34873	0.07406	0.28362	0.00478	1820	21	1610	24	88
Z5	0.1054	0.00108	4.58105	0.07321	0.31524	0.00512	1721	19	1766	25	103
Z6	0.11138	0.00114	3.04911	0.04967	0.19861	0.00331	1822	19	1168	18	64
Z7	0.10575	0.00108	4.08833	0.06596	0.28041	0.0046	1727	19	1593	23	92
Z8	0.10601	0.00107	4.54218	0.07152	0.31077	0.00498	1732	18	1745	24	101
Z9	0.10546	0.00111	4.49317	0.07233	0.30901	0.00501	1722	19	1736	25	101
Z10	0.10516	0.00123	3.35015	0.06211	0.23105	0.00435	1717	21	1340	23	78
Z11	0.10522	0.00149	4.0263	0.08105	0.27764	0.00545	1718	26	1580	27	92
Z12	0.12301	0.0017	2.32409	0.04231	0.13704	0.00235	2000	24	828	13	41
Z13	0.11089	0.00127	2.62499	0.0426	0.17169	0.00272	1814	21	1021	15	56
Z14	0.10192	0.00148	3.07141	0.05376	0.21919	0.00371	1659	27	1278	20	77
Z15	0.10608	0.00107	4.62435	0.07441	0.31621	0.0052	1733	18	1771	25	102
Z16	0.10906	0.00117	4.07919	0.06374	0.27132	0.00426	1784	19	1548	22	87
Z18	0.10665	0.00116	4.04301	0.06644	0.275	0.00449	1743	20	1566	23	90
Z19	0.10762	0.00122	3.54935	0.06328	0.23919	0.00429	1760	21	1383	22	79
Z20	0.10641	0.00113	4.32168	0.07256	0.29461	0.00501	1739	19	1665	25	96
Z21	0.10637	0.00123	4.22138	0.06613	0.28811	0.00444	1738	21	1632	22	94
Z22	0.10545	0.00116	4.38128	0.0645	0.30142	0.00437	1722	20	1698	22	99
Z23	0.10938	0.00124	3.8833	0.06041	0.25759	0.00399	1789	20	1478	20	83
Z24	0.10861	0.00122	4.17043	0.06353	0.27859	0.00417	1776	20	1584	21	89
Z25	0.107	0.00128	3.31383	0.05238	0.22474	0.00341	1749	22	1307	18	75
Z26	0.1064	0.00117	4.19975	0.06164	0.28632	0.00414	1739	20	1623	21	93
Z28	0.10704	0.00111	4.12377	0.05701	0.27941	0.00386	1750	19	1588	19	91
Z29	0.10502	0.00109	4.35112	0.06008	0.30051	0.00415	1715	19	1694	21	99
Z30	0.10878	0.00151	2.48385	0.04296	0.16564	0.00268	1779	25	988	15	56
Z31	0.10571	0.0011	4.37277	0.06205	0.30006	0.00428	1727	19	1692	21	98
Z32	0.10681	0.0011	4.11883	0.06141	0.2794	0.00422	1746	19	1588	21	91
Z33	0.1058	0.00125	4.18556	0.06505	0.28678	0.00432	1728	21	1625	22	94
Z34	0.10696	0.00118	3.97739	0.05864	0.26972	0.00393	1748	20	1539	20	88
Z35	0.10579	0.00107	4.36633	0.06001	0.29938	0.00416	1728	19	1688	21	98
Z36	0.10768	0.0012	4.30325	0.06634	0.28972	0.00447	1760	20	1640	22	93
Z37	0.10534	0.00119	4.31661	0.06522	0.29715	0.00443	1720	21	1677	22	97
Z38	0.11865	0.00127	2.17499	0.03147	0.13297	0.00192	1936	19	805	11	42
Z39	0.10944	0.00119	3.24147	0.0483	0.21477	0.0032	1790	20	1254	17	70
Z40	0.10554	0.0011	4.47275	0.06371	0.30744	0.00439	1724	19	1728	22	100
Sample R1473462											
Z1	0.10203	0.00099	4.41806	0.0455	0.31419	0.00333	1661	18	1761	16	106
Z2	0.10471	0.00136	4.26073	0.05571	0.29523	0.00334	1709	24	1668	17	98
Z3	0.10132	0.00098	4.48089	0.04661	0.32096	0.00347	1648	18	1794	17	109
Z4	0.10501	0.00145	4.45576	0.0613	0.30786	0.00352	1715	25	1730	17	101
Z5	0.1009	0.00109	4.14264	0.04779	0.29805	0.00337	1641	20	1682	17	102
Z6	0.10944	0.00119	2.7449	0.0306	0.18203	0.00195	1790	20	1078	11	60
Z7	0.10223	0.001	4.42572	0.04665	0.31431	0.00343	1665	18	1762	17	106
Z8	0.10469	0.0013	4.77333	0.06112	0.33101	0.0038	1709	23	1843	18	108
Z9	0.10402	0.0015	4.2751	0.06144	0.29825	0.00346	1697	26	1683	17	99
Z10	0.10046	0.00119	3.7053	0.04559	0.2678	0.00302	1633	22	1530	15	94
Z11	0.0996	0.00146	3.18274	0.04805	0.23272	0.00292	1617	27	1349	15	83
Z12	0.10213	0.00128	4.41322	0.05653	0.31402	0.00356	1663	23	1761	17	106
Z13	0.10437	0.00132	4.49348	0.05841	0.31278	0.00357	1703	23	1754	18	103
Z14	0.10295	0.00126	4.45564	0.05654	0.31434	0.00356	1678	22	1762	17	105

Analysis	Isotopic Ratios						Age (Ma)				%
	207Pb/206Pb (±)		207Pb/235U (±)		206Pb/238U (±)		207Pb/206Pb (±)		206Pb/238U (±)		Conc
Z15	0.10483	0.00138	4.51896	0.06133	0.3131	0.00363	1711	24	1756	18	103
Z16	0.10426	0.00152	4.41653	0.06614	0.30774	0.00377	1701	27	1730	19	102
Z17	0.10323	0.00117	4.39476	0.05277	0.30916	0.00348	1683	21	1737	17	103
Z18	0.10383	0.00107	4.47498	0.05013	0.31294	0.00346	1694	19	1755	17	104
Z19	0.10491	0.00127	4.52802	0.05849	0.31334	0.00363	1713	22	1757	18	103
Z20	0.10453	0.00148	4.49175	0.06633	0.31174	0.00381	1706	26	1749	19	103
Z21	0.10497	0.00122	4.47624	0.05552	0.30945	0.00354	1714	21	1738	17	101
Z22	0.10276	0.00131	4.44784	0.05924	0.31414	0.00365	1675	23	1761	18	105
Z23	0.11199	0.00117	2.19489	0.02526	0.14224	0.00161	1832	19	857	9	47
Z24	0.1033	0.0014	4.27038	0.06019	0.29993	0.00356	1684	25	1691	18	100
Z25	0.10466	0.00128	4.42947	0.05644	0.30709	0.00349	1708	22	1726	17	101
Z26	0.10337	0.00107	4.48076	0.04976	0.31451	0.00344	1686	19	1763	17	105
Z27	0.10478	0.00126	4.27642	0.05278	0.29609	0.00328	1711	22	1672	16	98
Z28	0.10564	0.00174	4.40627	0.07087	0.30263	0.00363	1725	30	1704	18	99
Z29	0.10325	0.00141	4.18156	0.05832	0.2938	0.00341	1683	25	1661	17	99
Z30	0.1029	0.00104	4.40576	0.04846	0.31062	0.00341	1677	19	1744	17	104
Z31	0.10378	0.00131	4.36469	0.05728	0.30513	0.00349	1693	23	1717	17	101
Z32	0.10454	0.00117	4.40293	0.05255	0.30555	0.00343	1706	20	1719	17	101
Z33	0.10566	0.00165	4.45455	0.07184	0.30598	0.00391	1726	28	1721	19	100
Z34	0.10488	0.00131	4.49822	0.05864	0.31113	0.00356	1712	23	1746	18	102
Z35	0.10474	0.00135	4.52311	0.06067	0.31327	0.00362	1710	24	1757	18	103
Z36	0.10473	0.00142	4.45184	0.06225	0.30835	0.00362	1710	25	1733	18	101
Z37	0.10619	0.00155	4.52306	0.06665	0.30896	0.00366	1735	26	1736	18	100

3. Monazite isotopic data

Analysis	Isotopic Ratios						Age (Ma)				% Conc
	207Pb/206Pb (±)		207Pb/235U (±)		206Pb/238U (±)		207Pb/206Pb (±)		206Pb/238U (±)		
Sample R1472756											
M1	0.10437	0.00108	4.42729	0.05806	0.30711	0.00404	1703	19	1727	20	99
M2	0.10315	0.00105	4.30852	0.05611	0.30241	0.00398	1682	19	1703	20	100
M3	0.10206	0.00106	4.25291	0.05621	0.30171	0.004	1662	19	1700	20	99
M4	0.10266	0.00105	4.41658	0.05776	0.31147	0.00411	1673	19	1748	20	98
M5	0.10318	0.0011	4.30759	0.05763	0.30226	0.00402	1682	20	1703	20	100
M6	0.10309	0.00103	4.28506	0.05563	0.30093	0.00397	1681	18	1696	20	100
M7	0.10242	0.00112	4.30464	0.05857	0.3043	0.00406	1668	20	1713	20	99
M8	0.10358	0.00118	4.41526	0.06163	0.30861	0.00415	1689	21	1734	20	99
M9	0.10365	0.00108	4.39617	0.05842	0.30707	0.00407	1690	19	1726	20	99
M10	0.10392	0.00112	4.4097	0.05957	0.3072	0.0041	1695	20	1727	20	99
M11	0.10307	0.00108	4.40309	0.05876	0.30927	0.00412	1680	19	1737	20	99
M12	0.10509	0.00107	4.49951	0.05927	0.30995	0.00411	1716	19	1741	20	99
M13	0.10303	0.00112	4.59041	0.06261	0.32257	0.00432	1679	20	1802	21	97
M14	0.10362	0.00107	4.48994	0.05967	0.31373	0.00417	1690	19	1759	20	98
M15	0.10489	0.00157	4.3912	0.07346	0.3031	0.00434	1712	27	1707	21	100
M16	0.10386	0.00111	4.36285	0.05933	0.30413	0.00409	1694	20	1712	20	100
M17	0.10269	0.00103	4.32165	0.0567	0.3047	0.00404	1673	18	1715	20	99
M18	0.10425	0.00105	4.36992	0.05745	0.3035	0.00402	1701	19	1709	20	100
M19	0.10446	0.00107	4.4486	0.05884	0.30835	0.00409	1705	19	1733	20	99
M20	0.10585	0.00122	4.31336	0.06109	0.29504	0.00401	1729	21	1667	20	102
Sample R1472759											
M1	0.10313	0.00128	4.19822	0.06077	0.29468	0.00391	1681	23	1665	19	100
M2	0.10207	0.00126	4.13156	0.05974	0.29305	0.00389	1662	23	1657	19	100
M3	0.10532	0.00152	4.32055	0.06928	0.29696	0.00406	1720	26	1676	20	100
M4	0.10214	0.00118	4.21306	0.05821	0.29859	0.00391	1663	21	1684	19	100
M5	0.10239	0.00117	4.03388	0.05507	0.28515	0.0037	1668	21	1617	19	100
M6	0.10244	0.00107	4.18878	0.05464	0.296	0.00382	1669	19	1672	19	100
M7	0.10225	0.0011	4.16396	0.0551	0.29465	0.00379	1665	20	1665	19	100
M8	0.10482	0.0014	4.2161	0.06385	0.29116	0.00391	1711	24	1647	20	101
M9	0.10355	0.00127	4.32249	0.06212	0.30219	0.004	1689	22	1702	20	100
M10	0.10201	0.00116	4.10079	0.05627	0.29102	0.0038	1661	21	1647	19	100
M11	0.10459	0.00144	4.26709	0.06614	0.29542	0.00402	1707	25	1669	20	100
M12	0.1034	0.00129	4.22747	0.06138	0.29598	0.00393	1686	23	1671	20	100
M13	0.10246	0.00106	4.17201	0.05426	0.29478	0.0038	1669	19	1665	19	100
M14	0.10248	0.00107	4.16165	0.05413	0.294	0.00379	1670	19	1662	19	100
M15	0.1023	0.00107	4.17956	0.05459	0.29576	0.00382	1666	19	1670	19	101
M16	0.1023	0.00105	4.19215	0.05424	0.29665	0.00381	1666	19	1675	19	100
M17	0.10254	0.00107	4.18269	0.05459	0.29529	0.00381	1671	19	1668	19	100
M18	0.10144	0.00105	4.11107	0.05327	0.29337	0.00378	1651	19	1658	19	101
M19	0.10246	0.00106	4.20856	0.05466	0.29733	0.00383	1669	19	1678	19	102
M20	0.10258	0.0013	4.19512	0.06129	0.29603	0.00393	1671	23	1672	20	101
Sample R1472781											
M1	0.09863	0.00105	3.97421	0.05234	0.29168	0.0038	1598	20	1650	19	99
M2	0.10223	0.00232	4.72004	0.10833	0.33429	0.00536	1665	41	1859	26	97
M3	0.10534	0.0011	4.65177	0.06092	0.31967	0.00416	1720	19	1788	20	95
M4	0.10309	0.00106	4.31522	0.05606	0.30303	0.00395	1681	19	1706	20	98
M5	0.10244	0.00104	4.39032	0.0567	0.31024	0.00403	1669	19	1742	20	97
M6	0.10486	0.00117	4.6499	0.06342	0.32099	0.00424	1712	20	1795	21	97
M7	0.10687	0.00164	4.50662	0.0757	0.30522	0.00431	1747	28	1717	21	99
M8	0.10697	0.00176	4.62412	0.08226	0.31288	0.00452	1748	30	1755	22	93
M9	0.10406	0.00143	4.46435	0.06949	0.31055	0.00427	1698	25	1743	21	97
M10	0.10526	0.00117	4.43258	0.0607	0.30477	0.00405	1719	20	1715	20	100
M11	0.10312	0.00108	5.04903	0.06742	0.35447	0.00472	1681	19	1956	22	99
M12	0.10396	0.00109	4.34919	0.05751	0.30288	0.004	1696	19	1706	20	98
M13	0.10751	0.00114	4.78443	0.06363	0.32218	0.00426	1758	19	1800	21	100
M14	0.10573	0.00111	4.81412	0.06426	0.32964	0.00439	1727	19	1837	21	98
M15	0.10312	0.00103	4.558	0.05905	0.31999	0.00421	1681	18	1790	21	98
M16	0.10268	0.00145	4.57212	0.07257	0.32242	0.00449	1673	26	1802	22	97
M17	0.11518	0.00128	5.25969	0.07198	0.33059	0.00442	1883	20	1841	21	101

Analysis	Isotopic Ratios						Age (Ma)				%
	207Pb/206Pb (±)		207Pb/235U (±)		206Pb/238U (±)		207Pb/206Pb (±)		206Pb/238U (±)		Conc
M18	0.10262	0.00104	4.5802	0.05994	0.32313	0.00428	1672	19	1805	21	100
M19	0.10207	0.00116	4.46529	0.06222	0.31674	0.00426	1662	21	1774	21	99
M20	0.10549	0.00131	4.67628	0.06846	0.32095	0.00436	1723	23	1794	21	101
Sample R1472785											
M1	0.10214	0.00111	4.12897	0.05516	0.29266	0.00383	1663	20	1655	19	100
M2	0.10228	0.00108	4.07258	0.05368	0.28824	0.00376	1666	19	1633	19	101
M3	0.10171	0.0011	4.10458	0.0548	0.29213	0.00383	1656	20	1652	19	100
M4	0.10199	0.00101	4.23377	0.0538	0.3005	0.00389	1661	18	1694	19	99
M5	0.10131	0.001	4.17764	0.05325	0.29852	0.00388	1648	18	1684	19	99
M6	0.10125	0.00099	4.20265	0.05342	0.30047	0.00391	1647	18	1694	19	99
M7	0.10088	0.00109	4.0653	0.05447	0.29171	0.00384	1640	20	1650	19	100
M8	0.10308	0.00105	4.25187	0.05522	0.29858	0.00391	1680	19	1684	19	100
M9	0.10206	0.00103	4.16982	0.05383	0.29572	0.00387	1662	19	1670	19	100
M10	0.10045	0.00107	4.07851	0.05438	0.29388	0.00388	1633	20	1661	19	99
M11	0.10244	0.00102	4.28258	0.05571	0.30265	0.00399	1669	18	1705	20	99
M12	0.10258	0.00103	4.30387	0.05616	0.30371	0.00401	1671	18	1710	20	99
M13	0.1023	0.00111	4.33466	0.05888	0.30674	0.00409	1666	20	1725	20	99
M14	0.10284	0.00105	4.29729	0.05644	0.30249	0.00399	1676	19	1704	20	99
M15	0.103	0.00104	4.22043	0.05535	0.29662	0.00391	1679	19	1675	19	100
M16	0.10272	0.00104	4.18436	0.05481	0.29491	0.00389	1674	19	1666	19	100
M17	0.10245	0.00104	4.21426	0.05536	0.29778	0.00392	1669	19	1680	19	100
M18	0.10305	0.00105	4.21289	0.05519	0.296	0.00388	1680	19	1671	19	100
M19	0.10153	0.00109	4.08863	0.05518	0.29153	0.00386	1652	20	1649	19	100
M20	0.10324	0.00105	4.28571	0.05623	0.30053	0.00395	1683	19	1694	20	100
M21	0.10172	0.00109	4.10624	0.05465	0.2922	0.00382	1656	20	1653	19	100
M22	0.10261	0.00108	4.19848	0.05549	0.29617	0.00387	1672	19	1672	19	100
M23	0.10215	0.00104	4.18159	0.05374	0.29629	0.00383	1664	19	1673	19	100
M24	0.10291	0.00112	4.30764	0.05835	0.30298	0.00401	1677	20	1706	20	99
M26	0.10331	0.00112	4.03125	0.05359	0.28244	0.00366	1684	20	1604	18	102
M27	0.10264	0.00106	4.1555	0.05325	0.29305	0.00374	1672	19	1657	19	101
M28	0.10283	0.00105	4.16733	0.05295	0.29331	0.00372	1676	19	1658	19	101
M29	0.10054	0.00111	3.88171	0.05111	0.27946	0.00354	1634	20	1589	18	101
M30	0.10165	0.00111	4.005	0.0525	0.28518	0.00363	1655	20	1617	18	100

REFERENCES

Chalmers, N.C., 2007. The Mount Woods Domain: a geological review and discussion on mineralisation potential. South Australia. Department of Primary Industries and Resources. Report Book, 2007/7.

Daly, S.J., Fanning, C.M. and Fairclough, M.C., 1998. Tectonic evolution and exploration potential of the Gawler Craton, South Australia. AGSO Journal of Australian Geology and Geophysics, 17(3): 145-168.

Daly, S.J., Tonkin, D.G., Purvis, A.C. and Shi, Z., 1994. Colona Drilling Program, Gawler Craton. Mines and Energy, South Australia Open File Envelope, 8768.

Dutch, R., Hand, M. and Kinny, P., 2008. High-grade Palaeoproterozoic reworking in the southeastern Gawler Craton, South Australia. Australian Journal of Earth Sciences, In Press.

Dutch, R., Hand, M. and Reid, A., 2007. Orogen-parallel flow during continental convergence: Numerical experiments and Archean field examples: COMMENT and REPLY. GEOLOGY, doi: 10.1130/G24419C.1.

Fanning, C.M., Reid, A.J. and Teale, G.S., 2007. A geochronological framework for the Gawler Craton, South Australia. South Australia Geological Survey, Bulletin, 55.

Ferris, G., Schwarz, M. and Heithersay, P., 2002. The Geological Framework, Distribution and Controls of Fe-Oxide and Related Alteration, and Cu-Au Mineralisation in the Gawler Craton, South Australia: Part 1: Geological and Tectonic Framework. In: T. Porter (Editor), Hydrothermal Iron Oxide Copper-Gold & Related Deposits: A Global Perspective. PGC Publishing, Adelaide.

Ferris, G.M., 2001. The geology and geochemistry of granitoids in the CHILDARA region, western Gawler Craton, South Australia: implications for the Proterozoic tectonic history of the western Gawler Craton and the development of lode-style gold mineralisation at Tunkillia. Masters Thesis, University of Tasmania, 156 pp.

Fraser, G.L. and Lyons, P., 2006. Timing of Mesoproterozoic tectonic activity in the northwestern Gawler Craton constrained by Ar-40/Ar-39 geochronology. Precambrian Research, 151(3-4): 160-184.

Jagodzinski, E., 2005. Compilation of SHRIMP U-Pb geochronological data, Olympic Domain, Gawler Craton, South Australia, 2001-2003. Geoscience Australia, Record, 2005/20: 197pp.

Jagodzinski, E. et al., 2007. Compilation of SHRIMP U-Pb geochronological data for the Gawler Craton, South Australia, 2007. Deparment for Primary Industries and Resources. Report Book, 20007/27.

Morris, B.J., Hill, P.W. and Ferris, G.M., 1994. Barton beadrock drilling program. MInes and Energy, South Australia. Report Book, 1994/019.

Oliver, R.L. and Fanning, C.M., 1997. Australia and Antarctica; precise correlation of Palaeoproterozoic terrains. In: R. C.A (Editor), The Antarctic region; geological evolution and processes; proceedings of the VII international symposium on Antarctic earth sciences. International Symposium on Antarctic Earth Sciences. Terra Antarctica Publication, Siena, Italy, pp. 163-172.

Payne, J.L., 2008. Palaeo- to Mesoproterozoic Evolution of the Gawler Craton, Australia: Geochronological, geochemical and isotopic constraints. Ph.D Thesis, University of Adelaide, Adelaide.

Payne, J.L., Barovich, K.M. and hand, M., 2006. Provenance of metasedimentary rocks in the northern Gawler Craton, Australia: Implications for Palaeoproterozoic reconstructions. Precambrian Research, 148(3-4): 275-291.

Reid, A.J., Payne, J.L. and Wade, B.P., 2006. A new geochronological capability for South Australia: U-Pb zircon dating via LA-ICPMS. MESA Journal, 42: 27-31.

Swain, G.M., Hand, M., Teasdale, J., Rutherford, L. and Clark, C., 2005. Age constraints on terrane-scale shear zones in the Gawler Craton, southern Australia. Precambrian Research, 139(3-4): 164-180.

Teasdale, J., 1997. Methods for understanding poorly exposed terrains: The interpretive geology and tectonothermal evolution of the western Gawler craton. Ph.D. Thesis, University of Adelaide, Adelaide, 182 pp.

Thomas, J., 2004. Towards the development of a tectonic framework for the Fowler Domain in the western Gawler Craton, South Australia: event chronology and evidence for transpressional reworking. Honours Thesis, University of Adelaide.

Thomas, J.L., Direen, N.G. and Hand, M., In Press. Blind orogen: Integrated appraisal of multiple episodes of Mesoproterozoic deformation and reworking in the Fowler Domain, western Gawler Craton, Australia. Precambrian Research: (2008), doi:10.1016/j.precamres.2007.05.006.